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Benchmark study on climate adaptation change policies

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The authors certify that no element of their past or present activities has affected their impartiality in the drafting of this report

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Summary

Extreme weather events, such as droughts, floods, and forest fires, are now occurring with frequency in France, and the summer of 2022 was probably the hottest on record in Europe.¹ Regardless of the results achieved in reducing greenhouse gas emissions, the effects of climate change will keep increasing over the decades to come.

We now possess enough knowledge about climate change to rapidly implement adaptation actions at all levels. The forthcoming draft of an energy and climate planning law that includes a component on climate change adaptation and of a third Plan National d'Adaptation au Changement Climatique (PNACC) (National Adaptation Plan for Climate Change), present an opportunity to spur the mobilisation of public and private actors.

The purpose of this report was to provide a comparative overview (benchmarking) of climate change adaptation policies in eight countries (Austria, Germany, the Netherlands, Spain, Switzerland, Canada, Japan, and the UK). Some forty interviews were conducted with representatives of the ministries and groups concerned in the countries studied and in France; with international organisations such as the European Commission and the Organisation for Economic Cooperation and Development (OECD); and with experts.

The mission identified methodologies common to most of the countries studied; it also identified good practices that sometimes varied from one country to another. A growing awareness of the issues was observed, along with new lines of questioning—even in some of the countries that were first to develop robust methodological frameworks, such as Germany, the UK, and Japan. In all countries, including France, the primary goal is the mobilisation of actors—particularly local authorities, who are on the front line. Not only do they face the full force of adaptation, they are also expected to make significant efforts towards reducing greenhouse gas emissions.

The mission focused on the content of legislative provisions, governance issues (particularly in terms of connecting national and subnational levels), the content of national adaptation plans, and the various elements of the update cycle, focusing on risk assessment, evaluation, and indicators.

The legislative provisions on adaptation adopted by some of the countries in the benchmarking process define the principles of the adaptation plan, as well as its update cycle. Whether required to do so by law or not, the European benchmarking countries have adopted a planning cycle that includes a risk assessment and an evaluation system. Advocated by the UN, this approach is now imposed by regulation No. 2021/1119, the “European Climate Law”.

Broadly speaking, the climate scenario to consider appears in the risk assessment and not in law. Finally, the legislative provisions studied impose very few obligations on entities other than the state, even in a centralised country such as Japan. This lack of obligation is all the more pronounced in federal countries.

Meanwhile, systems are evolving in several of the countries studied: Germany is drafting a new national plan and an adaptation bill, described in the coalition agreement of the parties forming the government. This law should provide for measurable goals to be defined in the adaptation strategy.

The recommendations made by the mission are based on the findings it has made, while also taking France's current situation into consideration.

The mission recommends that French law define the broad outlines of the adaptation plan's content, which should designate those responsible for implementing the measures. The law should also specify the various components of the update cycle, including risk assessment, evaluation, and indicators. Lastly, given the importance of the matter at hand, the plan should mention the climate reference to consider.

¹According to the European Copernicus programme

In terms of organisation at the national level, the mission observed the existence of structured and formalised inter-ministerial coordination in most of the countries studied. It recommends strengthening inter-ministerial steering and entrusting ministries and public agencies with explicit responsibilities, set out in the published action plan.

The content of the plan should be amplified to include the study of the exposure of the most vulnerable populations and high-risk territories. It should spur policies to protect water and biodiversity and prevent natural risks. Sectoral adaptation plans should be developed, under the framework of initiatives launched by the relevant ministry and the environment ministry, such as the “Varenne agricole de l’eau et de l’adaptation au changement climatique” (water and climate change adaptation forum) and the Assises de la forêt (forestry conference). The plan should also ensure that the effects of global warming accounted for in technical standards and reference systems.

The mission recommends that the national risk assessment be conducted in parallel with the drafting of the third PNACC, in order to optimise the schedule and ensure that the evaluation of the PNACC's implementation is conducted in a participatory manner, thereby helping to mobilise stakeholders. It also recommends the establishment of a balanced set of indicators, including impact indicators that reflect the effects of climate change, and result indicators that illustrate not only the actions carried out under the plan but also, where possible, their effects.

For the vast majority of subjects (development, transport, water, housing, etc.), adaptation action is to be implemented at the local scale: it is therefore fundamental that the impetus given by the national planning framework is translated into operational tools made available to the territories.

In several countries, including federal countries, the mission observed the existence of a working community, sometimes long established, between the state and the regions. It recommends establishing such working groups to handle technical aspects. At regional level, the mission recommends entrusting prefects with the task of setting up a dialogue system that includes groups at all levels, with a view to streamlining territorial action in conducting local risk assessments and ensuring the coherence of adaptation under the “Plans climat-air-énergie territoriaux” (PCAET) (Territorial climate air energy plans) and the “Schémas régionaux d’aménagement, de développement durable et d’égalité des territoires” (SRADDET) (Regional plans for planning, sustainable development, and territorial equality regional development), and coherence in the implementation of these plans.

The mission noted that many states assist local authorities by leveraging two drivers: financial incentives and methodological and technical support. This support notably includes the engineering expertise required to make risk assessments and action plans. In France, such support could be provided in the performance of risk assessments and the development of the PCAET and SRADDET adaptation components. In addition, the resource centre set up by ONERC, Météo-France, ADEME, and CEREMA should be developed by further streamlining the action of these institutions, in view of giving stakeholders access to tools for analysing the consequences of climate change, at local scale, and for assisting the decision-making process involved in developing action plans.

List of recommendations

- Recommandation 1. (MTECT and MTE) In the forthcoming energy-climate bill, include a section on adaptation specifying the stages of the national planning cycle, the responsibilities of the actors, the coordination system, the reference climate scenario applicable to risk assessments, the PNACC, SRADDET, and PCAET, as well as sectoral guidelines. 17**
- Recommandation 2. (SGPE and MTECT) Devote at least half of the credits from the ecological transition support fund to financing the adaptation policy of regional and local authorities and then register the credits required in a multi-annual planning law. 17**
- Recommandation 3. (SGPE and DGEC) Build a structured organisation at national level to support inter-ministerial steering of the national plan, sectoral approaches at the level of the ministers concerned, and consultation..... 21**
- Recommandation 4. (DGEC and regional prefects) Establish a working community on adaptation: at the national level, between the central government and the regions; and, in each region, between the central government and the regional and local authorities. 23**
- Recommandation 5. (MTECT) Provide financial support from the state, through the ecological transition support fund, for risk assessments and the development of action plans to strengthen the SRADDET and PCAET adaptation components..... 24**
- Recommandation 6. (DGEC, with SG support) Mobilise the Ministry of Ecological Transition and Territorial Cohesion operators to reinforce the integrated set of climate services available in order to help regional and local authorities and companies develop assessments and action plans. 25**
- Recommandation 7. (DGEC) Propose, in law, a climate reference expressed in the form of temperature rises and based on two IPCC scenarios: a moderate scenario and a more pessimistic scenario..... 30**
- Recommandation 8. (DGEC, supported by SG) Organise the mobilisation of operators from the Ministry of Ecological Transition and Territorial Cohesion (CEREMA, Météo-France, ADEME in particular) to assist economic actors, critical infrastructure managers, and the regional authorities of the most high-risk territories in conducting risk assessments and stress tests. 33**
- Recommandation 9. (DGEC) In future climate change adaptation plans, include specific measures relating to the most vulnerable populations and territories, as well as cross-border impacts such as climate migration or disruption of supply chains. 38**

Recommandation 10. (DGEC) Include in the future climate change adaptation plan a grid for implementing the actions to be undertaken over the course of the plan's duration: quantified goals where possible, supervisor and associated persons, schedule, monitoring indicators, budget. 39

Recommandation 11. (MTECT) Complement national water roadmaps with measures on sectoral water-saving plans, the development of early warning systems for natural hazards, and the organisation of a debate about the desired level of protection of people and property. Whenever possible, conduct cost-benefit analyses in support of these programmes..... 49

Recommandation 12. (MEFSIN and MTECT) Strengthen the involvement of the banking and insurance sectors, by developing a structured dialogue that includes risk assessment and data sharing, while instilling greater consideration of climate change adaptation in “green finance” 51

Recommandation 13. (CGDD, DGEC, DGPR, DGALN, DGITM, DGE and AFNOR) Ensure that the impacts of climate change are systematically taken into account when developing and revising technical standards and reference systems, particularly those relating to infrastructure and buildings..... 53

Introduction

Extreme weather events such as droughts, floods, and forest fires are now occurring with frequency in our territory and, according to the European Copernicus programme, the summer of 2022 was the hottest ever recorded in Europe. We now possess enough knowledge about climate change to take action and prepare our territory for the inevitable changes.

The climate projections produced by Météo France in 2021 predict a rise in temperatures of 2.2 degrees in France in 2100 based on the “middle of the road” RCP 4.5 scenario issued by the Intergovernmental Panel on Climate Change (IPCC). However, according to a study published in October 2022 by a group of scientific institutions, including the Centre national de la recherche scientifique (CNRS) (France's National Centre for Scientific Research) and Météo France, this scenario could result in a temperature rise of up to 3.8 degrees in France by 2100².

Despite these uncertainties (that are less pronounced for projections to 2050), we now have sufficient knowledge about climate change to take action and prepare our territory for the inevitable changes.

Like other European countries, France has been engaged in a process of climate change adaptation for the last fifteen years or so. France launched its initial adaptation strategy in 2006. A first national plan was adopted in 2011 and a second in 2018. In spite of these successive plans and many local initiatives, however, the process of gearing up to large-scale action has been slow. This is also the case in the other benchmarking countries.

The 2019 energy-climate law provides that the government shall develop a legislative proposal on planning in 2023, setting the principal targets for energy. This proposal could be expanded to cover climate policy, including the aspect of adaptation. It is also in 2023 that the national adaptation plan is to be revised.

It is in this context that the Ministre de la transition écologique (MTE) (Ministry for Ecological Transition) instructed the CGEDD—by letter dated April 11, 2022—to carry out a benchmarking mission on climate change adaptation in Europe and internationally. This assignment was entrusted to Patricia Blanc, General Engineer of Mines; Bernard Schwob, General Engineer of Bridges, Waters, and Forests; and Marc Strauss, Inspector General of Sustainable Development Administration.

The mission statement emphasises that adaptation is by nature an eminently cross-cutting topic, since climate change affects many sectors of activity and natural environments. Moreover, the actions to be carried out very often come under the remit of local authorities. The mission therefore brought its research to bear on the organisational structures adopted at the national level, including inter-ministerial action and government agency activities. It examined how the connections between national and subnational levels could be used to effectively mobilise local and regional authorities.

Eight countries were investigated in the mission's benchmarking work, presenting a wide variety of organisational structures: Germany, Austria, Switzerland, and Canada, which are federal states; Japan, a unitary state; Spain, the Netherlands, and the UK, which have an intermediary political system.

In several of the countries studied, the established systems are undergoing changes. Germany and Switzerland are preparing new climate laws; the UK and the Netherlands are preparing new adaptation plans; and Canada is preparing its first strategy at federal level.

²Study published on October 4, 2022, in the journal *Earth System Dynamics*.

For its international research, the mission primarily consulted those involved in adaptation policymaking in ministries and environment agencies, as well as policymakers at the European Commission. In some countries, the mission broadened dialogue to include representatives of sub-national regional and local governments or the authorities tasked with evaluation. In France, it also consulted the administrations and agencies concerned, alongside experts and actors in the field, in view of determining the feasibility of the envisaged recommendations. Some forty interviews were conducted, based on preliminary documentary work. In addition, a multi-country workshop on the topics in question was held in collaboration with OECD.

The first section of the report presents the legislative provisions adopted or planned.

The second section deals with the organisation established at national level, particularly at inter-ministerial level, as well as relations between the state and sub-national levels (regions and municipalities): collaborative work, provision of resource centres and methodological tools, financial support.

The third section details the actual adaptation plans, as well as their toolboxes, comprised of risk assessments, together with their climate scenario hypotheses, evaluation system, and indicators used.

The following sections provide examples of sectoral adaptation approaches: water, flooding and biodiversity, the financial sector, update of standards and technical regulations.

This benchmarking task naturally led the mission to make recommendations for the draft of the next national plan. Needless to say, the work carried out by the mission does not constitute a comprehensive evaluation or even analysis of the current plan's implementation or its content; as opposed to the work completed by the CGEDD in its mission to evaluate the first adaptation plan³, or the senate report entitled “Adapter la France aux dérèglements climatiques à l’horizon 2050” (“Adapting France to climate change by 2050”).⁴

³G. Caude, P. Lavarde, M. Viora, M. Guespereau, Evaluation of the National Climate Change Adaptation Plan, November 2015.

⁴Senate Information Report, by R. Dantec and J-Y. Roux, on “Adaptation de la France aux dérèglements climatiques à l’horizon 2050”, May 2019.

1 Several countries have adopted legislative provisions for adaptation

1.1 Existing or planned legislative provisions are largely drawn from planning laws

1.1.1 Existing laws

Half the countries examined in the benchmarking process have integrated climate change adaptation into their legal corpus, via cross-cutting provisions that, for the most part, are contained in broader climate laws (this is the case for the UK, Spain, and Switzerland). Japan has a complete law specifically on adaptation. The consequences of climate change have also been gradually integrated into sectoral legislative frameworks (water, nature, impact studies, urban planning, natural risks in particular).

Cross-cutting provisions generally set out a roadmap at national level and are seldom binding towards third parties—local authorities and companies in particular. They act more like planning laws.

The cross-cutting provisions that tend to be adopted concern:

- Conducting risk assessments;
- Planning;
- Governance;
- Funding.

These provisions are detailed in paragraph 1.2 below.

The Japanese law on climate change adaptation of June 13, 2018⁵ is one of the most comprehensive laws on the subject and contains some twenty articles. In Spain's case, the 'adaptation' section of the national climate law⁶ is comprised of ten articles addressing the conventional cross-cutting provisions and guidelines to consider in sectoral policies (water, coastline, territorial management and urban planning, food security, health, biodiversity, agriculture, forests, renewable energies, identification and mapping of carbon sinks). These sectoral provisions are addressed to the "administrations concerned", including at subnational level. As a last example, the adaptation chapter of the British Climate Act of 2008⁷, with fourteen articles, is also fairly detailed in terms of governance and methodological framework.

In federal countries, some entities have enshrined their plans, or other adaptation provisions, in a "regional" climate law (Länder in Germany, states in the US, provinces in Canada, some Spanish Autonomous Communities such as Catalonia; and, in the UK, following devolution, Scotland, Northern Ireland, and Wales).

At present, Swiss regulations are distinguished by a reporting measure: the 2012 ordinance, issued under the 2011 "Federal Act on the Reduction of CO2 Emissions", provides that the cantons shall "inform the Federal Office of the measures they have taken [concerning adaptation]". The mission did not identify other countries that have this kind of mandatory reporting provision; however, several countries do have an effective system for centralising information related to local plans. Examples include Japan, whose environment agency (NIES) has a website called "A-PLAT", on which it publishes adaptation plans developed at the level of prefectures and municipalities; and the US, with the platform managed by the Georgetown

⁵Japan, Law 2018/50 of June 13, 2018

⁶Spain, Law 7:21 of May 20, 2021

⁷UK, Climate Change Act of November 26, 2008

Climate Center. The Spanish platform *Adapte-CC* is also very comprehensive.

Finally, at European level, there is the Climate Adapt platform, that contains information provided by Member States as part of the reporting obligation established by European Community Law.

At European scale, Regulation 2021/1119 known as the “European Climate Law”, that implements the Paris Agreement, devotes an article to adaptation (Article 5). This provision provides that “Member States shall adopt and implement national adaptation strategies and plans that take the Union's climate change adaptation strategy into account; are based on sound climate change and vulnerability analyses, progress evaluations, and indicators; and are guided by the best available and most up-to-date scientific evidence”. This article also provides for the European Commission to adopt adaptation guidelines by July 2022, notably for the identification of risks. The Directorate-General for the Environment (DG ENV) has prepared a first draft, that is currently under discussion with the Member States.

The EU's “Fit for 55” climate package, currently under negotiation, does not include an adaptation text, aside from enhancing financial instruments, such as LIFE, that support adaptation projects in particular.

1.1.2 Draft legislation

Acknowledging the inadequacies of the system in place, the German government plans to remedy them through legislation. The coalition agreement between the parties forming the current government has approved this project. The law should define the framework for collaborative action by the federal state and the Länder, while establishing joint funding to support local actions.⁸ The draft law is expected in 2023. Sectoral legislation (particularly on soils and floods) is also projected.

The Austrian environment ministry is also planning to prepare a draft law, but the schedule has yet to be established.

In Switzerland, a draft law was prepared with the intention of supplementing the 2011 law that provides for the confederation and cantons to be “jointly responsible” for coordinating adaptation measures. The bill was rejected by vote in 2021. The Swiss authorities are working on a new text.

1.2 These laws set out relatively similar planning cycles for adaptation.

1.2.1 National risk assessments

Several countries have legislation providing that a risk assessment at national scale should precede the draft of the adaptation plan. This is the case for the UK, Spain, and Japan. The law also tends to provide a five-year review cycle in order to allow for advances in knowledge.

The UK's 2008 “Climate Change Act” entrusts the Department for Environment, Food and Rural Affairs (DEFRA) with the task of conducting the assessment, based on the work carried

⁸In some federal countries, like Germany, the establishment of financing jointly provided by central and regional government bodies for other actors (such as municipalities) raises complex legal problems: according to some analyses, constitutional changes may be required.

out by the Climate Change Committee (CCC), the counterpart of the France's Haut Conseil pour le Climat (High Council on Climate). The assessment forms the basis for the “national plans” of England, Scotland, Northern Ireland, and Wales.

The Japanese law of 2018 assigns the risk assessment to the environment ministry, after consultation with the Central Council for the Environment. At the same time, it entrusts the National Institute for Environmental Studies (NIES) with the task of collecting information on the impacts of climate change and making it available to regional and local authorities, companies, and the general public.

In some cases, local authorities and business are invited by law to conduct such assessments at their own level (notably in Japan).

1.2.2 Planning at national and local levels

The adoption of a national adaptation strategy or plan is the flagstone of cross-cutting legislation on adaptation. Under UK law, the adaptation plan must define the UK Government's goals, specify the proposals and policies to achieve those goals, and address the risks identified in the risk assessment (article 58 of the “Climate Change Act”). In their national legislation, Spain and Japan detail the content and method of elaboration of their national adaptation plans, including a list of topics to be addressed, the persons involved in elaborating the plans, and the evaluation method.

More rarely, the law invites local authorities to create such plans. The mission did not identify any cases where the law would seem to formulate an obligation in an imperative manner.

Thus, Japanese law provides that prefectures and municipalities “shall endeavour” to draw up plans. In practice, 46 out of 47 prefectures have published their plans. This invitation seems to have been followed up effectively at the prefectural level, but less so at the municipal level: from a total of 1,700 municipalities in Japan, only about a hundred plans have been drawn up. It is in major cities (Tokyo, for example), or nearby, that plans are actually drawn up. There is no specific financial system set up by the state to help cities carry out their plans.

In Germany, a law of the Land of Bavaria recommends that municipalities develop an adaptation strategy and implement the corresponding measures.

UK law and the draft law envisaged in Germany lay down the principle of defining adaptation goals in the adaptation plan or strategy. In Germany, this would involve setting 20 to 30 measurable goals, divided into several main areas: water, infrastructure, soil and biodiversity, health, agriculture, and the economy. Japanese law provides that the “fundamental goal” of adaptation policy shall be set out in the plan.

No country has set in law the climate reference to be considered when drafting the plans, despite the fact that this reference is used in the risk assessment. The mission believes that including a definition of the climate reference in adaptation law could enhance the required mobilisation of all actors whilst also providing them with the coherence framework they need in order to act. Chapter 3.2 of this report presents the various options for defining such a reference and a recommendation to that effect.

1.2.3 Governance

The law sometimes provides for the establishment of advisory committees: in Japan, for instance, regional committees may be set up, involving local authorities, companies, etc. These committees may refer any question to the National Institute of Environmental Studies, that must then provide them with technical assistance. At the national level, this law provides that the Central Council for the Environment should be involved throughout the entire planning process. By and large, however, governance issues (in the sense of consultation and implementation arrangements) tend to be handled outside the legislative framework (see

1.2.4 Costing and financing

Financial provisions are usually processed via specific legislative vehicles (budget). Several countries, such as the US, the Netherlands and Canada, have set up significant cross-cutting funds to finance adaptation.

The US Inflation Reduction and Climate Change Act of August 2022, that frees up a total budget of 362 billion over ten years, allocates nearly 30 billion to financing adaptation projects in the fields of water, agriculture, and forestry.

In the Netherlands, a financial scheme for a total amount of 600 million—one third of which is provided by national environment ministry and two-thirds by the has been allocated to local adaptation projects, adding to the already very substantial funding of the Delta Programme on water that includes flood protection (on average 1.4 billion per year over the period 2022-2035). In Quebec, federal funds are supplemented by revenues from the province's carbon market.

More broadly, it appears that the favoured mode of intervention in North America (Canada and the US) to encourage action at subnational level is through major federal financial programmes, rather than through other means (legal, technical, etc.). In this region, the most proactive states and provinces (California, British Columbia, Quebec, etc.) began to take adaptation action ahead of the central government.

The establishment of these budgets, corresponding to “no regrets” measures (financing of studies, strengthening of water policies, natural risk prevention, forest protection, etc.), is not yet based on exhaustive assessments of the cost of adaptation.

As Ronan Dantec and Jean-Yves Roux pointed out in their 2019 report, this is firstly due to the large number of stakeholders involved and the rather diffuse nature of the costs. Another reason is that it is often difficult to distinguish costs specific to adaptation when costing current policies for improved resilience, since such policies have a variety of goals to attain.

The study published in June 2022 by the I4CE association ⁹on the costs of adaptation in France proposes an initial costing of specific adaptation measures (for instance, the financing of facilitators to assist regional and local authorities in the preparation of risk assessments and adaptation plans) or measures that can be taken immediately since they come under the “no regrets” category (strengthening policies to protect water resources and forests, prevent natural risks, ensure civil security, decrease the urban heat island effect, take account of future climate in construction, and so on).

I4CE estimates the additional cost of this first set of 18 measures at 2.3 billion euros per year, while indicating that the adaptation policy shall not be restricted to this initial stage; and that the ensuing decisions, which will be more structuring, shall require in-depth debate (evolution of agricultural and tourism models, organisation of solidarity towards the most affected territories, particularly the coastline, the French overseas territories, and mountainous areas).

The mission considers that, despite the difficulty of working out an overall estimate of adaptation costs in advance, this task of quantifying needs (and matching them with the financial resources available or to be mobilised) is essential if we are to build a shared vision of France's adaptation pathway. Like the approach proposed by I4CE, such work—even if it is

⁹I4CE June 2022, “Se donner les moyens de s’adapter au changement climatique en France : de combien parle-t-on ?” (“Ensuring sufficient means to adapt to climate change consequences in France: What are the costs?”) ”

only partial or built in stages—could feed a draft law on multi-year finance planning for the ecological transition as early as next year.

1.2.5 Sectoral guidelines

In a few countries, the adoption of cross-cutting legislative provisions on adaptation has made it possible to supplement sectoral legislation such that it brings climate change impacts into consideration:

- This has been the case in Spanish law on water resources planning and management, the coastline and coastal public domain, territorial and urban planning, food security, health, and biodiversity;
- with regard to the draft law envisaged by Germany, the coalition agreement announces specific national provisions, notably on flood prevention (that largely came under the Länder's remit until now) and soil protection, with the announcement of a new federal law aligning the fight against climate change with restoration of biodiversity.

Such sectoral guidelines could also be required for French regulations, particularly in the areas of environment, health, urban planning, and transport: it would be useful to conduct a review of the current provisions of these regulations to check that climate change impacts are indeed taken into account.

To conclude this section, the mission considers that, even if a specific legislative framework on adaptation is not mandatory for action, discussing the possibility would open up a debate in Parliament on the goals and means of such a policy, and would speed up mobilisation: this has indeed been the case for the main European countries studied. Such legislative provisions could address the following points: :

- the various stages of the national planning cycle, including risk assessment, the plan itself, and the plan's evaluation;
- the responsibilities of the actors (ministerial departments, state operators, a national council for adaptation to climate change—that would be created from the current specialised commission of the Conseil national de la transition écologique (CNTE) (National Council for Ecological Transition)—, local authorities, companies, and even the general public);
- a system with three levels of coordination: at national level, firstly at interministerial level and secondly between the state and the regions; and at regional level, between the decentralised state and the various local authorities (region, departments, établissements publics de coopération intercommunale, EPCI) (Public Institutions for Inter-municipal Cooperation);
- the climate reference to be considered in risk assessments and national, regional, and local plans. The reference recommended by the mission is the intermediate scenario, corresponding to a global temperature rise beyond the 2°C target of the Paris Agreement (see point 3-2);
- sectoral guidelines, following a review of the relevant regulations, in areas particularly sensitive to climate change.

