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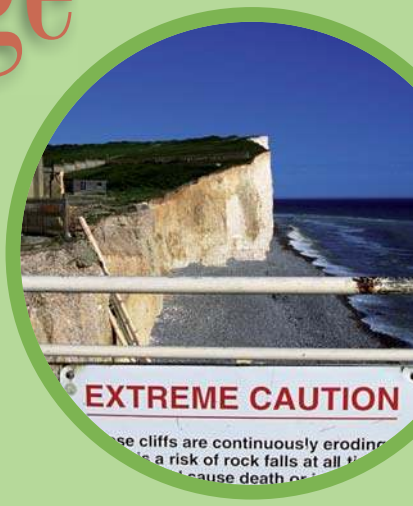
Europe Adapts to Climate Change

Comparing National Adaptation Strategies



Rob Swart, Robbert Biesbroek, Svend Binnerup, Timothy R. Carter, Caroline Cowan, Thomas Henrichs, Sophie Loquen, Hanna Mela, Michael Morecroft, Moritz Reese and Daniela Rey

PARTNERSHIP FOR EUROPEAN ENVIRONMENTAL RESEARCH

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[1] *JRC/IES did not contribute to this report.*

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PEER Report No 1

PARTNERSHIP FOR EUROPEAN ENVIRONMENTAL RESEARCH
Helsinki

Page layout: Marja Vierimaa
Cover photos: Natural England, GAW, Stuart Chalmers, SYKE and RWS

The publication is available also on the Internet:
www.peer.eu

Rob Swart, Robbert Biesbroek, Svend Binnerup, Timothy R. Carter, Caroline Cowan, Thomas Henrichs, Sophie Loquen, Hanna Mela, Michael Morecroft, Moritz Reese and Daniela Rey 2009.
Europe Adapts to Climate Change: Comparing National Adaptation Strategies.
PEER Report No 1. Helsinki: Partnership for European Environmental Research.

This publication is printed on paper produced in an environmentally friendly way.

Printed by Vammalan Kirjapaino Oy, Sastamala 2009

ISBN 978-952-11-3450-0 (pbk.)
ISBN 978-952-11-3451-7 (PDF)

Foreword

The scientific evidence of a likely link between climate change and human activity provides a major challenge to policy-making. Mitigation and adaptation will affect our environment and our societies in many ways. The scale and complexity of the interactions between society and the environment represent an unprecedented challenge for research institutions. This is from a scientific point of view as well as an organisational one. Major progress in understanding the complex interplay of the processes of global change, mitigation and adaptation measures and their impacts can only be made through well-coordinated joint research across national and disciplinary borders.

In November 2007, the Directors of seven of Europe's large environmental research organisations, united in the Partnership for European Environmental Research (PEER), expressed their commitment to this twofold challenge. They decided to implement two joint research projects in 2008: 1) A comparison of national adaptation strategies in EU countries (this report), and 2) Climate change policy integration, coherence and governance (Mickwitz et al. 2009). The rationale for this choice was the fact, that over the last decades, climate change research has focused primarily on the climate system, impacts in general terms and on mitigation. The very rapid emergence of climate change adaptation policies in Europe poses new challenges, however. It must be recognised that the environmental, economic and social impacts of adaptation and mitigation policies will also be affected by many other policies, which makes climate policy integration and coherence essential.

The PEER centres are strongly involved in multidisciplinary environmental research programmes funded by the European Commission and in national and regional research initiatives. This is an excellent position from which to compare the climate policies and coherence problems of different European countries, using common concepts, methods and data. With this approach, important differences as well as similarities can be identified. Moreover, well-founded conclusions and recommendations to policy makers at EU and Member State level can be presented - not only as an academic exercise, but also in order to assess the implications they have for future policy development in the EU.

This volume reports on the results of the project: A comparative analysis of National Adaptation Strategies in EU countries. After focusing mainly on mitigation for almost two decades, Europe was rather slow in picking up the challenge of adaptation. From 2005 onwards, however, climate adaptation strategies accelerated rapidly. This poses a great challenge to the scientific community, not to tail the policy development, but direct the way through targeted impacts and adaptation research. And while there are

many differences between regions in Europe, the report also shows many commonalities. It focuses on six important cross-cutting dimensions: drivers of adaptation policy, the interactions between science and policy, communication and awareness raising, policy integration, multi-level governance, and implementation and evaluation. Most of the current strategies are still rather general, setting the stage for the next steps towards development and implementation of adaptation actions. The report gives an overview of the current strategies, provides suggestions for the next steps, and identifies priority knowledge gaps.

In my role as PEER chair it is my pleasure to introduce these projects to our stakeholders in the international scientific community and to policy makers. I also want to thank the many colleagues from various disciplines who contributed to the studies. Directly, as members of the two project teams. Indirectly, by identifying and mobilising the multidisciplinary knowledge in the PEER research reservoir for the purpose of these studies. The lessons that we have learned by doing this will be of great value for our future activities.

As PEER, we are committed to further strengthening our research in these areas and providing sound and policy-relevant information to Europe's decision makers. We also are looking forward to contributing to the further development of the European Research Area by sharing and exchanging our expertise and skills with other research institutions active in this field. We cannot avoid climate change, but we can ensure that future decisions will be based on the best information available. This can minimize risks, and, in some cases, turn threats into opportunities.

Wallingford, U.K., May 5, 2009

Prof. dr. Pat Nuttall
PEER chair

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Acknowledgements

The preparation of this first PEER report entitled "Europe Adapts to Climate Change: Comparing National Adaptation Strategies" would not have been possible without the support, hard work and tireless efforts of a large number of individuals and organisations. In addition, it could not have existed without the resources (in time and funds) that were made available by the partner institutes in the Partnership for European Environmental Research (PEER): Alterra (Netherlands), CEH (United Kingdom), CEMAGREF (France), NERI (Denmark), SYKE (Finland), UFZ (Germany). Our special thanks go to SYKE and CEMAGREF for hosting two project workshops in Helsinki and Paris, respectively. We thank Ruth Williams and Paulette Burns (CEH) for language editing of the final draft.

Special acknowledgement should be made to external sponsors, to whom we are gratefully for supporting the institutes financially in developing this report:

- The contribution by Wageningen University / Research Centre Alterra has been funded by the Dutch national research programme "Knowledge for Climate" that aims to develop knowledge and services that makes it possible to climate proof the Netherlands. More information is available on the website www.knowledgeforclimate.org
- The work of SYKE has partly been funded by the European CIRCLE network project which aims to implement a European Research Area in the field of climate change and adaptation research. See also the website www.circle-era.net.
- Caroline Cowan's work in collaboration with CEH was funded by Natural England, the government conservation agency for England.

We would like to use this opportunity to express our gratitude to the wide variety of scientists, policy makers and consultants who have taken the time and effort to review (sections of) this report or have otherwise contributed to its completion. In alphabetical order:

Silke Beck (UFZ, Germany)
Carole Bout (CEMAGREF, France)
Ieva Bruneniece, (Ministry of the Environment, Latvia)
Tiago Capela Lourenço, (University of Lisbon, Portugal)
Margaret Desmond (Environmental Protection Agency, Ireland)
Achim Dschkeit (Federal Environmental Agency, Germany)

Peter Driessen (Utrecht University, the Netherlands)
Povl Frich, (Ministry of Climate and Energy, Denmark)
Heikki Granholm, (Ministry of Agriculture and Forestry, Finland)
Pirkko Heikinheimo, (Prime Minister's Office, Finland)
Tor Håkon Inderberg, (The Fritjof Nansen Institute, Norway)
Saara Jääskeläinen, (Ministry of Transport and Communication, Finland)
Wolfgang Koeck (UFZ, Germany)
Wiebren Kuindersma (Wageningen University and Research Centre Alterra, Netherlands)
Markus Leitner, (Umweltsbundesamt, Austria)
Marianne Lilliesköld, (Swedish Environmental Protection Agency, Sweden)
Nicholas Macgregor (Natural England, United Kingdom)
Petra Mahrenholz (Federal Environmental Ministry, Germany)
Maria Manez (CEMAGREF, France)
Veikko Marttila, (Ministry of Agriculture and Forestry, Finland)
Frank Mcgovern (Environmental Protection Agency, Ireland)
Jelle van Minnen (Netherlands Environmental Assessment Agency),
Almut Nagel (Federal Environmental Ministry, Germany)
Reija Ruuhela, (Ministry of Agriculture and Forestry, Finland)
Kaj van de Sandt (Wageningen University and Research Centre Alterra, Netherlands),
Rob Schoonman (Ministry of Housing, Spatial Planning and the Environment, Netherlands)
Louise Simonsson, (University of Linköping, Sweden)
Ulla-Riitta Soveri, (Ministry of the Environment, Finland)
Jeroen Veraart (Wageningen University and Research Centre Alterra, Netherlands)
Saskia Werners (Wageningen University and Research Centre Alterra, Netherlands)
Severine van Bommel (Wageningen University and Research Centre Alterra, Netherlands)
Alain Vidal (CEMAGREF, France)

We also thank *Jan Marco Müller (CEH, United Kingdom)* for presenting the project's results at the December 2008 UNFCC COP meeting in Poznan (Poland)

Executive summary

Climate Change is happening. Even if global emission reductions and mitigation efforts over the next decades prove to be successful, a significant amount of human-induced climate change has become inevitable. In addition to efforts to reduce greenhouse gas emissions, many EU countries are therefore developing and putting in place adaptation strategies to help them cope with the expected impacts of climate change. This report presents a comparative analysis of national adaptation strategies in a sample of European countries. The primary objectives of this study are to identify policy-relevant findings and formulate recommendations for further research. Through these objectives, this report aims at providing both policy makers and research managers with enhanced insights into the variety of approaches taken by countries and knowledge gaps, and to thus facilitate the exchange of information on how to tackle adaptation across Europe and develop relevant research agendas. Our focus is on national level strategies, examining top-down approaches to and coordination of adaptation measures in each country. There is clearly also an important role for bottom-up action, action which is often already taking place at the local scale, where climate impacts are expected to be experienced. This is covered in a parallel PEER report (Mickwitz et al., 2009).

Six key themes

The report is structured around six key themes that were identified by the research team on the basis of an initial inventory as distinctive elements of all the National Adaptation Strategies (NASs) that have been analysed. We examine how the countries have approached each of these themes, analyse how much progress has been made and identify policy needs and research gaps that we believe will help improve understanding and enhance the implementation of adaptation policy at the national level.

