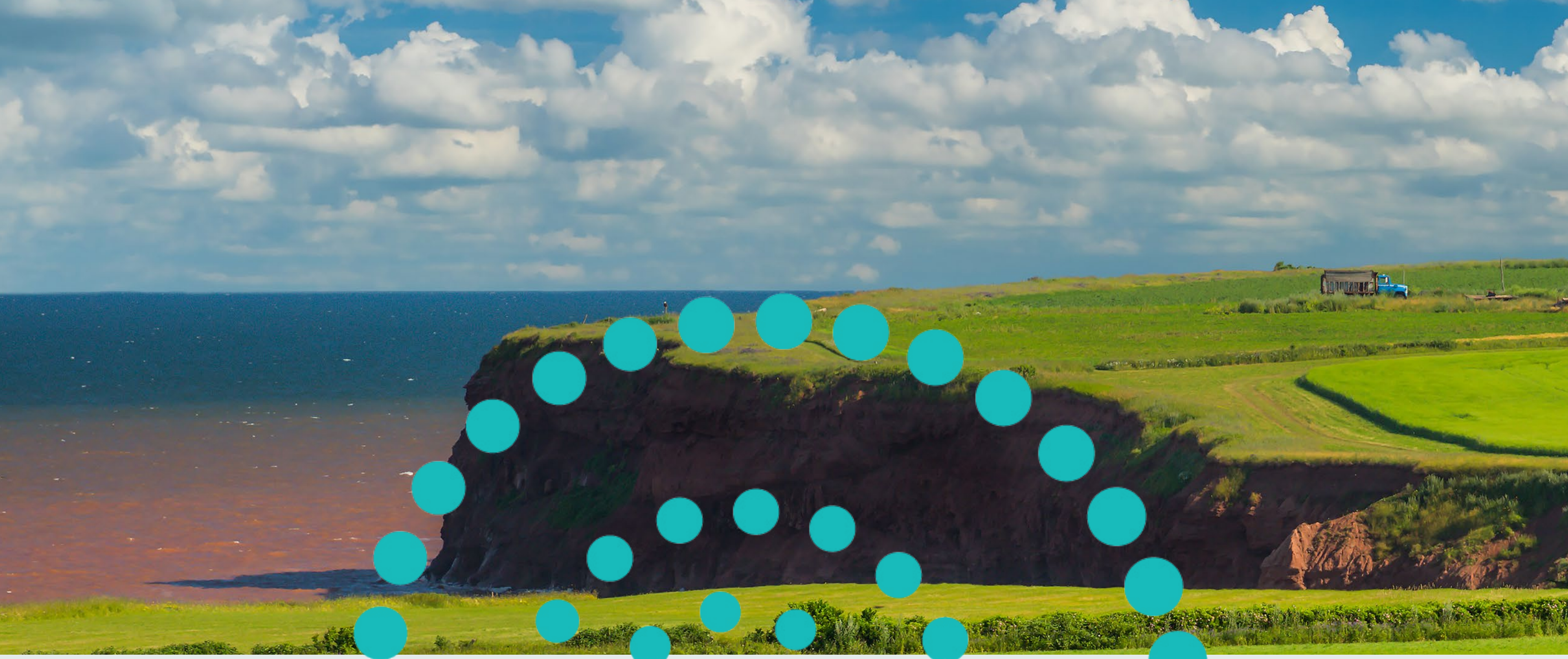

A Synthetic Review of Climate Risk and Opportunity Assessment Practices in 11 Jurisdictions

Final Report - April 2025

Ouranos Scientific Coordination - Adaptation Science

Ouranos

A Synthetic Review of Climate Risk and Opportunity Assessment Practices in 11 Jurisdictions

Final Report

April 2025

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List of Acronyms

CROA	Climate risk and opportunity assessment
CAD	Canadian dollars
CCC	Climate Change Committee
CNAP	California-Nevada Climate Applications Program
DACC	Direction de l'adaptation aux changements climatiques (climate change adaptation division)
MELCCFP	Ministère de l'Environnement et de la Lutte contre les Changements Climatiques, de la Faune et des Parcs (Ministry of the Environment, the Fight Against Climate Change, Wildlife and Parks)
MERN	Ministère de l'Énergie et des Ressources naturelles (Ministry of Energy and Natural Resources)
OECD	Organisation for Economic Co-operation and Development
SMART	Specific, measurable, achievable, realistic and time-bound targets

1 Introduction

1.1 Context of the mandate

The Government of Québec has committed to carrying out a climate risk and opportunity assessment (hereinafter "CROA"), in accordance with the Plan for a Green Economy, through an initiative led by the Ministère de l'Environnement et de la Lutte contre les Changements Climatiques, de la Faune et des Parcs (MELCCFP). The government intends to model its CROA on the practices followed in other jurisdictions, in Canada and internationally, to ensure that the process undertaken across Quebec is well-founded.

1.2 Objectives

The MELCCFP's climate change adaptation division, the DACC, requested that Ouranos review the knowledge and practices for CROAs in other jurisdictions, in the aim of supporting the establishment of the context and scope of the first iteration of CROAs for Quebec. The results of this review will be used to:

- Assist the ministry in defining the scope of the analysis
- Identify the issues to be considered
- Determine the best methods
- Identify the stakeholders that should be involved
- Identify the factors that will facilitate the process of assessing climate risks and opportunities

1.3 Structure of the synthetic review

This review begins by looking at what a CROA is. The methodology of the analysis is described next. Lastly, the findings drawn from the literature review, the CROA reports, and the interviews with the representatives of the previously published CROAs are presented. The appendices provide the analysis criteria followed by the summaries for each jurisdiction, and selected examples of good practices.

2. Definition of a Climate Change Risk and Opportunity Assessment (CROA)

The purpose of a climate change risk and opportunity assessment is to identify, analyze and evaluate the risks to a defined area and its communities by examining climate information, vulnerabilities and potential consequences in the current and future climate (adapted from Ouranos & MELCCFP, 2024). Note that although opportunities that may arise due to climate change are not yet systematically included in this type of assessment (therefore more commonly called "climate change risk assessments" or CCRA), for this review the term and acronym "CROA" is used to better describe the scope of the study.

A national climate risk and opportunity assessment:

- Provides a national overview, using the best available information and evidence, of how an area may be affected by various hazards and threats caused, exacerbated or influenced by climate change, as well as the resulting risks and opportunities,
- Helps decision-makers better understand the wide range of risks their area will face and which risks to address as a priority,
- Guides priorities for adaptation programs at different levels of government, and supports a strategic approach to the adaptation of businesses and communities,
- Establishes a baseline against which future assessments can be measured.

The adaptation process is continuous and iterative, and must take new knowledge or changes in the system into account. For example, a better understanding of the climate may call the magnitude of anticipated risks into question, while a significant change in regulations (municipal or provincial) could influence potential adaptation measures or force the modification of those already in place. There are several approaches to adaptation. However, Ouranos and the MELCCFP favour the adaptation process shown in Figure 1, in which a CROA is included in the third step.

Figure 1: An adaptation process, drawn from Élaborer un plan d'adaptation aux changements climatiques – Guide pour les organismes municipaux (developing a climate change adaptation plan – a guide in support of municipal organizations) (Ouranos & MELCCFP, 2024).

The first two steps of the adaptation process are the foundation on which the success of a CROA rests. The risk and opportunity assessment step is found in the middle of the five steps. It is a key part of adaptation as it allows for the prioritization of the risks and opportunities that require adaptation measures (or risk management). The assessment is done at a specific time with the data available at that time, and therefore needs to be updated in order to keep the adaptation measures up to date. The two final steps of the process involve identifying and implementing adaptation measures as well as monitoring their effectiveness to manage as the identified risks arise.

3. Analysis of CROA practices

3.1 Methodology

The methodological approach to understanding current CROA practices is divided into three steps:

1. Literature review of the 11 selected CROAs
2. Interviews with CROA representatives from each jurisdiction
3. Comparative analysis

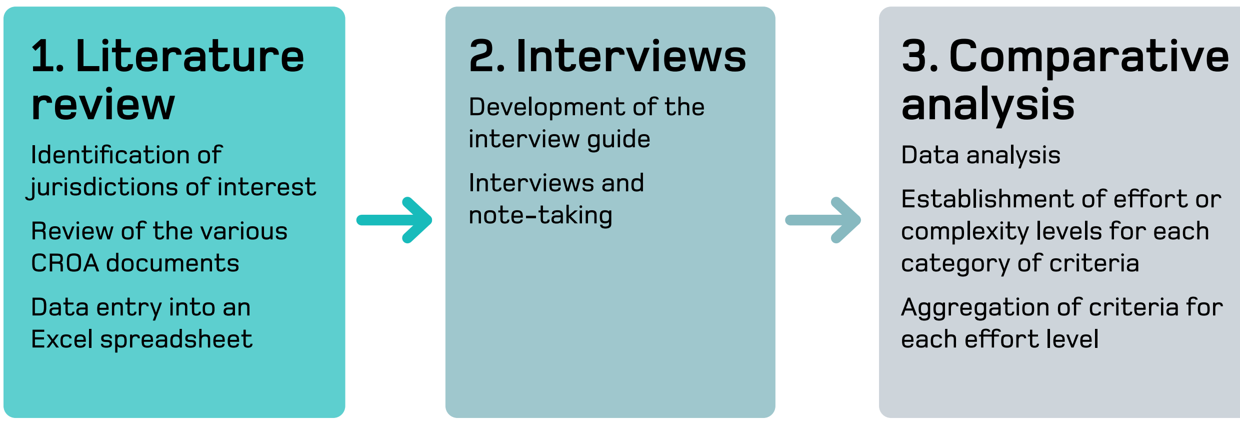


Figure 2: Methodological approach and associated tasks for the comparative analysis of 11 CROAs

3.1.1 Litterature review

Identification of jurisdictions of interest

Eleven jurisdictions were chosen based on the potential similarities they may have with Quebec, in order to maximize the concordance and relevance of potential recommendations to the DACC. These jurisdictions were chosen based on certain criteria: socioeconomic (OECD countries), political (Canadian provinces) and climatic (humid continental climate).