Additionally, in order to provide for the financing of actions to be carried out by local authorities, at least half of the credits from the ecological transition support fund currently being finalised could be devoted to adaptation.

At a later stage, including these resources in a multi-annual planning law would give the actors involved the visibility they need.

Recommendation 1. (MTECT¹⁰ and MTE¹¹) In the forthcoming energy-climate bill, include a section on adaptation specifying the stages of the national planning cycle, the responsibilities of the actors, the coordination system, the reference climate scenario applicable to risk assessments, the PNACC, SRADDET, and PCAET, as well as sectoral guidelines.

Recommendation 2. (SGPE¹² and MTECT) Devote at least half of the credits from the ecological transition support fund to financing the adaptation policy of regional and local authorities and then register the credits required in a multi-annual planning law.

¹⁰Ministère de la transition écologique et de la cohésion des territoires (MTECT) (Ministry of Ecological Transition and Territorial Cohesion)

¹¹Ministère de la transition énergétique (MTE) (Ministry of Energy Transition)

¹²Secrétariat général à la planification écologique (SGPE) (General Secretariat for Ecological Planning)

2 The governance of adaptation policy must reflect the urgency of collective mobilisation

2.1 Inter-ministerial governance could be improved following the examples of other countries

Within their governmental structure, all the countries studied by the mission identified a lead ministry for adaptation (which happens to be the environment ministry in all the countries studied) responsible for mobilising the various ministries concerned, sector by sector. In Germany, while the economy ministry is currently in charge of climate (and therefore mitigation), it is still the environment ministry that steers adaptation.

At the time the mission had access to the information, it found that the organisations studied all had an adaptation unit, usually resembling the National Observatory on the Effects of Global Warming (ONERC)¹³ in terms of staffing:

- In Japan, the Climate Change Adaptation Department of the environment ministry (MOE) is located within the Central Council for the Environment. Its head of department has the title of director and the department is composed of a dozen people,
- In Canada, a Director of Adaptation is identified within the climate change branch of the environment and climate change ministry,
- In Germany, adaptation is handled by a unit of eight people, within the “transformations: digital, circular economy, adaptation” department of the Federal Ministry for the Environment, Nature Protection, Nuclear Safety, and Consumer Protection (BMUV);
- In Spain, adaptation is handled by the Spanish climate change office (Sub-Directorate-General for the Coordination of Climate Action), holding the rank of director-general within the ecological transition ministry in a unit of equivalent size,
- In the UK, the “Climate Adaptation” service is a unit of the Department for Environment, Food, and Rural Affairs (DEFRA).

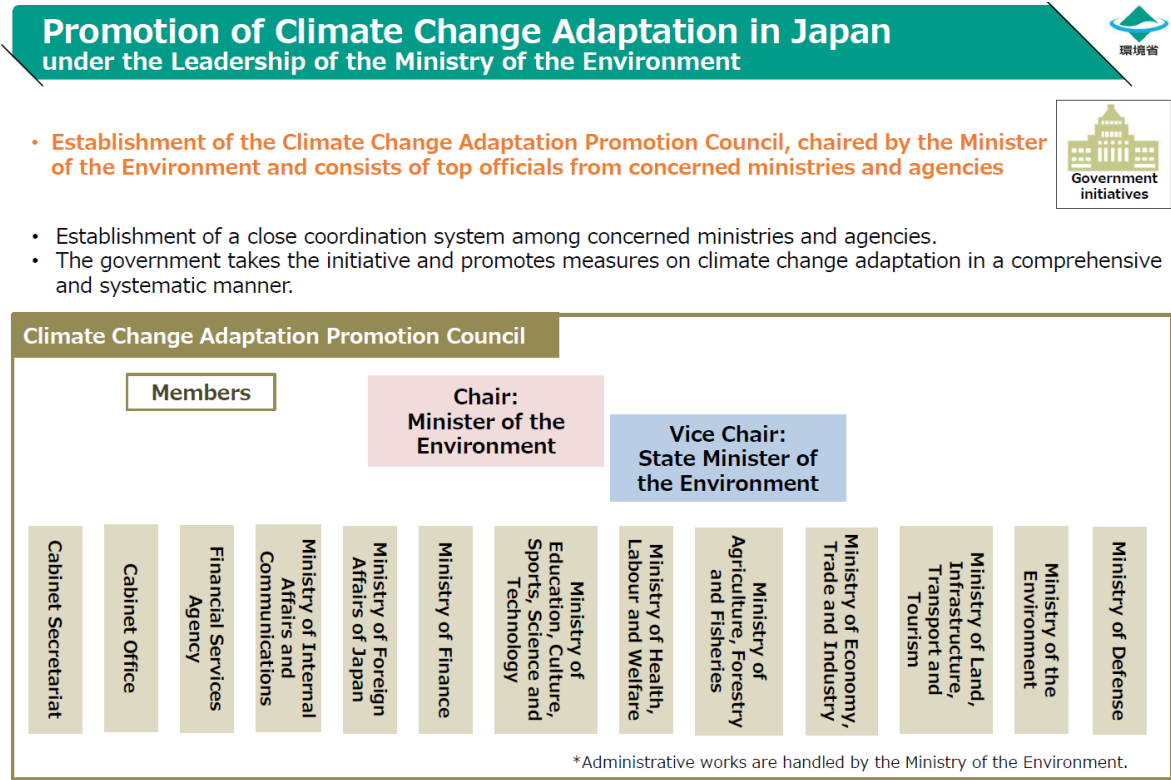
In several of these countries (e.g. Austria, Germany, Japan, UK), the work of the environment ministries is supported and complemented by national agencies that play an important role in the development and implementation of climate change adaptation policies. These agencies often have more human resources than the ministries. For instance, the English Environment Agency (which therefore does not cover Scotland, Wales, or Northern Ireland) employs 10,000 staff.

The mobilisation of all ministerial departments and the integration of the consequences of climate change into the activities within their field of competence are generally identified in national strategies as decisive in achieving the goals.

¹³ONERC is a sub-directorate of the DGEC that belongs to the Climate and Energy Efficiency Department. The scope of the corresponding units in the countries studied, and more specifically the exact number of FTEs dealing exclusively with climate change adaptation action, could not be analysed in detail. However, we can basically conclude that, overall, they are similar to ONERC, in some cases with a slightly greater number of staff.

In general, therefore, an inter-ministerial body is tasked with steering the implementation of the adaptation plan, under the chairmanship of the environment minister. This is the case in Japan, where a “Climate Change Adaptation Promotion Council” has been set up, chaired by the environment minister himself and involving twelve ministries and government agencies. This Council met for the first time at the end of 2018 and five times thereafter.

Figure1: Japanese Inter-Ministerial Adaptation Council



Source: Japanese environment ministry

In Canada, this function is fulfilled by the “Directors General Accommodation Policy Steering Committee” (DGAPSC). It is chaired by the Strategic Policy Director of environment and climate ministry, who reports to the Deputy Ministers' Committee on Climate Change, Energy, and the Environment.

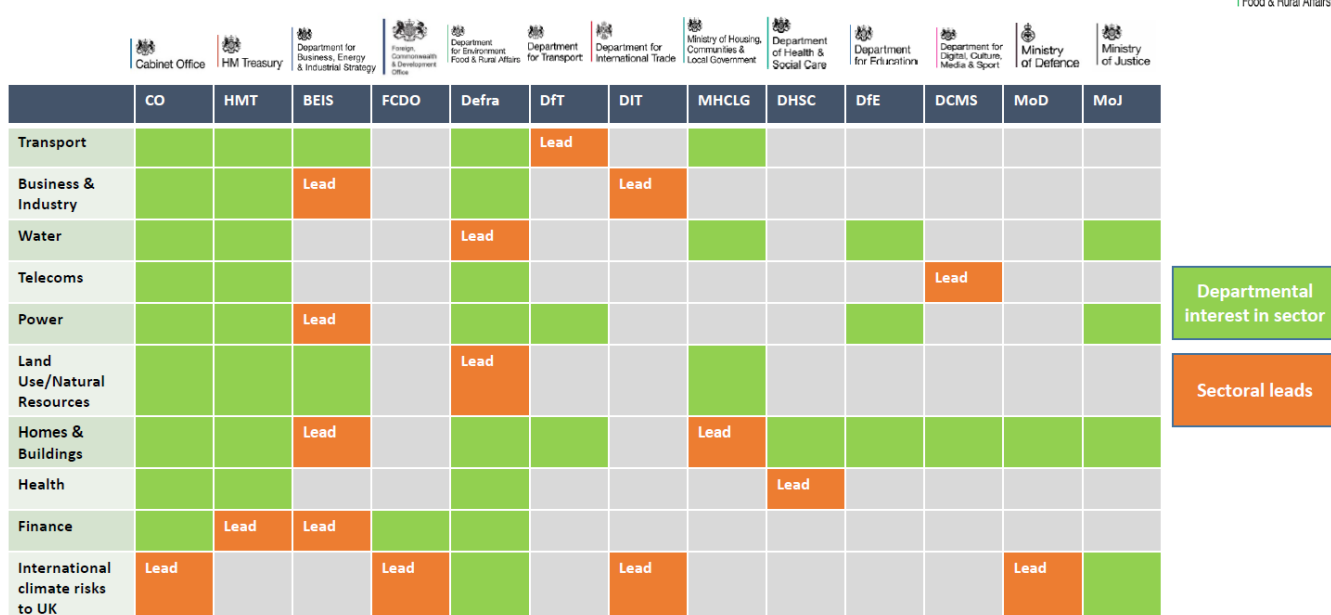
In Germany, an “inter-ministerial working group on adaptation to climate change”, chaired by the head of the unit tasked with adaptation at environment ministry, brings together all ministries. According to the mission's contacts, the work is efficient and relatively consensual, more so than in the field of mitigation.

Similar organisations exist in Spain and Austria.

In the UK, the organisation shows a particularly clear division of responsibilities (with a designation for each action of the lead actors and associated ministries) and a fairly broad scope, notably including the economy and treasury ministry.

Figure2: Governmental structure for adaptation in the UK

Tackling climate change is a whole of government challenge



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Source: English environment ministry (DEFRA)

In some countries, government ministries and agencies have been invited to make their own adaptation plans, on their scope and at all their locations. This is particularly the case in the US, where, for example, the national environment agency (US EPA) has a very comprehensive adaptation plan available for consultation, reviewing all its activities and facilities.

Areas that bring together the stakeholders involved in drawing up plans (companies, experts, NGOs, the public, etc.) tend to be more heterogeneous; and it seems that they do not systematically exist for adaptation issues. These areas are usually active during the planning phase, but it is hard to determine whether they continue to be active afterwards.

In Spain, for example, the government has set up a fairly structured system of working groups with civil society at national level, to monitor the plan's implementation after the drafting process. More broadly, Spain shows a great willingness to consult stakeholders and the general public in all its strategic documents.

In any case, political impetus is clearly pivotal everywhere in driving mobilisation and effective action, beyond the intentions stated in the national plans: this is because environment ministries do not have the capacity to implement such actions on their own—they depend on the involvement of other ministries along with regional and local authorities.

Exactly what organisation turns out to be most effective in this domain naturally depends on the culture and practices of each country. Everywhere, however, the involvement of ministers themselves is considered essential. In France, the first mobilisation was brought about by the agricultural “Varenne de l'eau et de l'adaptation au changement climatique” (water and climate change adaptation forum) and the “Assises de la forêt” (forestry conference), conducted in 2021 and 2022. It would be possible to amplify such mobilisation by replicating these steps in other sectors, especially now that attitudes have changed in the aftermath of the drought

and heat waves of 2022. With the building of ecological planning sites underway, we now also have a opportunity to bring the various sectors concerned into line.

It would be imperative to associate such exercises with various ministerial departments, under the aegis of the SGPE, including: the Ministry of Economy and Finance (for industry, tourism, and financial sectors); the Ministry of Health and Prevention; the Ministry of Culture (for the protection of heritage); and the Ministry of the Interior and Overseas Territories (for risks specific to the overseas territories, climate migration, and early warning systems on natural disasters).

Ministries (Ministry of Ecological Transition and Territorial Cohesion) and ministers concerned would be asked to lead the work of diagnosis and roadmap development at their level, working with the major sectors, notably agriculture, industry, banking, insurance, health, culture, and tourism.

A cross-cutting group composed of the central government directors concerned would be tasked with monitoring the drafting of the plan, its implementation, and its evaluation. Beyond steering the plan itself, this group could oversee any regulatory changes needed to facilitate action, based on the needs expressed by regional and local authorities and decentralised services.

The CNTE's specialised commission would be renamed the “National Council for Adaptation to Climate Change” and involved in all stages of the process.

A broad consultation would be organised with the actors concerned and the general public.

The competent entity to coordinate and stimulate this system is the ONERC (National Observatory of the Effects of Global Warming). It may be worth renaming this entity, to make it clear that the time for mere observation has passed and it is now time for action. Consequently, it is important that ONERC firmly positions itself as an entity in charge of steering the PNACC both in an inter-ministerial dynamic and in connection with the various public institutions to be mobilised and coordinated.

Recommendation 3. (SGPE and DGEC) Build a structured organisation at national level to support inter-ministerial steering of the national plan, sectoral approaches at the level of the ministers concerned, and consultation.

2.2 A working community between the state and the regions has been established in several of the benchmarking countries

The national and territorial organisations of the countries studied differ widely not only according to whether or not they are federal, but also according to their size and the central government's mode of intervention.

The manner in which the different levels interact depends on these contexts even though, in all cases, it appears that the central government's mode of intervention at the regional and local levels mainly takes the form of financial, technical, and methodological support; and, to a much lesser extent, legislative and regulatory action. However, there are a few nuances worth noting.

In some countries (federal or “quasi-federal”), constitutional standards largely govern the relations between the central government and the level below, making it difficult for the federal government and even Parliament to impose obligations on them, even by law. In some of these states (Germany, Switzerland), joint financing by the central government and the

regional level of municipal action raises constitutional difficulties. In unitary states, even decentralised ones, it is easier to act by ordinary law.

Finally, in large federal countries, such as Canada and the US, the central government intervenes overwhelmingly in the form of federal financial programmes that encourage federal states to act in accordance with the national framework, so as to benefit from these considerable resources.

2.2.1 Collaboration between national and subnational levels

In Germany, collaborative work between the federal and regional levels is a well-established tradition, and other countries also engage in such collaboration:

For many years now, cooperation between the federal level and the Länder has been deeply embedded in Germany's operational methods. It occurs at the political and operational levels:

- at the political and decision-making level, in the field of the environment: twice a year, the Bundesministerium für Umwelt (Ministerial Conference for the Environment) brings together the environment ministers of the federal state and the Länder as well as members of the Bundesrat;
- at the operational level: a set of working groups, called “working communities” is in place; these groups are organised in the form of one main working group and “specialised commissions”.

Several of them deal with adaptation to climate change or related topics:

- the “climate-energy-mobility-sustainability” working community includes the “adaptation to climate change” specialised committee;
- the “water” working community notably includes the “adaptation to climate change”, “coastal protection”, and “flood protection” specialised committees.

The measures of the adaptation plan can themselves take the form of collaborative work: one example is the development of a strategy on the accelerating pace of sea-level rise, springing from a joint effort by the federal state and the Länder.

In Spain, the central government has set up a structured and collaborative working group with the Autonomous Communities, whose participation is given on a voluntary basis, to prepare, implement, and evaluate the Spanish PNACC.

In Austria, four working groups were launched in September 2021, composed of representatives of the federal state and the Länder, to tackle the following topics:

- relevant information for authorities and decision-makers;
- construction adapted to climate and climate change;
- adaptation to climate change for companies;
- protection against natural disasters.

A similar working group has been set up in Switzerland, comprising the Confederation and the cantons. It produces various documents, for example a methodological framework for drawing up plans, strategies, and risk assessments for the cantons.

Conversely, no structured and permanent system involving the state and the communal or intercommunal level has been identified, due to the large number of municipalities in all countries.

In France, as elsewhere, there are three main levels of organisation: national, regional, and local. Adaptation to climate change must be integrated into the Regional planning framework

for sustainable development and equality of territorial development (SRADDET) and the Territorial Climate Air Energy Plans (PCAET) of the EPCI.

In view of the above and in order to implement mitigation and adaptation policies in a coordinated manner, the mission proposes to set up a working community on adaptation between the central government and local authorities. This community would be developed at national and regional levels:

- at national level, as in several European countries, the technical aspect would require the central government and regions to work in a concerted manner on developing elements of shared doctrine concerning the goals, means, methodological framework, and regional risk assessments, as well as the SRADDET's adaptation component;
- at regional level, the prefects would be asked to set up a forum for dialogue incorporating the various levels of community authorities (region, departments, EPCI), to streamline territorial action in carrying out local studies and bring coherence to the adaptation components of the PCAETs as well as to action plans and their implementation.

Recommendation 4. (DGEC and regional prefects) Establish a working community on adaptation: at the national level, between the central government and the regions; and, in each region, between the central government and the regional and local authorities.

2.2.2 Financial support and methodological assistance from the central government for subnational levels

In many cases, the countries studied have set up methodological and financial support initiatives for regions and municipalities.

In Austria, the federal environment ministry has launched a programme called “Klar! ”, aiming to help groups of rural municipalities set up adaptation actions. A service platform is made available and events are held to stimulate the network of local authorities.

The people contacted by the mission indicated that their unofficial goal was for all rural communes participate in a Klar! project by 2030. There is an evident desire to upscale.

In addition, 75 federally funded advisors are available to the territories to carry out local action plans and assist in their implementation.

In addition, the federal ministry and the coordinating bodies of the Länder for climate protection have financed and produced a brochure on good practices for municipalities¹⁴. This example also illustrates the collaborative work between the federal level and the Länder.

In the same vein, Germany's adaptation plan provides for a programme of “climate change adaptation measures” for municipalities. Its aim is to assist them in the implementation of adaptation approaches. Financial assistance of up to €500,000 can be granted.¹⁵

Similar funding programmes for local initiatives exist in the various countries studied, as they do in France,; in England (with a £200m fund dedicated to local adaptation initiatives managed by the Environment Agency), the Netherlands, Canada, and the US states in particular.

In Spain, the ministry:

¹⁴ *Unsere Gemeinden im Klimawandel – good practice Broschüre -2016.*

¹⁵ <https://www.bmu.de/programm/foerderung-von-massnahmen-zur-anpassung-an-die-folgen-des-klimawandels>

- develops guides and toolkits for local authorities;
- implements a €10 million/year programme, targeting specific topics each year, to stimulate progress from the Autonomous Communities on the development and implementation of their adaptation strategy.

In Japan, the environment ministry assists the development of local adaptation plans by drafting guides and providing experts.

In France, the adaptation component of PCAETs or SRADDET is, in most cases, underdeveloped, generic, and of limited operational content. Appropriation of the subject is difficult because of its complexity and cross-cutting nature. A financial and technical support system for risk assessments and the development of action plans, combined with active facilitation of the network of actors (see paragraph 2.2.3 below on resource centres), would significantly improve this situation. Funding for diagnostics and engineering from the Fonds d'accompagnement de la transition écologique (Ecological transition support fund), currently being finalised, could be used for this purpose.

Recommandation 5. (MTECT) Provide financial support from the state, through the ecological transition support fund, for risk assessments and the development of action plans to strengthen the SRADDET and PCAET adaptation components.

2.2.3 Resource centres and technical assistance for climate change

All the benchmarking countries have established at least one climate change resource centre for local authorities and companies:

National resource centres, in open access on the internet, generally offer:

- Accessible summaries of the scientific literature as well as technical and methodological guides,
- Regionalised climate projections (temperatures, precipitation, in some cases forest fires), sometimes at the municipal level,
- A database of local adaptation plans, toolkits (including tutorials), and examples of good adaptation practices,

In some countries, the resource centre also organises networking activities, including events and training.

The Japanese centre (CCCCA), managed by the environment agency (NIES), is one of the most comprehensive in this regard. It is complemented by many local variations, underpinned by regional and local authorities or universities depending on the various cases: To date, 53 local centres have been set up; 40 at the prefecture level and 13 at the municipal level.

Similarly, Georgetown Climate Center, the US federal resource centre, and its statewide variations, such as California-based CAL-ADAPT, offer clear and localised climate forecasts at the scale of each commune on the internet.

In France's case, the mission contacted CEREMA, which confirmed its ambition to make the newly created resource centre more dynamic, notably by further stimulating a network of actors. The centre could focus on building climate services tailored to uses and developing simplified tools. This would provide valuable support for the development of risk assessments and action plans. The "Climadiag collectivités" and "Climadiag entreprises" tools, recently proposed by Météo-France, are one example. Regional and local authorities ("collectivités") and companies ("entreprises") seek simple tools to diagnose their vulnerabilities and identify

actions to implement.

It is therefore essential to reinforce the entire set of climate services on offer in order to support regional and local authorities and companies in the development of their assessments and action plans. This means improving the coordination of actions by state operators (Météo France, ADEME, CEREMA, and water agencies), expanding the national resource centre, and ensuring that climate services are put to use and shared at the most local level.

This approach can be coordinated with the actions carried out under the “adaptation mission” of the European Commission's Horizon Europe programme, one of whose goals is to help local and regional authorities better understand, prepare for, and manage climate risks and opportunities. Local authorities participating in the programme will have access to climate risk profiles and receive guidance in the development of comprehensive risk management plans.

The proliferation of adaptation initiatives requires a clear framework for allocating roles among operators. To define this framework with them, the DGEC will be backed up by the SG, responsible for resource allocation.

Recommandation 6. (DGEC, with SG support) Mobilise the Ministry of Ecological Transition and Territorial Cohesion operators to reinforce the integrated set of climate services available in order to help regional and local authorities and companies develop assessments and action plans.

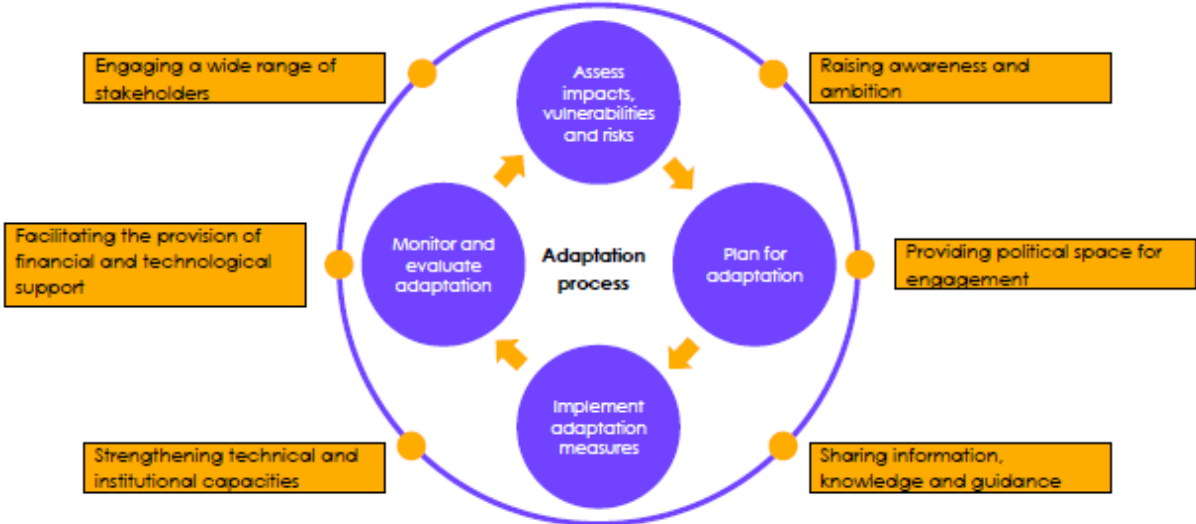
3 Adaptation plans and their update cycles are very similar in the benchmarking countries

3.1 The update cycle for the plans

Most of the countries studied have established a cyclical approach to updating their national adaptation plans, following a method recommended by the secretariat of the United Nations Framework Convention on Climate Change (UNFCCC, see figure below), the European Commission, and the European Environment Agency. This method has just been introduced into European law under Article 5 of Regulation 2021/1119 (see §1.1.1).

The standard cycle has a duration of around five years and applies in the context of successive plans, thus enabling the experience acquired to be capitalised on. The diagram below illustrates this method, introducing the various elements (evaluation, risk assessment) described in this chapter.

Figure3: The typical cycle for updating a national plan



Source: UNFCCC (UN Framework Convention on Climate Change)

Midway through a plan, two steps are taken to prepare for the next one:

- An evaluation of the plan, developed to a greater or lesser degree in a framework of participation with external actors. This evaluation, based on predefined indicators, is formalised midway through the plan and at its culmination;
- A risk assessment that specifies vulnerabilities based climate scenarios and sets an order of priority for action areas.

The evaluation and risk assessment then provide the foundations on which to build the national plan, which is subjected to further consultations with stakeholders.