The six themes are:

1. Motivating and facilitating factors for strategy development
2. Science-policy interactions and the place of research
3. The role of communicating adaptation
4. Multi-level governance in shaping and delivering National Adaptation Strategies
5. The integration of adaptation into sectoral policies
6. The role of policy monitoring, review and enforcement

In our assessment, we included the countries of the authors as well as other countries that are developing plans for adaptation, for which information about these plans was accessible to the team. We found that the countries reviewed are addressing all of the issues above to a varying degree, with the least action in the area of monitoring, review and enforcement where there is very little explicit activity taking place as yet – only Finland, Germany and the UK have put in place any formal procedures for review and monitoring.

Motivating factors for developing National Adaptation Strategies

There are many issues that in combination drive countries to develop adaptation strategies. It is impossible to separate them out and identify a single key factor: they all play a role in most countries, but with different weights. Drivers include international climate negotiations, EU policies, experience of extreme weather events, examples of adaptation actions in other countries, research on impacts and adaptation, assessment of the economic costs of inaction or recognition of the opportunities presented by climate change. Equally important, but often poorly understood, are key facilitating factors without which it is unlikely that the drivers would be acted upon. These facilitating factors include, for example, availability of knowledge, political will, good co-ordination between key actors and identification of compatibility with other policies. The NASs vary in their emphasis: for example water availability is stressed in southern European countries, whereas flood risk is a recurrent theme in central and northern Europe where some potential benefits are also highlighted. Interestingly, given the historical ties of many European countries, there is only superficial treatment of the national implications of climate change impacts occurring elsewhere in the world. The NASs analysed reflect the national and socio-economic conditions of a country, placing emphasis on dealing with the challenges that are most relevant in that country.

Research and scientific assessment

In all the countries reviewed the availability of scientific information was crucial in stimulating the development of a national adaptation strategy. Three broad

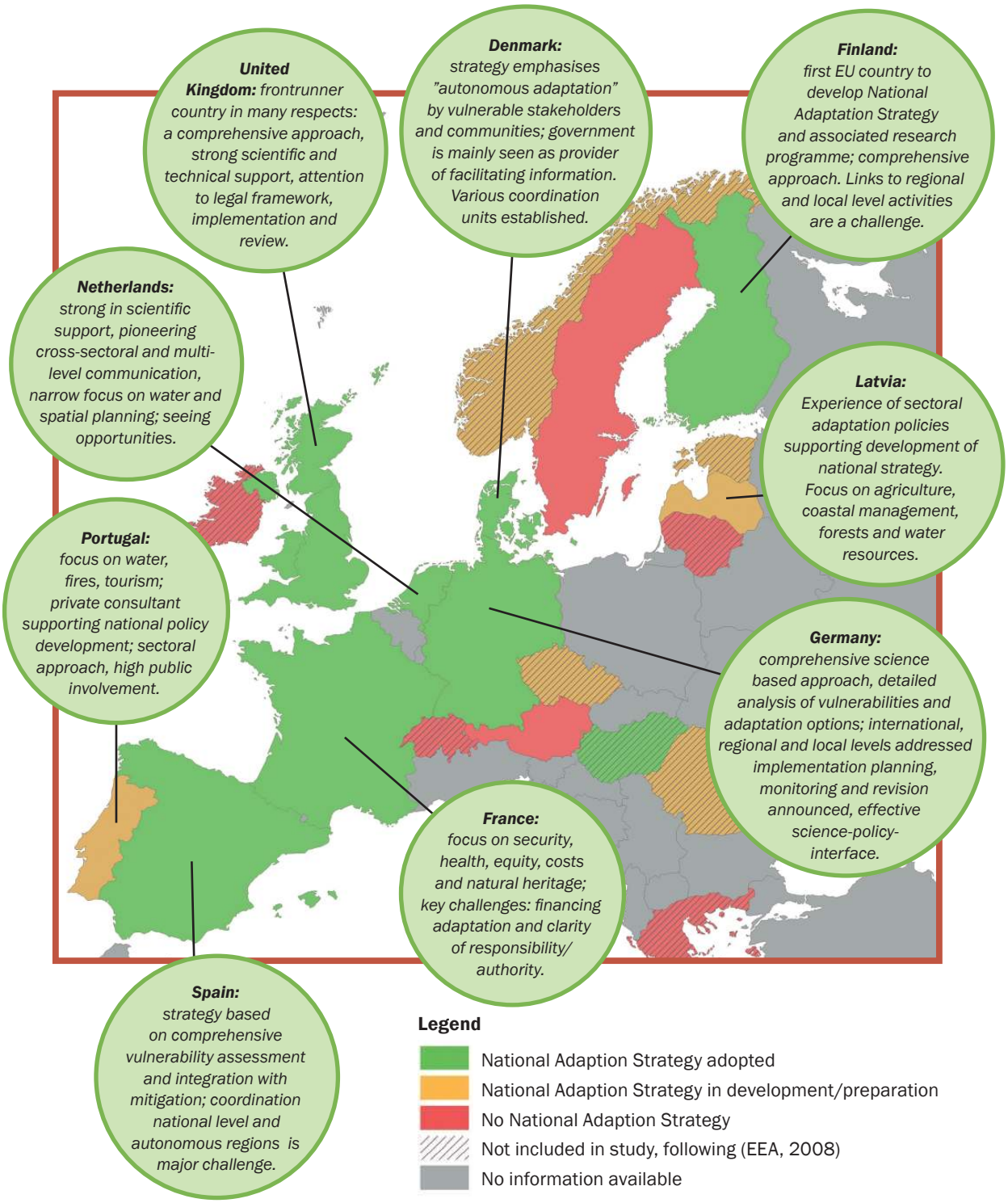

Figure 0.1 *Summary of the National Adaptation Strategies in European Countries. Note that England is currently the only part of the United Kingdom with a formally adopted Strategy.*

stages of information development can be identified: climate system research (understanding climate dynamics and attributing climate change), impacts research (the biophysical impacts of climate change on environmental and human systems) and vulnerability and adaptation assessments (understanding the factors that make a system vulnerable to change, and how and at which costs vulnerability can be reduced). These phases are not consecutive but incremental as the subsequent stages build on understanding of earlier stages rather than replace them. Progress in research depends on both scientific agenda setting and the political priority of climate change concerns and associated available resources. Partly because of the emphasis on preventing climate change through mitigation, political and scientific attention to adaptation in Europe developed rather late. We noted difference between countries in the variety of approaches to integrating scientific knowledge into policy making, ranging from the creation of specific boundary organisations (UK Climate Impacts Programme) to the establishment of a joint committee of scientists and politicians (Germany). Because adaptation policies are yet to be implemented, it is too early to judge which mechanism works best in which circumstances. We also note that notwithstanding large uncertainties, the strategies are generally neither based on a systematic analysis of policy-relevant scientific uncertainties nor contain specific plans for such analysis, posing a possible challenge for the scientific community.

Communication and awareness raising: from mitigation to adaptation

The ability to communicate information on impacts, vulnerability and adaptation is considered to be necessary and vital for effective adaptation according to the national adaptation strategies. However, there is little agreement on how to do this and only sparse evidence of any clear communications strategies in the NASs. On a positive note, most countries have developed internet tools that complement their NASs and which can provide a single portal for information and advice. Communication on climate change in the countries reviewed still remains predominantly focused on mitigation and this needs to be addressed urgently if adaptation, which poses a different set of challenges, is to be effective.

The challenge of multilevel governance

Our study confirmed the finding in the as yet sparse literature about adaptation in Europe that action on adaptation needs to happen at all levels of governance from international to local. There is limited recognition of the international scale in the NASs, both with respect to emerging EU policy and to the influence that

global activity may have on national outcomes. However, nearly all the NASs emphasise the need to take action at the regional or local level with a shared responsibility across administrative scales, reflecting that the effects of climate change will be felt locally and may vary greatly even within national borders. The acknowledgement of the important role of multi-level governance in adaptation is a positive step forward in moving towards implementation of adaptation action. Nevertheless, there are still a number of barriers to turning theory into reality. Few countries have set out clearly defined responsibilities for the different levels of governance, nor set up co-ordinating bodies. Another major issue is the question of funding – who should pay for which aspects of adaptation. Finally there is little discussion of how conflicts between levels of governance can be resolved which may lead to contradictory approaches being taken.

Integration of climate change adaptation into sector policies

A key challenge for adaptation at the national level is to ensure it is integrated into sectoral policies. Adaptation cannot be delivered in isolation, it must be at the basis of all policies to ensure they remain appropriate as the climate changes. Unlike many other areas of environmental policy, adaptation is likely to be motivated in many cases by self-interest and undertaken voluntarily. However, the majority of NASs recognise that there are still barriers to this and Government action will be required to push forward the integration agenda. Although the relevance of better climate projections is often recognised, most barriers appear to be of a policy coordination and implementation nature: how can adaptation actions be designed, organised and financed? The main roles for Government will be to provide information and raise awareness of the need for timely action, to support building of adaptive capacity and to ensure public goods are integrated into cost-benefit analyses and secured through regulation, instruments and incentives. Key to ensuring this happens is strong political leadership, clear objectives, effective administration and co-ordination and suitable policy design processes that allow for integration. The current generation of NASs, while recognising the challenges of integration, do not put in place clear measures for ensuring that policy integration actually happens. However, we conclude that the process of developing NASs has improved administrative integration with interdepartmental committees having been or being set up in a number of countries.

Instruments have to be developed and adaptation policies to be periodically evaluated and revised

Most NASs are the start rather than the end of a policy process, putting the issue on the national policy agenda but often without elaborating concrete proposals

or processes for measuring effectiveness of the NAS. Knowledge on vulnerability and adaptation options will increase over the coming years. Flexible mechanisms to implement, evaluate and revise adaptation strategies will be required. This will include metrics to gauge progress and policy effectiveness, as well as sets of regulatory, economic and other instruments.

Strengths and weaknesses, opportunities and threats

Our research shows that the countries studied are taking a variety of approaches to developing NASs, in part reflecting their own cultural norms, political system and assessment of the risks posed by climate change. However, we have also identified a number of key issues which we believe need to be addressed in order that the NASs are effective. The conclusions set out a number of policy recommendations which we believe are relevant to all countries. We have also made an initial assessment of the relative foci – and associated strengths and weaknesses – of the various approaches adopted by countries in dealing with the key themes outlined above. While we note a variety of approaches and promising progress, no country can be complacent about what it needs to achieve as there are thematic areas that could be strengthened or better coordinated in all countries. Rather than focusing on differences between countries, Table ES1 gives an overview of strengths, weaknesses, opportunities and threats that European countries appear to have in common. European countries share a strong commitment to scientific support to adaptation, to a systematic planning of adaptation actions, and to involvement of relevant actors at all levels and sectors.