Table 1: List of jurisdictions whose CROAs were analyzed

International jurisdictions	Canadian jurisdictions
1. Germany	8. Ontario
2. France	9. Nova Scotia
3. United Kingdom	10. New Brunswick
4. Norway	11. British Colombia
5. New Zealand	
6. United States	
7. California	

For each of the 11 jurisdictions, relevant official documents (supporting documents, infographics, additional analyses, etc.) were acquired and recorded on the Ouranos server.

Review of the various CROA documents

The documents were carefully reviewed and their data was sorted and recorded in an Excel file (see Appendix 1 for the structure of the Excel file).

The 11 CROAs were examined using 38 criteria grouped into 3 categories:

- The "Framing" category covers criteria on the scope and objectives of the CROA, project management, the conceptual framework and governance.
- The "Methodology" category covers methodological criteria on the scales of work, both spatial and temporal, the choice of risk management approach, the comprehensiveness of the approach, whether or not opportunities are addressed alongside risks, and the limits and constraints of the approach.
- The "Dissemination of results" category includes the criteria on the format of the results and the dissemination mechanisms used to deliver the CROA to its target audience(s).

Where the information needed to evaluate these criteria was not available, the CROA representatives were contacted to find the missing information.

At the same time, other summary reports on the practices and lessons learned from previous CROAs conducted internationally were analyzed in order to add to the information collected in the 11 CROAs and to gather their various recommendations (see Finding No. 4).

- National Risk Assessments — a cross country perspective (OECD, 2017)
- National climate change vulnerability and risk assessments in Europe (European Development Agency, 2018)
- Evaluation of California's Fourth Climate Change Assessment - San Diego and Sierra Nevada Region Reports (CNAP, 2021)

3.1.2 Interviews

Given the diversity found across jurisdictions, interviews were conducted to delve deeper into the three categories of criteria and to ask CROA representatives about the lessons learned from their experiences. The interview phase with the international representatives of the various CROAs aimed to enrich the content recorded in the spreadsheet, identify the advantages and disadvantages associated with certain methodological choices, and highlight the factors that contributed to the success of the CROA as well as the pitfalls to avoid. The interviews uncovered information that was not found in the reports and which could help build on lessons learned elsewhere.

While analyzing the various documents from the jurisdictions and completing the different cells of the spreadsheet, it became clear that certain criteria were generally less well-documented in the publications. Those criteria then served as a starting point for designing the interview guide. Questions associated with each of the less well-documented criteria were included in the interview guide, in addition to a question on the advantages and disadvantages linked to these choices.

The interview guide was divided into five sections: sections 1 to 3 on the three criterion categories (framing, methodology, and dissemination of results). Sections 4 and 5 were dedicated to gathering advice on issues specific to Quebec in a CROA process (regional characteristics, multi-ministry approach and how to generate results within a limited timeframe), and to understanding the main success factors and pitfalls to avoid.

Eleven interviews with CROA officials were led by at least two members of Ouranos.

3.1.3 Comparative analysis

Data analysis

The analysis phase consisted of synthesizing the information collected in the literature and in the interviews in order to report on the diversity of the approaches to conducting a CROA and ultimately formulate a proposed framework for the DACC. In addition to the three categories of criteria, a fourth section was added to the spreadsheet to record information from the interviews regarding success factors, advice for avoiding pitfalls, advantages, disadvantages, and advice for integrating regional specificities.

In this fourth set of information, the considerations regarding the advantages and disadvantages are specific to the approaches taken by the jurisdictions, while the advice for avoiding pitfalls and the success factors is broader and can potentially be transferable to other contexts.

Establishment of effort levels by criterion category

Through a preliminary analysis of the approaches of the different jurisdictions, it was observed that the level of effort expended on carrying out the CROAs was highly variable. As this variability was closely linked to available resources and political will, the effort level appeared as a relevant common denominator for sorting the information and possibly matching the needs of the Quebec government with the right level of effort to expend on a first CROA iteration.

For each of the 38 criteria in the Excel spreadsheet, the content entered for the 11 jurisdictions was therefore sorted according to three effort levels in additional columns: moderate, intermediate, and extensive.

Classification of the 11 CROAs by effort level

It is important to note that the classification of a CROA by effort level was done relative to others, based on the sample of the 11 jurisdictions under study. By comparing their estimated levels of effort, the effort level scale was established. Thus, an effort level described as “moderate” in this study could appear to be underestimated in another analysis context. The effort levels were determined and sorted for the 38 criteria of the Excel spreadsheet. In order to do this sorting, which is in fact quite arbitrary, a few guidelines were followed in the classification. The table below shows the main ones:

Table 2: Main guidelines for the classification of CROAs by level of effort (framing, methodology and dissemination of results).

	Moderate effort	Intermediate effort	Extensive effort
Framing	• Objective: To provide an overview of the effects of climate change • Financial resources of ± $175,000 CAD • Project team of less than 5 people • A year and a half to produce • A single scale assessment	• Objective: To identify and prioritize climate change risks (and opportunities) • Financial resources of ± $500,000 CAD + time in kind • Project team of 5 to 10 people • 2 to 4 years to produce • Two scales of assessment (national + one subdivision)	• Objective: Identify and prioritize climate change risks and opportunities + inform adaptation programs and plans (support multilevel decision-making in adaptation) • Financial resources of ± $3 million CAD • Project team of 10 to 20 people • 4 to 6 years to produce • Three scales of assessment (national + two subdivisions)
Methodology	• Methodology based on a review of knowledge	• Risk assessment methodology based on ISO 31000 and/or 14091 • Two timescales and climate scenarios	• Methodology based on a vulnerability analysis (analysis of sensitivity and adaptive capacity) and climate impact chains • Three timescales and climate scenarios + socioeconomic development scenarios
Dissemination of results	• Brief, simple presentation of the results	• Presentation of evolving risk over time in a risk matrix + communication efforts	• Detailed presentation in a risk matrix, broken down into timescales, confidence levels, affected regions, and systems • Multiple means of disseminating knowledge (dedicated website, podcast, etc.)

3.2 Results of CROA practices

3.2.1 Finding n°1: Variety of risk assessment types

A climate risk assessment and a climate assessment are two complementary, but distinct, approaches to analyzing climate-related issues. A **climate risk assessment** involves analyzing the specific impacts of climate change or extreme weather events on a given system, such as a city, business, or ecosystem, and is typically based on the ISO 31000:2018 or ISO 14091:2019 standards. Its aim is to identify the risks (floods, droughts, storms, etc.), to assess their probability and severity of consequences, and to propose strategies to adapt to or mitigate them. In contrast, a **climate assessment** is a more general analysis that looks at the state of the climate, its current and future trends, as well as its causes and developments, without necessarily focusing on specific impacts. It provides global or regional data on aspects like temperatures, precipitation or greenhouse gas emissions. The essential difference therefore lies in their objective: while a climate risk assessment is oriented towards risk management and decision-making in the face of identified threats, a climate assessment is descriptive and serves as a basis for understanding climate phenomena in a given context.

Among the 11 CROAs analyzed, the type of analysis differs in the conceptual framework and therefore in the results. Some jurisdictions did not produce a CROA in the sense of a risk assessment aligned with the ISO 31000 standard on risk management, but rather carried out a review of current knowledge (Norway), or an assessment of the cost of inaction (France), or national climate assessments (California, United States), and did not include a risk score or risk matrix. The jurisdictions that conducted climate risk assessments (the United Kingdom, New Zealand, Nova Scotia, Germany, Ontario, British Columbia) vary in terms of the conceptualization of the risk and the level of detail of the results. This finding highlights the importance of several analysis criteria, including the scope and the objective of the CROA, on which the methodology and the format of the results are based.

Figure 3 presents the spectrum of the different types of analysis found in the CROAs examined, from a review of knowledge to an exhaustive CROA, based on the ISO standards.

Review of current knowledge, literature review

A climate change assessment looks at the results in the literature on the observed impacts of climate change without analyzing the risks.

A targeted CROA,

for example based on the ISO 31000 risk management framework or on an impact analysis depending on climate scenarios and 1 socio-economic baseline scenario; may include 1 economic estimate of damage.

A comprehensive CROA,

based on vulnerability and impact chains (based on ISO 31000 and ISO 14090-91), that includes economic estimates of damage, several socio-economic development scenarios, the risks with and without adaptation, and an urgency scoring.

Figure 3: Finding n°1 : The variety of approaches to assessing climate change risks and opportunities.

3.2.2 Finding n°2: Two key elements and four determining criteria

The analysis of the practices in the 11 CROAs showed that two key elements and four criteria are decisive in defining and planning a CROA.

The following **two key elements** are the foundations of a CROA:

- The **governance** in place with regard to climate change adaptation and more specifically to conducting a CROA at the scale of a jurisdiction:
  - Inter-ministerial governance
  - Advisory committee
  - Committee of experts
  - Mechanism for keeping the process independent

- The **objectives and scope of the CROA**, i.e. the expected results and the use to which they will be put:
  - Associating the objectives of the CROA with the adaptation process at the selected scale
  - Defining the scope of the CROA in relation to the future use that will be made of it

Among the 38 criteria analyzed across the 11 jurisdictions and then the three effort levels, the four determining criteria are:

In the **framing** criterion category:

- **Stakeholder engagement**
  - Engaging stakeholders in specific, concrete objectives to move the CROA forward and at key moments in the process
- **The financial and human resources** dedicated to the implementation of the CROA
  - Ensuring there are sufficient financial resources to conduct a CROA with the defined scope and objectives
  - Allocating the necessary internal human resources dedicated to the CROA process and the external human resources needed for support or management

In the **methodology** criterion category:

- **Assessment scale**:
  - Performing the assessment at the scale(s) (e.g., provincial, regional, industry-wide) at which the CROA results will be actionable
- **Methodological approach** (comprehenssiveness):
  - Adapting the methodology to the objectives and scope of the CROA
  - Building on existing work and past CROAs

Since these criteria are determinant in defining the framing, Figure 4 suggests a sequence for decision making when framing a CROA.