The plan incorporates a framework for evaluation and accountability. It forges strong links between the risks, goals, and actions to be implemented. It contains indicators. These elements feed into a risk assessment and evaluation cycle that lays the ground for the following plan.

3.2 The climate reference

3.2.1 Climate references in the benchmarking countries

For its second plan, the reference France has adopted is a global temperature rise of 2°C. The mission investigated whether a reference in the form of a temperature rise is the most appropriate and whether the date on which the temperature rise occurs should be specified. By way of comparison, the UK, in its risk assessment¹⁶, chose to consider the two end-of-century scenarios of global 2°C and 4°C rises, respectively corresponding to IPCC scenarios RCP 2.6 and 6.0.¹⁷

In the other benchmarking countries, the risk assessment is based on climate assumptions expressed by reference to the IPCC scenarios. Aside from exceptional cases, there are two scenarios that are generally considered, one of which is the RCP 8.5. scenario.

Table1: Climate scenarios for risk assessments

Canada, Germany	Austria, Spain, Quebec	Switzerland, Japan	UK	France PNACC- 2
<p>one single scenario RCP 8.5</p> <p><u>Germany</u>: the risk assessment divides this scenario into an optimistic and a pessimistic case</p>	<p>2 scenarios: RCP 4.5 and 8.5</p> <p>- <u>Austria</u>: the assessment specifies the temperature rise corresponding to these scenarios in Austria.</p> <p>- <u>Quebec</u>: RCP 8.5 for critical infrastructure, 4.5 for the rest.</p>	<p>2 scenarios: RCP 2.6 and 8.5</p> <p><u>Switzerland</u>: special attention to scenario 8.5, in the name of the precautionary principle</p>	<p>2 scenarios: +2°C and +4°C corresponding to the scenarios RCP 2.6 and 6.0</p> <p>Adaptation to +2°C and consideration of +4°C</p>	<p>one single scenario: +2°C at horizon 2050</p>

Source: table created by the mission

The justification provided for considering the RCP 8.5 scenario is simple: this is a matter of assessing risks, and the risk that the pessimistic RCP 8.5 scenario will be manifested is sufficiently high for this scenario to be considered, particularly for decisions that produce long-term effects (infrastructure, forest). This scenario corresponds to a rise of over 4°C in global average temperature by the end of the century.

When selecting a reference scenario, however, it is essential to consult the very latest IPCC studies.

3.2.2 If states fulfil their commitments, global warming is estimated at 2.8°C by the end of the century.

According to the sixth IPCC report, if countries fulfill their commitments, warming would reach 2.8°C at the end of the century; and if they continue with current policies, warming would

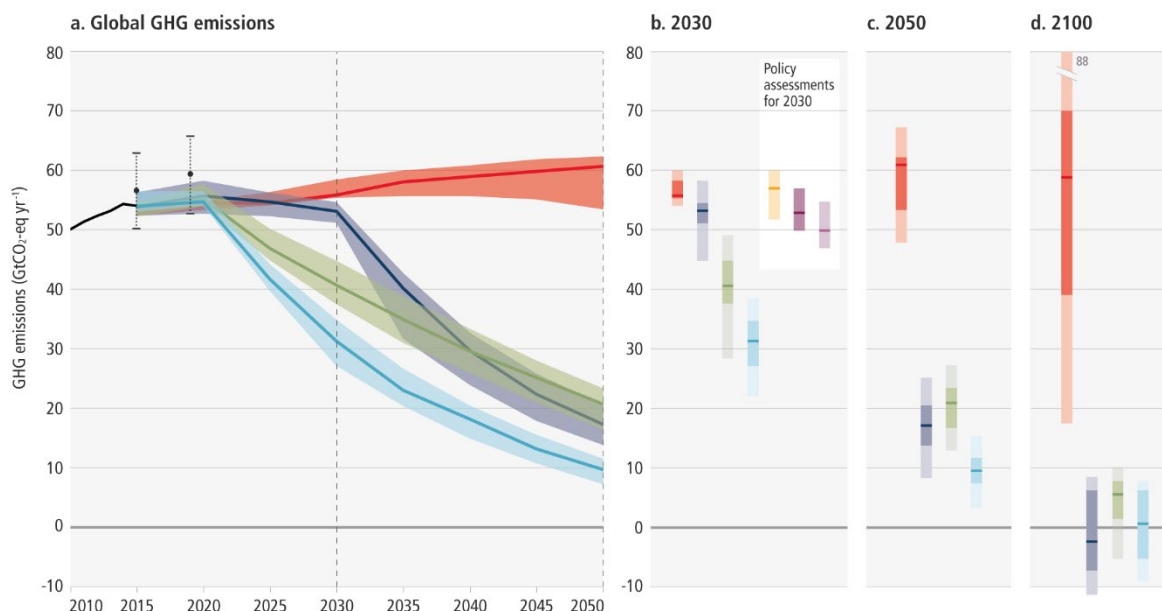
¹⁶ UK climate risk independent assessment (CCRA 3) – technical report

¹⁷See Appendix 7 on the definition of IPCC scenarios

reach 3.2°C.¹⁸¹⁹ The United Nations' "emissions gap" report—which, however, is not subject to review by states—yields lower values.²⁰

The illustration below shows the corresponding greenhouse gas emissions, as well as those that would meet the 1.5 or 2°C warming targets of the Paris Agreement.

Figure4: Global Greenhouse Gas Emissions



Source: Sixth IPCC report, Group III contribution, summary for policymakers

The curves on the left show the evolution of greenhouse gas emissions from 2010 to 2050 according to different hypotheses:

- in red: current state policies and their continuation over time;
- in blue: states' commitments until 2030; then warming limited to 2°C (probability greater than 67%) or return to a warming of 1.5°C after a peak (50%);
- in green: warming limited to 2°C (probability greater than 67%);
- in light blue: warming limited to 1,5°C (probability greater than 50%).

The right side of the figure shows the corresponding emissions in 2030, 2050, and 2100.

3.2.3 The climate reference can be expressed in the form of a temperature rise

The Working Group I contribution to the sixth IPCC report, entitled "Climate Change 2021: The Physical Science Basis", published in October 2021, bases its analysis on a selection of scenarios and, for each, indicates for the foreseeable temperature rises at three time horizons:

¹⁸ Countries' commitments are the "nationally determined contributions – NDCs" set out in the Paris Agreement

¹⁹Sixth IPCC report, Group III contribution, summary for policymakers

²⁰Source: *The closing window. Climate crisis calls for rapid transformation of societies. Emission Gap Report 2022*. UNEP. The implementation of unconditional commitments by states would lead to a warming of 2.6°C and the continuation of current policies to warming of 2.8°C

“current” (2020-2040), “mid-century” (2041-2060), and “end-of-century” (2081-2100).

Table2: Forecast temperature rise according to IPCC scenarios

Scenario*	Current (2020-2040)	Mid century (2041-2060)	End of century (2081-2100)
SSP 1-2.6	1.5°C	1.7°C	1.8°C
SSP 2-4.5	1.5°C	2°C	2.7°C
SSP 5-8.5	1.6°C	2.4°C	4.4°C

Source: table created by the mission

The SSP 2-4.5 scenario thus leads to end-of-century warming of 2.7°C, that can be approximated to 2.8°C, as a result of countries fulfilling their commitments.

These temperature rises are calculated on a global scale. The corresponding rises at country or regional level are different.

Thus, for France, the study of the “nouvelles projections climatiques de référence - DRIAS 2020” (new climate reference projections issued by the 2020 DRIAS project) indicates an end-of-century rise of 2.2 °C for mainland France in RCP 4.5, the moderate scenario. A recent study conducted by a group of scientific bodies, including the CNRS, forecasts a rise of 3.8°C under this scenario²¹. This new method, while considered promising, has so far not led Météo-France to re-examine the results of previous studies.

In addition, the projected rise for France is higher than the global average because land warms faster than oceans.

The IPCC report also finds that temperature rises are themselves directly related to many climate changes: “Many changes in the climate system grow greater in direct relation to increasing global warming. Among these changes, there are increases in the frequency and intensity of hot extremes, marine heatwaves, heavy precipitation, and, in some regions, agricultural and ecological droughts. There is also a rise in the proportion of intense tropical cyclones; and drops in Arctic sea ice, snow cover, and permafrost”.

Notwithstanding, the reference that remains anchored in the public mind since the Paris Agreement is the one expressed in terms of a global temperature rise.

For these reasons, the mission considers it proper that, in adaptation policies, the climate reference should be expressed according to temperature rise hypotheses. A given rise in temperature will be linked to a set of climate change characteristics, that will be used to define adaptation measures. The reference should be expressed at mid-century and end-of-century horizons, to take long-term investments into account.

3.2.4 The mission's recommendation

The mission recommends (see recommendation 1) that the law establish a reference expressed in the form of temperature rises, a concept that is more meaningful to the public

²¹An updated assessment of France's past and future warming based on regional observational constraint, Earth system dynamics, October 2022

The so-called “regional observational constraint” method consists in selecting, from the set of models used, the subset that best reproduces the past evolution over a given region, and then using this subset to evaluate the future situation in that region.

than the IPCC scenarios. This reference should be considered in the risk assessments as well as in the PNACC, SRADDET, and PCAET.

Should the temperature rise be expressed at global scale or at the scale of France? Retaining the global value would bring the reference closer to the Paris Agreement. In addition, global values are more stable than local values. Indeed, significant uncertainties surround the projected effects of a global temperature rise on the national territory. The Mission recommends that the rise be expressed as a global value.

The temperature rises used as a reference could be defined from two scenarios, the moderate “middle of the road” SSP 2-4.5 scenario and a more pessimistic scenario. The choice of scenario SSP 2-4.5, corresponding to a 2°C rise in global temperatures at mid-century and 2.7°C at the end of the century, is to be compared to the warming resulting from states' current commitments (2.8°C at the end of the century). The more pessimistic scenario will be considered for long-term investments.

Indeed, in risk assessments, the scenarios to be considered may vary according to the planned investment areas and lifetimes, so as to forestall a failure to adapt. The pessimistic scenario should be considered for long-term investments such as infrastructure, urban planning, construction, and tree planting. Conversely, in the field of agriculture, it is justifiable to use a moderate global warming scenario, in cases where it would be harmful to anticipate the disappearance of March frosts too soon.

In order to avoid the risk of litigation, the law's explanatory memorandum should specify that this reference is intended to guide the development of adaptation plan measures, but is not itself an adaptation goal; as such, it does not put the state and the stakeholders invited to use the reference under obligation to attain it.

Recommandation 7. (DGEC) Propose, in law, a climate reference expressed in the form of temperature rises and based on two IPCC scenarios: a moderate scenario and a more pessimistic scenario.

3.3 Risk assessments

Other than Canada, which is currently developing an adaptation strategy, all the countries studied in the benchmarking process are conducting national risk assessments. Together with the evaluation of plans previously implemented, these studies are the bedrock upon which new adaptation plans are developed. Such an approach aligns with the guidelines issued by the European Commission and the European Environment Agency several years ago. European regulation n° 2021/1119, also known as “European Climate Law” and, in particular, the provisions that come under Article 5, now make the risk assessment mandatory.

This assessment tends to be conducted by the environment ministry, assisted by experts (other ministries, government agencies, scientific institutions, design offices, and consultants). That is the case in Germany, for example, where the environment ministry calls on a wide network of public agencies (28 agencies) to conduct studies that are undertaken over the course of several years (studies published in 2015 and 2021).

The UK is distinguished by a specific procedure: while conducting a risk assessment is a legal obligation incumbent on the environment ministry, the ministry must attend to the “advice” of the Climate Change Committee (CCC), an independent body. In practice, the study is conducted over several years by the CCC, which calls on academic institutions and consults stakeholders, including economic actors. The report is several thousand pages long. A summary is made public (Climate Change Independent Risk Assessment – CCIRA). The UK

environment ministries validate the content (Climate Change Risk Assessment – CCRA).

The British and German risk assessments appear to be the most elaborate. The content, scope, drafting methodology, and monitoring process brought to the risk assessment are detailed below.

3.3.1 Content and field of application

3.3.1.1 Content

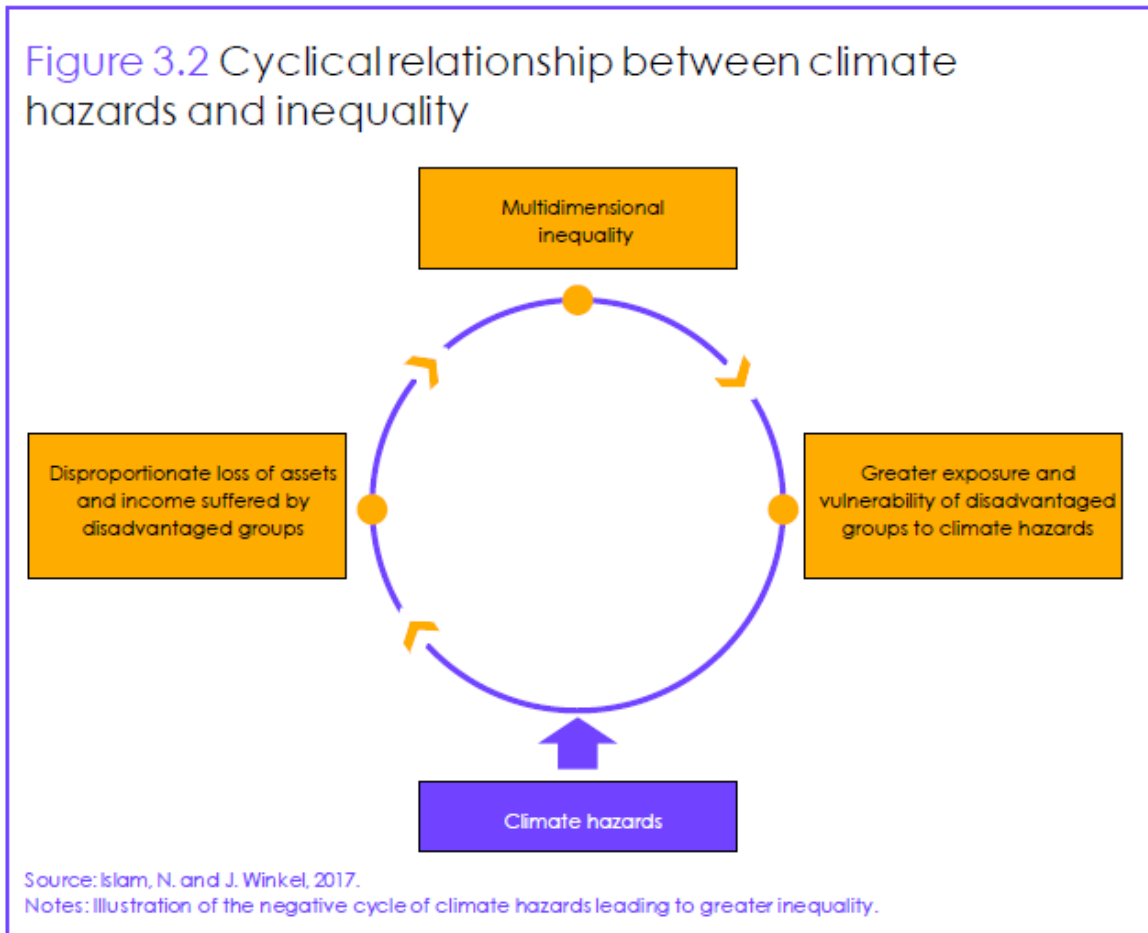
The risk assessments include a common core corresponding to the “traditional” risks affecting the various sectoral areas: water, agriculture, infrastructure, health, etc.

Some also cover social and societal risks, such as gender and vulnerable populations (Spain, UK); the overall functioning of the economy and notably the financial sector (UK); and international vulnerabilities, for instance with regard to supply chains (UK).

The UK risk assessments thus focus on the disproportionate risks faced by the poorest populations, geographically located in high-risk areas and whose wealth consists of exposed assets (e.g. housing). They propose that the corresponding plans map the redistributive effects of adaptation measures on the most vulnerable populations. Indeed, the effects of climate change, such as adaptation measures, can disproportionately affect the incomes and assets of some particularly vulnerable groups.

The diagram below, taken from the 2021 UK Global Risk Assessment, illustrates the relationship between climate risks and inequalities.

Diagram5: Relationships between climate risks and inequalities



Source: CCIRA

The British and Dutch studies focus on the interactions between risks, cumulative impacts, and maladaptation. The UK risk assessment highlights the severity of cascading effects and the way they are underestimated in silo approaches. It shows the chain of consequences that would follow a power supply interruption, particularly on economic activities and the health sector. Similarly, drought affects soil quality, which in turn affects the stability of infrastructure and buildings, the carbon storage capacity of natural environments, ecosystem services, biodiversity, and water quality.

These studies also introduce the “lock in” concept, that refers to both a risk of technical deadlock (for instance, a critical infrastructure construction standard with an unsuitable provision for climate change, that would be difficult to remedy) and a risk of major additional costs (when there is a need to intervene several times, for instance in housing renovation, whereas a single well-designed intervention would have been much less costly).

3.3.1.2 Scope: territorial and sectoral approaches, critical infrastructure

Risk assessments are generally conducted at the national level. However, two countries have undertaken assessments at regional or territorial level.

In the UK, risk assessments are prepared for each of the four nations (England, Scotland, Wales, and Northern Ireland). In Switzerland, eight specific case studies were conducted in collaboration with local authorities, for various types of territories and situations. These territorial risk assessments served as a basis for the national assessment and provided the other cantons with a methodological framework under which to carry out their own work.

Risk assessments are conducted at the sub-national level by regions, including some Canadian provinces (Quebec and British Columbia) and municipalities.

Many studies are conducted at sectoral level, for example on critical infrastructure (with a particular focus on energy infrastructure in the UK) or in specific areas (including water, agriculture, coastline, tourism, social impacts, health, etc.). The UK puts particular emphasis on examining the consequences of network interdependencies (risk of chain failures), particularly in flood prevention. A National Infrastructure Resilience Council, reporting to the prime minister's office, brings together leading companies to establish a common framework, particularly for data sharing.

Stress tests on extreme scenarios are conducted, or planned, in some territories and for some operators. Examples include the coastal territories in the Netherlands and the financial sector (see chapter on mobilising the financial sector).

In France, network operators such as RTE²² have undertaken risk assessments on critical infrastructure. This approach should be generalised to identify interdependencies and critical points, especially since some networks (water and energy in particular) are to undergo major renovation over the coming years.

In complement to national, regional, and local risk assessment, sectoral stress tests are conducted targeting specific areas (e.g., coastal areas at risk of flooding) and activities that are particularly vulnerable to climate change (including critical infrastructure). These should be encouraged by the state.

Recommandation 8. (DGEC, supported by SG) Organise the mobilisation of operators from the Ministry of Ecological Transition and Territorial Cohesion (CEREMA, Météo-France, ADEME in particular) to assist economic actors, critical infrastructure managers, and the regional authorities of the most high-risk territories in conducting risk assessments and stress tests.

3.3.2 Methodology for drafting risk assessments

The risk assessments conducted in the various benchmarking countries broadly follow the same methodology, though each has its own specificities. The mission endeavoured to trace a common thread.

To begin with, the fundamental climate data that is to be considered in the assessment must be defined. To this end, the first step is to select from the climate scenarios laid out by the IPCC (see § 3.2). Based on these scenarios, models can then be used to specify the

²²As part of the “Futurs énergétiques 2050” (“Energy Futures 2050”) study

fundamental climate data (temperature increases, number of very hot days, precipitation, droughts, etc.), as well as the effects of climate change (sea level rise, for example).

The rest of the process, composed of three stages, is summarised in the following diagram:



Stage One: Identification of the “impacts” of climate change:

From the climate scenarios, the assessments generally identify a few dozen “impacts” or “risks”, the vocabulary used varying from one country to another. Accordingly, in the UK, 61 risks have been selected, distributed into six “risk families” (carbon sink degradation, damage to natural habitats and terrestrial and aquatic species, etc.), to which two new risk families were added in 2021: supply chains and international. In Germany, 102 risks have been selected and are distributed into the action plan’s 13 “action areas”. In Japan, the risk assessment is based on the analysis of 1,260 scientific articles, and groups the 71 risks studied into seven principal sectors.

By way of illustration, for Germany, the “biodiversity” action area includes climatic “impacts” such as “spread of invasive species”, “loss of genetic diversity”, “damage to habitats linked to water and wetlands”, “damage to coastal ecosystems”, and “ecosystem performance”.

Stage Two: Risk assessment for each climate change “impact”:

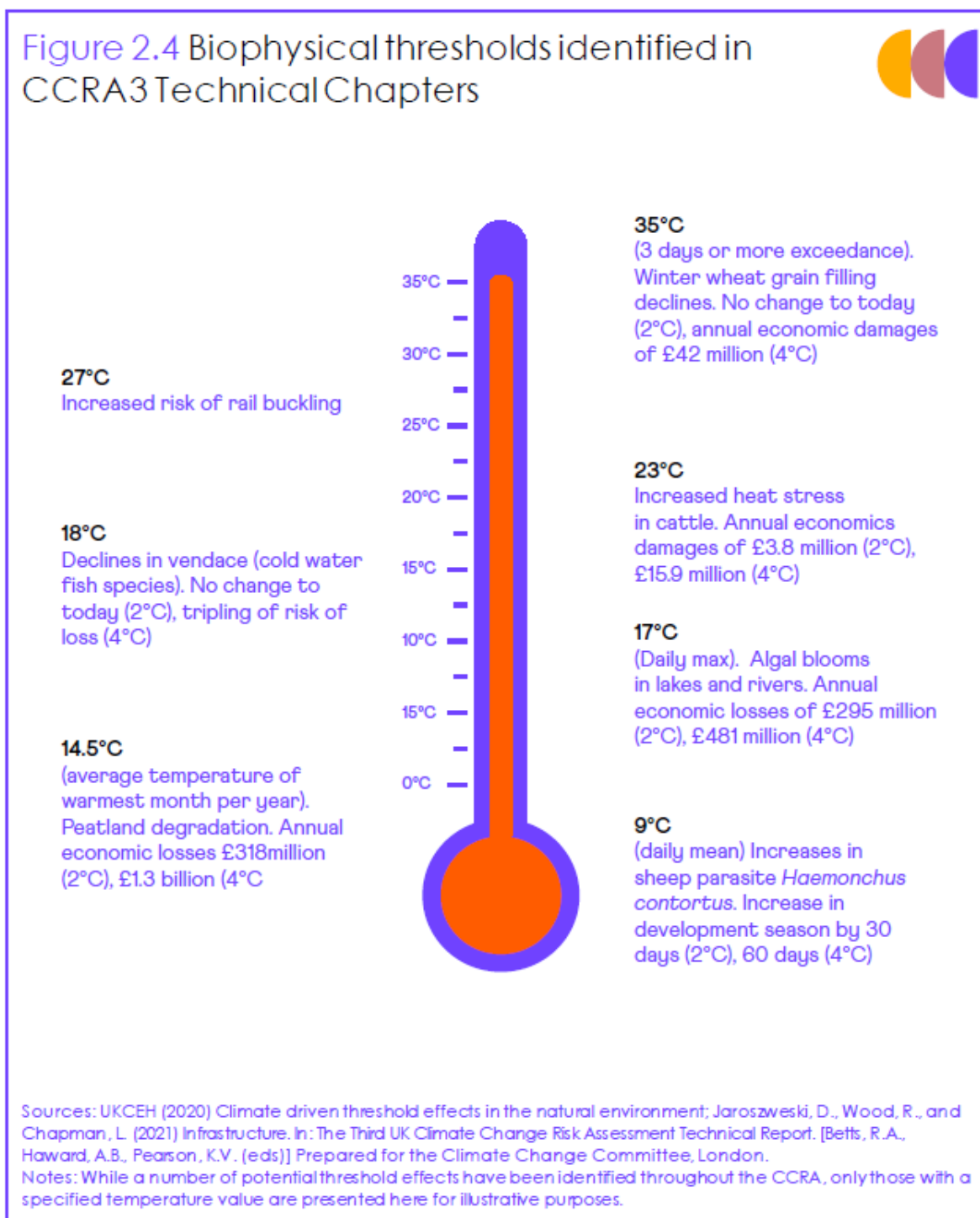
For each “impact”, the study assesses the level of risk (low, medium, or high) resulting from climate change and, more specifically, climatic characteristics such as intense heat, drought, rise in average temperature, heavy rains, decrease in average rainfall, and strong winds. This evaluation is carried out at various time horizons, generally mid and end of century.

In the UK, an estimate is made of the annual cost of a given risk by 2050 in the absence of action. Thus, a risk will be considered “very high” beyond a cost of over 1 billion pounds per year, and “high” beyond 100 million.

In addition, the UK highlights the “threshold effects”, considering that beyond a certain point, the increase in risk is no longer linear but becomes particularly critical. The British CCRA identifies different biophysical risks related to temperature levels: for instance, when the temperature goes above 17 degrees, algae bloom is observed in lakes and rivers.