As is often the case with strengths, these factors are compounded by related weaknesses: notwithstanding the commitments in the strategies, coordination between administrative levels and between sectors is as yet poor in many countries, and the very rapid development of adaptation policy takes place at a time when adaptation research is only yet beginning, with the risk of a mismatch in timing between science and policy. Successful implementation of the strategies is threatened by a number of factors, including lack of committed resources, lack of public support, and failing coordination between administrative levels and sectors. The national focus of most of the strategies ignores the possibility that indirect impacts of climate change through global systems and networks may be significant. Opportunities that may be captured to facilitate and accelerate implementation of adaptation policies are related to employment and export opportunities of adaptation technology and knowledge, and to the use of climate change adaptation as a vehicle to strengthen multilevel governance and policy integration and coherence in areas broader than climate change alone.

Table ES1 *Generic strengths, weaknesses, opportunities and threats that are typical for several National Adaptation Strategies in EU countries*

	Contributing significantly to achieving the NAS objectives	***Hindering the achievement of the NAS objectives***
Related to historical conditions and institutional development of the NAS	• *targeted adaptation research* • *planning for implementation, review and funding* • *coordination between sectors and administrative levels* ***STRENGTHS***	• *lack of coordination between sectors* • *lack of stakeholder involvement* • *unclear responsibilities between administrative levels* • *lack of specialised knowledge* • *scientific uncertainties* ***WEAKNESSES***
Related to current and future conditions and developments external to the NAS	• *development and export of knowledge* • *spill-over of policy integration and multilevel governance for non-climate policies* ***OPPORTUNITIES***	• *cross-level conflicts* • *cross-sectoral conflicts* • *lack of resources* • *lack of public support* • *global impacts* ***THREATS***

Developing and sharing knowledge internationally

The research community also needs to undertake further work to support the development and implementation of adaptation in Europe, and beyond. There are a wide range of areas of uncertainty in each of the key issues, many of which are common to all countries. This would suggest that a joint approach to research could be beneficial and help reduce the uncertainties regarding adaptation which provide a major barrier to action. The report concludes by highlighting a number of knowledge gaps, which would have to be addressed to enhance the knowledge basis for effective climate adaptation policy and may provide a basis for developing national and international adaptation research agendas. In contrast to climate system and mitigation research, a common feature of most of these recommendations is that research to be relevant for the assessment of impacts, vulnerability and adaptation should have a proper balance between generic knowledge development and targeted, context-specific research, in close collaboration with local and sectoral stakeholders. To make adaptation research relevant for decision-making and turn adaptation strategies into effective action, an increased role for the social sciences is required.

1. Introduction

1.1. What is climate change adaptation?

Climate change is happening. Even if global emission reductions and mitigation efforts over the next decades prove to be successful, some further climate change now seems inevitable (CEC, 2007b). Wide-ranging impacts of changes in current climate have been documented, and a growing body of scientific studies anticipates that nearly all European regions will be negatively affected by some future impacts of climate change. These are bound to put significant additional pressure on ecosystems across Europe, as well as posing challenges to many economic sectors (EEA, 2005b, 2008).

Climate change adaptation comprises all spontaneous responses and planned action taken to cope with the impacts of, or reduce vulnerability to, a changing climate. Such adaptation is needed to tackle current problems or anticipate possible future changes, with the aim of reducing risk and damage cost-effectively, and perhaps even exploiting potential benefits. In the past, adaptation measures have seldom been undertaken in response to climate change alone, but have been part of approaches that deal with extreme weather events (Adger et al., 2007). Moreover, in responding to other environmental pressures or as a result of precautionary policy, the adaptive capacity of natural or human systems has often been increased implicitly. However, as the risk and urgency associated with climate change increases, so too does the need to address adaptation explicitly.

A combination of adaptation and mitigation measures can reduce the risks associated with climate change. Until recently, the focus of policy related explicitly to climate change was largely geared towards enhancing mitigation efforts. Assessments of climate change impacts and vulnerability have highlighted the fact that that European countries are vulnerable to the effects of climate change and require adaptive action (EEA, 2008). Increasingly, therefore, society and policy-makers are making preparations to counter adverse impacts and initiating dedicated adaptation action. Such adaptation action, which may be anticipatory, autonomous or planned (see Box 1.1), includes both national and regional

adaptation strategies as well as practical steps taken at community level or by individuals.

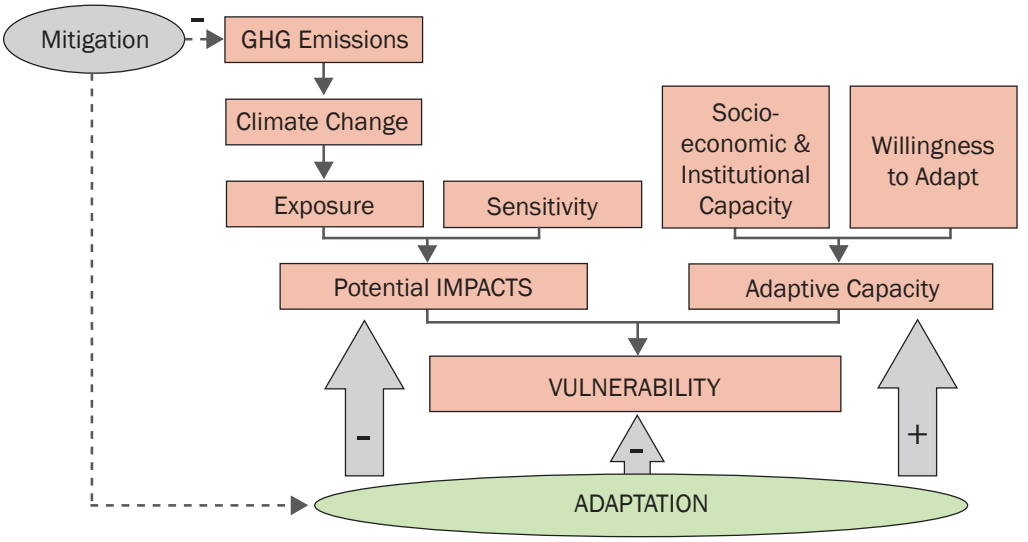

Figure 1.1 *Conceptual diagram showing the interrelation between climate change impacts, vulnerability and adaptation. Important in this framework is the notion that vulnerability is determined by both potential climate change impacts and adaptive capacity. Adaptation strategies can address either. Source: (Isoard et al., 2008)*

1.2. Scope and methods of this study

This report presents a comparative analysis of national adaptation strategies in different European countries. Adaptation strategies can be defined as "a general plan of action for addressing the impacts of climate change, including climate variability and extremes. It will include a mix of policies and measures with the overarching objective of reducing the country's vulnerability. Depending on the circumstances, the strategy can be comprehensive at a national level, addressing adaptation across sectors, regions and vulnerable populations, or it can be more limited, focusing on just one or two sectors or regions." (UNDP, 2005). In this study, we primarily looked at formal National Adaptation Strategies; i.e. in the sense that in order to be included they are to be developed by the respective governments for adoption by national policy makers.[2]

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[2] *We only refer to sectoral or regional initiatives (e.g., the Dutch water safety plans or the recent London adaptation strategy) where known and considered relevant from a national perspective. The inventory and harmonization of such initiatives through national coordination would be an interesting subject for a follow-up study, see also chapter 6 and 7.*

Box 1.1 Defining adaptation (based on glossary of IPCC)

While there is no generally accepted definition of adaptation, in this report we use the one of the Intergovernmental Panel on Climate Change: "adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities".

Various types of adaptation can be distinguished: anticipatory adaptation (i.e. "which takes place before impacts of climate change are observed"), autonomous adaptation (i.e. "which does not constitute a conscious response to climatic stimuli but is triggered by ecological changes in natural systems and by market or welfare changes in human systems") and planned adaptation (i.e. "which is the result of a deliberate policy decision, based on an awareness that conditions have changed or are about to change and that action is required to return to, maintain, or achieve a desired state").

Adaptation can be geared to reduce both potential impacts of (i.e. "effects of climate change on natural and human systems") and our general vulnerability to (i.e. "the degree to which a system is susceptible to, and unable to cope with, adverse effects") climate change – or towards increasing adaptive capacity (i.e. "the ability of a system to adjust to climate change, to moderate potential damages, to take advantage of opportunities, or to cope with the consequences).

The UNFCCC defines impacts and adaptation in the context of anthropogenic climate change only, but in the European National Adaptation Strategies this distinction is not made.

A key objective of this is to provide insight into the various approaches taken in different countries and thus to facilitate an exchange of information on how to tackle adaptation across Europe. Our analysis is guided by two principal sets of questions:

- What is the status of national climate change adaptation strategies in different European countries? What are the similarities and differences, strengths and weaknesses, foci and gaps of national climate change adaptation strategies – and how can they be explained?
- What are the gaps in knowledge that need to be filled in order that the impacts, vulnerability, costs and benefits of adaptation measures in Europe might be assessed as a sound basis for developing and implementing adaptation strategies?

For the purposes of this analysis, the national approaches of a total of 14 European countries have first been reviewed and summarised (Chapter 2). The selection of these countries was based on accessibility of the information. Thus besides the respective home countries of the authors also such countries are included, for which adaptation strategies are available (or being developed) and are accessible in terms of availability of information in languages covered by the team.[3]. In line with the traditional policy cycle of problem recognition, agenda setting, policy formulation, decision making, implementation and evaluation, this chapter highlights where each country stands as regards the development of national adaptation strategies.

A comparative analysis was carried out, using a sub-set of national adaptation strategies (i.e. all but the Hungarian example). An earlier inventory of 27 European countries was based on the 4th national communications for the UNFCCC (Massey and Bergsma, 2008). Because of the very rapid development of adaptation policies in Europe, our study focused on more up-to-date national documents, usually in the local languages. After an initial literature search and several brainstorming sessions, the following six themes were selected as a basis for structuring the analysis: the motivation behind establishing national adaptation strategies (Chapter 3); the interaction between science policy and research coordination (Chapter 4); approaches to communication and knowledge transfer (Chapter 5); the ways in which tasks and responsibilities are distributed between different levels of governance (Chapter 6); the institutional arrangements for incorporating adaptation into sectoral policies (Chapter 7); and whether and how countries ensure that their adaptation strategies are reviewed and implemented (Chapter 8).[4]

This study has benefited greatly from being carried out as a joint project of the Partnership for European Environmental Research (PEER) initiative[5], as this has enabled us to build on insights into divergent country perspectives and

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[3] For example, for this reason all Scandinavian countries are included, even if they do not all have a national strategy yet, but Hungary, which does have a national strategy, not because of language constraints.