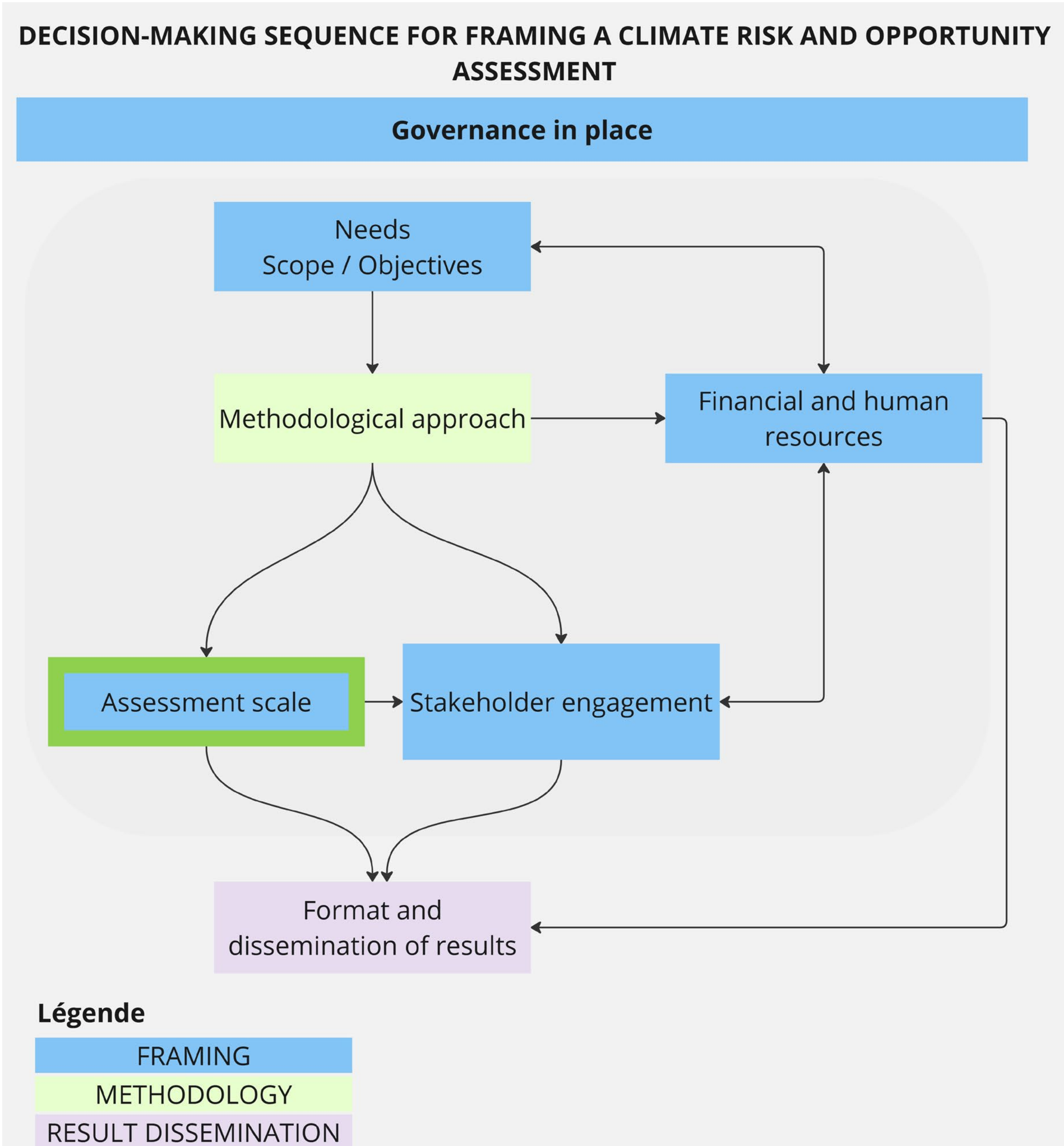


Figure 4: Suggested sequence for making key decisions when framing a CROA (Source: The authors of this report).

3.2.3 Finding n°3: Effort according to the four determining criteria

Sorting the 11 CROAs according to these four criteria shows the levels of effort made by the jurisdictions and demonstrated the variety of existing CROAs. It seems clear that devoting greater resources does not necessarily mean that the result is the same in terms of detail. The four determining criteria display more or less linear relationships. This is true for stakeholder engagement with the other three criteria.

- The more resources devoted to carrying out a CROA, the more stakeholder engagement there is.
- The more comprehensive the CROA approach, the more stakeholder engagement there is.
- The more different scales the CROA covers, the more stakeholder engagement there is.

Another linear relationship is found between the level of resources and the assessment scales. The greater the resources devoted to a CROA, the more it is conducted at different scales (United Kingdom, California, United States).

The criteria demonstrating a less linear relationship are between the comprehensiveness of the process and the assessment scales and the financial and human resources.

- Some jurisdictions devoted a moderate amount of resources to achieving a comprehensive CROA (Germany, New Zealand, Ontario).
- Conversely, the resources devoted to the CROAs in California and the United States were considerable for a review of current knowledge and a targeted CROA.

Lastly, it is important to note that the jurisdictions that have conducted multiple CROAs (UK, US, Germany, California) demonstrate an increasing level of effort from the first iteration to the most recent.

Table 3 displays the different effort levels and the corresponding four determining criteria. Each of the 11 CROAs was assessed and classified according to these different levels of effort (see Appendix 2 for the summaries for each jurisdiction). Since the relationships between criteria are not necessarily linear, each CROA does not fall into a single overall effort level, but rather is found in several effort levels depending on the criterion being evaluated. For example, California scores in the extensive effort level for the first three criteria, but intermediate for the comprehensiveness of the method.

Classifying CROAs according to these four determining criteria provided insight into how the framing, scope and objectives can have a determinant impact on the outcome of a CROA.

Table 3: Effort levels according to the four determining criteria.

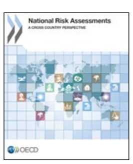
Effort level	Financial and human resources	Stakeholder engagement	Scale(s) of work	Comprehensiveness of methodological approach
1 - Moderate	± 175k $ CAD 2 to 7 people	< 100	National	Summary of current knowledge, literature review
2 - Inter-mediate	± 500k $CAD + in-kind time 5 to 10 people + consultation and expertise	100 - 200	National + subdivision (by sector, system or region)	Targeted CROA, based on, for example, the ISO 31000 risk management framework or on an impact analysis according to climate change scenarios and 1 socio-economic development scenario; May include economic estimate of damage
3 - Extensive	environ 3 M$ CAD 10 to 20 people + technical team + consultation + expertise + community and Indigenous representation	> 200	National + 2 sous-divisions (en secteurs et régions)	Comprehensive CROA, based on vulnerability and impact chains (e.g based on ISO 31000 and ISO 14090-91), several socioeconomic development scenarios economic and estimates of damages

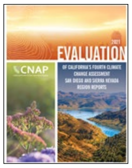
3.2.4 Finding n°4 : Success factors and recommendations

The success factors presented here are drawn from the interviews and classified according to the three categories of CROA analysis criteria: the framing of the assessment, the methodology, and the dissemination of the results. Recommendations from three key reports have been added to these success factors and categorized in the same way to provide additional support to jurisdictions that are ready to conduct a CROA.

Table 4: Success factors from interviews and recommendations from three key reports for conducting a successful CROA.

Framing	Methodology	Dissemination of results
Interviews with the représentatives of 11 CROAS		
Planning • Plan for a CROA preparation period (3-6 months minimum) – context establishment stage (step 2 of the adaptation process) **Governance** • Good governance in place to start the process • Mechanism for keeping the process independent **Stakeholder engagement** • Strong engagement from the start, maintained throughout the project (e.g. delegating stakeholder engagement by region) **Financial resources** • Realistic budget and time allocation **Human resources** • Multidisciplinary collaboration • Clearly attributed roles • Clarity in communicating objectives, results and timelines	**Choice of method** • Adapt the method to the objective • Ensure transparency + clear boundaries • Provide structure for expert judgment • Address solutions, not just risks • Provide indicators on the impacts and usefulness of the process **Review process** • Establish a robust, rigorous process for reviewing the analysis and deliverables	**Dissemination of results** • A team dedicated to promotion and dissemination • Adapt the communication of results to different target audiences **Format** • Concise reports and summaries • Visualization, fact sheets • Interactive online support • Access to the basic data and to the research using this data **Diffusion** • Training • Simultaneous publication of the CROA and the adaptation plan • Other parties relaying information
National risk assessments, a cross-country perspective, (OECD, 2017)		
Planification • Conduct national risk assessments as part of a comprehensive risk management strategy **Governance** • Assign clear responsibility for leading the process and clarify risk ownership across government **Stakeholder engagement** • Identify and involve stakeholders early and regularly	**Choice of method** • Adopt an all-hazards approach to national risk assessments • Ensure that the methodology produces comparable results **Review process** • Encourage a process of continuous review	**Dissemination of results** • Use the results to inform policy decisions **Diffusion** • Present the results to policy makers and/or the appropriate legislative committees for formal adoption





Framing	Methodology	Dissemination of results
Evaluation of California's fourth climate change assessment regional reports for San Diego and Sierra Nevada, (CNAP 2021)		

Stakeholder participation
• Involving stakeholders as early as possible in drafting reports and offering them different opportunities for participation, to help them:
  ○ Inform the questions asked and the directions taken
  ○ Indicate the types of information and analyses that would best facilitate local and regional adaptation planning and implementation
  ○ Review and provide feedback on draft reports
• Examine whether the geographical scope of each regional report corresponds to stakeholder needs and whether (and how) this influences practicality.
• Allow more time for stakeholder engagement so that reports can be developed in close collaboration.
Human resources
• Recruit more diverse experts to assist in reviewing reports to ensure that:
  ○ Each section is relevant to stakeholders
  ○ Generalizations are avoided
  ○ The content is generally accessible to all target audiences
• Involve researchers and/or stakeholders that are knowledgeable about how to use climate information within organizations to help inform the content and presentation of reports.
• Include stakeholders from neighbouring provinces in the development of regional reports to support cross-border adaptation planning and implementation.
		Actionability and use
		• Include examples throughout each report demonstrating how different organizations have used information on climate change and its impacts from previous regional reports.
		• Discuss uncertainty where it exists and offer recommended steps to overcome it and/or include case studies illustrating how some organizations have managed it in their decision-making.
		• Present information on climate change and its impacts in a more holistic way (i.e. "storytelling") to help stakeholders understand and communicate the interrelationships of impacts.
		• Make presenting published reports to stakeholder groups a regular component of their publication.
		Format of reports
		• Follow a more equitable and collaborative report development model that provides compensation to stakeholder organizations that are unable to devote their time to such initiatives.