The illustration below shows the main thresholds identified.

Figure6: Biophysical thresholds identified in the UK risk assessment



Source: CCIRA

Stage Three: Assessment of the system's “adaptability”

Some countries (Germany, Austria) then proceed to examine a system's ability to adapt; this

influences the extent to which a potential risk becomes a real risk. This capacity is analysed according to various criteria such as the state of knowledge, the acceptability of adaptation measures, and financial resources.

After assessing each risk, the Japanese study ranks them according to the level of confidence in the state of knowledge and the urgency to act.

At the culmination of these three stages, a synopsis is drafted. The synopsis demonstrates how the assessment of risks evolves over time (mid-century, end-of-century) and in relation to adaptation measures. The analysis distinguishes between measures already decided and additional measures that appear plausible in the existing political framework and socio-economic conditions.

The resulting analysis grid enables the “impacts” for which action is urgently needed to be identified. This grid then serves as a basis for the development of action plans.

Originally developed by the IPCC, the method implemented in Germany is now described in the ISO 14091 standard of 2021, that presents the guidelines on risk assessment related to the impacts of climate change.²³

3.3.3 Follow-up of the risk assessment

3.3.3.1 Connection between risk assessments and national plans

The grid yielded by risk assessments is generally used as a starting point for drafting national action plans (determining actions, goals, and indicators). As an example, in the UK, the risk assessment grid is integrally carried over into the action plan.

In some countries, such as the Netherlands (for actions outside the Delta Programme), discontinuity in the cycle of developing national adaptation plans has led to occasional dissociation between the action plan and the risk assessment. An interim 2023-2024 action plan is being developed in parallel with the completion, over the same period, of a risk assessment that will serve as the basis for a new five-year 2025-2029 action plan. This is also the case in Germany, where an update of the national adaptation plan was adopted in 2020, while the risk assessment dated back to 2015. The 2021 risk assessment will form the basis of the next plan.

France does not have a recent national risk assessment. It would therefore be desirable to have such an assessment available for the draft of the PNACC 3. In order not to delay the necessary and urgent actions, the mission recommends coordinating the creation of the risk assessment and the national adaptation plan, the results of the first gradually feeding into the development of the second (see Appendix 13).

3.3.3.2 Impact of national risk assessments on actions carried out at different territorial levels

The level of quality and depth of national risk assessments, as well as local risk studies, seems to be rather variable. The European Environment Agency and the European Commis-

²³To guarantee the quality of risk assessments, we could consider developing a certification system to ensure that the certified company conducting a risk assessment complies with the requirements of standard 14 091. The current approach does not seem adequate, as standard 14 091 is limited to defining guidelines and is too imprecise to give rise to a certification scheme. For quality control to work, the standards used must have requirements that are sufficiently precise to be verifiable.

sion consider them to be, on the whole, insufficient: the approaches are too generic; the methodological framework too limited; they are weak on the operational side; appropriation by stakeholders is lacking; etc.

Even when the quality of these assessments is good, as is the case in Japan, the UK, and Germany, the question arises as to how much impact they, and the national plans, will actually have on the ground. A highly sophisticated national approach in terms of risk analysis and planning does not necessarily lead to action by all stakeholders instituting an effective response to the challenge of climate change adaptation.

In addition, continuity between national and subnational risk assessments is not always ensured, although some countries are making considerable efforts to provide methodological frameworks to local actors.

Nevertheless, in spite of these limitations, conducting a risk assessment at national level would mobilise stakeholders and establish shared priorities for action. The process would also help develop a common methodology among stakeholders for conducting risk assessments that are more operational at local scale, for infrastructure networks and activities. To facilitate the dissemination and appropriation of its results, such assessments could make use of virtual reality tools (for instance, to view the consequences of rising sea levels).

3.4 Scope, content, and form of adaptation plans

Article 7.9 of the Paris Agreement provides that each signatory state shall implement an “adaptation planning process”, on whose progress a report shall be made annually to the climate convention (UNFCCC) secretariat. A little more than 70 countries (including about 40 developing countries, whose adaptation plans are monitored by the UNFCCC, in particular, under the Cancun process) have so far notified such processes to the UNFCCC secretariat²⁴. Terminology varies as to the outcome of these processes: sometimes they are called “strategies” or “programmes”; most often they are “plans”. All the countries studied in the benchmarking process have developed an adaptation strategy and plan, apart from Canada, where the development of the strategy is underway.

To describe the adaptation plans, the mission sought to examine their scope, design, and type of content.

3.4.1 The scope of the plan

The scope of a plan can be analysed from its list of policy areas, corresponding to the main policies impacted by climate change. The table in Appendix 6 offers a comparison of the scopes of the German, English, and French plans. It appears that these plans, that are of the same generation, cover roughly the same scopes, although they are structured in slightly different ways.

Regarding the content of the next generations of British and German plans (also expected for 2023), detailed information is sparse at this stage. The risk assessment published by the UK in 2021 includes two new risk families:

- multiple risks for the UK due to the impacts of climate change overseas;
- risks in supply chains.

It will be interesting to see how the new UK plans take account of these new risk families and the mapping of vulnerable populations prescribed by the risk assessment.

²⁴Source: T. Leiter, nov. 2021, “Do governments track the implementation of national climate change adaptation plans? An evidence-based global stocktake of monitoring and evaluation systems”).

The Spanish plan devotes a specific chapter to gender inequalities and vulnerable populations.

Moreover, depending on the country, the overall plan can be supplemented or developed by sectoral plans that are sometimes just as structural.

In the Netherlands, for instance, the main vehicle for spatial adaptation planning seems to be the Delta Programme. This programme initially focused on building and strengthening one of the world's largest systems of protection against marine submersion. Over the course of its revisions, it gradually expanded into a comprehensive plan for water resource protection and flood prevention, promoting nature-based solutions in addition to more conventional infrastructure (as found in all the flood chapters of the various plans analysed by the mission). It now also includes a spatial adaptation planning component.

In the case of Spain, it is also worth mentioning the sectoral plan on urban planning and construction (Spanish Urban Agenda – AUE-), presented in Appendix 12.

The national adaptation plan includes the main goals of each sectoral policy, setting out the methods by which this goal is to be attained.

Finally, the mission identifies few subjects that would appear to be given less attention in the French plan than in comparable plans. The contents of the so-called sectoral topics are very similar.

On the other hand, several so-called transversal topics could be better addressed in the French plan, by drawing inspiration from other plans:

- Supporting the most vulnerable populations: a notable reference on this subject is the European Environment Agency's report, "Unequal exposure and unequal impacts: social vulnerability to air pollution, noise and extreme temperatures in Europe" (2018). The 2018 European Strategy recommends that resilience efforts be implemented in a fair and equitable manner;
- Addressing territorial inequalities and the level of solidarity to be implemented with regard to the most affected territories, particularly the overseas territories and coastal and mountain territories;
- Cross-border and international impacts, such as climate migration or the vulnerability of supply chains.

Recommandation 9. (DGEC) In future climate change adaptation plans, include specific measures relating to the most vulnerable populations and territories, as well as cross-border impacts such as climate migration or disruption of supply chains.

3.4.2 Typology of planned measures

In attempting to identify a typology of the measures described in the plans, it is useful to distinguish between the following categories, that correspond to the various levers of action available to public authorities at national scale:

- improvement of knowledge (studies, research);
- establishment of working groups (for instance, a working group at federal level and for federal states to establish a doctrine on sea level rise);
- monitoring, for example to develop early warning systems for natural hazards;
- drafting of legislative or regulatory provisions;

- funding;
- technical support to stakeholders, such as the establishment of resource centres;
- education, information, and awareness-raising, dissemination of good practices;
- direct action on wealth administration (exemplary state) and infrastructure managed directly by the national level (rivers that come under federal management, etc.);
- recommendations to other stakeholders (local authorities, private sector).

By way of illustration, it may be noted that, in the German plan, the measures of each of the seven fields of action are classified according to the following eight headings, that largely correspond to the typology proposed above:

- infrastructure adaptation;
- adaptation of legal instruments, technical regulations and standards;
- training;
- means of financing and incentivising;
- research and monitoring;
- networking and cooperation;
- publication, communication, and information work;
- other.

International issues are addressed in a specific plan of their own.

3.4.3 The design—or form—of the plan

In general, a summary table of the measures is annexed. For each measure, this table details the supervisor, the associated persons, the schedule, the monitoring indicator(s), the risk identified in the risk assessment, and even (albeit rarely) the budget (in some cases, such as France, this summary exists but is not published).

This methodical approach is likely to forestall the risk that measures provided for in the plan are not identified by the entities who are supposed to implement them. For example, in France, the “GOUV-5” measure relating to the inclusion of climate change in technical standards does not seem to be known either to the services of the French standardization authority (AFNOR) or to its parent ministry, the ministry in charge of industry.

The mission considers it essential to strengthen monitoring and implementation systems to ensure that the planned measures are effectively implemented, notably by the competent ministries.

This entails that the plan itself, in its public version, should provide for specific modalities to this effect, including quantified targets where possible, entities designated as responsible, a schedule, monitoring indicators, and the necessary financial instruments.

Recommendation 10. (DGEC) Include in the future climate change adaptation plan a grid for implementing the actions to be undertaken over the course of the plan's duration: quantified goals where possible, supervisor and associated persons, schedule, monitoring indicators, budget.

The level of detail in the description of the measures varies from one plan to another. The length of the plan provides the first clue as to its level of detail. The mission observed that the French plan is very significantly shorter, and consequently less precise, than the other plans studied (see table in Appendix 6, to which can be added the length of the Spanish plan, with 190 pages, or that of the Swiss plan, with 82 pages).

The relative importance of each area of action, and the way the various parties are structured in the plan's summary, depends on the issues and intellectual approaches specific to each country as well as the level of maturity and consensus on the various topics, since these plans are built in collaboration with stakeholders. The mission therefore does not propose a “standard summary” or a standard organisation of the future French plan, as this must spring from the required collaboration with stakeholders. The mixed approach adopted in France, comprising both sectoral elements (biodiversity, agriculture, forestry, etc.) and cross-cutting topics (vulnerable populations, effects on the economy as a whole, etc.), corresponds to what is practiced by several of the countries studied; this approach could be maintained.

3.5 Evaluation

Based on the evaluations carried out in the benchmarking countries, the mission identified two main points that should be taken into account when defining an evaluation system that is not merely a monitoring report prepared by the administration responsible for adaptation policy:

- by whom should the evaluation be conducted? Should it be conducted independently?
- what questions does it need to answer?

3.5.1 Independent or not, the evaluation is often based on wide consultation with stakeholders

Examples from the benchmarking countries show that the evaluation can be carried out either independently or not:

- evaluation entrusted to an “independent” authority:

In the UK, the 2008 Climate Change Act entrusts the Committee on Climate Change (CCC)—an independent body—, with the task of providing progress reports every two or three years, depending on the nation.

- external evaluation:

In Germany and Switzerland, the administration entrusts the evaluation to consultants. In Germany, the evaluation was subjected to a preliminary research project, after which it was validated by the inter-ministerial working group on adaptation before being implemented. In Switzerland, evaluation has been entrusted to research institutes.

When the evaluation is led by the administration itself, the administration adopts a procedure to ensure that the conclusions are not simply its own.

In Spain, the evaluation of the PNACC was conducted by the administration with the input of external opinions²⁵: an advisory committee, including European, national, and regional experts, as well as local institutions, universities, and NGOs, accompanied the process; and a consultation was conducted with a great many institutions and individuals (over 300), who participated in the PNACC's implementation.

In Austria, the “progress report” is also drafted in a participatory manner: topical workshops bring together experts from ministries, the Länder, and various institutions. For each policy area overall, and for each measure, an assessment is made of how well goals have been achieved, describing what areas are on track and laying out the challenges to be met. The results of the measurements are scored by each workshop participant. In addition to analyses of the workshops, the evaluation considers a set of indicators, called “criteria” (see § 3.6 “indicators” below). The report draws a general conclusion for each action area, based on both the results of the workshops and the analysis of the criteria.

In France, the CGEDD carried out an evaluation of the PNACC 1 in 2015. For the PNACC 2, the administration prepared a mid-term monitoring report, while the Haut Conseil pour le climat (HCC) (High Council on Climate) made recommendations in its 2022 annual report, without, however, conducting out an actual evaluation. The annual reviews and the mid-term review are submitted to the CNTE specialised commission and the CNTE issues an annual opinion on the PNACC's progress.

3.5.2 The evaluation reviews the stages of the plan and its results

The examples from the countries studied show that the evaluation reports are based on a prior methodological reflection specifying the questions to be answered by the report.

To identify these issues, some countries explicitly or implicitly deconstruct the process of implementing the plan, including its development, implementation, and impacts (have risks been reduced?), and then consider the issues that pertain to each of these steps.

In the UK, the CCC conducts not only the evaluation but also the risk assessment, which is particularly thorough. As a result, much of the evaluation conducted by the CCC is devoted to examining the extent to which the plan's implementation has led to progress in risk management.

The following table summarises the approaches taken in Switzerland, Germany, and the UK:

Table3: content of the evaluation in some of the benchmarking countries

Switzerland	Germany	England
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²⁵Evaluation Report of the National Climate Change Adaptation Plan, Executive Summary, p. 3

The issues examined in the evaluation relate to the process steps listed below:		The evaluation examines two main questions:
- plan design - implementation (evaluation of the organisation) - what it has produced - results obtained on behavioural change in target groups - plan's effects	- plan design - what it has produced - results (raising stakeholders' awareness).	- Is the plan of good quality? - Is progress being made in managing risks: - treatment of risks in actions carried out; - effect of actions on risk

Source: table created by the mission

These steps are described in more detail in Appendix 8.

3.5.3 Recommendation on evaluation

Evaluations review the various stages of the plan's implementation, including its design and what it has produced (have the measures been implemented and how effectively?). They also measure the effects of actions. The evaluation of effects includes behavioural changes on the part of the target groups concerned by the measures of the national plan, for example municipalities.

To evaluate the plan's results, notably whether the actions have been implemented effectively, the mission recommends a participatory approach, as this would help mobilise stakeholders. Evaluation of the plan's design should be conducted externally, preferably by an independent authority.

3.6 The indicators

3.6.1 Different types of indicators

Monitoring the proper implementation of the adaptation plan, based on a set of indicators, is part of the requirements of European Regulation No.2021/1119, known as the "European Climate Law". However, these indicators are not easy to define, for two main reasons:

- the effects of the actions taken are often only measurable in the long term;
- as the adaptation plan is being implemented, the impacts of climate change may increase.

For these reasons, the literature distinguishes two main categories of indicators: impact indicators, measuring the effects of climate change; and "response" indicators, measuring the results of actions taken.

In the "impact" category, the most elaborate analyses distinguish between different sub-categories of indicators, based on the concepts developed in the discipline relating to risk assessment: exposure, sensitivity, adaptive capacity, vulnerability (synthetic indicator resulting from the three previous indicators), hazard (indicator measuring the risk of an extreme climate event).

In the "response" category, an essential distinction is made between the output and outcome indicators. Here is a concrete example to illustrate this: suppose that one of the plan's actions

is to make a brochure for the elderly on how to behave during heat waves; the output indicator concerns whether or not the brochure has been produced, while the outcome indicator would measure the change in the target population's behaviour. Finally, so-called input indicators that measure what is provided for an action (for instance a certain amount of funding), are sometimes included.

The following table presents the main categories of indicators.

Table4: main categories of indicators

What is measured	Type	Examples
The measure concerns the effects of climate change on a system impact	Exposure	Number of people dependent on vulnerable and unprotected energy infrastructure
	Vulnerability	Extinction of fish species and appearance of new species (by number)
	hazard	Number of forest fires
The measure relates to adaptation action Response	Input	What is being provided for action: R&D funding for adaptation measures in agriculture
	Output Action	What is immediately produced by the action: number of new plans adopted
	Outcome Effect	The effects of the action: - stabilise agricultural yields despite water stress - reduce the number of critical infrastructure failures

Source: table created by the mission

In the “response” category, the merit of the output indicators is that they indicate whether or not the planned measure has been carried out: While this first level of information is essential, it says nothing about the effect of the action, or “output”. The output's effect on climate change adaptation may be indirect and therefore not measurable. As an example, this would be the case for an action to help local authorities develop adaptation plans. Or it may be an action that only yields effects in the long term, which would render attempts to measure it in the short term pointless.

Lastly, a more sophisticated approach has been developed in the UK, based on a theory of change that sets out different “stages” of the action taken: impact, input, output, outcome. A description of this approach is annexed.

In France, the PNACC contains about 140 indicators, including some 30 impact indicators, some 100 action indicators and some 15 impact indicators.

3.6.2 Good Practices

In Germany, the system contains some 100 indicators, distributed in a balanced manner among impact and “response” indicators, without further detailing the type of response indicator in question. The main indicators are listed in Appendix 9.

This balanced approach between impact and response indicators seems judicious. Nonetheless, the mission deems that it would be appropriate to specify, among the response indicators, which are the action indicators (input or output) and which the effect indicators (outcome).

In Japan, the key performance indicators (KPIs) of the 2021 plan are distinguished by the fact that they are accompanied by targets set for the year 2026.²⁶

Table5: Indicators matched with targets (Japan)

sector	Indicator	Target
health	Number of annual heat-related deaths	< 1000
agriculture	Percentage of rice paddy areas planted with species resistant to high temperatures	18
natural disasters	Number of flood protection improvement plans that take climate change into account	About 20

Source: Japanese environment ministry website

This approach can be compared to the German project of establishing in law the principle that the strategy will set targets with measurable results (three or four targets for each of the plan's six main sectors).

Finally, Austria uses indicators called “criteria”, that are presented in a qualitative manner, thus providing more complete and detailed information than qualitative indicators alone. The criteria (three to five for each of the 14 policy areas, i.e., around 50 in total) illustrate developments and trends. Emphasis is placed on criteria that illustrate progress in adaptation: “response” criteria. However, as there is still little knowledge on the effects of climate change (for instance, on the spread of allergenic species), in some areas it was considered important to first observe the challenges posed by climate change: for these observations, “impact” criteria are used.

By way of illustration, here are the criteria used in a particular action area:

Indicators for the “water management and economics” area

- Groundwater quantity and quality
- Buildings that constitute main residences in flood-prone areas
- Retention areas
- Ecological and chemical state of surface waters
- Projects and measures that contribute to improving river and lake ecology
- Changes in water temperature in selected rivers and lakes

These criteria give rise to a thorough analysis. Such indicators do not take the form of a simple number. Consequently, they cannot be understood in an instant; and, while they do require more attention from the reader, they have the advantage of providing more comprehensive and explicit information on the physical state of the systems considered and their evolution. Such information is valuable in determining whether action is on track or whether it should be strengthened.

3.6.3 Recommendation on indicators

Based on the example of the countries studied, the mission recommends a balanced approach founded on the following principles:

- adopt a balanced set of impact and response indicators;

²⁶<https://www.env.go.jp/en/earth/cc/adaptation.html>

- for proper governance of the adaptation plan, it is crucial to know whether its actions have been implemented or not: for this, a monitoring report could be made and justification provided for action indicators (input or output) concerning important actions that would not be likely to give rise to impact indicators;
- define outcome indicators when the effects of action appear measurable;
- set results targets for action (output) and effect (outcome) indicators;
- reflect on impact and outcome indicators, with a view to improving the collection of relevant accessible data;
- and finally, for complex subjects, it seems desirable to complement the set of indicators with qualitative descriptions to yield better overall understanding.

4 Adapting water and biodiversity policies: from a common core, new types of action emerge

4.1 Climate change impacts on the water cycle are much better documented than impacts on biodiversity

It is in the water sector that the consequences of climate change are often felt first and foremost: repeated droughts that lead to restrictions and conflicts of use, reduced river flow with impacts on species and habitats, rising sea levels, saline water infiltrations, exceptional rainfall and flooding, etc.

It is therefore in this area that the impacts of climate change are best documented. For France, the Explore 2070²⁷ study provided scenarios for mid-century evolution in river and groundwater flows in 2012, based on IPCC work. Its findings projected a significant decrease in groundwater recharge, a 30 to 60 % drop in mean annual streamflow, with low flow instances becoming more severe, arising earlier in the year, and lasting longer. The Explore 2070 study is currently being updated; the results of Explore 2 are expected in 2023.

Less is known about the impact of climate change on biodiversity; and yet, the first joint IPBES²⁸ and IPCC report “Biodiversity and Climate Change – Scientific Outcome” shows that climate change—which was just one of the pressures driving the collapse of biodiversity—, if left unchecked, could soon contribute to precipitating that collapse.²⁹ More specifically, this report estimates that the proportion of species threatened with extinction due to climate is 5% under a 2°C warming scenario, but increases to 16% under 4.3°C warming.

The sixth IPCC report indicates that approximately half of the species studied have begun to migrate to the poles or higher altitudes; it also finds that the first extinctions of species due to climate change are already being observed.³⁰

4.2 Adaptation solutions are fairly convergent, but it remains difficult to assess how effectively they are being implemented.

4.2.1 All the plans studied agree that protection and restoration policies should be continued and nature-based solutions developed.

Climate change impact assessments and roadmaps for the water sector are available in most of the surveyed countries, both at national level and in regions where there are major river basins. These roadmaps incorporate the impacts of climate change. In France, for example, the roadmap was drafted following the Assises nationales de l’eau de 2019 (national water conference) on adaptation, and climate change adaptation strategies were drafted for each major river basin.

In such exercises, three types of time horizons are considered:

- In European countries, the river basin roadmaps adopt the timeframes required by

²⁷2012, French ecology ministry in partnership with several public institutions

²⁸Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES)

²⁹2021, IPBES-IPCC co-sponsored workshop report on biodiversity and climate change

³⁰2022, IPCC: Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II

the Water Framework Directive and the Floods Directive; that is, six-year cycles. The current plans target Horizon 2027, in some cases (as for Spain) extending over one or two cycles beyond (2033 and 2039) to account for the effects of global warming,

- some national plans have medium/long term horizons, such as the British “25 year environment plan” adopted in 2019, or the Netherlands' Delta Programme that sets targets for 2050,
- finally, some plans have even more distant horizons, particularly for the prevention of floods related to rising sea levels, such as the 2100 Thames Estuary Programme. These programmes therefore clearly form part of a structured rationale of climate change adaptation—despite the uncertainties involved—with the study of several scenarios, and the notion of “adaptation pathways” that lead to progressively taking “no-regrets decisions”. They provide convergence points for our evolving knowledge on climate impacts, to feed decisions at the most structural level.

These water roadmaps and programmes—that were, in many cases, originally limited to floods (Delta Programme in the Netherlands) or environmental water quality (France's Schémas directeur d'aménagement et de gestion des eaux (SDAGE); master plans for water development and management)—are increasingly being extended to the entire water cycle (drinking water, sanitation, and protection of water resources) and the resilience of aquatic and wetland ecosystems. As a result of this overall development, conventional “grey” civil engineering infrastructure projects (dykes, rainwater collection networks and treatment facilities, etc.) are now being complemented by “nature-based solutions (NBS)” projects such as flood expansion areas (“room for the river” programmes in Germany and the Netherlands), wetland restoration, and waterproofing and management of rainwater sources in cities; projects whose cost-benefit ratio is often worthwhile, though it could be better quantified.

The mission notes that such evolution leading to the development of nature-based solutions is cited as a goal in all the plans studied, at least in principle. However, it is still difficult to judge the extent of practical application, as NBSs cover a wide field and interpretations of the term can differ. However, a harmonised definition is gradually emerging from the work of the International Union for Conservation of Nature (IUCN) and the United Nations Environment Assembly (UNEA).³¹

This growing trend towards adopting NBSs is encouraged in all countries, as it is in France, by the exchange of good practices and a number of pilot experiments. It is a first step towards integrated management of biodiversity and climate change, as enjoined by the IPCC and IPBES in their joint report.

But the notion of integrated biodiversity and climate change management does not only mean promoting nature-based solutions: it is also the absolute necessity to consider the negative impacts of some mitigation solutions on biodiversity. Biodiversity is one of the fields where the risks of misadaptation are greatest, particularly with regard to bioenergy, hydroelectricity, some afforestation policies, and the development of irrigation and water reservoirs.

Broadly speaking, the plans and roadmaps studied by the mission stress that the most appropriate response is to speed up the progress of existing water and biodiversity policies, and of policies for the protection of areas and species.

The plans studied insist more on the need to accelerate policies for the protection and restoration of habitats, their functionalities, continuities, and refuge areas, than on work

³¹Resolution adopted at the fifth United Nations Environment Assembly (UNEA) in Nairobi in May 2022, establishing a common definition of NBS based on the work of IUCN. NBSs are described “as actions to protect, conserve, restore, use, and sustainably manage natural or modified terrestrial, freshwater, coastal, and marine ecosystems that respond to social, economic, and environmental challenges in an effective and adaptive manner, while simultaneously enhancing human well-being, providing ecosystem services, and producing benefits of resilience and biodiversity”.

directly concerning species, other than a few instances of displacement/reintroduction of highly endangered species (Japan, UK). It is emphasised everywhere that recovering continuities (green and blue grid) is key to promoting the migration of species and advancing the fight against invasive alien species.