[4] Note that Chapters 3 through to 8 compare approaches across European countries. Country-level descriptions of the respective national adaptation strategies are presented as annexes to this report.

[5] The PEER initiative includes a group of seven environmental research institutions based in different European countries: Alterra (based in the Netherlands), CEH (based in the United Kingdom), CEMAGREF (based in France), NERI (based in Denmark), SYKE (based in Finland) and UFZ (based in Germany). For additional information, please see http://peer-initiative.org. Please note that while the European Commission's JRC-IES (in Ispra, Italy) is also part of PEER, it has not been involved in this study.

to develop a unique cross-cutting comparison of strategies developed at the national level. The analysis itself was performed primarily as a desk-study[6], in which available material on national adaptation strategies was evaluated in line with the criteria outlined above. Where necessary and possible, this analysis was complemented with information gathered through interviews and personal communication with policy-makers involved in the development of the respective national adaptation strategies.

It should be stressed that adaptation activities take place at various levels. Initially, adaptation was approached in a "top-down" manner, from a scientific perspective: assessments of global climate change were down-scaled to arrive at regional and local "physical" vulnerability. Whether impacts on people occur as a result of this physical vulnerability depends also on "social" vulnerability, which is related to local socio-economic and cultural characteristics and analysed in a "bottom-up" fashion (Figure 1.2). The situation in terms of policy development is very similar to the top-down and bottom-up reconciliation required for assessments as reflected in Figure 1.2. In many countries adaptation policies are being developed in a "top-down" manner, responding to concerns about global climate change; however adaptation is by no means limited to what is captured in the existing "formalised" national adaptation strategies (see Figure 1.2). "Bottom-up" responses to reduce vulnerabilities to observed climate variability (e.g., floods, heat waves) can already be seen in some communities and businesses.

Nevertheless, the analysis presented in this report focuses deliberately on national adaptation strategies – i.e. those "top-down" attempts geared towards framing "bottom-up" measures. This approach – using a similar evidence base across countries – allows for a higher level of comparability. Another reason for focusing this report on more generic aspects of adaptation strategies at the national level is that adaptation measures are very much dependent on the context of a particular vulnerable sector or location. Analysis of local and sectoral adaptation activities is beyond the scope of this report, we accept that this will have led to some relevant trends and activities being overlooked.

It is worth noting that the study presented here is complemented by a second joint project carried out by the PEER network on "Climate Policy Integration, Coherence and Governance". This second study analyses policy integration for mitigation and adaptation efforts in more detail for selected case studies from six European countries (Mickwitz et al., 2009).

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[6] In addition to the desk-based studies carried out at the respective partner institutes, consistency across chapters was ensured by regular project team meetings via e-mail, teleconference and two project workshops (i.e. in Helsinki in May 2008 and in Paris in September 2008).

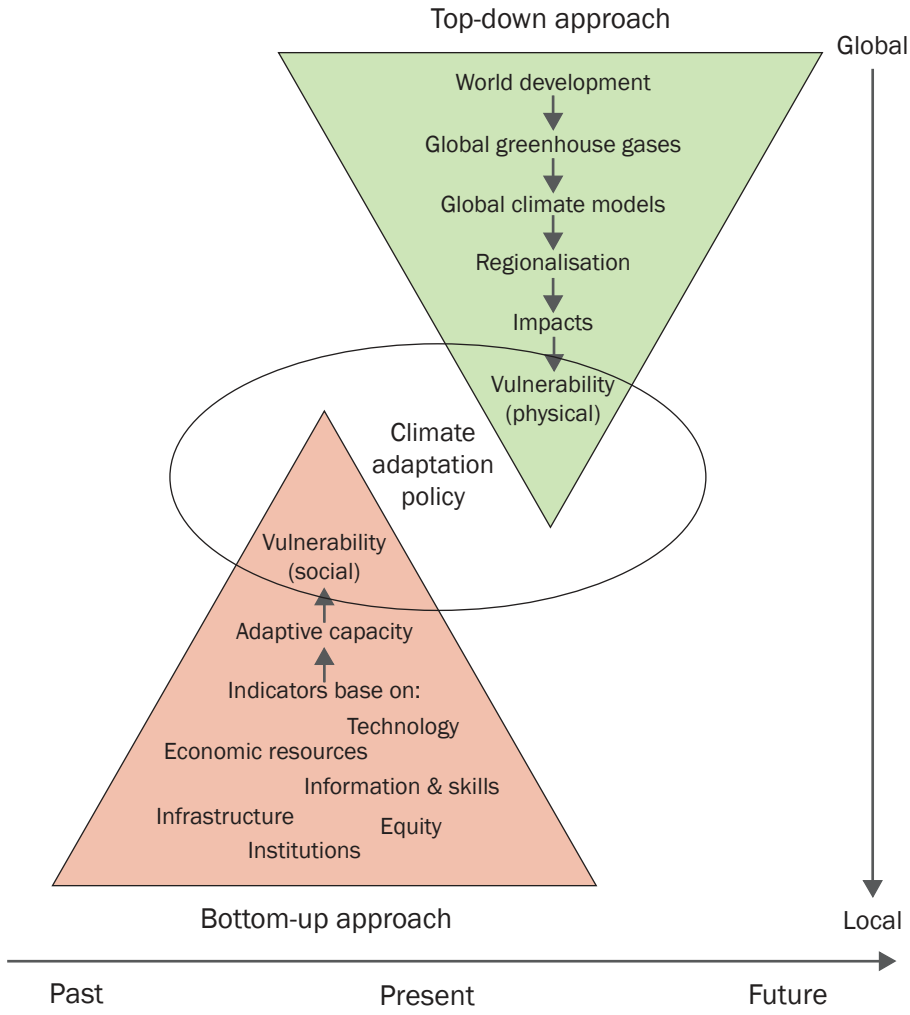


Figure 1.2 *"Top-down" and "bottom-up" approaches used to inform climate adaptation policy (Dessai and Hulme, 2003).*

2. National Adaptation Strategies in Europe

This chapter puts the development of National Adaptation Strategies (NAS) into the international context. Second, it provides a brief summary of developments in selected European countries. Full descriptions of the strategies are available in the annex.

2.1. International and European level policy efforts

We start the discussion about national strategies by considering whether they have been triggered by international developments, and if so, to what extent. In the international policy context the need for additional adaptation efforts is framed by the United Nations Framework Convention on Climate Change (UNFCCC, Article 4), and more specifically by the Nairobi five-year programme of work on impacts, vulnerability and adaptation to climate change (UNFCCC, 2006), the National Adaptation Plans of Actions (i.e. NAPAs) and the Bali Action Plan (UNFCCC, 2007a). Furthermore, it is recognised that the issue of adaptation will need to be addressed explicitly in any future global climate change agreement – such an agreement for the post–2012 period is currently being negotiated with a view to reaching an accord by the end of 2009 (i.e. the 15th Conference of Parties in Copenhagen).

At the European level, a Green Paper published by the European Commission in 2007 entitled "Adapting to climate change in Europe – options for EU action" sets out four lines of priority action at the Community level (see CEC, (2007b)[7] :

- The first covers early action in areas from agriculture to trade that are backed by EU policies and available Community funds.

[7] *Also see http://ec.europa.eu/environment/climat/adaptation/index_en.htm.*

- The second recommends integration of adaptation into existing EU external actions; in particular, its promotion in developing countries.
- The third calls for intensified climate research; in particular, on the impacts of global warming and technological innovation.
- The fourth is about involving all segments of society, business and the public in the further development of adaptation strategies.

In the spring of 2009, a White Paper is expected to provide more concrete policy development at EU level. At the time of writing, it is not known to what extent and in what manner the White Paper may influence national adaptation efforts.

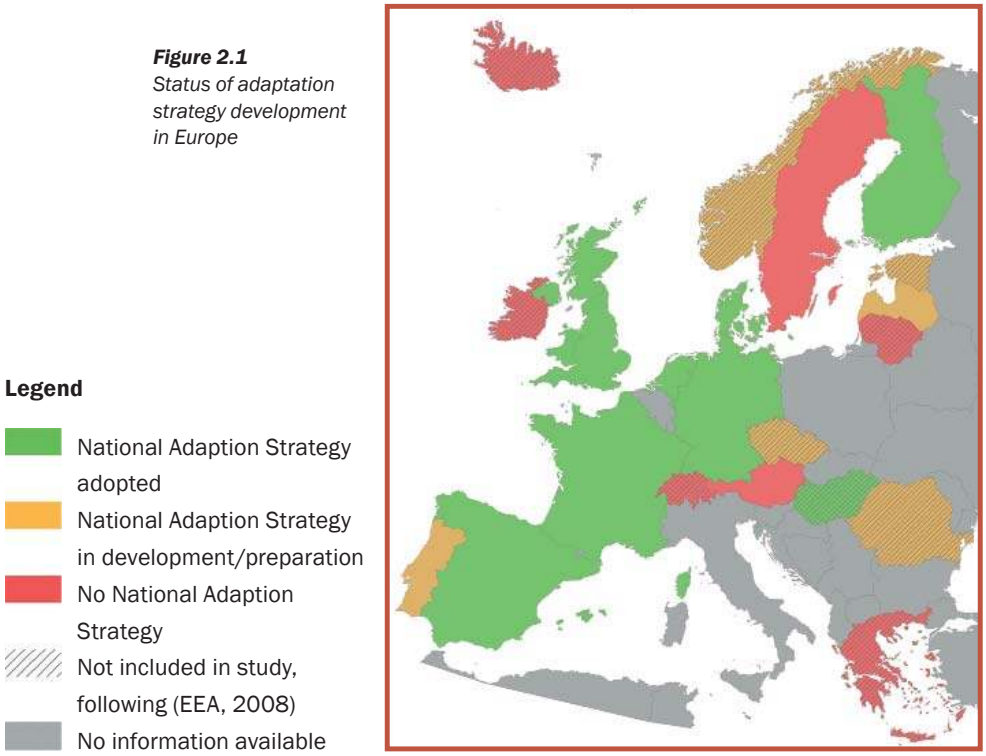
2.2. Overview of national adaptation strategies in Europe

European countries are at different stages in preparing, developing and implementing national adaptation strategies. The progress made thus far depends on a number of factors including the magnitude and nature of observed impacts, the assessment of current and future vulnerability, and the existing capacity to adapt (see also Chapter 3). While all countries have submitted information on their plans for adaptation in their 4th National Communication to the UNFCCC (2005), not in all countries is this also reflected in an explicit national adaptation strategy (Figure 2.1).