National climate change vulnerability and risk assessments in europe, (European environment agency, 2018)		
Stakeholder engagement • Stakeholder engagement provides access to relevant knowledge, ensures buy-in, and facilitates mutual learning. It is most effective when stakeholders are included at all stages of the assessment. • Regularly updating a national CROA (e.g. every 5 years) allows relevant developments to be integrated into the knowledge base and into policies.	**Choice of method** • The choice of assessment approaches and methods must take the specific information needs and the objective of the CROA into account. • In many countries, the focus has shifted from simply assessing climate change impacts and vulnerabilities to identifying adaptation measures and actions to reduce these vulnerabilities (2/3 of CROAs considered adaptation measures).	**Dissemination of results** • Tailor the communication of key findings to different audiences.

Framing	Methodology	Dissemination of results
Alignment with other similar approaches • National CROAs could benefit from closer coordination with national risk assessments conducted for disaster prevention and risk reduction.	• CROAs provide a broad overview and can help define thematic and regional priorities, but sub-national and local information is needed to develop targeted adaptation measures. **Address the following elements more systematically:** • Non-climatic factors, including those affecting adaptive capacity • Intersectoral and international (cross-border) impacts • The development of harmonized metrics of impacts and vulnerabilities, potentially harmonized at the international level, in addition to contextual metrics specific to regions and localities • The evaluation and communication of uncertainties • Assessment of the impacts of climate change over time under different scenarios	

4. Conclusion

In conclusion of this report on current CROA practices in 11 jurisdictions, the key messages that emerge from the four findings are the following:

- The wide variety of CROAs is related to the fact that there is no systematic framework for conducting a CROA at the jurisdictional level. Most jurisdictions (9 out of 11) follow the framework provided by the ISO 31000:2018 and ISO 14090:2019 standards. However, the methodology and comprehensiveness of CROAs are often tailored to the objectives, desired scope and available resources, so the level of detail varies greatly from one CROA to another.
- Two key elements—the governance of the CROA, including the political will, and the definition of objectives and scope—have a direct influence on four determining criteria (methodological approach, stakeholder engagement, the assessment scale, and the resources available) which themselves influence the CROA's level of detail, its format, and the dissemination of its results (see Figure 4).
- Different levels of effort exist for each of these four determinant criteria within a CROA. This demonstrates that the relationships between them are not necessarily always linear, except for stakeholder engagement: the more there is, the greater the resources attributed, the higher the number of scales of work included (national, regional and industry-wide) and the more comprehensive the process. There is also a positive relationship between the level of resources and the number of scales of work.
- The success factors for carrying out a CROA, which were mentioned by the CROA representatives interviewed and drawn from three reports (see Table 2) highlight the central importance of the following aspects:
    - The planning phase, during which the governance for conducting the CROA is defined, as well as the objectives and scope of the CROA.
    - Stakeholder engagement, defined according to the objectives, the scope of the process and the available resources, is decisive in the implementation of adaptation measures further to the CROA. The earlier stakeholders are involved in the process, the more they understand the need to adapt to climate change and the higher the acceptability of the measures. For adaptation to be successful, stakeholders must be an integral part of the CROA process so that they fully understand the risks and opportunities of climate change. This engagement, when structured by effective governance, makes it possible to align the CROA and its results with other existing or future plans.
    - A robust review process planned in advance to ensure relevant and actionable results at the scale(s) assessed.
    - A plan to disseminate the results involving different formats and distribution channels, adapted according to each target audience.

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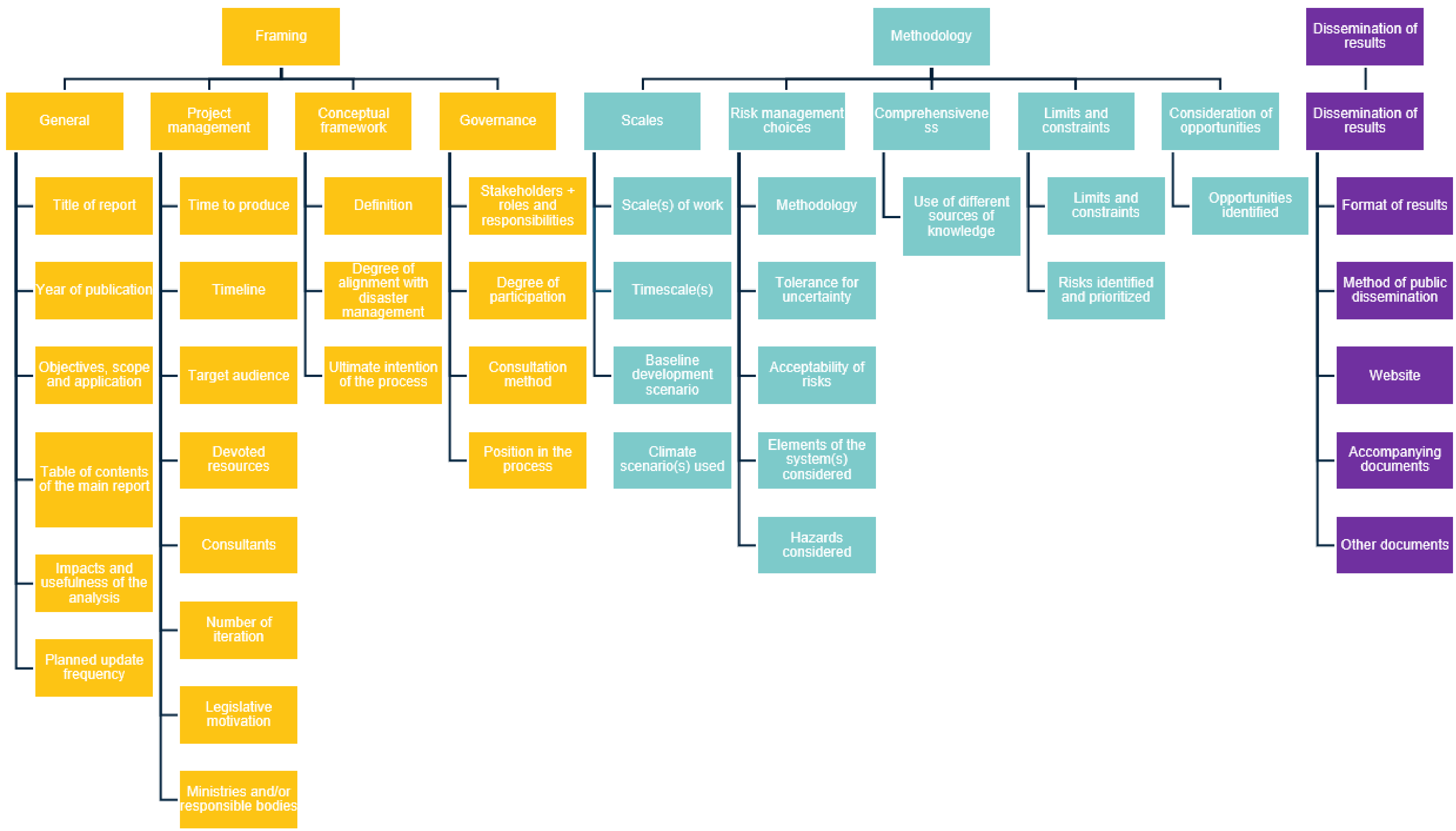
Appendices

Appendix 1 : Structure of the excel spreadsheet

1st level : Categories ; 2nd level : Subcategories ; 3rd level : Criteria



Appendix 2 : Jurisdiction one-pager summaries

The 11 CROAs are presented below in one-pager form. For each CROA, the highlights, advantages and disadvantages of the approach used as well as the success factors are shown for the three categories of analysis criteria: framing, methodology and dissemination. A box at the top right of each summary displays the level of effort with the corresponding four determinant criteria used in the analysis: financial and human resources, stakeholder engagement, scale(s) of work, and comprehensiveness of the method. This data is combined in the reference grid below.

Table 5: Reference grid of the different effort levels and the corresponding four selected determinant criteria.

Effort level	Financial and human resources	Stakeholder engagement	Scale(s) of work	Comprehensiveness of methodological approach
1 - Moderate	± 175k $ CAD 2 to 7 people	< 100	National	Summary of current knowledge, literature review
2 - Intermediate	± 500k $CAD + in-kind time 5 to 10 people + consultation and expertise	100 - 200	National + subdivision (by sector, system or region)	Targeted CROA, based on, for example, the ISO 31000 risk management framework or on an impact analysis according to climate change scenarios and 1 socio-economic development scenario; May include economic estimate of damage
3 - Extensive	environ 3 M$ CAD 10 to 20 people + technical team + consultation + expertise + community and Indigenous representation	> 200	National + 2 sous-divisions (en secteurs et régions)	Comprehensive CROA, based on vulnerability and impact chains (e.g based on ISO 31000 and ISO 14090-91), several socioeconomic development scenarios economic and estimates of damages

Germany (2021) 2nd iteration

Duration: 3 years

Ressources: CAD 1,2M + in-kind contributions

Update frequency: 6 years

Status: 2nd iteration completed

Resources

Scale(s)

Engagement

Comprehensiveness

	Key aspects	Advantages / Drawbacks	Success factors
Scope	Aims to create a basis for the further development of adaptation in Germany, in particular for the preparation of future adaptation action plans by the federal government Over 180 experts consulted, plus a technical team Developed by a scientific consortium, in close collaboration with the climate change and adaptation authorities' network	The time spent establishing the network (2 years) ensures a consistent understanding among stakeholders	The process is more important than the methodology Include risk owners in the process as early as possible
Methodology	Based on ISO14091 standards (vulnerability and impact chains) and the latest vulnerability analysis in 2015 and the corresponding methodological guide; based on the climate impact chains, rooted in the concept of adapted climate risk, compatible with the first analysis in 2015 and the IPCC's AR5 Considers two socio-economic development reference scenarios in evaluating future climate risks	Comprehensive approach to analysis Differentiation made between scientific results and normative evaluation of scientific results by a network of mandated federal authorities Assessed adaptive capacity to reduce climate risks Investigated cascading effects Socio-economic development scenarios are always connected to higher uncertainties than climate change (war, migration, etc.)	Transparency A network of experts from different authorities is necessary for integrating cross-sectoral perspectives and creating a robust assessment
Dissemination	Full report available online, along with summaries and reports by cluster	Spatially explicit outputs in the form of maps for climate hotspots or climate regions	Use different communication formats depending on the target audience Avoid lengthy texts and reports, and produce good summaries