4.2.2 Beyond this common core of accelerating and strengthening policies, the fast pace of climate change demands new actions

However, a few points more specifically related to climate change need to be added or reinforced in adaptation plans, as compared to existing policies:

- In the water sector, in view of the recurrence of droughts and their far-reaching consequences, particularly on agriculture, alongside the gradual drop in available resources, it has become even more urgent to speed the progress of policies to save water and share it among uses—yet these issues are given little attention in European directives. The examination of the benchmarking plans does not reveal a different approach to these subjects than that adopted in France, in other words: the need to set quantified and shared goals for water saving; integrated management by watershed, that takes the needs of the environments into account; prioritisation of uses, announced in terms of intention yet still underdeveloped in applicable law. The list of levers that can be mobilised is recognised and cited in all plans (tackling leaks in the networks, reuse of wastewater, drip irrigation, etc.). Plans sometimes also mention incentivising tools for pricing that are being experimented with in some jurisdictions. Logically, there is a particular focus on the agricultural sector, setting out short-term solutions that may be based on the development of storage capacities and medium- and long-term solutions that envisage a transformation of production models.

On the subject of flood prevention, the definition of reference hazards must include the impacts of climate change. This is beginning to happen with regard to rising sea levels and retreating coastlines (the Netherlands, the UK, and France are particular examples of this), and must be further developed with regard to the impact of changes in precipitation patterns on floods, as knowledge in this area is rapidly advancing. In general, the plans studied by the mission project investment in the development and reliability of monitoring and alert systems for extreme phenomena, that are deemed essential and “no regrets”; this is particularly true for France's overseas territories.

Flood prevention policies will, in some cases, lead to major reworking of spatial planning for some territories. With regard to anticipating the consequences of rising sea levels, the mission specifically identified the 2100 Thames Estuary Programme and the 2022 update of the Netherlands' Delta Programme as good examples of constructed adaptation policies, involving Parliament or civil society in the most structuring decisions. Specifically, these programmes question what is the desired level of protection of people and property against natural hazards, often by offering three options:

- maintaining the current level of protection despite climate change—the most common choice—, which entails boosting prevention policy;
- the goal of raising the level of protection for certain sectors or territories;
- a reduction in the level of protection for others (see the annexed map of the Thames programme's challenges, published by the English environment agency).

Naturally, this is a very sensitive debate, one that needs to be explained and shared as widely as possible: the Delta and 2100 Thames Estuary programmes provide inspiring examples of this.

- Climate change risk assessments for protected areas or ecosystems are now being initiated (particularly in the UK), alongside the need to develop integrated soil protection policies that take water retention, biodiversity, and carbon storage capacity into account, starting with the development of integrated indicators (Japan, Germany).
- Cost-benefit analyses are still scarce, but one instance worth mentioning is the return on investment calculation presented in the English adaptation plan regarding the policy for flood prevention and control of coastal erosion: a spending programme of £2.6 billion over six years is expected to yield £30 billion in benefits.

These different examples could contribute to the chapter on water, natural risks, and biodiversity in the draft of France's future adaptation plan.

Recommendation 11. (MTECT) Complement national water roadmaps with measures on sectoral water-saving plans, the development of early warning systems for natural hazards, and the organisation of a debate about the desired level of protection of people and property. Whenever possible, conduct cost-benefit analyses in support of these programmes.

5 The mobilisation of the banking and insurance sectors will have a decisive leverage effect on all stakeholders

Despite the fact that climate change adaptation largely affects the banking and insurance sectors, the subject still appears to be in its early days here. The problem presents itself differently in each of these sectors, with more advanced thinking in the insurance sector owing to sound knowledge on the evolution of claims and losses.

5.1 The banking sector

5.1.1 Risk assessment and “stress tests”

The banking sector identifies climate change adaptation as a cross-cutting risk and highlights two main risks, not always clearly distinguished from mitigation:

- Physical risk, leading to a financial loss related to climatic hazards (drought, flooding, etc.), that is closely linked to insurance coverage.
- A climate transition risk linked to the delay in tackling climate change (adaptation to technological changes, new business models, changes in regulations and consumer choices).

As there are no past models to draw from, assessing these risks is a complex task.

Central banks have begun to take an interest in these issues. The ECB published initial elements in November 2020 and decided to carry out stress tests every two years from 2022. The Bank of England has taken a similar step.

Stress tests focus more on carbon-based assets than on exposure to climate risks themselves. Nevertheless, they take elements such as heat waves and floods into account. Analyses of the resilience of balance sheets to climate risks are conducted on the basis of climate scenarios (orderly transition, disorderly transition, impacts on inflation, employment, etc.). Strategies, carbon offsets, and their risk profiles are also taken into account. However, the ECB has yet to establish a proper methodology.

Additionally, in 2020 and 2021, the Banque de France and the Bank of England published risk analyses of their banking sectors based on large-scale studies.

Lastly, since 2015, the British Treasury has engaged in the creation of the Task Force on Climate-related Financial Disclosures (TCFD), a structured approach to informing the public about risks and opportunities management for companies in the light of climate change. This initiative is particularly relevant to the financial sector in the broader context of “green finance”, a growing trend. The latest roadmap, published in 2021, specifies the structure of the information to be put in place by companies and asset managers, setting out different areas (governance, strategy, risk management, indicators and objectives) for each financial product, along with the planned schedule.

5.1.2 The data

Collection of operational data appears to be a difficult task for the banking sector, since it does not possess the same information as the insurance sector. It seems that there is still a need to deepen the dialogue between these two sectors. The banking sector uses generic

approaches: sectoral analysis, index of climate change materiality, exposure assessment, maturity (management, strategy, plan), climate score³².

5.2 The insurance sector

5.2.1 The claims ratio

The insurance sector has a profound understanding of climate change adaptation from the perspective of claim rates for natural disasters. In France, according to France Assureurs, the cost of these claims has increased from one billion euros in 2000, to three in 2020, and five in 2022; an annual amount of ten billion is now anticipated.

Risk coverage appears to be effective in France thanks to the “Catnat” system; this does not exist in the other countries studied, where compensation is low and insurance costs are high. However, in some areas it is difficult or even impossible for the private sector to provide coverage.

In France, the level of premiums does not allow for a genuinely inciting signal price. It seems that this is not the case in some other places, especially in California where premiums are high.

5.2.2 Data and “stress tests”

Unlike the banking sector, insurers have fairly accurate data on claims related to large-scale events, and they can draw from regionalised databases.

As for banks, initial stress tests concerning French insurers were conducted by the Autorité de contrôle prudentiel et de résolution (ACPR) (Prudential Supervisory and Resolution Authority) in 2021 and will be renewed every two years.

5.3 The mission's recommendation

PNACC 2 comprises actions that concern the financial sector. It provides for better understanding of risks to be sought, in view of adapting investment strategies and promoting adaptation financing in France. It also mentions the establishment of a recurring dialogue between public authorities (including local authorities), climatologists, (re)insurers, banks, institutional investors, and asset managers. Such actions, that have seemingly been performed only to a feeble extent, should be further developed.

Recommandation 12. (MEFSIN and MTECT) Strengthen the involvement of the banking and insurance sectors, by developing a structured dialogue that includes risk assessment and data sharing, while instilling greater consideration of climate change adaptation in “green finance”.

³² The BPI has built a climate score based on the geolocation of the consideration and its exposure to climatic hazards, regardless of its activity, and on the sector's vulnerability to climatic hazards. The result gives a score of 1 to 5, shedding light on the decision without mechanical impact on the credit policy. Many financial institutions develop composite scores of this type, each with its own methods. Some follow a logic of accompaniment, whilst others, especially in Anglo-Saxon countries, act according to their “appetite for risk”.

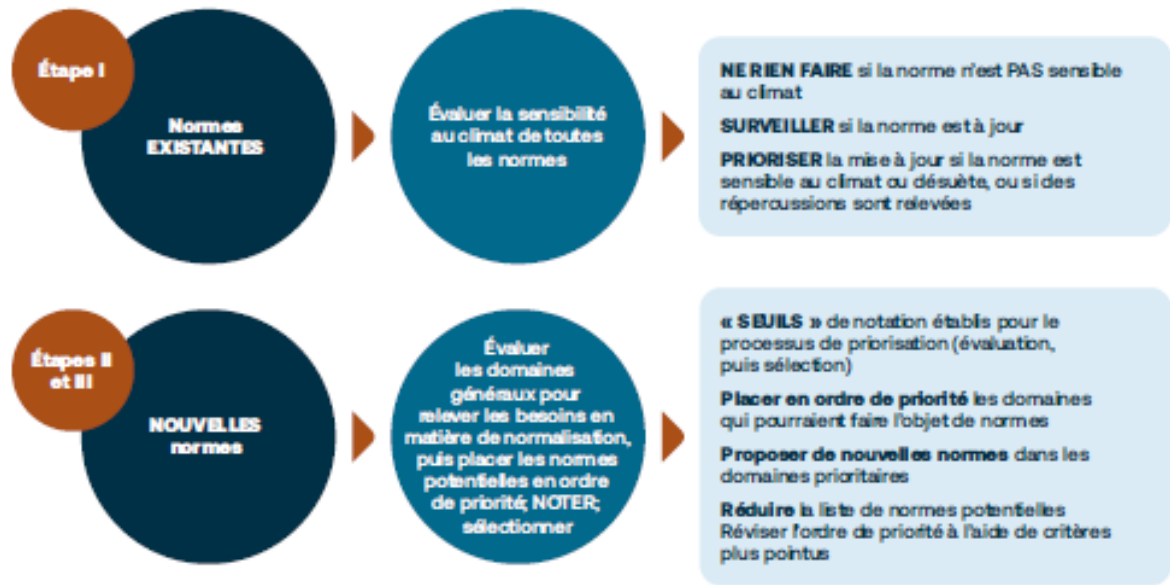
6 It has become imperative to adapt technical standards and reference systems

Among the measures deemed necessary by the mission, special consideration was given to the consideration of climate change in the revision or development of technical standards and reference systems. This consideration is provided for in the French PNACC (“GOUV-5” action) but seems to have been poorly implemented so far, except in the cases of transport infrastructure and the consideration of summer comfort under the ER 2020. The AFNOR services have not identified it as an action in its own right and it is not yet included in the French standardisation strategy.

Nonetheless, actions—that could be significantly strengthened—are being carried out at European level under the adaptation strategy framework (CEN-CENELEC specific group), as well as at international scale, under the ISO framework.³³

It seems that the most advanced country in this domain is Canada, whose standards council has undertaken an urgent review process to identify standards.

Figure 7: Decision Tree of the Canadian Standards review approach



Source: Canadian Standards Association

Conducted under the “Standards Programme for Resilient Infrastructure” adopted in 2016, this review identified some 100 standards requiring urgent revision to take account of the effects of climate change, of which 63 are for infrastructure and buildings.

The standards revision programme was underpinned by an internet consultation. Four Standards Development Organizations (SDOs) accredited by the Standards Council of

³³ At ISO level, see <https://www.iso.org/sdg/SDG13.html> and the revision of ISO Guide 84 “Guidelines for addressing climate change in standards”

Canada (SCC) then reviewed a total of 714 infrastructure and building standards and recommended that 63 be updated to address at least one of the following issues: adaptation to the effects of climate change, reduction of greenhouse gas emissions, mitigation of adverse effects and environmental impacts, and sustainability or sustainable development.

While this review is not exhaustive and the total number of standards to be revised is probably much higher, such a systematic approach seems judicious. The percentage of standards to be revised after examination—of the order of 9% in two of the sectors most affected by climate change (infrastructure and buildings)—should certainly not be carelessly extrapolated to European and French standards, but it does provide an indication of how much work remains to be done.

At minimum, it must be ensured that the consequences of climate change are taken into account every time a technical standard is revised. ISO and CEN have published a guide for taking climate change into account in the development of standards: ISO version: 84:2020, CEN version: CEN-CENELEC 32:2016.

Germany (DIN) has drawn up a checklist (in Appendix 10) of points to be routinely checked at the time of standards reviews, involving consideration of the effects of climate change. Clearly, such an approach would also be of crucial importance in France, and it should be undertaken in a cross-cutting way that stretches beyond the sectoral approaches, particularly in the field of transport infrastructure³⁴.

At European level, the Commission (DG GROW and DG CLIMA) has just launched a preliminary study for the initiation of such an approach, following an introductory mandate in 2014 that brought about the review of some twenty standards. The aim is to seek as much help as possible from the Member States responsible for part of the standardisation activity.

In view of these experiences, it therefore appears necessary to take better account of adaptation in standards and technical reference systems. A more systematic approach should be taken when reviewing and elaborating them. Aside from these instances, it would also be desirable to identify the main standards that urgently need to be revised so that they can account for climate change impacts. These include critical infrastructure to be renovated in the near future, such as power grids, water networks, etc.

Recommandation 13. (CGDD, DGEC, DGPR, DGALN, DGITM, DGE³⁵ and AFNOR) Ensure that the impacts of climate change are systematically taken into account when developing and revising technical standards and reference systems, particularly those relating to infrastructure and buildings.³⁶

³⁴ CEREMA, 2019, knowledge collection, "Vulnérabilités et risques : les infrastructures de transport face au climat" (Vulnerabilities and risks: transport infrastructure facing the climate).

³⁵Direction générale des entreprises (Directorate-General for Enterprise)

Conclusion

The mission warmly thanks the various contact persons in the countries studied in the benchmarking process and in France, who were kind enough to devote their time to answering its questions. It also thanks the embassy counsellors who enabled these meetings, which were always very instructive, to be set up.

While policies to reduce greenhouse gas emissions logically remain at the forefront of climate concerns today, the extreme weather events that occurred in recent months in France and around the world have significantly increased public awareness of the importance of adaptation. Now is therefore the right time to give strong political impetus to this area, as the energy-climate programming law and the third national adaptation plan are being adopted.

The planning cycle procedure, implemented in most of the benchmarking countries, can now be considered properly defined. Risk assessment, drafting of the plan, evaluation, definition of indicators; none of these topics seem to raise any major difficulties. The major challenge is clearly that of managing the scope of a procedure that involves many actors in a wide range of action areas.

Additionally, several topics—that are already addressed in some of the benchmarking countries but lie beyond the mission's scope—require further reflection: the inclusion of vulnerable people in the risk analysis and then in the adaptation plan; the interactions between risks, cumulative impacts, and maladaptation; and international vulnerabilities, particularly for supply chains.

Adaptation is about far more than costs. Above all, it should be considered as a requirement, to be routinely taken into account in any project. As far as financial issues are concerned, however, several studies have been carried out in France on the costs of mitigation. With a view to creating an Energy-Climate programming law with an adaptation component, it would be useful to conduct a study on the projected cost of adaptation, following on from the one recently conducted by I4CE.

Marc Strauss



**Inspector General
of the administration of
sustainable development**

Bernard Schwob



**General Engineer
of bridges, waters
and forests**

Patricia Blanc



**General Engineer
of mines**

Annexes

Annexe 1. Lettre de mission



**MINISTÈRE
DE LA TRANSITION
ÉCOLOGIQUE**

*Liberté
Égalité
Fraternité*

→ SG J → TEC

La ministre

Paris, le 11 AVR. 2022

Réf : MTE/2022-04/14541

Affaire suivie par : Eric Brun
eric.brun-barriere@developpement-durable.gouv.fr
Tél. : 01.40.81.92.94

Monsieur Jean-Martin
DELORME
Vice-président du
Conseil général de
l'environnement et du
développement durable
Tour Séquoia
92055 PARIS LA DEFENSE
CEDEX

Objet : Mission sur le parangonnage des politiques d'adaptation en Europe et au-delà

Monsieur le Vice-président,

Hausse des températures plus forte que la moyenne mondiale, augmentation de l'intensité et de la fréquence des vagues de chaleur, des précipitations extrêmes et des sécheresses, baisse de la ressource en eau et de l'enneigement, hausse du niveau de la mer, intensification des cyclones : tels sont les impacts du changement climatique que les émissions de gaz à effet de serre passées rendent désormais inéluctables et auxquels la France doit se préparer.

La France s'est dotée très tôt d'une stratégie de planification de l'adaptation au changement climatique. Dès 2011, elle a ainsi publié le premier plan national d'adaptation au changement climatique (PNACC) pour une période de cinq ans, avec l'objectif d'intégrer l'adaptation dans l'ensemble des politiques publiques. Puis en 2018, le second plan a été adopté.

Dans le cadre de la future stratégie française Energie et Climat (SFEC) dont j'ai lancé les travaux le 11 octobre dernier, le troisième plan national d'adaptation au changement climatique (PNACC-3) devra succéder au PNACC-2 pour couvrir la période 2024-2029. Un de ses principaux objectifs pourrait être de renforcer l'articulation entre les politiques nationales et territoriales d'adaptation au changement climatique.

De par les nombreux secteurs d'activité et milieux naturels potentiellement impactés, la question de l'adaptation au changement climatique est éminemment transversale et nécessite la mobilisation de tous, à commencer par les services de mon ministère et ses opérateurs.

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Dans ce contexte, je souhaite vous confier une mission qui visera à un parangonnage des principaux pays ayant une expérience forte en matière de politique d'adaptation au changement climatique, tels que l'Allemagne, l'Autriche, la Suisse, les Pays-Bas, le Royaume-Uni, le Japon, par exemple, sur les points suivants :

- Les outils législatifs et réglementaires sur lesquels s'appuient leurs politiques, contraignants ou non ;
- L'articulation entre les niveaux national et infra-national ;
- Les mécanismes de gouvernance, notamment en matière de suivi et de coordination, ainsi que les différents indicateurs utilisés (suivi, progrès, performance, etc.) ;
- Les institutions contribuant à la gouvernance de l'adaptation, que ce soit au niveau gouvernemental ou scientifique ;
- Le périmètre couvert par les politiques d'adaptation ;
- Les types de contenu et la forme des documents de pilotage des politiques d'adaptation, notamment les stratégies d'adaptation ainsi que leurs plans de mise en œuvre ;
- Le contenu, la forme et la méthode d'élaboration des études de vulnérabilité servant de base pour la rédaction des stratégies et plans nationaux d'adaptation.

La mission bénéficiera du concours des services et opérateurs du ministère et prendra tout contact utile auprès des parties prenantes concernées, notamment les organismes scientifiques développant des services climatiques ou ayant conduit des études sectorielles.

La mission rendra son rapport d'ici fin juin 2022, en cohérence avec le calendrier de la Stratégie française Energie et Climat.

Je vous prie d'agréer, Monsieur le Vice-président, l'expression de ma considération distinguée.



Barbara POMPILI

Annexe 2. Liste des personnes rencontrées

Nom	Prénom	Organisme	Fonction	Date de rencontre
Ministère de la transition écologique et de la cohésion territoriale (MTE-CT)				
<i>Cabinet du ministre</i>				
ZAKHARTCHOUK	Adrien	MTE-CT	Conseiller transition bas carbone, efficacité énergétique, adaptation au changement climatique, air	29/08/2022 20/10/2022
WOLFF	Anastasia	Secrétariat d'Etat à l'écologie	Conseillère eau, milieux aquatiques, mobilisation des acteurs économiques	20/10/2022
COLAS	Hélène	Secrétariat d'Etat à l'écologie	Conseillère biodiversité, paysage, mobilisation de la jeunesse	20/10/2022
<i>Inspection générale de l'environnement et du développement durable</i>				
CAUDE	Geoffroy	Section mobilités et transports	Membre permanent	21/06/2022
BREHIER	Régine	Section mobilités et transports	Membre permanent	21/06/2022
CINOTTI	Bruno	Section milieux, ressources et risques	Membre permanent	22/06/2022
SCHMITT	Alby	Section milieux, ressources et risques	Membre permanent	22/06/2022
<i>Direction générale de l'énergie et du climat</i>				
DAVID	Olivier	Service du climat et de l'efficacité énergétique	Chef de service	7/06/2022 6/10/2022
BRUN	Eric	Observatoire national sur les effets du réchauffement climatique (ONERC)	Secrétaire général	7/06/2022 25/08/2022 6/10/2022
CARREGA	Marie	ONERC	Adjointe au secrétaire général	7/06/2022 25/08/2022 6/10/2022
DUVERNOY	Jérôme	ONERC	Chargé de mission	7/06/2022

Nom	Prénom	Organisme	Fonction	Date de rencontre
				25/08/2022 6/10/2022
VOIRIN	Sarah	ONERC	Chargée de mission	6/10/2022
SCHAFFERER	Frédéric	ONERC	Chargé de mission	6/10/2022
MOURLON	Sophie	Direction de l'énergie	Directrice	23/9/2022
CLAUSSET	Nicolas	Direction de l'énergie	Sous-directeur des systèmes électriques et énergies renouvelables	23/9/2022
<i>Direction générale de la prévention des risques</i>				
LEHIDEUX	Véronique	Service des risques naturels et hydrauliques	Cheffe de service	17/06/2022
MULLER	Sybille	Bureau des risques inondation et littoraux	Chef de bureau	17/06/2022
BUFFETRILLE	Juliette	Bureau des risques inondation et littoraux	Chargée de mission	17/06/2022
<i>Direction générale de l'aménagement, du logement et de la nature</i>				
HUET	Brice	DGALN	Adjoint à la directrice générale	31/08/2022
ALBOUY	Delphine	Direction de l'eau et de la biodiversité (DEB)	Chef de la mission projets transversaux prioritaires protection et restauration des écosystèmes	31/08/2022
HAZET	Charles	DEB	Adjoint au sous-directeur de la protection et de la gestion de l'eau, des ressources minérales et des écosystèmes aquatiques	31/08/2022
DEBAERE	Olivier	DEB	Adjoint à la sous-directrice de la protection et de la restauration des écosystèmes	31/08/2022

Nom	Prénom	Organisme	Fonction	Date de rencontre
			terrestres	
MAURY	Baptiste	DEB	Chef du bureau des outils territoriaux de la biodiversité	31/08/2022
MONTRIEUX	Vincent	Direction de l'habitat, de l'urbanisme et des paysages	Sous-directeur de la qualité du cadre de vie	31/08/2022
CARON	Antoine	Direction de l'habitat, de l'urbanisme et des paysages	Sous-directeur de la qualité et du développement durable dans la construction	31/08/2022
<i>Direction générale des infrastructures, des transports et des mobilités</i>				
POPESCU	Teodora	Mission de la synthèse et de l'analyse stratégiques	Chargée de mission infrastructures et adaptation au changement climatique	15/06/2022
<i>Commissariat général au développement durable</i>				
APIED	Viviane	CGDD	Déléguée ministérielle aux normes	27/9/2022
<i>Directions régionales de l'environnement, de l'aménagement et du logement</i>				
MEDARD	Alice-Anne	Nouvelle-Aquitaine	Directrice	21/9/2022
MAZOYER	David	Grand-Est	Directeur-adjoint	13/09/2022
LOMBARD	Aline	Grand-Est	Adjointe au chef de service	13/09/2022
GAUBY	Guillaume	Grand-Est	Chef de pôle	13/09/2022
<i>Ministère de l'économie, des finances et de la souveraineté industrielle et numérique</i>				
<i>Direction générale des entreprises</i>				
STEFANINI	Rémi		Sous-directeur de la normalisation, de la réglementation des produits et de la métrologie, délégué interministériel aux normes	16/9/2022
<i>Sénat</i>				
DANTEC	Ronan	Sénateur	Président de la commission spécialisée	20/09/2022

Nom	Prénom	Organisme	Fonction	Date de rencontre
			« adaptation au changement climatique » du CNTE	
ADEME				
RANSQUIN	Johan	Direction Adaptation, Aménagement, et Trajectoires bas carbone (DAAT)	Directeur	5/09/2022
BELLINI	Robert	DAAT	Adjoint au directeur	5/09/2022
AFNOR				
RAIMBAULT-VERRIER	Mélanie	AFNOR Innovation	Responsable développement économie circulaire	12/9/2022
REMY	Jean-Michel	AFNOR Innovation	Responsable du département construction et cycle de l'eau	12/9/2022
Caisse centrale de réassurance				
BAUDUCEAU	Nicolas	Direction des fonds publics et de la prévention	Directeur	18/07/2022
QUANTIN	Antoine	Direction des réassurances et des fonds publics	Directeur	18/07/2022
CEREMA				
BERTEAUD	Pascal	CEREMA	Directeur général	10/10/2022
FERRY	Annabelle	CEREMA	Directrice territoires et villes	10/10/2022
Haut conseil pour le climat				
LE QUERE	Corinne	HCC	Présidente	4/10/2022
RAHMANI	Said	HCC	Directeur exécutif	4/10/ 2022
Institute for climate economics - I4CE				
NICOL	Morgane	I4CE	Directrice du programme territoires	12/09/2022
DEPOUES	Vivian	I4CE	Chef de projet Adaptation au changement climatique	12/09/2022