Indeed, until 2005 only one country in Europe – Finland – had an explicit adaptation strategy. In a parallel development, several countries – including Denmark, Spain and France – followed suit recently with the development and publication of national strategies. Other countries – such as the United Kingdom – have followed a somewhat more diffuse approach, first initiating local and sectoral adaptation activities and subsequently collating them under a common framework (see Table 2.1 for an overview). Several countries are expected to adopt national adaptation strategies in 2009 and beyond. The recent and current rapid pace of developments in the context of national adaptation strategies across Europe implies that policies in this area are developing extremely rapidly, and the information about the national activities provided in this report will soon be outdated. However, we hope that the more substantial issues related to the six cross-cutting aspects discussed in this report can add to a diverse and effective development of adaptation policies in Europe, together with research programmes adequately underpinning these policies.

Below we introduce briefly the progress made in the respective countries analysed in this report. As annexes to this report, we provide a more elaborate

Figure 2.1
Status of adaptation strategy development in Europe



description of activities related to national adaptation strategies in the selected countries based on information available in mid–2008.

2.2.1. Countries in which a formal National Adaptation Strategy has been adopted

As noted above, **Finland** was the first European country to initiate a comprehensive national adaptation strategy (Marttila et al., 2005), in response to the first national climate strategy submitted to parliament in 2001. Its preparation began in 2003 and Finland's National Strategy for Adaptation to Climate Change was finalised at the end of 2004. The objective of the National Adaptation Strategy is to reduce the negative consequences of climate change as well as to take advantage of its potential opportunities. The strategy describes vulnerability to climate change and its potential impacts on several sectors and suggests measures to improve adaptation capacity for each one of these. The sectors covered in the strategy are agriculture and food production, forestry, fisheries, reindeer and game husbandry, water resources, biodiversity, industry, energy, transport, land use and communities, building, health, tourism and recreation, and insurance. The responsibility for implementation of the national adaptation strategy lies with the

Table 2.1 *National adaptation strategies (NAS) under preparation or adopted, based on EEA (2008). Note that England is currently the only part of the United Kingdom with a formally adopted Strategy.*

European countries in which a formal National Adaptation Strategy (NAS) has been adopted	***Year in which a NAS was adopted***
Finland	*2004*
France	*2006*
Spain	*2006*
Denmark	*2008*
Hungary	*2008*
Netherlands	*2008*
United Kingdom	*2008*
Germany	*2008*
European countries in which governments are preparing a NAS or in which preparatory work has been undertaken	***Year in which a NAS is expected***
Austria (*)	*n.a.*
Belgium (*)	*(expected for 2012)*
Czech Republic (*)	*(expected for 2009)*
Estonia (*)	*(expected for 2009)*
Ireland (*)	*n.a.*
Latvia	*(expected for 2009)*
Norway (*)	*n.a.*
Portugal	*n.a.*
Sweden	*n.a.*
Romania (*)	*(expected for 2008)*

(*) Note: Not analysed in this report

respective sectoral ministries, some of which have started to prepare sectoral assessments and action plans to include adaptation into other policies.

In **France** a national adaptation strategy was published by the national observatory dedicated to the effects of climate change (ONERC, 2007), after its adoption by the inter-ministerial committees for sustainable development in November 2006. This strategy highlights the key priorities for adaptation in France: in particular, public security and health; social aspects, including inequality of risks, costs and opportunities and preservation of natural heritage. It includes 43 specific recommendations. The next step is to translate these recommendations into a binding national adaptation plan, which comprises substantive proposals for action, by 2010–2011. In parallel, the "Grenelle de l'environnement" – a national government initiative launched in 2007 and expected to be translated into concrete measures during 2008 – also touches upon climate change issues. However, it focuses mainly on mitigation efforts, and only marginally addresses adaptation (reflecting current policy priorities in France).

Spain has had a national climate change strategy since 2005, established by a national decree. Since 2001, a national office for climate change has existed within the former ministry of environment which is in charge of reaching the goals of the Kyoto Protocol. However, the main components of this strategy relate to mitigation options. In addition, a national adaptation plan – "Plan Nacional de Adaptación al Cambio Climático (PNACC, 2006)" – was published in 2006 . The PNACC focuses on the following sectors: biodiversity, water resources, forest, agriculture, coastal zones, hunting and continental fishing, mountainous regions, soils, marine ecosystems and fisheries, transport, human health, industry and energy, tourism, construction and urbanisation, finance and insurance. An initial review of progress made was carried out towards the end of 2008. The review looked at the four priority lines of research already described in the PNACC, i.e. the generation of scenarios, the evaluation of impacts in the water sector, the evaluation of impacts in coastal zones and the evaluation of the impacts on biodiversity.

In **Denmark**, the government introduced its "Strategi for tilpasning til klimaændringer i Danmark" (Danish strategy for adaptation to a changing climate) in March 2008 (Danish Energy Agency (Energistyrelsen), 2008). This strategy stresses that it is important that, as far as possible, authorities, enterprises and individuals should react to the consequences of climate change in good time on their own initiative. To support this, the Danish strategy calls for the implementation of information initiatives, a research strategy and measures to facilitate the consideration of climate change issues in planning and development. In addition, the strategy outlines the challenges faced by vulnerable sectors in particular coastal management, construction, energy supply, water supply, agriculture and forestry, fisheries, nature and nature management, planning, human health, emergency and rescue services, and insurance related aspects.

In **the Netherlands**, the government has formulated a formal Dutch National Adaptation Strategy in 2007 entitled "Make Space for Climate!" (VROM, 2007b). This strategy consists of a short political document endorsed by all relevant ministries and other governmental bodies, and a more detailed background document. The National Implementation Agenda "Make Space for Climate", which is currently under development and is scheduled for publication in early 2009, describes how the strategy will be implemented. The strategy documents are the starting points for formulating more substantive climate adaptation policy. However, it should be noted that this document relates primarily to spatial measures, although raising awareness and identifying gaps in knowledge are also part of the strategy. In addition, sectoral plans have been developed, including a national plan for heat waves (Ministry of VWS, 2007), and a State Advisory

Commission (Delta Commission, 2008) has presented recommendations in September 2008. The minister responsible for Climate and Spatial Planning stressed that adaptation to climate change has to be concerned with threats to public health, with flooding, drought and heat-waves, with changing habitats for species of plants and animals and with possible economic damage, illustrating that climate proofing involves the spatial development of the entire country.

The **United Kingdom** has been active in climate change science from an early stage and policy responses have been debated and developed from the late 1980s onwards[8]. Adaptation has been approached through a number of programmes and initiatives, some general, some sector-specific. In its UK Climate Change programme (established 2000, reviewed 2006) the government set out its intention to develop a "comprehensive and robust approach to adaptation in the UK", alongside mitigation issues. In the summer of 2008 the Government launched "Adapting to Climate Change in England: a Framework for Action" (DEFRA, 2008a), the national adaptation strategy for England, the largest constituent country of the UK. A Climate Change Act has been adopted. This will place a statutory duty on the Government to carry out a detailed national risk assessment and develop a programme to implement adaptation (together with a series of other measures including reductions in greenhouse gas emissions).

The **German** NAS has been adopted by the cabinet in December 2008. The intention to develop a national adaptation strategy was first announced officially in 2005 by the German Climate Change Mitigation Programme (German Federal Government, 2005). The actual development process was launched in 2007, conducted by the Federal Environmental Ministry, informed by numerous stakeholder consultations and supported i.a. by KOMPASS, a special focal point of the Federal Environmental Agency commissioned to coordinate research and to enhance the science-policy-nexus. The NAS aspires to integrate the work that is already in progress in various ministries and to establish a transparent and structured mid term process which, in conjunction with all relevant actors, shall progressively ascertain action needs, define objectives, identify and resolve conflicts, and develop and implement potential adaptation measures. A detailed analysis of regional vulnerabilities and possible adaptation measures was drawn from a relatively broad domestic scientific knowledge basis. Major knowledge gaps

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[8] The UK Climate Impacts Programme (UKCIP) is notable here. It was established in 1997 and is geared to wards identifying common research priorities; facilitating interaction within and between studies; offering expertise on impacts assessment and independent advice on the most appropriate methodologies and research approaches; and communicating results from the assessments to a wide audience to inform decision-making.

are identified, International, regional and local challenges and responsibilities are considered in view of the possible national governments contributions. The establishment of an inter-ministerial working unit is announced. This unit is commissioned by the NAS to develop an implementation programme by April 2011. Moreover, the development of vulnerability indicators and a national monitoring system is proclaimed providing the basis for a continuous review process. First mid-term review is scheduled for April 2013.

2.2.2. Countries in which no formal National Adaptation Strategy has been adopted

Austria has only recently begun to work on a national adaptation strategy; in 2007 the Austrian government decided informally to develop an adaptation strategy. However, to date there have been no official statements regarding the general aims, concepts and timescale of such a strategy. Meanwhile, Austria has evaluated the available knowledge base, concluding that Austria lacks sufficient and comprehensive understanding of the regional impacts of climate change and adaptation options. Nevertheless, for some sectors, specific impact and adaptation studies exist (e.g., on flood protection – although these are not been specifically linked to the issue of climate change).

Latvia does not yet have a national adaptation strategy. Meanwhile, an informative report on adaptation was submitted to the government in 2008 (Ministry of the Environment, 2008a), and will serve as a basis for the further development of a national strategy. The process of developing a strategy is currently led and coordinated by the Climate and Renewable Department within the Latvian Ministry of the Environment. The national adaptation strategy is due to be finalised by the end of 2009, within one year of the delivery of the EU's White Paper on adaptation. The strategy will be developed by two working groups, of which one will be an inter-governmental expert group and the second will consist of scientists, specialists from different agencies as well as representatives of enterprises and insurance sector. It will promote the integration of adaptation into existing policies in a more systemic way as well as the creation of new adaptation policy measures.

In **Norway**, a scoping study for a national adaptation strategy was published in 2004, outlining the key challenges a strategy would need to address and discussing possible approaches to structuring adaptation policy (Næss et al., 2004). However, by mid–2008, this study had yet to result in the adoption of a national adaptation strategy. Recently, the Norwegian Government published a draft consultation paper on three main objectives designed to tackle the issue of climate change adaptation: (a) map vulnerability to climate change in Norway; (b)

enhance understanding about climate change and adaptation; and (c) stimulate the exchange of information and capacity building (Miljøverndepartmentet, 2008). Complementing this, the Ministry of Environment – based on input from 13 ministries – presented a cross-cutting report in early 2007 detailing Norway's vulnerability and adaptation to climate change. This report summarises challenges for key sectors, i.e. biodiversity, agriculture, forestry, fisheries, infrastructure, spatial planning, energy, human health, insurance, foreign policy and the Arctic (Miljøverndepartmentet, 2007).