Sources: interview, november 2023 ; Kahlenborn, W., Porst, L., Voss, M., Fritsch, U., Renner, K., Zebisch, M., Wolf, M., Schönthaler, K., & Schauser, I. (2021). Climate impact and risk assessment 2021 for Germany Summary (UBA-FB--000574/KURZ,ENG). Germany. URL: https://www.umweltbundesamt.de/en/publikationen/KWRA-English-Summary

California (2018) 4th iteration

Duration: 9 months

Ressources: CAD 2M

Update frequency: 6 years

Status: 5th iteration in progress

Resources

Scale(s)

Engagement

Comprehensiveness

	Key aspects	Advantages / Drawbacks	Success factors
Scope	Aims to support adaptation actions and risk analyses at the statewide, regional, and local levels, and to directly inform government policies, plans, programs, and directives to promote effective, integrated action High-level engagement of stakeholders, but a large number of them (over 300 experts consulted) Developed through collaboration between several agencies, departments, and organizations in California	Time-consuming engagement process and generally insufficient lead times to allow for engagement	Generate a common message and vocabulary, talk about the same issues and priorities
Methodology	Literature review on the impacts of climate change at the statewide scale, but no risk assessment Emphasis on multiple scales of analysis (sectoral and regional); proposes solutions and ways of adapting		Plan how to continue when data is unavailable Careful delimitation of climatic regions for aggregation Important to set timeframes
Dissemination	Website dedicated to hosting regional reports, techniques, and visualization tools and acquiring climate data	A large amount of information may hinder the target audience's understanding	Provide regional reports Clarify differences compared to other related government-led initiatives Make data and visualizations available, provide tools for customizing climate data and projections

Sources: interview, november 2023 ; Bedsworth, L., Cayan, D., Franco, G., Fisher, L., & Ziaja, S. (2018). Statewide Summary Report. California's Fourth Climate Change Assessment. (California Governor's Office of Planning and Research, Scripps Institution of Oceanography, California Energy Commission, California Public Utilities Commission). Publication number: SUM CCCA4-2018-013. URL: ; California-Nevada Climate Applications Program - CNAP (2021) Evaluation of California's fourth climate change assessment. San Diego and Sierra Nevada Region Reports. https://cnap.ucsd.edu/2021/06/28/2021-evalutation/

United States (2018) 4th iteration

Duration: 2–3 years

Ressources: several million CAD

Update frequency: 4 years

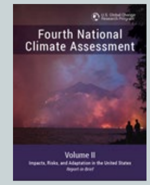
Status: 5th report published

Resources

Scale(s)

Engagement

Comprehensiveness



	Key aspects	Advantages / Drawbacks	Success factors
Scope	Helps inform policymakers, utility and natural resource managers, public health officials, emergency planners, educators and other stakeholders by providing an in-depth look at the effects of climate change on the United States Coordinated by the US Global Change Research Programme (USGCRP): 6 to 8 full-time people Input from over 300 federal and non-federal experts (including sector-specific authors): over 1,000 stakeholders in total Legislative vehicle in place for publication of the report	Having many authors can be beneficial for dissemination Trying to meet everyone's needs gives rise to a huge project, and if political support is weak, the task will be difficult	Early and sustained stakeholder engagement Be selective at the outset and allow for flexibility later on Choose a lead author for each chapter to gather perspectives in different parts of the evaluation Establish a vision and clear rules for managing conflicts between authors
Methodology	Literature review on the analysis of the effects of CC on different sectors of society, analysis of current trends in CC of both human and natural origin, and projection of major trends for the next 25 to 100 years Socio-economic scenario based on population and land use change projections		Rigorous review and revision process
Dissemination	Considerable effort: 10 to 12 people in the technical support unit dedicated to producing high-quality graphics Website dedicated to the report: Excellent navigability, metadata is accessible	Have sufficient material and tools to optimize different audiences' engagement with the content Reports and materials are accessible to, and usable by, individuals with disabilities	Emphasis on clear and consistent communication efforts Avoid simply publishing dense documents

Sources: interview, november 2023 ; USGCRP. (2018). Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II: Report-in-Brief. Reidmiller, D.R., Avery, C.W., Easterling, D.R., Kunkel, K.E., Lewis, K.L.M., Maycock, T.K., & Stewart, B.C. (Eds.). U.S. Global Change Research Program, Washington, DC, USA, 186 pp. doi: 10.7930/NCA4.2018.RiB

France (2023) 2nd iteration

Duration: 1.5 years

Ressources: n/a

Update frequency: none

Status: 2nd iteration completed

Resources

Scale(s)

Engagement

Comprehensiveness

	Key aspects	Advantages / Drawbacks	Success factors
Scope	Aims to provide input for the climate change adaptation component of France's future energy and climate strategy (potential to support adaptation plans) Project led by a department under the Prime Minister, with no consultation firm, only reviewers from other ministries, public institutions and qualified individuals		Method adapted to the objective Easy networking with other administrations
Methodology	A simple, educational overview of the various climate change impact assessments in the main sectors of activity (the costs of inaction) An economic perspective on quantifying the anticipated impacts of climate change	Economic quantification gives rise to a vocabulary and understanding suited to different realities	Organise a formal scientific review process with academics
Dissemination	Main report available to the public online Hosted on the government's website Communications team responsible for dissemination	Good level of effort for project needs	Define a formal conceptual framework ex ante to lead the discussion

Sources: interview, november 2023 ; France Stratégie. (2023). Coût de l'inaction face au changement climatique en France : que sait-on ? [Working document]. URL: https://www.strategie.gouv.fr/publications/cout-de-linaction-face-changement-climatique-france-sait

New Zealand (2020) 1st iteration

Duration: 9 months

Ressources: CAD 600,000

Update frequency: 6 years

Status: 1st iteration completed

Resources

Scale(s)

Engagement

Comprehensiveness

	Key aspects	Advantages / Drawbacks	Success factors
Scope	Aims to directly inform the adaptation plan, as required by law, and is also intended for the general public Sustained stakeholder engagement (collaboration between multiple ministries, expert committee, Indigenous consultations, workshops, teleconferences, survey) Strong interconnections with Maori belief and value systems Mandated by the government, managed by a consulting firm and supported by researchers and specialists	Communicate on methods and means helped build awareness and trust and uncovered sources of information unknown to researchers	Keeping the core team united and the roles clear Involving the team in building the narrative of indirect and cascading risks
Methodology	Qualitative climate risk assessment based on vulnerability, around 5 value domains: human, social, cultural, natural, built environment	A comprehensive analysis Use of urgency scores (developed by the UK) Lack of data, especially on social cohesion, use of data from other parts of the world	Developing judgment rules in the absence of data Maintaining a balance between a high level analysis and going beyond direct impacts
Dissemination	Main report and summary for decision-makers available to the public Hosted on the government's website	The ministry has much greater power to disseminate and share information at the national level The ministry has the mandate to disseminate, but it does not have the experience or background to explain everything	Plan for dissemination through a government platform Acquire the necessary expertise to support dissemination and explanation to the general public

Sources: interview, november 2023 ; Ministry for the Environment. (2020). National Climate Change Risk Assessment for Aotearoa New Zealand: Main report – Arotakenga Tūraru mō te Huringa Āhuarangi o Āotearoa: Pūrongo whakatōpū. Wellington: Ministry for the Environment.

Norway (2018) 2nd iteration

Duration: 1 year

Ressources: CAD 150,000

Update frequency: 8 years

Status: 2nd iteration completed

Resources

Scale(s)

Engagement

Comprehensiveness

	Key aspects	Advantages / Drawbacks	Success factors
Scope	Aims to collect existing knowledge on the consequences of climate change for Norway (including the perspective of adaptation), to guide the government Project conducted by a partnership of research centres for the Ministry of the Environment ; project team of 5-7 people + a few authors	Coordination with partners sometimes difficult (distance and timing)	Diversity of expertise on the project team Contact with local governments Manage strong differences of opinion
Methodology	Literature review on the consequences of climate change on society (non-exhaustive), structured around four central issues Interviews with experts and good communication with the environment agency supported the research process Only the RCP 8.5 scenario was used for the analysis	Lots of pre-existing information—easy to gather RCP 8.5 scenario too unrealistic and extreme	
Dissemination	Main report available to the public online Hosted on the government's website	Good level of effort for project needs	

Sources: interview, november 2023 ; CICERO and Vestlandsforsking. (2018). Oppdatering av kunnskap om konsekvenser av klimaendringer i Norge (knowledge update on the consequences of climate change in Norway) URL: https://www.miljodirektoratet.no/globalassets/publikasjoner/m1209/m1209.pdf

United Kingdom (2022) 3rd iteration

Duration: 4 years

Ressources: CAD 3M

Update frequency: 5 years

Status: 3rd iteration completed

Resources

Scale(s)

Engagement

Comprehensiveness


UK Climate Change Risk Assessment 2022

	Key aspects	Advantages / Drawbacks	Success factors
Scope	Produced by the Climate Change Committee, mandated by the UK government Aims to analyze the risks and opportunities resulting from climate change for the UK; the objective is to inform the priorities of the UK government's National Adaptation Programme, as well as the adaptation programs of the devolved administrations Legislative vehicle in place Over 250 stakeholders engaged 15-person project team + contributions from over 450 experts from more than 130 organizations	Legislative vehicle offers scientific independence from government Many stakeholders: many perspectives to reconcile; difficult to manage conflicts	Closely manage the team and stakeholders (investing resources in a clear process is essential)
Methodology	Evidence-based method relying on prioritizing risks and opportunities using urgency scores to identify where action is most urgently needed over the next five years 61 UK-wide risks and opportunities assessed and grouped into 5 sectors: Natural Environment and Assets (18), Infrastructure (13), Health, Communities and the Built Environment (13), Business and Industry (7), International Dimensions (10) Use of three climate scenarios by degree of warming	Urgency scores permit use of multiple types of data and greater transferability	Keep in mind that it always takes longer than one would think and plan for contingencies Focus assessment on necessary actions rather than risk characterization
Dissemination	Technical reports, national summaries (England, Northern Ireland, Scotland and Wales), sector briefings, research projects, recommendations and visualizations hosted on a website, independent of the government		Make communication directly accessible to different groups and audiences