Nom	Prénom	Organisme	Fonction	Date de rencontre
METEO FRANCE				
JOSSE	Patrick	Direction de la climatologie et des services climatiques	Directeur	11/07/2022
SOUBEYROUX	Jean-Michel	Direction de la climatologie et des services climatiques	Directeur adjoint scientifique	11/07/2022
ONF				
ULRICH	Erwin	Mission adaptation des forêts au changement climatique	Pilote de la mission	3/10/2022
Régions de France				
DE MALEVILLE	Olivia	ARF	Conseillère transition écologique	13/10/2022
VALLON	Marie-Caroline	Région Sud	Chef de projet à la direction de la transition énergétique et des territoires	13/10/2022
Ville de Paris				
CROQUETTE	François	Ville de Paris	Directeur de la transition écologique et du climat	13/10/2022
MERRHEIM	Grégoire	Ville de Paris	Chargé de mission énergie-climat	13/10/2022
Autriche				
HOPFGARTNER	Marie-Christine	Ministère pour l'action climatique, l'environnement et l'énergie	Chargée de mission, Direction VI/1 – coordination de la politique climatique	7/09/2022
LEITNER	Markus	Agence de l'environnement	Chef du pôle adaptation au changement climatique et résilience	7/09/2022
Japon				
YOSHIKAWA	Keiko	Centre national pour l'adaptation au changement climatique (CCCA)	Directrice-adjointe	26/9/2022
MACHIMURA	Tasuku	CCCA	Chargé de	26/9/2022

Nom	Prénom	Organisme	Fonction	Date de rencontre
			mission	
MOEJ	Shuhei	Ministère de l'environnement (MOE) – service de l'adaptation au changement climatique	Chargé de mission	26/9/2022
CARDINET	Rémy	Ambassade de France – Service économique régional	Conseiller développement durable	26/9/2022
		Canada		
SEMICHON	Carole	Ambassade de France - Service économique régional,	Conseillère développement durable	07 /10/ 2022 14/10/2022
SIGG	Dominique	Ministère de l'environnement et du changement climatique de Colombie britannique	Conseillère	7/10/2022
MONTREUIL	Olivier	Ministère de l'environnement du Québec Direction de la prospective	Conseiller	14/10/2022
GAUTHIER	Catherine	Direction de la prospective	Directrice	14/10/2022
FOURNIER	Michèle	Direction des affaires internationales	Directrice	14/10/2022
Royaume-Uni				
Mac CARTNEY	Dan	Ministère de l'Environnement, de l'Alimentation et des Affaires rurales, DEFRA	Chef de l'unité adaptation au changement climatique	12/09/2022
KENNEDY	Myriam	Conseil pour le Changement Climatique (CCC)	Analyste senior	13/09/2022
FOLEY	Julie	Agence de l'environnement d'Angleterre (EA)	Flood & Coastal Risk Management - Director Strategy & National Adaptation	25/10/2022
EDEN	Andrew	Agence de l'environnement	Flood & Coastal Risk	25/10/2022

Nom	Prénom	Organisme	Fonction	Date de rencontre
		d'Angleterre (EA)	Management – Manager Adaptation & Resilience	
CUTHBERTSON	David	Thames Estuary 2100 Programme	Team Leader	25/10/2022
Pays-Bas				
WOLTERS	Roald	Ministère de l'environnement	Chargé de mission, unité adaptation au changement climatique	30/08/2022
VON ALPHEN	Jos	Commissariat à la mise en œuvre du programme Delta	Conseiller auprès du commissaire	30/9/2022
Allemagne				
JUNG	Silke	Ministère de l'environnement, de la protection de la nature, de la sécurité nucléaire et de la protection du consommateur	Cheffe du bureau affaires politiques, stratégie et droit de l'adaptation au changement climatique	12/10 /2022
ALSEN	Nina	même ministère	Chargée de mission	12/10/2022
HASSE	Clemens	Agence allemande de l'environnement	Chargé de mission - section adaptation et impacts climatiques	28 /10/ 2022
GRAMBOW	Martin	Agence bavaroise de l'environnement	Directeur général	7/10/2022
KORK	Jane	Agence bavaroise de l'environnement	Coordinatrice des sujets eau	7/10/2022
Suisse				
HOHMANN	Roland	Office Fédéral de l'Environnement	Chef de l'unité adaptation au changement climatique	29/07/2022
Espagne				
HERAS HERNANDEZ	Francisco	Ministère de la transition	Conseiller technique	26/07/2022

Nom	Prénom	Organisme	Fonction	Date de rencontre
		écologique	auprès du directeur général pour le changement climatique (OECC)	
Commission européenne				
VISNAR MALINOVSKA	Elena	DG CLIMA	Chef d'unité adaptation au changement climatique	06/09/2022
MATT	Stéphanie	DG CLIMA	Chargée de mission. Unité adaptation au CC	
BERGDAHL	Mathias	DG GROW	Chef d'unité adjoint normalisation	26/10/2022
MUSSO	Federico	DG GROW	Team leader pour la normalisation	26/10/2022
COUZIGOU	Gwénoélé	DG GROW	Directeur normalisation, construction, machinerie et équipement	26/10/2022
Conseil européen des régions				
GRUBISIC	Mario		conseiller	16/09/ 2022
Experts				
LEITER	Timo	Grantham Research Institute on Climate Change and the Environment	PhD candidate	27/9/2022
CANALE	Elena	France Assureurs	Responsable développement durable	27/10/2022
		France Assureurs		
PIERROT	Emmanuel	BPI France	Directeur des risques climatiques	20/10/2022

Annexe 3. Eléments de bibliographie

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Annexe 4. Exemples inspirants identifiés par la mission dans chaque pays

Allemagne

- L'accord de coalition et l'annonce d'un projet de loi traitant de l'adaptation,
- La « communauté de travail » entre l'Etat et les Länder aux niveaux politique et technique,
- L'évaluation des risques,
- Le projet de définir 30 à 40 objectifs d'adaptation, dont les résultats soient mesurables.

Autriche

- Le réseau de conseillers mis à disposition des collectivités locales,
- Les critères d'évaluation qualitatifs.

Suisse

- L'étude de risques territorialisée,
- Les modalités d'évaluation,
- Le rapportage des initiatives locales.

Canada

- L'apport scientifique, technique et pédagogique du consortium public-privé OURANOS pour l'adaptation et notamment les portraits climatiques publiés par région,
- Les mécanismes de financement notamment alimentés par les recettes des fonds carbone au Québec,
- La démarche systématique menée par le conseil canadien des normes.

Espagne

- Le titre de la Loi climat concernant l'adaptation qui comporte également une approche sectorielle,
- Le processus de consultation et de participation,
- La prise en compte des populations les plus vulnérables.

Etats-Unis

- Le budget conséquent voté dans le cadre de la loi de réduction de l'inflation d'août 2022 dont un volet de 30 Md de dollars sur l'adaptation,
- Le fait que chaque agence gouvernementale élabore son propre plan d'adaptation,
- Le centre de ressources fédéral du Georgetown Climate Center et la base de données en ligne « adaptation clearinghouse » qui peut se décliner au niveau de chaque Etat,
- Le site internet de l'Etat de Californie « Cal-Adapt » qui fournit des données climatiques très facilement accessibles par les particuliers et les professionnels.

Japon

- La loi de 2018 et son effet d'entraînement pour la réalisation de plans d'adaptation dans chaque préfecture,
- L'évaluation des risques,
- Le centre de ressources national « A-PLAT » destiné à l'ensemble des acteurs (professionnels, collectivités, particuliers), décliné aussi au plan local.

Pays-Bas

- La capacité de vision et d'anticipation (montée du niveau de la mer à l'horizon 2100),
- Le budget conséquent du programme Delta et son élargissement progressif aux solutions fondées sur la nature et à l'adaptation spatiale,
- Le partage avec l'ensemble de la société notamment à travers les débats annuels au Parlement sur le programme Delta.

Royaume-Uni

- L'évaluation des risques,
- Le programme Estuaire de la Tamise 2100,
- Les fonds dédiés gérés notamment par l'agence de l'environnement avec en particulier un financement de projets innovants,
- Les stress tests réalisés sur les infrastructures critiques,
- L'élargissement annoncé du plan aux enjeux d'approvisionnement et de vulnérabilité du secteur financier.

Annexe 5. Dispositions législatives en vigueur dans les pays du parangonnage

	Royaume-Uni (2008)	Japon (2018)	Espagne (2021)	Etats-Unis, ☐ Canada (2022)
Répartition des rôles	Entre le CCC, le Royaume-Uni et les 4 Nations	Entre ministères, collectivités, entreprises et grand public	Administrations publiques	Non
☐ Evaluation des risques	Oui, par le DEFRA sur l'avis du CCC	Oui, par le ministère de l'environnement et recommandée pour les autres acteurs	Oui, intégrée au PNACC	Non
Planification	Oui, existence de plans nationaux et cycle de révision, rien sur les plans locaux	Oui, contenu du plan national, cycle de révision et invitation des autres acteurs à réaliser leur plan	Oui, description détaillée du contenu du plan national, plans sectoriels pour chaque ministère, rien sur plans locaux	Non
Orientations sectorielles	Non	Non	Oui, assez complètes	Non
Financement dédié	Non à notre connaissance	Non	Non à notre connaissance, fonds sectoriels	Inflation Act: 30Md USD Fonds canadien : 3 Md CAD

Annexe 6. Analyse comparative du contenu de différents plans

Le tableau ci-après présente une comparaison du périmètre des plans allemand, français et anglais. Il met en évidence un très large tronc commun entre ces différents plans.

Allemagne (2020)	France (2018)	Angleterre (2018)
<p><u>Eau</u> : eau ; protection des côtes et inondation ; pêche ;</p> <p><u>Infrastructures</u> : construction ; énergie ; transport et infrastructures de transport ;</p> <p><u>« Land »</u> : Sol ; Biodiversité ;</p> <p>Agriculture ; forêt et économie forestière,</p> <p><u>Santé</u> : santé humaine</p> <p><u>Économie</u>: industrie et entreprises ; tourisme ; économie financière et de l'assurance ;</p>	<p><u>Nature et milieu</u> : Eau, écosystèmes, sols, mer et littoral, forêts, biodiversité</p> <p><u>Prévention et résilience</u> : risques naturels, feux de forêt, santé, aménagement du territoire</p> <p>Filières économiques et agricoles, tourisme</p>	<p><u>Eau</u> Inondation et protection côtière</p> <p>Construction ; Energie ; Transports</p> <p>Protection des sols et stockage naturel du carbone</p> <p>Résilience écologique terrestre ainsi que dans les rivières et les lacs</p> <p>Résilience écologique marine (yc pêche, aires protégées etc.)</p> <p>Agriculture ; forêts</p> <p>Santé et services sociaux</p> <p>Economie (pertes de productivité, supply chain, accès au capital)</p> <p>Services d'urgence et résilience des communautés</p>

<p><u>Activités transversales :</u></p> <p>protection de la population et protection contre les catastrophes ;</p> <p>planification locale et planification de la construction</p> <p>plan d'action à l'international complémentaire au plan</p>	<p>Connaissance et information</p> <p>Gouvernance : articulation avec les niveaux territoriaux dont l'Outre-Mer, participation de la société civile, corpus juridique et normatif</p> <p>Action internationale, aide au développement</p>	<p>Planification</p> <p>Biosécurité (yc espèces invasives)</p> <p>Télécommunications</p> <p>Gouvernements locaux</p> <p>Accroissement des connaissances</p> <p>Plan d'actions à l'international complémentaire au plan</p>
<p>Tableau récapitulatif des mesures avec le pilote, le calendrier, dans certains cas le budget et les indicateurs de suivi</p>	<p>Dispositif de mise en œuvre décrit, s'appuyant sur la commission spécialisée du CNTE, mais pas de dispositif d'évaluation</p> <p>Pas de tableau détaillé publié mentionnant pour chaque mesure le budget, le pilote, le calendrier, les objectifs chiffrés</p>	<p>Chapitre détaillé consacré au reporting (le dispositif d'évaluation étant prévu par la loi)</p> <p>Tableau détaillé annexé avec pilote, calendrier, indicateurs (avec ponctuellement quelques objectifs chiffrés mais assez peu).</p>
<p>61 pages hors annexes</p>	<p>24 pages</p>	<p>76 pages hors annexes</p>

Annexe 7. Compléments sur la référence climatique

Les scénarios du GIEC

La contribution du groupe de travail I au 6^{ème} rapport du GIEC, intitulée « changement climatique 2021- éléments issus des sciences physiques » et publiée en octobre 2021 », fonde son analyse sur une sélection de 5 scénarios, les scénarios SP1-1.9, SSP1-2.6, SSP2-4.5, SSP3-7.0 et SSP5-8.5, classés du plus favorable au moins favorable en termes d'émissions de gaz à effet de serre.

Encadré : définition des scénarios du GIEC

Pour explorer l'avenir du climat, le GIEC a développé des projections de changement climatique à l'aide de jeux de données décrivant notamment les émissions de gaz à effet de serre.

Pour le 5^{ème} rapport du GIEC, les scénarios ont été appelées « chemins de concentration représentatifs » (RCP- Representative Concentration Pathways). Pour le 6^{ème} rapport, ces scénarios ont été appelés « chemins socio-économiques partagés » (SSP shared socioeconomic pathways). Les RCP sont un ensemble de quatre trajectoires qui couvrent une large plage de « forçages radiatifs » possibles, définis comme un apport d'énergie accru au niveau de la surface en watts par mètre carré, allant de 2,6 W/ m² (RCP2.6) à 8,5 W/ m² (RCP 8.5) d'ici la fin du 21^e siècle, avec les RCP4.5 et RCP6.0 comme scénarios intermédiaires. Le RCP2.6 est un scénario de pic et de déclin atteignant 3 W/ m² avant 2100.

Un ensemble de base de cinq scénarios SSP, à savoir SSP1 –1.9, SSP1–2.6, SSP2–4.5, SSP3–7.0 et SSP5–8.5, a été sélectionné dans la contribution du groupe de travail I pour le 6^{ème} rapport. Le premier chiffre de la désignation concerne l'ensemble particulier d'hypothèses socio-économiques à l'origine des émissions et le deuxième chiffre est le niveau de « forçage radiatif » atteint en 2100.

Le SSP1–1.9 est un scénario compatible avec la limitation du réchauffement moyen mondial à 1,5°C, le SSP1-2.6 un scénario compatible avec la limitation du réchauffement à 2°C. Outre les RCP et les SSP, il existe de nombreuses autres possibilités d'émission et d'évolutions économiques, ce qui entraîne une incertitude qui affecte l'exposition et la vulnérabilité au changement climatique. En outre, il convient de noter que la probabilité d'un scénario d'émissions affecte la probabilité d'un résultat climatique et la distribution globale des résultats climatiques. Cela est important car la plausibilité des émissions RCP et SSP les plus élevées et les plus basses a été remise en question.

Source : contribution du groupe 1 au 6^{ème} rapport du GIEC

Relation entre le réchauffement de la température et différents changements climatiques

La contribution du groupe de travail indique quelles sont, par scénarios, les hausses prévisibles de température, aux 3 horizons temporels « actuels » (2020-2040), « milieu du siècle » (2041-2060) et « fin de siècle » (2081- 2100) :

hausse prévisionnelle de la température en fonction des scénarios du GIEC

Scénario	actuel (2020-2040)	Milieu de siècle (2041-2060)	Fin de siècle (2081- 2100)
SSP 1-2.6	1,5°C	1,7°C	1,8°C
SSP 2-4.5	1,5°C	2°C	2,7°C
SSP 5-8.5	1,6°C	2,4 °C	4 ,4°C

Ces hausses de température sont des moyennes à l'échelle mondiale. Les hausses correspondantes à l'échelle d'un pays ou d'une région sont différentes.

Si les scénarios définis par le GIEC conduisent à certaines hausses de température à l'échelle mondiale, les hausses de température sont elles-mêmes en relation directe, ainsi que le document du GIEC le constate, avec de nombreux changements climatiques : « *De nombreux changements dans le système climatique s'amplifient en relation directe avec l'augmentation du réchauffement climatique. Parmi ces changements, on peut mentionner les augmentations de la fréquence et de l'intensité des températures extrêmes, les vagues de chaleur marines, les fortes précipitations et, dans certaines régions, les sécheresses agricoles et écologiques. On peut également mentionner l'augmentation de la proportion de cyclones tropicaux intenses, la réduction de la banquise arctique, de la couverture neigeuse et du pergélisol* ».

L'illustration ci-après, figurant dans la contribution du groupe I au 6^{ème} rapport du GIEC, montre, en fonction de l'augmentation de la température (1,5°C, 2°C ou 4 °C), les changements prévisionnels dans les évènements extrêmes (augmentation de la fréquence et de l'intensité).

changements climatiques

en fonction de différentes hypothèses de hausse de température

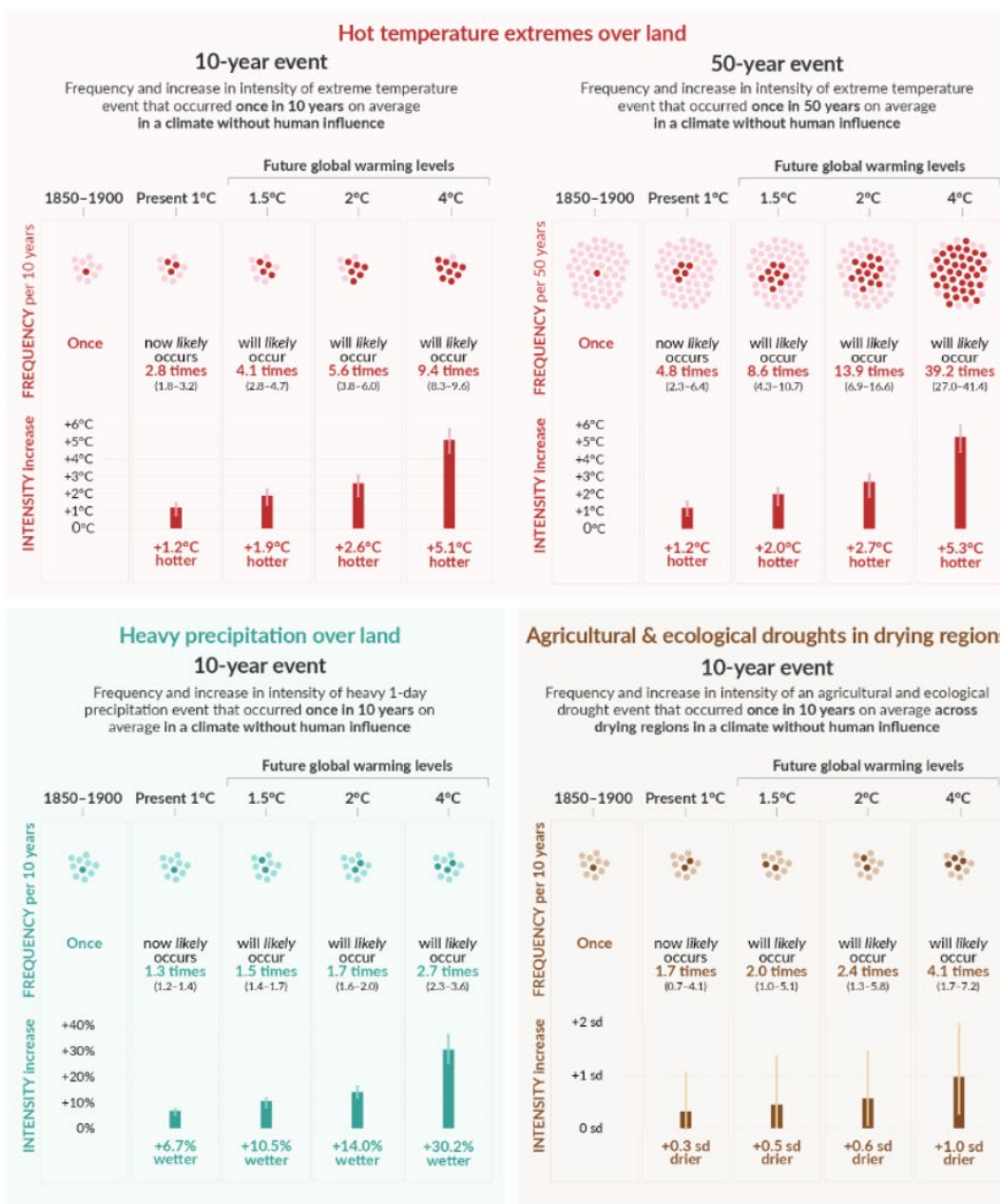


Figure SPM.6 | Projected changes in the intensity and frequency of hot temperature extremes over land, extreme precipitation over land, and agricultural and ecological droughts in drying regions

Projected changes are shown at global warming levels of 1°C, 1.5°C, 2°C, and 4°C and are relative to 1850-1900,⁹ representing a climate without human influence. The figure depicts frequencies and increases in intensity of 10- or 50-year extreme events from the base period (1850-1900) under different global warming levels.

Les hausses de température prises comme référence devraient être établies pour le milieu et la fin du siècle

Le tableau ci-dessus montre, pour différents scénarios du GIEC, la hausse de température en fonction du temps. Une hausse de 2,5 °C se réaliserait vers 2080 dans le scénario 4.5, mais dès 2050 dans le scénario 8.5. Les actions correspondantes d'adaptation ne se situent donc pas dans le même calendrier.

Ainsi, dans un domaine où le délai d'adaptation serait d'une trentaine d'années, décider maintenant de s'adapter à une augmentation de température d'environ 2 °C permet de faire face à la situation à l'horizon 2050, tout en laissant la possibilité de poursuivre les mesures d'adaptation, après avoir réévalué le risque ultérieurement.

Un autre constat essentiel est que, à l'horizon du milieu du siècle, les différences entre les scénarios restent assez limitées, ce qui tend à relativiser le débat sur les scénarios dans les domaines où le délai d'adaptation est inférieur à 30 ans.

En revanche, les écarts se creusent au-delà du milieu du siècle. Par conséquent, l'enjeu du choix entre les scénarios existe aujourd'hui principalement pour des choix qui seraient structurants sur le très long terme, au-delà de 30 ans (par exemple, les infrastructures lourdes ou encore la forêt). Pour ces investissements, il paraît indispensable de prendre en compte des risques tels que ceux résultant du scénario 8.5, quitte à prendre en compte ces risques de façon partielle dans une première étape, mais en s'assurant qu'il existe bien un « chemin d'adaptation » permettant leur prise en compte complète, le moment venu, s'il y a lieu.

La contribution du GT 2 au 6^{ème} rapport du GIEC souligne (page 28 du résumé pour les décideurs) l'existence d'un risque de « défaut d'adaptation » (« maladaptation » en anglais), notamment lorsque sont recherchés des gains à court terme, susceptibles de provoquer des situations de blocage à long terme lorsqu'ils ne sont pas intégrés dans un plan d'évolution global.

En conclusion, une référence exprimée sous la forme d'une hausse de température devrait être décrite sous la forme d'une trajectoire de la température dans le temps. Le plus simple est d'indiquer la hausse prévisionnelle pour le milieu et la fin du siècle.

Annexe 8. Compléments sur l'évaluation

Dans plusieurs pays, l'évaluation passe en revue les différentes étapes du processus de réalisation du plan, ainsi que les différents types de résultats atteints.

L'évaluation suisse prend en compte 5 étapes

L'évaluation suisse s'appuie sur une décomposition du processus de réalisation du plan en 5 « étapes » : sa conception, sa mise en œuvre (l'organisation adoptée à cet effet), ce qu'il a produit, les résultats obtenus en matière de changement de comportement des groupes-cibles et enfin les effets.