In **Portugal** no dedicated national adaptation strategy exists yet, although there is a growing recognition of the need for adaptation strategies. An interdepartmental commission for climate change (set up in 2001 and reactivated in 2006) has recently requested the development of a "reference document" for the definition of a national adaptation strategy. The SIAM project produced a comprehensive overview of scenarios, impacts, vulnerability and adaptation measures available (Santos et al., 2002). In the next 18 months, this reference document (Ecoprogresso, 2008) is to be translated into a concrete plan for adaptation, strongly based on active involvement and commitment by stakeholders from different sectors, such as agriculture, tourism, insurance companies, water companies, health sector etc. Meanwhile, several regional and sectoral actors and institutes have already started to take climate change into consideration in their sectoral plans; examples include the National Heat waves Contingency Plan, the Commission for Droughts, the Icarus alert system for the city of Lisbon, the Adaptation Measures in the National Forest Strategy and the related Plan against Forest Fires.

Sweden has not yet developed a dedicated national adaptation strategy, and may opt to stay with an integrated and coordinated cooperation between vulnerable sectors. In 2007 the "Klimat- och sårbarhetsutredningen" (Swedish Commission on Climate and Vulnerability); (SOU, 2007) presented its final report, "Sweden facing climate change – threats and opportunities". This 680-page report summarises the challenges Sweden faces; it focuses on key sectors (i.e. communications, technical support systems, development and buildings, rural businesses and tourism, the natural environment and environmental goals, human health, changes in the world around us and their impacts on Sweden). The report also looks at the information needed to help reduce vulnerability and offers a set of concrete proposals. It will be subject to a public review and will serve as one of the inputs into a forthcoming climate bill. This bill is expected to focus primarily on climate mitigation, however.

3. Motivating factors for developing national adaptation strategies in Europe

This chapter is divided into two sections. Section 3.1 seeks to contrast the main motivating factors persuading the PEER sample of European countries to develop national strategies for adaptation to climate change. Section 3.2 then considers the varied approaches countries have adopted in their strategies for framing the issue of adaptation and for initiating the process of formulating policies and measures for adapting to climate change.

3.1. Motivating factors for developing national adaptation strategies

Adaptation to climate change can be motivated by many factors, such as the protection of economic well-being or the enhancement of public safety in the face of weather-related impacts. Activities directed towards adapting to climate change are not isolated from other activities and decisions; they are undertaken in a specific demographic, cultural and economic context. They are also affected by globalising markets and other worldwide developments (O'Brien and Leichenko, 2000). Therefore, the decision to adapt is usually influenced by a mix of climate- and non-climate-related factors (Adger et al., 2005).

Figure 3.1 presents a simplified model of *drivers* that are thought to have influenced the development of national adaptation strategies (NAS) in Europe. These have been identified from published literature and policy documents or have been communicated by persons having direct involvement with adaptation strategy development. They are discussed in more detail below. Some of the drivers are exogenous to a country, such as international climate negotiations and European Union (EU) climate policies, while others are endogenous, such as recognition of the vulnerabilities and opportunities related to climate change in a particular country. Separate from the main drivers, we also distinguish a set of

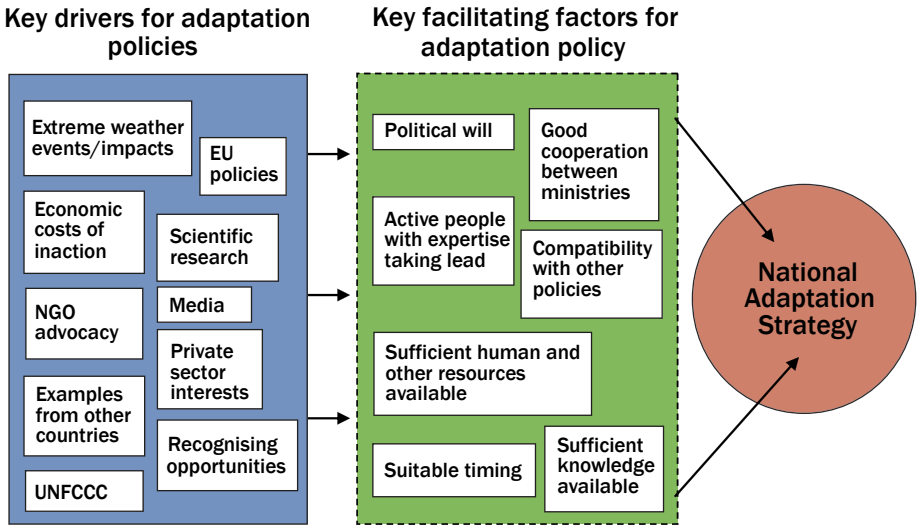

Figure 3.1 *Key drivers and facilitating factors for NAS development*

other factors that are required to convert the drivers into action, characterised in this study and in Figure 3.1 as *facilitating* factors. These are also discussed below.

3.1.1. Main drivers

It may not be possible to identify the most important driving force leading to the formulation of a NAS in a certain country, and direct causality between certain events and the development of national strategies may be difficult to prove. In addiiton, drivers often interact with one other. For example, experiences of weather-related extreme events, together with available scientific information on potential impacts of climate change, may increase public awareness on the need for adaptation and raise adaptation on the political agenda. This, in turn, may lead to more research on impacts and adaptation in support of policymaking.

It is also worth noting that many existing policies that apply to day-to-day monitoring and management procedures for coping with weather-related events, such as forest fires, floods or heat waves, already contribute to adaptation. Thus, adaptation activities cover a wide range of policies like water safety or disaster preparedness and prevention that are not necessarily ”labelled” as adaptation policies. These policies are increasingly taking into account future changes in climate and associated changes in the frequency amd magnitude of many weather-related extremes, thus integrating or ”mainstreaming” an adaptation approach into existing policy-making. However, most of these actions are not (yet) coupled to or fully integrated into the emerging National Adaptation Strategies. They form a very heterogeneous set of policies in a disparate arrray of sectoral

areas, and hence a comprehensive inventory was beyond the scope of this study.

International climate negotiations

An initial response to concerns about climate change has been international action to address the issue, particularly through the United Nations Framework Convention on Climate Change (UNFCCC). International action has focused mainly on mitigation, although adaptation is also included in the Convention and some requirements regarding adaptation are detailed as well. For example, the Convention commits countries to prepare for and facilitate adequate adaptation to climate change (Article 4.1), and all Parties are required to take actions to meet the specific needs and concerns of developing countries arising from the adverse effects of climate change (Article 4.8). Recently, the 2007 UN Climate Change Conference in Bali, identified in its action plan the need for enhanced action on adaptation by Parties to the Convention (UNFCCC, 2007a).

There are also examples of other adaptation-related activities within the UN, for example, the five-year (2005–2010) Nairobi Work Programme (NPW) on impacts, vulnerability and adaptation to climate change.[9] In addition, the UNFCCC web portal includes databases on implemented adaptation activities in different parts of the world, to provide examples of adaptation experiences and facilitate the transfer of adaptation related knowledge between countries.[10] The international climate negotiations have raised awareness not only of the need to cut greenhouse gas emissions but also to take measures to reduce vulnerability to the inevitable impacts of climate change. They have served as one trigger for the development of national mitigation and adaptation policies. Tompkins and Amundsen (2008) discuss the effectiveness of the UNFCCC and conclude that the Convention plays a role in shaping the discourse on climate change and in generating policy responses at national level, even though there are also several other drivers for national mitigation and adaptation policies that operate simultaneously. The international climate negotiations set the scene and provide a framework for developing national adaptation policies, but only a few NASs explicitly refer to the UNFCCC as a background. As an example, the Spanish NAS states that the adaptation strategy is one part of Spain's contribution to fulfill the requirements of the UNFCCC.

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[9] *For more information, see: http://unfccc.int/adaptation/sbsta_agenda_item_adaptation/items/3633.php.*
[10] *For more information, see: http://maindb.unfccc.int/public/adaptation_planning/.*

EU policies

The European Commission's European Climate Change Programme (ECCP) was founded in 2000. In its second phase (2005–) a working group on adaptation (Working Group II) was established. The general objective of the Working Group II is to define the EU's role in adaptation policies so as to integrate adaptation fully into relevant European policy areas, to identify good, cost-effective practices in the development of adaptation policy and to foster learning. During 2006 the group organised 10 thematic stakeholder meetings, contributing to the preparation of the EU Green Paper on Adaptation that was published in 2007. A White Paper on Adaptation is currently under preparation and is planned for publication in early 2009. Running in parallel to these direct initiatives, adaptation has also been dealt with indirectly in other EU policy making, for example, in the context of legislation such as the Flood Directive and Water Framework Directive as well as in other sectoral policies and strategies. Even if most NASs do not explicitly refer to European adaptation policies, future NASs might be influenced to a greater extent by EU-policies such as the EU Green Paper and the forthcoming White Paper on adaptation.

Experiences of adaptation in other countries

The example of countries that have developed or are developing their national adaptation policies may also have an influence on the policies of other countries. However, this influence may vary; policies in neighbouring countries or in countries with similar geographic, cultural or socio-economic conditions are generally of more interest and are paid more attention than developments in countries that are more remote and do not have so much in common with the country in question. For instance, Portugal is especially interested in adaptation developments taking place in its neighbour, Spain, which shares many of the same adaptation needs and challenges. Moreover, countries' ability to adapt can sometimes be influenced by activities in neighbouring countries. To illustrate, water use and regulation in one country can affect cross-border river flow and water availability in another country, thus influencing the second country's capacity to adapt. Adaptation work in Denmark was initially inspired by the Portuguese SIAM Report, as well as a systematic scanning of both positive and negative examples of early work in neighbouring countries (Garnak et al., 2006).

Examples of novel national initiatives on adaptation, such as the UK Climate Impacts Programme, have also been followed with interest by other countries and have served as a reference for some countries developing their adaptation policies. In addition, informal cooperation and networking between countries can

also be recognised as important from the point of view of sharing knowledge and experiences on adaptation.