Sources: interview, november 2023 ; University of Exeter led Consortium in partnership with the Met Office. (2021). The Third UK Climate Change Risk Assessment Technical Report. Prepared for the Climate Change Committee, London https://www.ukclimaterisk.org/wp-content/uploads/2021/06/Technical-Report-The-Third-Climate-Change-Risk-Assessment.pdf

British Columbia (2019) 1st iteration

Duration: 1 year

Ressources: CAD 100,000 + consulting

Update frequency: none

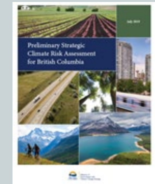
Status: 1st iteration completed

Resources

Scale(s)

Engagement

Comprehensiveness



	Key aspects	Advantages / Drawbacks	Success factors
Scope	Aims to examine climate risks up to 2050 to help the provincial government proactively prepare for climate change A consulting firm was hired to produce the report Project team: one full-time senior member and one part-time junior member	Lack of involvement of Indigenous peoples (requires a much longer timeframe and a specific style of engagement)	Social connections are important Preparing the ground years in advance Political support Indigenous input through consultation must be integrated into the process from the outset
Methodology	Based on the strategic climate risk assessment framework in order to be consistent with the Risk Management Guideline for the B.C. Public Sector (aligned with ISO 31000) Identification and prioritization of various risk events A single time horizon (2050) and a single climate scenario (RCP 8.5)		Take the time needed and avoid an overly simplistic approach
Dissemination	Presentation of risk events as a risk matrix (consequences, likelihood) for 2050 Publication of the main report + summary and framework on the government website		Adapt the vocabulary and prepare the ground for different groups, especially Indigenous peoples Show appreciation and sensitivity and create safe cultural spaces

Sources: interview, november 2023 ; Ministry of Environment and Climate Change Strategy (2019). Preliminary Strategic Climate Risk Assessment for British Columbia. Report prepared for the Government of British Columbia, Victoria, BC. URL: https://www2.gov.bc.ca/gov/content/environment/climatechange/adaptation/riskassessment

New Brunswick (in prep.) 1st iteration

Duration: 18 months estimated in RFP

Ressources: n/a

Update frequency: none

Status: 1st iteration in progress

Resources	Engagement
n/d	n/d
Scale(s)	**Comprehensiveness**
n/d	n/d

In progress

	Key aspects	Success factors
Scope	The province is aware of the risks, RFP released on Nov 16, 2023: project planned to start early 2024 and end in March 2025 (Action 23) The assessment will be used to draw up an adaptation plan, which is also part of the government's climate action plan Stakeholder engagement plan, with First Nations to be incorporated in the risk estimation	Maintain an objective approach that is not subject to political influence Including people from different backgrounds, in-the-field (grassroots) groups and Indigenous groups in determining the content of this document
Methodology	Consistent with ISO31000:2018 or other appropriate Risk Assessment Framework principles Use of a well-being index to assess risk, based on Nova Scotia's methodology, is being considered (see Nova Scotia) or another consensus approach to consider sub-categories such as health and social, economic, environmental and cultural aspects (TBD by successful vendor in collaboration with Dept of Local and Environment Government)	n/d
Dissemination	Consultant will be responsible for sharing the results with internal government stakeholders through a presentation One report to communicate findings effectively to policy makers A complementary public-facing report for Government to share the risk assessment results with the general public A complete risk information library in both languages	Be actionable: include a step to develop an action plan, have information accessible to all types of people so that the information is actionable for everyone It is important to have people on hand to talk about the results, and to avoid relying solely on infographics Work to strengthen trust in government publications

Sources: interview, november 2023 ; Appel à proposition - Request for Proposal #1454002-24 for Provincial Climate Change Risk Assessment – Province of New Brunswick, issue date: November 16, 2023.

Nova Scotia (2022) 2nd iteration

Duration: 2 years

Ressources: n/a

Update frequency: 5 years

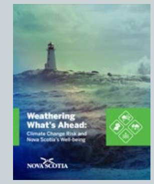
Status: 3rd iteration in progress

Resources

Scale(s)

Engagement

Comprehensiveness



	Key aspects	Advantages / Drawbacks	Success factors
Scope	Aims to inform various levels of government on priorities for adaptation Internal participatory approach (government), with input from others on subject matter content or community viewpoints The methodology, analysis and technical report were designed by a consulting firm, coordinated by the government	Having a dedicated lead on the project provides immersion and focus High level, provincial risk assessments can lack of the level of detail needed to support more local/ sectoral/ departmental decision making	Putting well-being at the heart of the analysis Sustained stakeholder engagement (was challenging during COVID pandemic) Analysis captures disproportionate impacts of climate change
Methodology	Quantitative climate change risk assessment based on climate impacts and their relationship to the well-being of Nova Scotians Well-being is central to the design approach	The well-being approach provides a holistic overview of climate impacts and opportunities Risks are relative and there are no total damage estimates provided	
Dissemination	Main technical report and summary version available to the public Hosted on the government's website	A plain language and technical report can reach different audiences Difficult to communicate technical content and uncertainty in a way that presents risks appropriately to motivate interest and action	Publish the report with a plan for addressing climate change, including both mitigation and adaptation actions Avoid a message focused solely on risks and damage

Sources: interview, november 2023 ; Department of Environment and Climate Change. (2022). Weathering What's Ahead: Climate Change Risk and Nova Scotia's Well-being. ISBN: 978-1-77448-419-7; Eyzaguirre, J., et al. (2022). Understanding Climate Change Impacts in Relation to Wellbeing for Nova Scotia – Synthesis Report. Report prepared by ESSA Technologies Ltd. and collaborators for Nova Scotia Environment and Climate Change.

Ontario (2023) 1st iteration

Duration: 2.5 years

Ressources: CAD 2M

Update frequency: none

Status: 1st iteration completed

Resources

Scale(s)

Engagement

Comprehensiveness

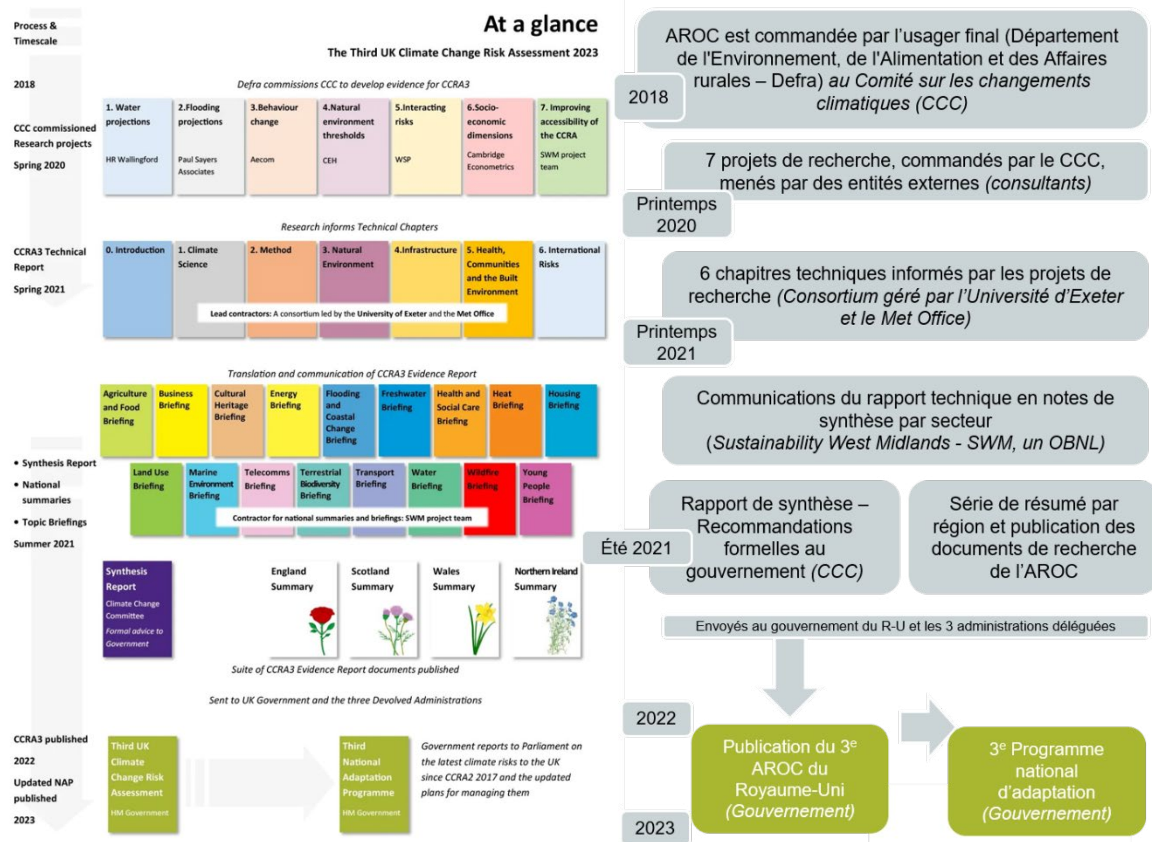
	Key aspects	Advantages / Drawbacks	Success factors
Scope	Aims to help the government, Indigenous communities, municipalities, and businesses make more informed decisions to cope with the regional and sectoral impacts of climate change 3 to 4 managers of a consulting firm; one champion for each specific topic, and a few junior staff members responsible for the literature review; the provincial government acted as an advisory committee	Engagement methods were established and concrete before the evaluation began There were several deliverables dependent on the content of one another, necessitating additional resources and time	Ensure clarity of deliverables with the government Solid project management and relationships Draw up a project contingency plan Mobilize sectoral experts and generalists to provide input at broader levels across the province
Methodology	Semi-quantitative (high-level) assessment of climate change impacts in 6 regions of the province (following census division lines, with the exception of the northernmost region, which was an ecoregion) Based on a risk assessment aligned with ISO 31000; includes an opportunity assessment Use of a socio-economic pathway adapted from SSP2	Regional reports have the advantage of specifying what might be of interest to the different regions Methods enabled a comprehensive assessment of climate impacts across 5 Areas of Focus, analysing more than 3,400 individual scenarios To represent the connectedness and complex interactions between the five Areas of Focus, a detailed cross-sectoral analysis was conducted for five cross-sectoral themes Due to the nature of the methods and categories, along with resource availability, fulsome engagement of Indigenous Peoples and Communities is a limitation of the assessment	Semi-quantitative approach enabled a range of quantitative and qualitative information sources to be applied to individual risk scenarios
Dissemination	Main report and technical report available online on the government's website Presentation of results as a risk/ opportunity matrix divided into sub-systems	Absence of a clear strategy for disseminating the results to different audiences	Plan the project all the way to the end, even if it's difficult at first: consider in advance what the final results should look like Find a way to generate positive results

Sources: interview, november 2023 ; Climate Risk Institute in collaboration with Dillon Consulting Limited. (2023). Ontario Provincial Climate Change Impact Assessment Technical Report. Prepared for the Ontario Ministry of the Environment, Conservation and Parks.