Les principales questions soulevées dans l'évaluation suisse, classées selon les 5 étapes de réalisation du plan, sont les suivantes :

- Sur l'étape de la conception de la stratégie et du plan :
 - Les huit « défis » thématiques couvrent-ils les principaux impacts du changement climatique ? Sont-ils les bons « défis » en ce qui concerne l'augmentation de la capacité d'agir du gouvernement fédéral ?
 - Ces défis sont-ils clairs et formulés de manière cohérente ? Les objectifs sont-ils adaptés, clairement formulés et complets ?
 - pour chaque défi, les groupes-cibles sont-ils clairement définis ?
 - est-ce que les mesures qui contribuent à relever les défis sont formulées clairement ? Compte tenu des connaissances actuelles, s'agit-il des mesures appropriées pour relever ces défis ?
- sur l'étape de la mise en œuvre :
 - Les structures organisationnelles au niveau fédéral étaient-elles appropriées, que ce soit pour faire face aux défis thématiques ou pour mettre en œuvre les mesures associées ?
 - La répartition des tâches et des compétences au niveau fédéral est-elle claire pour relever les défis ? Les tâches sont-elles mises en œuvre de façon appropriée ?
 - Quel rôle joue l'équipe de coordination pour relever les défis ?
- Sur l'étape de la production :
 - Les 64 mesures prévues ont-elles été mises en œuvre et avec quelle efficacité ?
 - Du point de vue des participants à la mise en œuvre, faut-il des ajustements aux mesures ?
 - Les ressources sont-elles suffisantes pour mettre en œuvre les mesures ?
- Sur l'étape des résultats :
 - les agences fédérales concernées se sont-elles adaptées (connaissances améliorées, prise de conscience et comportement modifiés) ?
 - Les bénéficiaires des activités menées pour relever les défis thématiques (cantons, tiers) se sont-ils adaptés (connaissances améliorées, prise de conscience et comportement modifiés) ?
- Sur l'étape des effets
 - Grâce à la mise en œuvre des mesures, est-ce que la capacité d'adaptation a pu être augmentée, les opportunités utilisées et les risques réduits ?
 - Quels ont été les résultats de la démarche de coordination de l'équipe de coordination du ministère ?
 - Quelles conclusions peut-on tirer au sujet des effets des activités d'adaptation ? Quelles possibilités d'optimisation en découlent ?

L'évaluation allemande prend en compte 3 étapes

Pour l'Allemagne, le but de l'évaluation est d'examiner si les mesures et les outils de la stratégie permettent d'atteindre son objectif, ainsi formulé : réduire la vulnérabilité, maintenir et améliorer l'adaptation des systèmes naturels, sociaux et économiques aux effets inévitables du changement climatique global.

La méthode mise en œuvre s'appuie une analyse conceptuelle, conduisant notamment à bien distinguer les deux notions de « résultat » et « d'effet » d'une mesure : par résultat d'une mesure, on entend par exemple la production d'une brochure sur les mesures de prévention en cas de canicule ; l'effet de cette mesure sera alors le changement de comportement des lecteurs de la brochure.

Le rapport d'évaluation examine ainsi les questions principales suivantes :

- Les conditions générales du travail mené pour élaborer la stratégie d'adaptation sont-elles satisfaisantes ?
 - Les échanges et la coordination sont-ils appropriés au niveau des instances fédérales ?
 - Quelle qualité des échanges et de la coordination entre le niveau fédéral et les Länder ? ...
- Quel est l'état de mise en œuvre du plan d'adaptation ?
- Quel effet a déjà pu être atteint ?
 - Le thème de l'adaptation s'est-il imposé au niveau fédéral ?
 - Dans quelle mesure les citoyens et les entreprises sont-ils conscients de leur responsabilité en matière d'adaptation ?...

Si l'on compare avec la démarche suisse, en reprenant la terminologie adoptée par cette dernière, il apparaît que l'Allemagne examine les étapes de « conception du plan », de « production » (mise en œuvre des mesures) et de « résultats » (prise de conscience par les acteurs).

L'évaluation du Royaume – Uni accorde une large place à l'analyse des progrès dans la maîtrise des risques

Le rapport de progrès établi en 2021 par le CCC examine deux questions ³⁷ :

- 1) Le plan est-il de bonne qualité ?

Le CCC a examiné si les plans établis comprennent des actions d'adaptation permettant de préparer le pays au changement climatique inévitable (augmentation d'environ 2 °C de la température mondiale), tout en prenant en compte les risques d'un scénario à + 4 °C.

Il a également examiné si les plans sont spécifiques, mesurables, réalisables, pertinents et limités dans le temps. Ainsi, un bon plan aura clairement indiqué les résultats appropriés dans le contexte du changement climatique, pris en compte les effets à court et à long terme du changement climatique, établi un cadre efficace de suivi et d'évaluation et démontré des liens clairs entre les résultats et les actions correspondantes. Un plan plus faible pourrait avoir des résultats vagues ou peu clairs, établir des liens plus faibles avec les effets actuels et futurs du changement climatique, et n'inclure que des orientations, sans exiger d'action spécifique.

- 2) Des progrès sont-ils réalisés dans la maîtrise des risques ?

Le comité examine les indicateurs de vulnérabilité, l'exposition, l'action d'adaptation et les effets du changement climatique, afin d'évaluer comment le risque évolue et si les objectifs

³⁷Rapport de progrès 2021 du CCC (CCC 2021 Progress Report), p. 47

restent en bonne voie d'être atteints lorsque cela est pertinent. Le Comité examine également dans quelle mesure les actions en cours se réfèrent aux risques identifiés dans l'évaluation des risques liés au changement climatique et si elles sont mises en œuvre conformément au plan. Enfin, l'évaluation recherche une preuve de l'impact des actions sur le risque, dans la mesure du possible.

Sachant que le CCC établit une analyse de risques particulièrement approfondie, il conduit une démarche pleinement cohérente en consacrant une large part de l'évaluation à examiner dans quelle mesure la mise en œuvre du plan a permis de progresser dans la maîtrise des risques.

La première question examinée (qualité du plan) correspond à la question « conception du plan » dans les approches suisse et allemande. La seconde question (progrès dans la maîtrise de risques) correspond aux questions relatives à la production et aux effets du plan.

Annexe 9. Compléments sur les indicateurs

La présente annexe précise quels sont les principaux indicateurs utilisés en Allemagne et décrit la démarche, s'appuyant sur une théorie du changement, préconisée en Grande-Bretagne par le CCC.

L'Allemagne

Le tableau ci-après présente les principaux indicateurs adoptés en Allemagne :

Indicateurs adoptés en Allemagne

Domaine <input type="checkbox"/> d'action	Indicateur d'impact	Indicateur de réponse
santé	nombre de décès dus à la canicule	Service d'alerte de canicule
eau	-Inondation -basses eaux -niveau de la mer et température de la mer	-Protection contre les inondations -investissements dans la protection des côtes
pêche	Augmentation des espèces marines adaptées à la chaleur	
agriculture	-Report des phases phénologiques -variation des récoltes - dommages dus à la grêle	-Adaptation des rythmes agricoles -adaptation du spectre des espèces
Forêt et économie <input type="checkbox"/> forestière	-peuplement d'épicéas endommagés	-Incitations à la transformation de la forêt -réserve d'humus dans les sols forestiers
Biodiversité	-Modifications phénologiques parmi les espèces sauvages -index de température de la communauté des oiseaux	-Prise en compte du changement climatique dans les programmes et plans-cadres
construction	-Montant des sinistres déclarés aux assurances	
énergie	-Interruptions de la fourniture de courant dues aux conditions météorologiques -diminution de la production des centrales thermiques du fait des conditions de température	-Diversification de la production d'électricité -diversification de l'utilisation d'énergie finale pour le chaud et le froid
transport	-Fermetures sur le Rhin dues aux hautes eaux	
Tourisme	-Enneigement pour le sport d'hiver	
finances	-Dommages en matières d'assurance habitation	
Planification de l'espace et de la construction		-Réserves d'espaces naturels -construction en zone inondable

Protection de la population	Nombre d'heures d'intervention pour des événements météorologiques	- Information sur le comportement en cas de catastrophe
Indicateurs transversaux		-adaptation au changement climatique à l'échelle communale - financement de l'adaptation à l'international sur moyens budgétaires

Source : tableau établi par la mission sur la base du rapport de monitoring 2019 sur la stratégie d'adaptation au changement climatique

Le Royaume-Uni

Au Royaume-Uni, le CCC a élaboré dans son rapport de 2019 un ensemble d'indicateurs se répartissant en 4 types : vulnérabilité, impact, exposition et action. En 2021, le gouvernement n'ayant pas été en mesure de collecter les données nécessaires à la mesure d'un certain nombre de ces indicateurs, le CCC a établi une nouvelle liste, comprenant 136 indicateurs ³⁸.

La nouvelle liste repose désormais sur une double classification des indicateurs :

- D'une part, le CCC a développé une « théorie du changement » décrivant différentes « étapes » de l'action conduite : impact, input, output, outcome; les indicateurs sont classés selon ces différentes étapes ; une « théorie du changement » décrit les relations entre les objectifs de long terme d'une stratégie et les changements à court ou moyen terme nécessaires à sa réalisation. La théorie consiste ainsi à se concentrer sur le « comment faire pour que le changement se produise ? » plutôt que sur le « que doit faire le projet ? ». Le CCC a distingué des indicateurs décrivant le constat justifiant l'action (impact), ce qui est apporté pour l'action (input), ce qui est immédiatement produit par l'action (output) et les effets de l'action à plus long terme (outcome).
- Les indicateurs sont également classés en différentes « catégories de risque climatique » : exposition, vulnérabilité, aléa.

Principes du jeu d'indicateurs au Royaume-Uni – tableau établi par la mission

indicateur	Étape au sens de la théorie du changement	Catégorie de risque climatique
financement en R&D pour des mesures d'adaptation dans l'agriculture	input	vulnérabilité
Adoption de solutions fondées sur la nature pour la gestion du risque d'inondation	output	Vulnérabilité
Nombre total de fermes mettant en œuvre des mesures d'utilisation efficace de l'eau	outcome	Vulnérabilité
Nombre de feux de forêt	Impact	aléa
Pertes d'arbres du fait d'un événement extrême	Impact	exposition

³⁸<https://www.theccc.org.uk/wp-content/uploads/2021/06/Cross-sector-adaptation-indicators.xls>

Annexe 10. Mise à jour des normes et référentiels techniques : exemple de check list utilisée pour la prise en compte des changements climatiques

La check list ci-après est utilisée par l'institut allemand de normalisation (DIN) ³⁹ (traduction par la mission) :

<p>1) Vos spécifications normatives sont-elles dépendantes des conditions climatiques ?</p> <p>La norme considérée peut déjà contenir des paramètres climatiques ou météorologiques ou contiennent des références à des normes de données climatiques (par exemple, température, vitesse du vent ou quantité de précipitations).</p>
<p>2) L'objet de votre norme pourrait-il être vulnérable aux conditions météorologiques extrêmes, lorsqu'il est utilisé de manière appropriée ?</p> <p>Il se peut qu'il y ait eu des événements météorologiques extrêmes dans le passé qui ont eu un impact négatif sur votre sujet de normalisation (par ex. dysfonctionnements).</p>
<p>3) L'objet de votre norme contribue-t-il aux fonctions requises par des systèmes naturels et sociaux ?</p> <p>Voici des exemples d'objet de normes qui seraient dans ce cas : un plan d'urgence dans le cadre d'un système de gestion des urgences pour les événements météorologiques extrêmes, des règles de conception pour des éléments de construction intervenant dans la résistance à la pénétration de l'eau en cas d'inondation, des spécifications pour les produits résistants à la chaleur, des règles d'entretien.</p>
<p>4) Des modifications ou compléments de vos règles normatives sont-elles nécessaires pour minimiser la déficience fonctionnelle de systèmes naturels et sociaux en cas d'événements météorologiques extrêmes ?</p> <p>Exemples d'événements météorologiques extrêmes qui peuvent être renforcés du fait du changement climatique : grêle, chaleur et fortes pluies.</p> <p>Voici des exemples de processus ou de produits pertinents : le développement et la mise en œuvre de concepts contre les inondations liées aux fortes pluies, des matériaux et composants de construction résistants à la grêle ainsi que leurs essais techniques, des systèmes de refroidissement alimentés par des énergies renouvelables.</p>
<p>5) En examinant si une norme est concernée par les conséquences du changement climatique, identifiez-vous la nécessité de nouveaux thèmes de normes pour réduire la vulnérabilité fonctionnelle d'un système naturel ou social ?</p> <p>Exemples : peuvent ne pas être complètement réglementés sur le plan normatif la vérification des systèmes mobiles de lutte contre les inondations, les tests de résistance structurelle à la grêle dans la construction, les critères pour les spécifications globales de protection contre la chaleur.</p>

Si la réponse aux questions 1 à 3 du questionnaire est OUI, il est urgent d'examiner l'objet de votre norme au regard de l'adaptation aux conséquences du changement climatique. Lors de cette analyse, il convient d'évaluer la fonctionnalité des systèmes naturels ou sociaux concernés. Si nécessaire, les spécifications normatives doivent être ajustées, afin de minimiser ou réduire le risque d'altération fonctionnelle du système en raison du changement

³⁹Ist Ihr Standard "klimafest"? Fragebogen zur Klärung der Betroffenheit

climatique ou augmenter la résilience fonctionnelle du système.

Si, parmi les trois premières questions, seule la question 1 ou les questions 1 et 2 ont reçu la réponse OUI, tandis que la réponse à la question 3 est NON, il est recommandé de vérifier tout de même le sujet de votre norme en matière d'adaptation aux conséquences du changement climatique. Dans cette analyse, il convient d'examiner si les besoins du marché ou son acceptabilité peuvent être mieux satisfaits en adaptant les spécifications normatives, pour contribuer à l'adaptation au changement climatique.

Pour prendre en compte la question 4, il convient d'examiner l'objet de la norme en relation avec le concept d'adaptation du système considéré et adapter éventuellement la norme.

Si la réponse à la question 5 est OUI, les parties intéressées doivent soumettre une demande de normalisation.

Le Guide ISO 84 peut fournir un premier point de départ conceptuel pour l'analyse et l'évaluation.

On peut consulter également le guide publié par l'association allemande DWA qui intervient dans les domaines de l'eau et des déchets, guide disponible à l'adresse <https://de.dwa.de/de/thema-klimawandel.html>

Annexe 11. Supplementary information on water-related measures

Saving and sharing water

The top priority for water adaptation in most plans, logically, is to reduce its consumption. Nevertheless, there are relatively few target figures in this area (they tend to appear in sectoral plans rather than in national ones, equivalents of the French PNACC). In France, let's recall that a target for reducing water consumption was set as part of the Assises de l'Eau (water and climate change adaptation conference); but since this overall target has not been designated from the national level specifically to each sector or territory, it remains somewhat overlooked: -10% by 2024 and -25% by 2029.

Measures usually cited to reduce water consumption more effectively are

- resolving the problem of leaks in drinking water networks (very often cited, in almost all the plans studied): the UK plan, for instance, sets a target of reducing leaks by 15% on average by 2025;
- optimising industrial processes and, in particular, reusing wastewater;
- 'Micro-irrigation' or drip irrigation technology in agriculture, or the use of less water-intensive seeds;
- campaigns to raise public awareness;
- measuring and monitoring systems (meters, water police);
- and pricing, making particular use of fiscal leverage to reflect water scarcity in a gradual way (depending on each country's water pricing system).

Very few (if any) plans consider larger structural changes for agriculture or industry, such as relocation of activities, relocation of certain crops, etc.

The plans studied address the management of water resources – and more particularly, conflicts of use in times of drought – from a fairly general and conventional angle:

- integrated watershed management;
- taking all the needs and uses of the concerned environment into account.

England

England is implementing a plan to revise the major water abstraction authorisations under the “25 Year Environment Plan”, with the aim of gradually achieving equilibrium of groundwater and surface water bodies. This is the “water abstraction plan” adopted in 2017: 270 abstraction authorisations, for 30 million litres of water, have been scaled back since 2008. However, the principles and methodology for defining sustainable abstraction are not set out in the national plan (PNACC equivalent).

Germany

Germany exhibits a proactive policy of reducing water abstractions (all uses combined), by following an indicator that represents the total volume of abstractions related to the resource (“water exploitation index”). This indicator stood at 12.8 in 2016 compared to 24.6 in 1991: this shows very significant progress (a criticality threshold is set at 20). Our German contacts said the reduction of water abstractions or consumption are likely candidates to feature among the thirty or so target figures that are expected to appear in Germany's next PNACC.

The German plan also provides for the draft of proposals specifying the human needs for drinking water that are to be met as a matter of priority, in view of potentially prioritising water uses, setting criteria, and establishing decision-making procedures should conflicts of use arise; this approach follows similar examples from other countries.

Spain

Founding its plan on the equivalent of France's Masterplan for Water Development and Management (SDAGE), Spain aims to develop water vulnerability studies. Accordingly, the new Spanish 2022-2027 masterplans must assess the effects of climate change by 2039, while the 2027-2033 masterplan shall contain an assessment of risks related to climate change, particularly focusing on the ecological state of water bodies and, as far as possible, on cost-benefit assessments (with, however, an order of priority that puts sobriety at the top of the list). The Spanish plan states that irrigation and other agricultural uses already account for 70% of total national water demand, and that this demand is expected to rise owing to longer duration of droughts and increased evapotranspiration. It also notes that gaps in Spanish legislation need to be addressed in order to manage conflicts of use (at the time the plan was drawn up, for instance, there was no mention of drought situations in Spain's water act). The plan scarcely mentions policies for building irrigation storage facilities, despite the fact that this is a hot topic, chiefly due to filling problems, increasing evapotranspiration, and the impact on the surrounding environments.

Flood prevention

In this field, climate change impacts are taken into account through the modification of reference hazards, primarily concerning the coastline in connection with sea level rise (the work carried out in the Netherlands under the Delta Programme is particularly relevant here). Several plans announce the reinforcement of monitoring and warning systems, a measure classed as “no regrets” whatever the warming trajectory. Countries such as the UK and the Netherlands are starting to build medium- to long-term strategies for some highly exposed territories; these include consideration of far-reaching scenarios, such as a two-metre sea level rise. According to experts at the European consortium PROTECT (coordinated by the CNRS), such a rise is now inevitable, and its timing remains impossible to predict (as it largely depends on how the Antartican scenarios develop).

Germany

Germany's 3rd Adaptation Plan relegates this topic to the country's Federal Flood Prevention Plan. However, it does mention the harmonisation of flood risk maps at federal level by 2024.

The federal plan, adopted in 2014 following the floods of 2013, comes under the implementation of the flood directive and has a budget of €5.5 billion with a list of projects drawn up between the federal level and the Länder; notably, various “supra-regional” structuring projects led by the federal state at the scale of a large watershed. The programme includes 29 supra-regional projects to relocate dykes and create 20,000 ha of floodplains.

Japan

Japan promotes watershed management with plans that involve all stakeholders accompanied by actions that combine nature-based solutions (NBS) with conventional solutions. Japan's plan projects investment in a new generation of weather observation satellites by 2029 to improve forecasting and warning devices.

UK

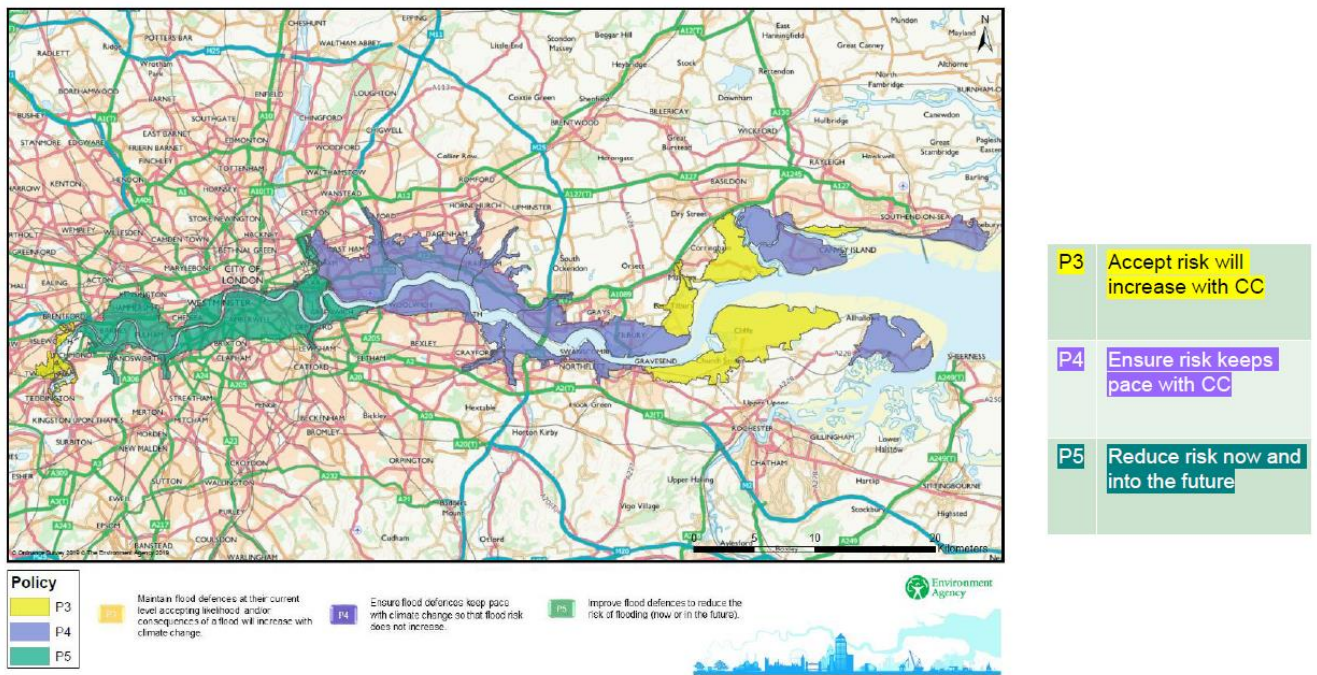
In addition to its conventional funding programme for flood protection works, the UK Environment

Agency has set up several impressive programmes to support territories wishing to experiment with flood-related adaptation solutions, allocating a budget of 200 million pounds over the period 2021-2027. Some thirty local authorities are currently participating in this programme, composed of three funds:

- £150 million for the “Flood and Coastal Resilience Innovation Programme”;
- £8 million for the “Adaptation Pathways Programme”;
- £36 million for the “Coastal Transition Accelerator Programme”.

The “Thames Estuary 2100” programme is one of the four programmes initiated under the “Adaptation Pathways” approach. Launched in 2012, this programme is regularly updated. It has identified sectors where the level of protection will be maintained despite climate change, others where it will decline, and others where it will increase. These goals require significant investments by 2100: the programme provides for a decision point in 2040 for the selection of one or more technological solutions to be implemented by 2070. The programme's latest review has just been published by the Environment Agency¹. It should lead to an update of the programme in 2023.

Map of the Thames Estuary 2100 programme



Source: UK Environment Agency (EA)

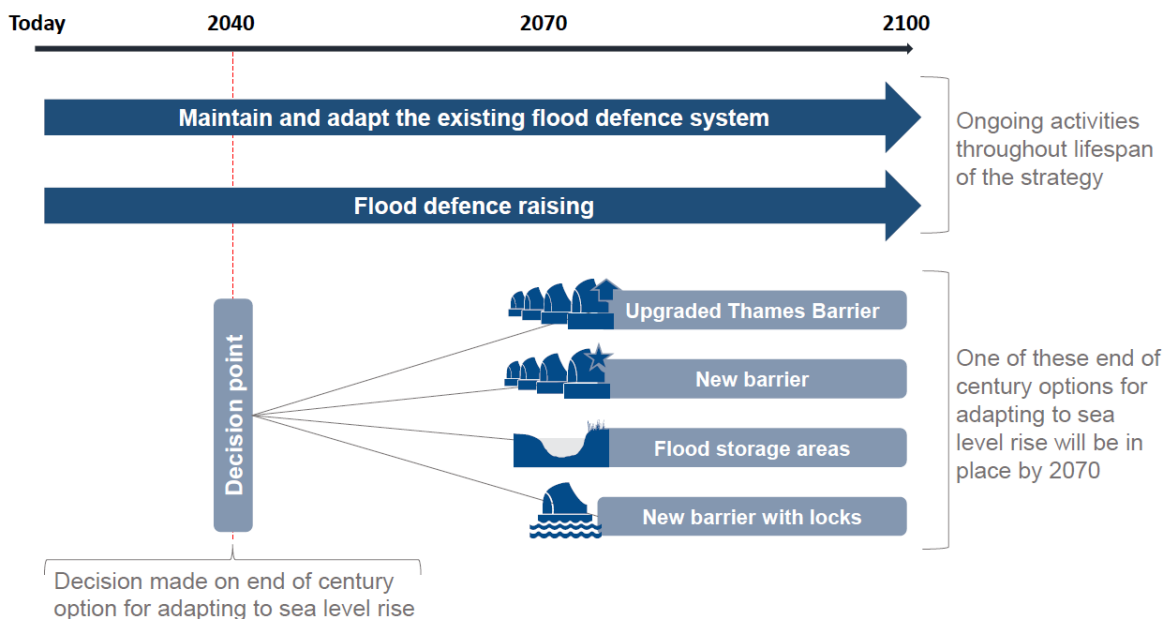
The above map and the below timeline, taken from the Thames Estuary 2100 programme, show the protection goals for three sectors, based on economic, social, cultural, and commercial value criteria, along with the long-term decision timeline:

Decision timeline of the Thames Estuary 2100 programme

¹ Thames Estuary 2100: 10-Year Review (Environment Agency)

Decision timeline of the Thames Estuary 2100 programme

Timeline



Source: UK Environment Agency (EA)

Netherlands

Ever since the 1950s, flood prevention policy in the Netherlands has been structured largely around the “Delta Programme”. The first programme, essentially a sea defence infrastructure plan, was devised after the dramatic floods that caused 1,835 deaths in 1953. Gradually, the Delta Programme grew to include a component on management of freshwater resources and a “spatial adaptation” plan that issues a series of recommendations to globally improve the resilience of territories.