Research on impacts and adaptation

Publication of results from national and international research programmes and projects related to climate change impacts and adaptation either directly at the request of policy makers or receiving attention through the media have also pushed countries towards developing national adaptation policies. They have generated new knowledge about future impacts of climate change in the countries as well as the countries' vulnerabilities and needs to adapt. Research outcomes on impacts and adaptation options are an important driver for the development of national adaptation strategies. Sufficient and relevant knowledge on adaptation needs and options has to be available before policies on adaptation can be formulated. However, even if applicable research results are not yet available, the mere fact that research on impacts and adaptation is being funded at all is already a sign that the issue is perceived as politically important.

As discussed later in Chapter 4, several European countries have undertaken scientific impact assessments and research programmes related to the impacts of and adaptation to climate change (see Tables 4.1–4.3). In cases where research has indicated that a country faces severe challenges as a result of climate change, this inevitably places pressure on policy-makers to prepare for these challenges and develop appropriate adaptive strategies to cope with them. However, because of the complex interactions between science and policy (Scott *et al*., 2005), it is not always apparent how research will influence the development of a NAS.

Weather-related extreme events

In some countries the occurrence of extreme weather events has raised awareness about the need to adapt to climate change and contributed to the formulation of national adaptation strategies. Storms, heavy rains, drought and heatwaves in recent years, with their consequences for people and the environment, have provoked discussion on how well societies are prepared for an anticipated higher frequency and/or increased magnitude of some extreme weather events in the future. The role of the media is also important in addressing these events and thus raising awareness of the need to adapt.

However, weather-related extremes cannot necessarily always be clearly associated with climate change. For example, disastrous flood events in Austria and Germany in 2002 led to actions on flood protection, but these reactive measures have not been explicitly connected with adaptation to climate change.

One reason for this might be that adaptation to climate change has only become prominent on the political agenda during the last few years, and more recent events have increasingly been associated with climate change in the minds of policy-makers and the public alike. For example, a report concerning the severe 2007 flooding in the UK (Pitt, 2007), makes explicit reference to climate change and was incorporated in the NAS. The report states that events of the same kind are likely to become more common in the future as a consequence of changing climate, and calls for timely and effective adaptation policies. The Swedish government adaptation report also refers several times to extreme weather events such as the Gudrun and Per storms in 2005 and 2007, respectively, and discusses adaptation to climate change in relation to similar events in the future.

Another example of a weather-related event in Europe that has influenced adaptation action is the 2003 heatwave that caused excess mortality in several central and southern European countries. The impacts were especially severe in France, and in 2004 the French authorities implemented local and national action plans that included several measures to evaluate and improve health care in relation to similar events in the future. Likewise, local and national governments across Europe have also developed similar plans as a result of the 2003 heatwave (Parry et al., 2007). While this can be considered to be a reactive response to a regional weather event, the new plans can also be regarded as anticipatory in the sense of seeking to avoid similar severe impacts in the future in regions likely to be susceptible to such events, even if these regions were little affected in 2003. It seems that weather-related extremes have an influence both on developing sectoral adaptation policies related to the extreme event in question, while at the same time serving as a trigger for developing more comprehensive, national adaptation policies.

Economic costs of inaction

Knowledge on the costs of inaction is still relatively limited. One of the main reasons for this is that such studies are very complex and need to use detailed integrated assessment models that link emissions, climate impacts, economic costs and adaptation. However, there are some examples of academic studies that have addressed the costs of adaptation and inaction in European countries (Kemfert and Schumacher, 2005; Tol, 2001, 2002). An overview of the studies is presented by EEA (2007b). The approach has typically been sectoral, addressing the costs on a specific sector. Insurance companies have also published several studies calculating the costs of extreme weather events in several countries (EEA, 2007b).

A growing awareness of the economic costs of inaction in relation to climate change can be recognised as one of the background drivers for adaptation policies. One of the most important recent studies that has boosted public discussion on the economic dimensions of climate change and the costs of inaction is the Stern Review on the Economics of Climate Change (Stern, 2007). The report stresses the importance of early action, in relation to both mitigation and adaptation, in order to avoid the most severe consequences of climate change. The economic costs of climate change impacts and the costs of inaction can be regarded as an important factor contributing to the development of both mitigation and adaptation policies. Some NASs refer directly to the Stern Review (UK, the Netherlands), but generally the discussion tends to be at a rather general level, recognising that more knowledge on the economics of adaptation is needed.

The English NAS presents calculations of the costs of recent national extreme weather events, and the Swedish Government adaptation report refers to estimates indicating that the cost of preventative action is in many cases less than the damage costs in the absence of action. For example, the cumulative cost of weather related damage to the Swedish road network up to 2100 has been estimated at SEK 5–14 billion, while the cost of preventative actions designed to avoid 75% of the cost of damage is SEK 2–3.5 billion. Another recent example regarding the potential storm surge risk in Copenhagen has been published by OECD (Hallegatte et al., 2008). In this study it was again estimated, that the cost of inaction grossly exceeds the costs of adaptation for a range of scenarios.

Private interest groups such as insurance companies can be contributors to adaptation discussions and policy formulation in some countries, for example in the UK, where the Association of British Insurers has spoken out on the issue of adaptation and agreed with the Government to develop measures that enable flood insurance to continue to become widely available without distorting the market (ABI, 2002, 2007).

Recognising opportunities related to climate change

As the national adaptation strategies analysed make relatively few references to the potential benefits of climate change, these cannot generally be seen as an important driver for adaptation policies. However, there is awareness about possible benefits in some sectors and some countries reflect more on this in their NASs than others. The issue of recognising opportunities in the NASs is discussed in more detail in section 3.2.3.

3.1.2. *Important facilitating factors*

In addition to the actual drivers motivating the development of adaptation policies, several factors that facilitate the process can also be identified. These can be seen as a filter through which the NAS development takes place (represented by a dashed line around the boxes on the right-hand side of Figure 3.1). For example, enough background knowledge on the potential impacts of climate change in a certain country is needed in order to formulate national adaptation policies, sufficient resources and expertise have to be available and ideally adaptation policies that are suggested should be consistent with other policy goals. On the other hand, the ”filter” can also become a barrier for the development of adaptation policies, if crucial facilitating factors are missing or are too weak. This may help to explain why the development process of adaptation policies has started more slowly in some countries than in others.

Individuals, such as active policy-makers and politicians taking the initiative can sometimes have an important role in raising climate change as an issue on the political agenda, thus facilitating the development of adaptation policies. Also the role of some celebrities taking part in climate change discussion has become more important in recent years, and Boykoff and Goodman (Boykoff and Goodman, in press) talk about ”celebritization” of climate change, where media, politics and science intersect.

National adaptation strategies are often produced by inter-ministerial cooperation. Thus, good existing relationships and cooperation between different ministries facilitate the process. On the other hand, poor inter-ministerial communication or scepticism regarding climate change among key individuals may impede progress. Another facilitating factor that applies to policy development in general is the appropriate timing of the process. If adaptation policy development coincides with the introduction or updating of other relevant policy activities, synergies may be obtained and the overall costs of adaptation can be reduced (UKCIP, 2005). For example, the early appearance of the Finnish NAS was due, in part, to Parliament’s requirement for an update of the existing national climate strategy and a requirement that adaptation should be included in it.

3.2. Framing the issue of adaptation in developing national strategies

Across Europe there has already been substantial research into the potential impacts of climate change as well as some consideration of possible adaptation responses. Although not always explicit in the NASs, their design appears to

depend on the way the issue of adaptation is framed in different countries. These framing issues are likely to affect the eventual identification, evaluation, prioritization and then implemention of appropriate adaptation measures. The issues are:

a) how are future developments characterised (e.g., through scenarios)?
b) which vulnerable sectors are highlighted?
c) is climate change primarily a risk or are there also opportunities?
d) is adaptation a local or national, or an international problem?
e) which overarching paradigm dominates the adaptation debate?

These are examined in more detail below.

3.2.1. Characterising future developments

Most strategies offer several alternative characterisations of future national developments (scenarios) of relevance to climate change policy-making. Many provide projections of future climate, usually based on emissions scenarios presented in the Special Report on Emissions Scenarios (SRES) by the Intergovernmental Panel on Climate Change (IPCC), or linked to policy targets, such as the EU target to limit the average global mean annual temperature rise to 2°C relative to pre-industrial times, which is used in the Danish NAS. Some also provide information on recent trends and projections of national and regional economic development and population, observing that the ability to adapt and the costs of adaptation and mitigation will crucially depend on the structure and location of the population and its economic activity. Some of the scenarios adopted in different strategies are summarised in Table 3.1.

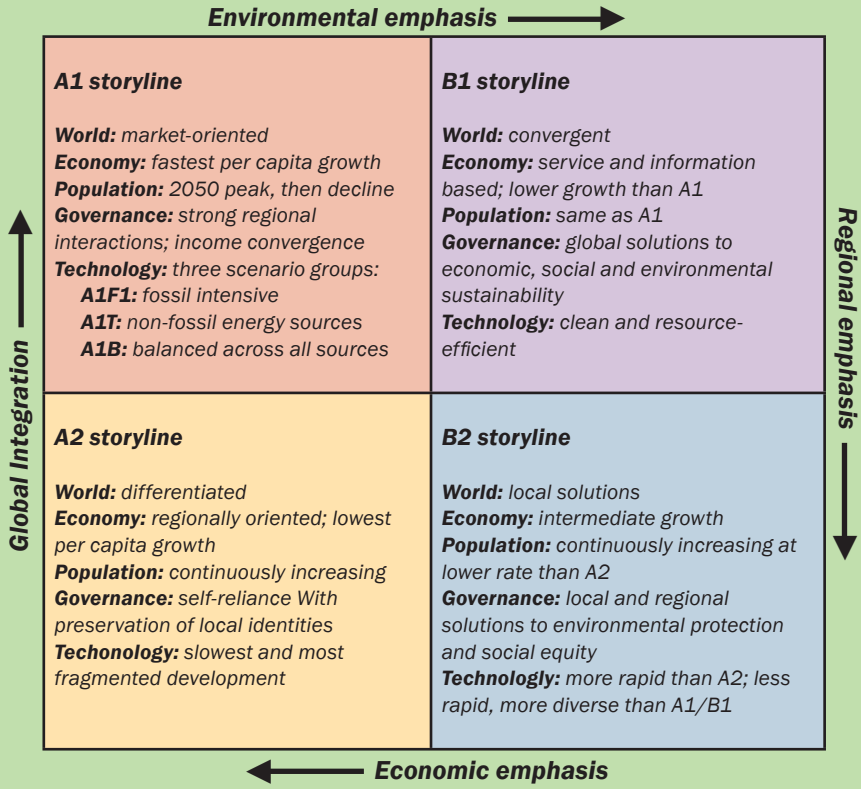
Table 3.1 *Climate and other scenarios for characterising future developments in national strategies. IPCC SRES-based scenarios are indicated where these have been used. For more details, see Box 3.1.*