Appendix 3: Examples of good practices

The example of the United Kingdom

The examples of good practices were selected on the basis of what could be applicable in Quebec.



Source: Watkiss, P. and Betts, R.A. (2021) Method. In: The Third UK Climate Change Risk Assessment Technical Report [Betts, R.A., Haward, A.B. and Pearson, K.V. (eds.)]. Prepared for the Climate Change Committee, London

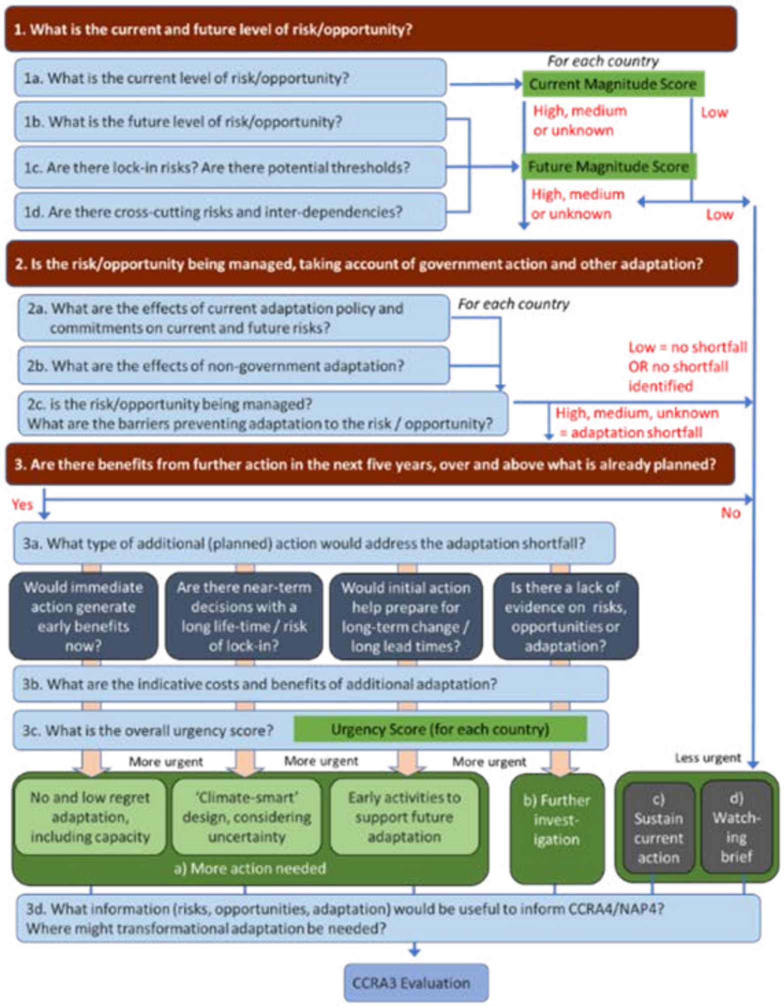
Figure A3.1: Overview of the United Kingdom's third CROA process

The figure above, taken from the UK report, shows the governance and timeline of the third CCRA conducted by the UK. The UK CCRA process is independent and is conducted at the behest of the Department for Environment, Food and Rural Affairs (DEFRA) by the UK Climate Change Committee (CCC), a non-ministerial public body established in 2008 to advise the UK government and parliament on climate change. For this third iteration of the CCRA, the UK has placed greater emphasis on co-design and co-production through participatory development shared by the CCC and the end user, i.e. the government (DEFRA and delegated administrations). The DEFRA also developed a Customer Requirement Document on what was required for this CCRA from the department's perspective, to clarify the needs in terms of governance, basic research, framing, methodology and results dissemination.

The UK CCRA is primarily based on thematic research projects (Figure A3.1), conducted by external consultants and managed by the CCC. From these research projects emerged six technical chapters, written by a consortium managed by the University of Exeter and the Met Office. In an effort to communicate in the most accessible way, the CCC engaged the non-profit organization SWM to evaluate the accessibility of the most recent UK CCRA (the second one) to draw learnings from it and improve the accessibility of the third one through consultations. Once the learnings were extracted, the technical reports were converted into sector-specific briefing notes to better communicate the results. The CCC also produced a summary report with formal recommendations for the government (DEFRA), as well as summaries by region.

Upon completion of its third CCRA, the United Kingdom has shown that governance involving co-design and co-production with the government—while keeping the report independent—seems to be a model that has proven itself over the three CCRAs.

Assigning an urgency score



Source: Watkiss, P. and Betts, R.A. (2021) Method. In: The Third UK Climate Change Risk Assessment Technical Report [Betts, R.A., Haward, A.B. and Pearson, K.V. (eds.)]. Prepared for the Climate Change Committee, London

Figure A3.2: Process for assigning an urgency score

Table 2.2
CCRA3 Risks and Opportunities by Urgency Score (UK-wide scores)

N1 Risks to terrestrial species and habitats	N2 Risks to terrestrial species and habitats from pests, pathogens and INNS	N4 Risk to soils from changing conditions, including seasonal aridity and wetness	N5 Risks to natural carbon stores and sequestration from changing conditions	N6 Risks to and opportunities for agricultural and forestry productivity
N7 Risks to agriculture from pests, pathogens and INNS	N8 Risks to forestry from pests, pathogens and INNS	N11 Risks to freshwater species and habitats	N12 Risks to freshwater species and habitats from pests, pathogens and INNS	N14 Risks to marine species, habitats and fisheries
N16 Risks to marine species and habitats from pests, pathogens and INNS	N17 Risks and opportunities to coastal species and habitats	I1 Risks to infrastructure networks from cascading failures	I2 Risks to infrastructure services from river and surface water flooding	I5 Risks to transport networks from slope and embankment failure
I8 Risks to public water supplies from reduced water availability	I12 Risks to transport from high and low temperatures, high winds, lightning	H1 Risks to health and wellbeing from high temperatures	H3 Risks to people, communities and buildings from flooding	H4 Risks to people, communities and buildings from sea level rise
H6 Risks and opportunities from summer and winter household energy demand	H8 Risks to health from vector-borne diseases	H11 Risks to cultural heritage	H12 Risks to health and social care delivery	H13 Risks to education and prison services
B1 Risks to business sites from flooding	B2 Risks to business locations and infrastructure from coastal change	B6 Risks to business from disruption to supply chains and distribution networks	ID1 Risks to UK food availability, safety, and quality from climate change overseas	ID5 Risks to international law and governance from climate change overseas that will impact the UK
ID4 Risks to the UK from international violent conflict resulting from climate change	ID9 Risk to UK public health from climate change overseas	ID7 Risks from climate change on international trade routes	ID10 Risk multiplication from the interactions and cascades of named risks across systems and geographies	N3 Opportunities from new species colonisations in terrestrial habitats
N9 Opportunities for agricultural and forestry productivity from new species	N10 Risks to aquifers and agricultural land from sea level rise, saltwater intrusion	N15 Opportunities for marine species, habitats and fisheries	N18 Risks and opportunities from climate change to landscape character	I3 - Risks to infrastructure services from coastal flooding and erosion
I4 Risks to bridges and pipelines from flooding and erosion	I6 Risks to hydroelectric generation from low or high river flows	I7 Risks to subterranean and surface infrastructure from subsidence	I9 Risks to energy generation from reduced water availability	I10 Risks to energy from high and low temperatures, high winds, lightning
I13 Risks to digital from high and low temperatures, high winds, lightning	H2 Opportunities for health and wellbeing from higher temperatures	H5 Risks to building fabric	H7 Risks to health and wellbeing from changes in air quality	H9 Risks to food safety and food security
H10 Risks to health from poor water quality and household water supply interruptions	B3 Risks to businesses from water scarcity	B5 Risks to business from reduced employee productivity – infrastructure disruption and higher temperatures	B7 Opportunities for business - changing demand for goods and services	N13 Opportunities to marine species, habitats and fisheries
I11 Risks to offshore infrastructure from storms and high waves	B4 Risks to finance, investment, insurance, access to capital	ID8 Risk to the UK finance sector from climate change overseas	ID2 Opportunities for UK food availability and exports	ID3 Risks to the UK from climate-related international human mobility
ID6 Opportunities (including Arctic ice melt) on international trade routes				

More Action Needed
Further Investigation
Sustain Current Action, Watching Brief

Source: Climate Change Committee, 2021, Independent Assessment of UK Climate Risk Advice to Government, For The UK's Third Climate Change Risk Assessment (CCRA3)

Table A3.1: United Kingdom's third CROA: Risks and Opportunities by Urgency Score (UK-wide scores)