To integrate the consequences of climate change into this programme, the Netherlands has undertaken a review of all protection structures with regard to the 2050 protection goals (that have been set by law). The programme states that the goals are based on two indicators: the level of protection of persons (a “basic” level is sought, or, in any case, a protection level that keeps pace with climate change) and the economic cost (with the aim of equalising the costs and benefits of protection).

A preliminary assessment estimates that 1,300 km of dykes need to be reinforced or upgraded by 2050 to meet these goals. An average of 50 km per year is projected. A report on the results of these evaluations is due to be submitted to Parliament by 31/12/2023.

A scientific council, the Delta Programme Signal Group, is tasked with alerting the commissioner to developments that may require adaptation. For example, this council recommended that extreme values of sea level rise or recurrence of droughts be simulated in the stress tests; several local studies have been launched in this direction.

In 2019, a scientific programme on sea level rise and its consequences on the Delta Programme was launched by the Ministry of Infrastructure and Water, involving companies and NGOs in its steering.

The various programmes announce substantial budgets:

The total budget of the “Delta Fund” is €19 billion over 2022-2035; in other words, an average of €1.4 billion per year.

As an example, the Delta Fund finances 50% of the work on the dykes, the bulk of its planning. But it also finances other types of projects, notably in the area of “water supply”.

- Flood protection: €568 million;
- Water supply: €63 million;
- Maintenance, replacement of structures: €232 million;
- Experiments: €21 million;
- Water quality: €103 million;
- Other, including financing of other programmes: €340 million.

Meanwhile, a financing fund of €600 million for adaptation over the period 2022-2027 (“temporary incentive scheme”) is also being set up:

- pre-distributed funds by region (“working region” – 45 in the Netherlands) according to their population and area,
- the ministry finances a third of projects, therefore contributing €200 million, while regional and local governments contribute €400 million.

Annexe 12. Un exemple d'articulation entre un Plan national d'adaptation au changement climatique (PNACC) et un cadre sectoriel : la construction et l'urbanisme en Espagne

A côté du PNACC 2021-2030, l'Espagne a développé un cadre sectoriel assez complet en matière de construction et d'urbanisme, l'Agenda urbain espagnol (AUE), et tenté d'articuler les deux instruments PNACC et AUE, qui portent respectivement sur les périodes 2021-2030 et 2019-2030.

I/ Le volet construction et urbanisme du PNACC espagnol :

Le volet construction et urbanisme du PNACC espagnol constitue l'un de ses chapitres sectoriels. Il comprend les 4 actions suivantes :

1/ Renforcer les liens entre l'agenda urbain espagnol (AUE) et le PNACC :

Le plan AUE de 2019 avait déjà comme objectif stratégique l'adaptation au changement climatique et la hausse de la résilience.

Afin de mieux coordonner PNACC et AUE : objectif de définir un cadre commun d'indicateurs et d'objectifs. Deux types d'indicateurs : descriptifs pour le diagnostic/suivi et évaluation permettant de mesurer l'effet des politiques d'adaptation.

Action partagée avec les communautés autonomes et les municipalités dans le cadre de groupes de travail.

Indicateurs :

- Accroître le nombre de villes qui développent des agendas urbains ;
- Intégrer les indicateurs de l'AUE dans le système d'indicateurs du PNACC

2/ Intégrer l'adaptation au CC dans la planification territoriale urbaine :

La prise en compte de l'adaptation au CC est un axe majeur de l'AUE. Il s'agit notamment de :

- « développer une planification sectorielle territoriale et urbaine qui intègre les risques avec des cartes de risques naturels (inondation, pluie torrentielles, élévation du niveau de la mer, etc.) ;
- intégrer dans les plans des solutions telles que SFN, trames verte et bleue ;
- créer des refuges climatiques (refugios climaticos) ;
- faire évoluer les formes urbaines et le design urbain (matériaux, végétation, design des espaces publics) ;
- densifier les aires urbaines et aller vers un modèle d'urbanisme plus compact ;
- développer des zones à faibles émissions (ZFE) ;
- développer les systèmes d'informations urbains (SIU).

Indicateurs :

- Développer un système d'informations électronique en temps réel pour les acteurs publics et privés sur le zonage des différentes aires urbaines, notamment cartes des

risques.

- analyser les risques CC et préciser les moyens de les atténuer dans les nouveaux plans territoriaux et urbains

3/ Intégrer l'adaptation au CC dans la construction :

La majorité du parc immobilier espagnol est antérieure à la mise en œuvre de la norme NBE CT 1979 qui exige un minimum d'efficacité énergétique. D'où un enjeu majeur de rénovation énergétique qui se décline selon les axes suivants :

Souhait de développer des politiques intégrées de rénovation des édifices et des zones urbaines

Récupération des eaux pluviales, évolution des matériaux et des procédés constructifs, verdissement.

Prise en compte des îlots de chaleur

Réalisation de cartes climatiques urbaines et cartes de ventilation urbaines

Indicateurs : nombre et superficie de logements faisant l'objet de réhabilitation pendant le PNACC (idem indicateurs AUE).

4/ Participation citoyenne à l'amélioration du milieu urbain :

Préserver le modèle de cité méditerranéenne compacte et dense face aux tendances actuelles de dispersion de l'habitat.

Accroître la participation citoyenne notamment à travers l'élaboration de plans et de projets, avec SFN et infrastructures vertes, dans le cadre de processus inclusifs avec tous les acteurs.

Développer des réseaux de villes : réseau des cités espagnoles pour le climat, réseau espagnol de soutenabilité locale, réseau des initiatives locales, etc.

Indicateur : nombre de personnes ayant bénéficié d'une sensibilisation ou formation dans les domaines couverts par l'AUE

II/ L'Agenda urbain espagnol et l'adaptation au CC

1/ Concept :

L'agenda urbain espagnol, approuvé par le Conseil des ministres du 22 février 2019, est la feuille de route qui définit la stratégie et les actions à mener jusqu'en 2030, pour faire des villes des zones de convivialité, d'accueil, de santé et de coexistence.

Il constitue un « menu à la carte » pour que tous les acteurs, publics et privés, qui interviennent dans les villes et qui recherchent un développement équitable, juste et durable à partir de leurs différents champs d'action, puissent élaborer leurs propres plans d'actions.

L'Agenda Urbain Espagnol (AUE) est un document stratégique, sans caractère normatif, et donc d'adhésion volontaire, qui a pour objectif la durabilité dans les politiques de développement urbain.

Il comporte également une méthode de travail et un processus pour tous les acteurs, publics et privés, qui interviennent dans les villes et qui recherchent un développement équitable, juste et durable à partir de leurs différents domaines d'action.

Issue d'un intense travail de préparation et d'un large processus participatif qui a duré près d'un an, cette stratégie de développement urbain intégré propose un Décalogue d'Objectifs Stratégiques qui décline un total de 30 objectifs spécifiques, et 291 lignes d'action, et met à la disposition des acteurs intéressés par sa mise en œuvre, un "menu à la carte" afin qu'ils puissent élaborer leurs propres plans d'actions.

L'AUE est conçu dans une perspective large qui inclut toutes les villes quelles que soient leur taille et leur population.

2/ Contenu :

L'agenda urbain espagnol comprend :

- un diagnostic de la situation urbaine et rurale ;
- un cadre stratégique structuré en un Décalogue d'Objectifs avec 30 objectifs spécifiques et leurs lignes d'action possibles.
- un système d'indicateurs qui permettra l'évaluation et le suivi du respect des objectifs ;
- des fiches d'information qui illustrent comment des plans d'actions peuvent être élaborés pour sa mise en œuvre ;
- un plan d'actions pour l'État avec des propositions spécifiques dans ses domaines de compétences.

L'un des 10 objectifs (le 3) est de « prévenir et de réduire les impacts du changement climatique et d'améliorer la résilience. ». Il prévoit 3 sous objectifs :

3/ Eléments détaillés sur l'objectif 3 de l'AUE :

L'AUE comprend un objectif dédié à l'adaptation au changement climatique, l'objectif 3, qui comprend lui-même 3 sous-objectifs, assortis d'indicateurs :

a/ adapter le modèle territorial et urbain aux effets du changement climatique et progresser dans sa prévention :

- Développer une planification sectorielle, territoriale et urbaine permettant la prévention contre les risques naturels et garantissant l'application d'une réglementation spécifique en la matière, tant dans les infrastructures, que dans les installations et dans les constructions et bâtiments.
- Intégrer les cartes des risques naturels dans la planification, afin d'éviter les transformations urbaines susceptibles d'être affectées par les inondations, les pluies torrentielles, l'élévation du niveau de la mer, l'insuffisance de l'eau, les risques de glissements de terrain, etc.
- Inclure de nouvelles prévisions dans les instruments de planification, liées à l'adaptation et à l'atténuation des effets du changement climatique : montée de la mer, perte de sols fertiles, des pluies torrentielles, incendies de forêt, températures élevées, longues périodes de sécheresse.
- Mettre en place des plans d'urgence face au changement climatique et, plus largement, des plans d'actions pour le climat et l'énergie durable.
- Promouvoir des actions de prévention et d'adaptation sur les territoires urbanisés susceptibles d'être affectés par des risques naturels.

- Incorporer le concept d'infrastructures urbaines vertes et bleues dans la planification et la gestion du territoire et de l'urbanisme, en tant que solutions multifonctionnelles basées sur la nature
- Réduire les îlots de chaleur des villes actuelles en agissant sur les facteurs qui influencent le comportement climatique de l'environnement urbain. Pour cela, favoriser la perméabilisation et la végétalisation des espaces publics, intégrer la cartographie du climat urbain dans les outils de planification et de gestion urbaine.
- Promouvoir des campagnes pour améliorer l'éducation et la sensibilisation sur l'atténuation du changement climatique dans lequel les usages et les habitudes de consommation jouent un rôle clé.
- Promouvoir la participation citoyenne et l'éducation citoyenne comme un axe important afin de prendre soin de l'environnement, en particulier l'environnement urbain.
- Mettre en place une gouvernance pour une gestion des risques réellement démocratique avec l'implication de toutes les parties prenantes (experts, gouvernements, secteur privé, société civile, etc.) dans la prise de décision et la mise en œuvre.

b/ Réduire les émissions de gaz à effet de serre :

- Encourager et promouvoir un modèle urbain bas carbone en suivant les mesures et recommandations nationales et internationales (services publics, infrastructures, bâtiment, etc.)
- Organiser les usages du sol et du bâti en tenant compte des aspects bioclimatiques et efficacité énergétique.
- Mettre en œuvre des stratégies « zéro émission » en milieu urbain.
- Réduire la dépendance aux véhicules particuliers en promouvant un modèle urbain compact prenant en compte les impacts du déplacement motorisé.
- Utiliser des technologies, des matériaux et des produits propres qui éliminent ou minimisent les émissions polluants et gaz à effet de serre.
- Favoriser le renouvellement du parc automobile.

c/ Améliorer la résilience aux changements climatique :

- Élaborer des plans de résilience au changement climatique et veiller à ce que, là où ils existent, ils soient connus et facilement accessibles aux citoyens. Profiter de cet outil pour préserver et améliorer les conditions de vie.
- Tirer parti du paysage comme opportunité et valeur, dans chaque ville, intégrer la « restauration écologique, et transformer les espaces verts dans l'imaginaire collectif dans des modèles indigènes qui permettent une gestion efficace des ressources.
- Être résilient, c'est-à-dire à faire face à d'éventuelles crises grèves, pannes, catastrophes naturelles, etc. avant leur arrivée. Cela nécessite d'évaluer les différents scénarios, d'étudier quels éléments du système urbain sont les plus concernés, de faire des stress test, d'optimiser les investissements pour réduire les risques et éviter d'éventuelles défaillances.
- Réaliser un diagnostic adéquat, avec la collaboration de tous les acteurs nécessaires, y compris la société civile et en évaluant la résilience lors des crises précédentes. Pour cela, l'approbation de protocoles d'action est proposée.

- Prendre en compte la forme spatiale de la ville, sa morphologie (rugosité urbaine, canyon urbain, visibilité du ciel, etc.), la présence de végétation, ou encore les matériaux de surface urbains pour minimiser l'impact des vagues de chaleur, dont les effets sont accrus par ce que l'on appelle « l'îlot de chaleur urbain ». Appliquer les critères bioclimatiques dans la conception des espaces ouverts.
- Prendre en compte dans l'urbanisme, ainsi que dans la conception et la construction des bâtiments, le phénomène d'îlot de chaleur urbain. Pour cela, étudier l'influence du climat régional et local et préparer une carte du climat urbain, identifiant la capacité d'absorption et de transfert de chaleur par les matériaux urbains (carte de surchauffe) et la capacité d'élimination de cette chaleur (carte de ventilation urbaine).
- Promouvoir la conservation des espèces animales et végétales indigènes.
- Augmenter la surface du sol capable de supporter la végétation et améliorer la perméabilité.
- Développer des projets spécifiques de prévention des dommages causés par les inondations.
- Réduire la déforestation et améliorer les écosystèmes.

4/ Les indicateurs de résultats des objectifs de l'AUE en matière d'adaptation au changement climatique :

a/ Existence au niveau local d'un plan ou d'une stratégie d'adaptation au changement climatique et de prévention contre les risques naturels :

Définition et pertinence :

Le suivi de cet indicateur permet de savoir si une ville a adopté des mesures contre le changement climatique et des actions qui répondent à la prévention des risques naturels, en intégrant des cartes des risques naturels dans la planification, en promouvant des actions de prévention et d'adaptation dans les territoires urbanisés susceptibles d'être affectés par des risques naturels, ainsi que des plans d'urgence contre le changement climatique.

Méthodologie :

L'administration compétente doit indiquer si elle dispose ou non d'un plan d'adaptation au changement climatique et de stratégies de réduction des risques de catastrophe conformément au cadre de Sendai pour la réduction des risques de catastrophe 2015-2030, et le cas échéant, précisera son nom, la phase dans laquelle il se trouve (en préparation, approuvé ou exécuté) et la période de validité temporaire de l'Instrument.

En cas d'absence de Plan en la matière, les engagements à assumer en la matière seront indiqués tout au long de la période de l'Agenda Urbain, en déterminant notamment les objectifs réduction du nombre de personnes touchées par des catastrophes et des risques naturels sur la base des données des années précédentes (morts, disparus, blessés, déplacés ou évacués). De même, l'objectif de réduction des pertes économiques associées aux dommages dus aux catastrophes dans les infrastructures sera également inclus, notamment l'interruption des services de base.

Indicateurs associés :

- Proportion de gouvernements locaux qui adoptent ou mettent en œuvre des stratégies locales de réduction des risques de catastrophe conformément au Cadre de Sendai 2015-2030.
- Nombre de morts, disparus, blessés, déplacés ou évacués en raison de catastrophes pour 100 000 habitants.
- Pertes économiques directes liées aux catastrophes par rapport au PIB mondial, y compris les dommages causés par les catastrophes aux infrastructures essentielles et la perturbation des services de base.
- Engagements de la Convention des Maires pour le Climat et l'Énergie (PAES) pour renforcer la résistance aux impacts du changement climatique.

b/ Superficie urbaine sur laquelle il est prévu de réaliser des actions d'amélioration ou de prévention des risques naturels, notamment les risques d'incendie et d'inondation :

Définition et pertinence :

Le suivi de cet indicateur permet de connaître la surface du foncier urbain qui fera l'objet d'actions d'amélioration pour réduire les effets éventuels des risques naturels qui affectent les villes.

Méthodologie :

L'Administration compétente doit déterminer la superficie en mètres carrés (m²) de toutes zones affectées par certains risques (inondation, pluies torrentielles, glissement de terrain, sécheresse, risque sismique, etc.) dans lequel des actions ont été programmées pour atténuer les effets ces risques.

c/ Superficie urbaine sur laquelle des actions d'amélioration sont prévues, notamment création d'espaces verts/et ou d'espaces publics sur la base de modèles autochtones et de critères bioclimatiques :

Définition et pertinence :

Le suivi de cet indicateur permet de connaître la surface du foncier urbain qui fera l'objet d'actions d'amélioration ou de nouvelle création d'espaces verts et/ou d'espaces verts dans la conception desquels des critères bioclimatiques seront intégrés et des espèces végétales et animales indigènes utilisées.

Méthodologie :

L'Administration compétente doit déterminer la superficie en mètres carrés (m²) des espaces verts, ou des espaces libres susceptibles d'être améliorés, ou de nouvelles créations programmés avec ces critères.

Annexe 13. Développer en parallèle étude de risques et PNACC : une première approche

Au vu des résultats du parangonnage et de la réglementation européenne, la mission a recommandé de mener une étude de risques en vue du PNACC 3. En règle générale, l'étude de risques précède l'élaboration du PNACC et l'alimente. Cependant, au regard du contexte français, et afin d'optimiser le calendrier, un recouvrement partiel des deux démarches paraît envisageable.

Pour mettre en évidence cette possibilité, la mission a tout d'abord mené un premier exercice de décomposition en une dizaine d'étapes des processus d'élaboration de l'étude de risques et du PNACC. Les résultats sont présentés ci-dessous.

Pour appréhender les possibilités de recouvrement des deux démarches, il convient de tenir compte de ce que les entités chargées de leur élaboration diffèrent largement, si l'on met à part les ministères. En effet, l'étude de risques suppose la mobilisation de nombreux experts scientifiques et techniques, alors que l'élaboration du PNACC est avant tout de la responsabilité des ministères concernés, en concertation avec les représentants des différents secteurs d'activité. A un certain stade, l'élaboration du PNACC dépend bien entendu des résultats de l'étude de risques.

La première étape d'élaboration du PNACC (structuration du projet : gouvernance, pilotage et coordination) n'est pas dépendante des apports de l'étude de risques et peut donc se faire en temps masqué. La deuxième étape (définition du cadre méthodologique) nécessite de disposer du cadre méthodologique de l'étude de risques, lancée préalablement. La troisième étape (consultation des parties prenantes) pourrait être lancée sur la base d'un rendu partiel de l'étude de risques (production de la partie générale qui devrait inclure la description des différents impacts attendus). Au-delà de ces trois premières étapes, il est nécessaire de disposer de l'étude de risques pour alimenter la réalisation du PNACC.

Phasage de l'étude de risques et du PNACC

1) Phasage de l'étude de risques :

a/ structuration du projet : gouvernance, pilotage, coordination, etc. :

- coordination : ONERC
- pilotage : ONERC + quelques DAC : DGPR, DGALN, etc. + quelques ministères : agriculture, santé, finances, etc.
- constitution d'un réseau de contributeurs : agences gouvernementales : Météo France, CEREMA, ADEME, ONF, ANSES, etc... HCC + comité scientifique (chercheurs, universitaires, etc.).

b/ cadrage méthodologique :

- choix des scénarios climatiques ;
- définition du travail de modélisation, notamment les différentes échelles territoriales à prendre en compte, la détermination de la nature des « impacts » à prendre en compte ;
- définition de la structure et du périmètre de l'étude de risques : secteurs, aspects transversaux, effets cumulés, choix d'effectuer des zooms territoriaux sur certaines zones, etc. ;
- définition de la méthode d'évaluation du risque attaché aux différents « impacts » ; possibilité de valorisation économique du risque ; méthode d'évaluation de la

capacité d'adaptation ; méthode d'élaboration de la synthèse⁴¹ ;

- choix du format de l'étude (cahiers thématiques, synthèse, etc.).

c/ rédaction de la partie générale de l'étude :

- scénarios climatiques ;
- modélisation ;
- description de la structure de l'étude, des méthodes d'évaluation du risque, des impacts ou risques et de la capacité d'adaptation.

d/ lancement de la partie thématique :

- rédaction d'une feuille de route pour chaque secteur étudié (et pour les aspects transversaux) avec identification du pilote ;
- consultation des parties prenantes ;
- premières analyses et rédactions ;

e/ travail intersectoriel :

- prise en compte des risques cumulés ;
- prise en compte des risques transversaux dans les travaux sectoriels.

f/ rédaction des parties thématiques

g/ rédaction de la synthèse

h/ validation

i/ monitoring des risques pendant le cycle à venir

j/ préparation de la prochaine étude de risques.

2/ phasage du PNACC :

Les points a, b et c peuvent être menés parallèlement à l'étude de risques

a/ structuration du projet : gouvernance, pilotage, coordination, etc. :

- coordination : ONERC avec éventuellement l'appui de consultants et/ou des moyens humains renforcés ;
- pilotage : création et structuration d'une Task Force interministérielle animée par l'ONERC ;
- définition des modalités d'association des parties prenantes : communauté de travail avec les régions, déclinaison territoriale, consultation du grand public et des acteurs sectoriels.

b/ cadrage méthodologique général : en tenant compte du cadrage méthodologique de l'étude de risques

- détermination des interfaces études de risques / PNACC : scénarios climatiques, modélisation, hiérarchisation des priorités, liens risques/actions et objectifs ;
- détermination des principes et valeurs : par exemple, équité territoriale, préservation des populations vulnérables, principe de précaution, impasses, mal-adaptation ;
- définition de la structure et périmètre du PNACC, par référence à l'étude de risques: secteurs, aspects transversaux, effets cumulés ;

⁴¹This method refers to the presentation of § 3.3.2

- définition des Méthodes de hiérarchisation des risques : risques climatiques, valeur économique du risque, « adaptation gap », etc. ;
- actions à mener : liens avec les risques, objectifs, indicateurs, redevabilité, financements.

c/ consultation des parties prenantes :

Sur la base de la partie générale de l'étude de risques :

- communauté de travail Etat/régions ;
- travail avec les différents niveaux de collectivités dans un cadre régional ;
- consultation des acteurs sectoriels ;
- consultation de la société civile organisée : ONG, think tanks, etc. ;
- consultation du grand public.

Les points 4 et suivants ne peuvent intervenir qu'après l'étude de risques.

d/ prise en compte des résultats de l'étude de risques et des consultations

e/ Détermination de la liste des actions à mener

f/ Définition d'un cadre d'évaluation et de redevabilité :

- définition des indicateurs généraux et pour les différentes actions ;
- identification des responsabilités ;
- calendrier

g/ rédaction de la partie générale du PNACC :

h/ rédaction de la partie thématique du PNACC

notamment de la liste des actions à mener (notamment tableau de synthèse et fiches actions)

i/ rédaction de la synthèse

j/ validation

Annexe 14. Glossaire des sigles et acronymes

Acronyme	Signification
ACPR	Autorité de contrôle prudentiel et de résolution
ADEME	Agence de la transition écologique
AFNOR	Association française de normalisation
ANUE	Assemblée des Nations-Unies pour l'environnement
BCE	Banque centrale européenne
BPI	Banque publique d'investissement
CCC	Climate change Committee
CCN	Conseil canadien des normes
CCRA	Climate Change Risk Assessment
CCRIA	Climate Change Independant Risk Assessment
CEREMA	Centre d'études et d'expertise sur les risques, l'environnement, la mobilité et l'aménagement
CGDD	Commissariat général au développement durable
CNRS	Centre national de la recherche scientifique
CCNUCC	Convention-cadre des Nations-Unies sur le changement climatique
CNTE	Conseil national de la transition écologique
DEFRA	Département de l'Environnement, de l'Alimentation et des Affaires rurales (Royaume-Uni)
DG ENV	Direction générale de l'environnement
DGE	Direction générale des entreprises
DGEC	Direction générale de l'énergie et du climat
DREAL	Direction régionale de l'environnement, de l'aménagement et du logement
EPCI	Établissement public de coopération internationale
GIEC	Groupe d'experts intergouvernemental sur l'évolution du climat
HCC	Haut Conseil pour le climat
I4CE	Institute for Climate Economics
IPBES	Plateforme intergouvernementale scientifique et politique sur la biodiversité et les services écosystémiques

Acronyme	Signification
MEFSIN	Ministère de l'économie, des finances et de la souveraineté industrielle et numérique
MTE	Ministère de la transition énergétique
MTECT	Ministère de la transition écologique et de la cohésion des territoires
OCDE	Organisation de coopération et de développement économique
OEN	Organisme d'élaboration des normes
ONERC	Observatoire national sur les effets du réchauffement climatique
PCAET	Plan climat-air-énergie territorial
PNACC	Plan national d'adaptation au changement climatique
RCP	Representative Concentration Pathways (trajectoires représentatives de concentration)
SDAGE	Schéma directeur d'aménagement et de gestion des eaux
SFN	Solution fondée sur la nature
SGPE	Secrétariat général à la planification écologique
SRADDET	Schéma régional d'aménagement, de développement durable et d'égalité des territoires
SSCP	Shared Socio-Economic Pathways (scenarios d'évolutions socio-économiques partagées)
TFCD	Task Force on Climate related Financial Disclosures
UICN	Union internationale pour la conservation de la nature



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