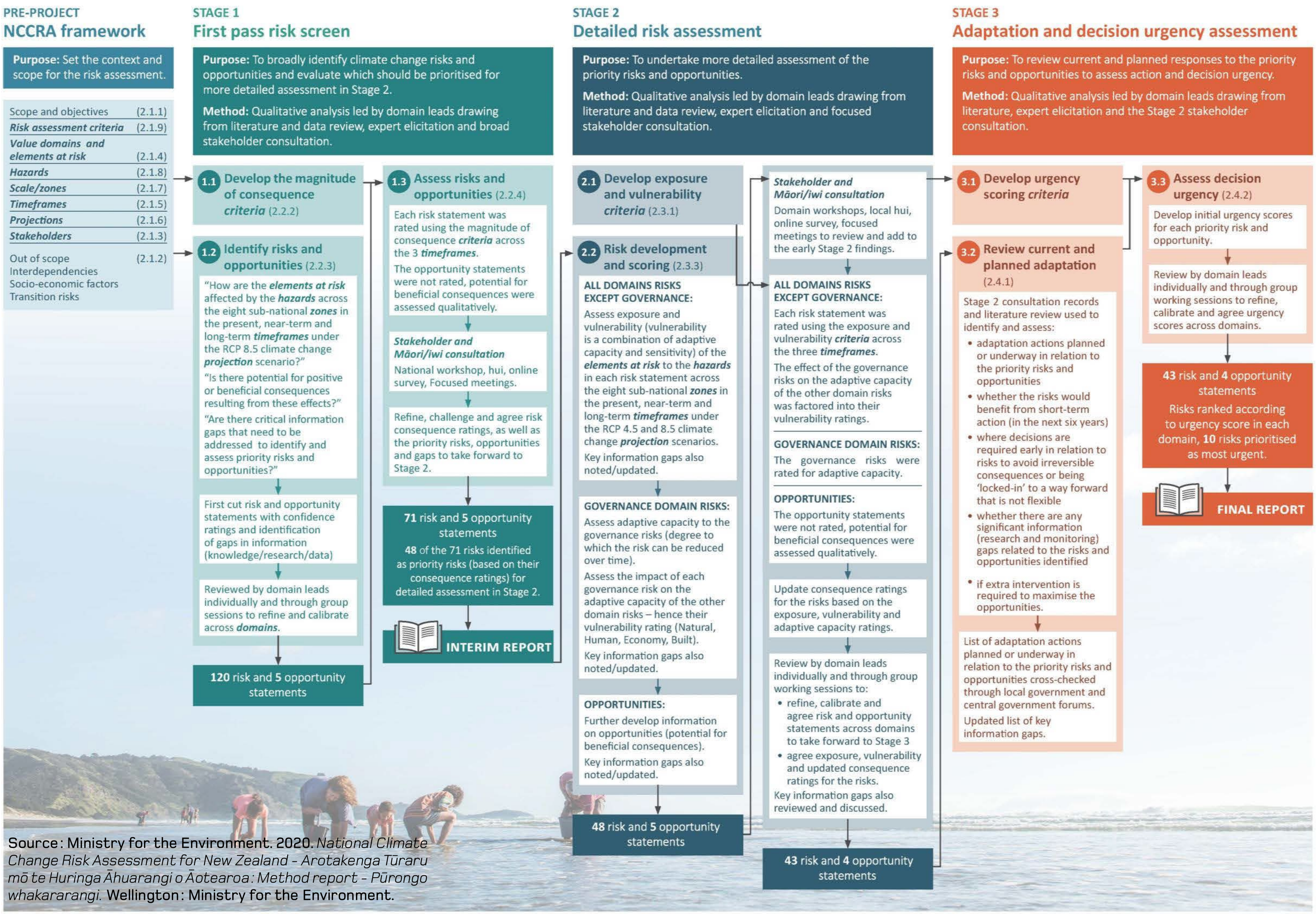
Scoring the urgency is a method developed by the United Kingdom (and adopted by New Zealand), which consists of asking a series of questions to prioritize the risks on which it is most urgent to act in the next five years (i.e. before the next iteration of the CROA and the adaptation plan). This approach also makes it possible to evaluate the impacts of the adaptation measures that are already in place or are being implemented and to decide whether they should be continued or abandoned in the next five years.

The method is presented in a decision tree in three steps, in red, the associated tasks, in blue, pointing to the results, in green.

- The first step here includes an assessment of risks and opportunities that makes it possible to score them (level or magnitude of risks). At the end of the first step, only high risks proceed to the second step.
- The second step identifies the risks and opportunities for which one or more measures are already in place or are being implemented, by which entity, and whether there are any obstacles to implementing them. To determine whether risks and opportunities have already been addressed, an analysis is carried out using a series of criteria (for example, a risk is considered "completely addressed" if there are policies or strategies with objectives and actions that are specific, measurable, achievable, realistic and time-bound (SMART).
- At the end of the second step, risks and opportunities are reassessed, taking current and planned adaptation measures into account to identify the residual risk. Only risks for which there is a lack of adaptation move on to the final step.
- This third and final step consists of analyzing whether risks with adaptation gaps could benefit from more measures in the next five years, in addition to what is already planned, in order to address the remaining risk.

Appendix 3.2: The example of New Zealand

The New Zealand CROA process follows the key steps of the ISO 31000 and 14091 standards, with a first stage of identifying risks and opportunities, then a second stage to analyze the identified risks and opportunities in more detail, and lastly, in the third stage, an analysis of current adaptation measures to better assess the urgency to act (like in steps 2 and 3 of the UK process).



Source: Ministry for the Environment. 2020. *National Climate Change Risk Assessment for New Zealand - Arotakenga Tūraru mō te Huringa Āhuarangi o Āotearoa: Method report - Pūrongo whakararangi.* Wellington: Ministry for the Environment.

Figure A3.3: CROA process led by New Zealand

Figure A3.4:

Risks classified by urgency score (drawn from the New Zealand CROA)

Figure 7: **NCCRA risks arranged by the 'more action needed' category**

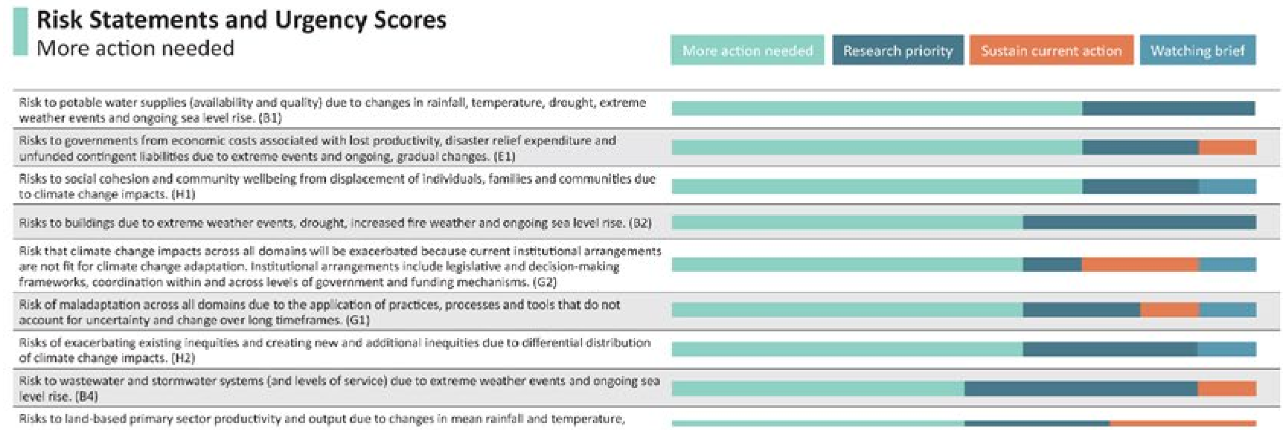


Table 11: Most significant risks and other priority risks in each domain based on urgency ratings

10 most significant risks

Natural environment: Risk	Ratings		
N1 Risks to coastal ecosystems, including the intertidal zone, estuaries, dunes, coastal lakes and wetlands, due to ongoing sea-level rise and extreme weather events.	Urgency		78
	Consequence**	Now	Min
		2050	Mod
		2100	Major
N2 Risks to indigenous ecosystems and species from the enhanced spread, survival and establishment of invasive species due to climate change.	Urgency		73
	Consequence	Now	Mod
		2050	Mod
		2100	Major

Human: Risk	Ratings		
H1 Risks to social cohesion and community wellbeing from displacement of individuals, families and communities due to climate change impacts.	Urgency		88
	Consequence	Now	Min
		2050	Ext
		2100	Ext
H2 Risks of exacerbating existing inequities and creating new and additional inequities due to differential distribution of climate change impacts.	Urgency		85
	Consequence	Now	Major
		2050	Ext
		2100	Ext

Economy: Risk	Ratings		
E1 Risks to governments from economic costs associated with lost productivity, disaster relief expenditure and unfunded contingent liabilities due to extreme events and ongoing, gradual changes.	Urgency		90
	Consequence	Now	Min
		2050	Major
		2100	Ext
E2 Risks to the financial system from instability due to extreme weather events and ongoing, gradual changes.	Urgency		83
	Consequence	Now	Min
		2050	Mod
		2100	Major

Built environment: Risk	Ratings		
B1 Risk to potable water supplies (availability and quality) due to changes in rainfall, temperature, drought, extreme weather events and ongoing sea-level rise.	Urgency		93
	Consequence	Now	Major
		2050	Major
		2100	Ext
B2 Risks to buildings due to extreme weather events, drought, increased fire weather and ongoing sea-level rise.	Urgency		90
	Consequence	Now	Major
		2050	Ext
		2100	Ext

Governance: Risk	Ratings		
G1 Risk of maladaptation across all domains due to the application of practices, processes and tools that do not account for uncertainty and change over long timeframes.	Urgency		83
	Consequence	Now	Major
		2050	Ext
		2100	Ext
G2 Risk that climate change impacts across all domains will be exacerbated because current institutional arrangements are not fit for climate change adaptation. Institutional arrangements include legislative and decision-making frameworks, coordination within and across levels of government, and funding mechanisms.	Urgency		80
	Consequence	Now	Major
		2050	Ext
		2100	Ext

Source: Ministry for the Environment. 2020. *National Climate Change Risk Assessment for New Zealand – Arotakenga Tūraru mō te Huringa Āhuarangi o Aotearoa: Method report – Pūrongo whakararangi*. Wellington: Ministry for the Environment.