Countries with NAS	**Climate scenarios used in the NAS**	**Other scenarios**
Denmark	*SRES-based scenarios A2 and B2 EU 2°C target.*	
Finland	*Four SRES-based scenarios: A1FI, A2, B2, B1.*	*Economy, population (SRES A1, A2, B1).*
France	*SRES-based scenarios A2 and B2*	
Germany	*Three SRES scenarios (A1B, A2, B1) covered by a multimodel approach with two dynamic and two downscaling methods*	
The Netherlands	*Two sets of scenarios consistent with 1°C and 2°C global mean warming, for each ΔT one showing regional patterns of change, the other assuming uniform change. KNMI scenarios.*	*Welfare and living environment (WLO) scenarios for economy, population, technology, etc.*
Spain	*Mostly SRES. Also includes regional downscaled information for Spain produced by different research projects.*	
UK	*The NAS is based on UKCIP02 climate scenarios, but refers to the UKCIP08 climate scenarios, new probabilistic projections of regional climate to be released in early 2009.*	*UKCIP has produced socio-economic scenarios for the UK. UKCIP08 will include sea- level scenarios.*
Countries with no NAS in place yet	*Climate scenarios used in the NAS.*	*Other scenarios.*
Austria	*Not yet specified.*	
Latvia	*Climate scenarios produced by national and international research projects.*	*Sea level change and coastal vulnerability scenarios for Latvia, calculated by Potsdam Institute.*
Portugal	*SRES-based downscaled scenarios from general circulation models.*	
Sweden	*Focus on SRES-based scenarios A2 and B2.*	

3.2.2. Identifying the vulnerable sectors

A wide range of topics and vulnerable sectors are covered in the national adaptation strategies, and many of them are common to all of the countries analysed. Some countries have identified a few key sectors while others do not attempt to prioritise. The work plan of the Spanish NAS (PNACC, 2006) identifies a few key sectors to be concentrated on first (water resources, biodiversity and coastal zones). It argues that these key sectors have a great impact on other sectors as well, such as agriculture, forestry and tourism, whose development is to a large extent dependent on adaptation possibilities in the aforementioned key sectors. Water resources, in particular, are identified as a priority area in the Spanish NAS and the evaluation of climate change impacts on the hydrology of Spain is considered extremely important as it will serve for assessing the adaptation options in other sectors as well. In contrast, the French NAS makes a distinction between cross-cutting issues (water, health, biodiversity and prevention of risks)

Box 3.1 Summary characteristics of the four SRES storylines



and sectoral approaches (agriculture, energy and industry, transport, building and housing, tourism, banks and insurance).

Table 3.2 presents vulnerable sectors that are dealt with in the national strategies. Some of the countries that are in the process of starting to develop their adaptation strategies may not yet have defined the vulnerable sectors to be addressed in the NAS (Austria, Ireland), and these countries are not presented in the table. In other countries, such as Portugal and Latvia, that are already more advanced in the process of developing their adaptation strategies, key vulnerable sectors have been identified. In Portugal, these sectors serve as themes for stakeholder workshops. Different naming conventions for sectors have been adopted in different strategies, so simplifications have been made in the table.

The table indicates that some countries have opted for a thematically very comprehensive strategy while others have decided to concentrate on a smaller number of key sectors. In general, water-related issues, such as floods and drought, seem to be among the most important concerns in the strategies,

Table 3.2 *Vulnerable sectors that are or will be dealt with in the national adaptation strategies. Key sectors or cross-cutting issues that have clearly been prioritized by some of the countries are marked with two crosses. Sectors above the horizontal line are addressed in at least seven of the eleven countries.*

Vulnerable sector	***DE***	***DK***	***ES***	***FI***	***FR***	***LV***	***NL***	***NO***	***PT***	***SE***	***UK***
Agriculture	X	X	X	X	X	X	X	X	X	X	X
Biodiversity/nature conservation	X	X	XX	X	XX	X	X	X	X	X	X
Energy, electricity supply	X	X	X	X	X	X		X	X	X	X
Finance and insurance	X	X	X	X	X	X	X	X	X		X
Forests, forestry	X	X	X	X		X	X	X	X	X	X
Human health	X	X	X	X	XX	X		X	X	X	X
Water resource management	X	X	XX	X	XX	X	XX		X	X	X
Construction and buildings	X	X	X	X	X		X		X	X	X
Fisheries	X	X	X	X		X		X	X	X	X
Coastal management	X	X	XX			X	X		X	X	X
Tourism and recreation	X		X	X	X		X		X	X	X
Spatial planning, land use	X	X		X			XX	X	X		X
Transport	X	X	X	X	X					X	X
Communications and infrastructure	X	X		X				X		X	
Industry	X		X	X	X						X
Emergency and rescue services	X	X				X					
Soils	X		X						X		
Foreign policy	X							X			
Hunting			X	X							
Mountainous zones	X		X								
Reindeer husbandry				X						X	
Arctic								X			

as they relate to many other issues such as agriculture and land use planning. Agriculture, biodiversity, energy issues, human health and forestry are also major issues in the NASs. Other topics that are considered to be important vulnerable sectors across most countries include coastal management, construction, fishery, insurance, spatial planning, tourism and transport. Some of the topics are more country-specific than others, reflecting local geographical conditions, natural resources and sources of livelihood. For example, Spain and Germany are the only countries which have a separate chapter on mountainous areas, while Finland and Sweden are the only ones to address reindeer husbandry in their adaptation policy documents. Coastal management is strongly emphasised in the Danish and Dutch NASs, which reflects the vulnerable geographic location of their coastlines. Soil, in turn, is an issue in the Spanish NAS and will be addressed in the Portuguese NAS as well, reflecting the challenges the countries are facing in relation to desertification and erosion.

3.2.3. Identifying potential opportunities

By and large, most impacts of climate change are considered to be adverse across the surveyed countries. Thus, national strategies focus strongly on how to avoid the negative impacts of climate change and to reduce vulnerability to them. However, the analysed NASs also provide examples of how to take advantage of

Figure 3.2 *Opportunities related to climate change identified in the NASs.*

the positive impacts of climate change in national adaptation policies. The Finnish NAS and the Swedish Government report on adaptation address the potential benefits of climate change more broadly than other NASs. This can be explained by the fact that more benefits from climate change are estimated for high-latitude countries than for countries further south (Alcamo et al. 2007). However, the opportunities are seldom discussed without referring to the flipside. The Danish NAS also addresses several potential benefits, but they are always mentioned together with negative impacts: for example, reduced demand for heating in winter implies a growing need for cooling in summer, or increased potential for wind power generation can on the other hand be hampered by more frequent interruptions as a result of increased storms. Figure 3.2 summarises the potential opportunities that are or will be addressed in the NASs surveyed.

In general, capturing opportunities related to climate change is a relatively minor issue in the NASs, though it is somewhat more visible in the Northern countries' NASs. However, adaptation has been defined as a process to moderate, cope with and take advantage of the consequences of climate change (Smit et al., 2001). Thus, identifying the potential opportunities and taking advantage of them can be seen as a potentially important issue to address in the national adaptation strategies, even if the expected negative impacts of climate change clearly outweigh the positive ones.

3.2.4. Global considerations in national adaptation strategies

The impacts of climate change in other regions of the world can have important implications for European countries and their policy making and research. Four different areas in which the international implications of climate change may become manifest are economy and trade, security, development co-operation and international policy making (Carter and Kankaanpää, forthcoming).

- *Economic impacts and trade.* Impacts on natural resources in different parts of the world can affect the production, supply, quality, transport and price of various traded commodities worldwide. Foreign investment may be influenced by heightened risks or emergent opportunities.
- *Security.* The opening of new sea routes, improved access to natural resources, degradation of permafrost, and coastal inundation and erosion due to sea level rise, could alter the economic and military geopolitical balance for some European countries. Resource scarcity exacerbated by climate change could result in forced migration and increased numbers of environmental refugees as well as potentially contribute to humanitarian crises, demanding a policy response from Europe.

- *Development co-operation.* Most European countries provide bilateral or multilateral assistance to partner countries in the developing world, many of which exhibit high vulnerability to climate change. There is a general recognition that climate change issues need to be mainstreamed into development co-operation strategies, plans and measures.
- *International policy making.* National policies are often tightly wedded to international policies and agreements. Climate policies negotiated within the UNFCCC and among EU members states will clearly have a strong influence on national policy making. Moreover, climate change is also a factor which impinges increasingly on other international policies relating to energy supply, human health, food security, water resources, transport, forestry, desertification and biodiversity as well as emerging issues such as international migration and national security.

The global context receives fairly cursory treatment in most of the national adaptation strategies studied. The focus instead is on dealing with the impacts of climate change and adaptation activities within the borders of the country. However, there are a few examples of countries that give more detailed considerations to the impacts of climate change and adaptation elsewhere in the world in their national adaptation strategies. The French NAS stresses the importance of participating in research and development projects that support adaptation in the developing countries, especially in west Africa. Also in Spain and Portugal the importance of supporting developing countries is stressed, particularly in their former colonies. In other countries this appears to be left to Ministries of Development Cooperation or Foreign Affairs which are not directly involved in the NAS.

The Finnish NAS deals to some extent with how to support adaptation through development co-operation. It also presents general and preliminary estimates of how climate change impacts elsewhere in the world can be reflected on different sectors and activities in Finland, such as forestry, agriculture, water resources, tourism, energy, transport and insurance. For example, precipitation changes in Norway and Sweden, through their effects on hydro-power, can affect the availability and cost of electricity supplied to Finland, and climate impacts in the Mediterranean and Alpine regions may affect the local conditions for tourism and make Finland more attractive for tourists.

The German NAS is dedicating one of its five chapters to the international dimension of the adaptation challenge. The NAS gives an overview of the main threats that climate change is imposing particularly on least developed african and small island states, and it notes that the German development policies

will have to be revised in view to their adaptation needs. As regards technical and financial support, the NAS is mainly referring to the diverse instruments and initiatives that are already operating, like e.g. the GEF climate funds, the Nairobi Work Program on impacts, vulnerability and adaptation and the ongoing negations on financial transfers within the UNFCCC framework and the Bali action plan. It is held that Germany will have to continue and extend its contributions to these initiatives and, moreover, strengthen its bilateral committments. However, no additional financial commitments are announced by the NAS. The strategy is only referring to exisiting budgetary dispositions.

The English NAS notes that even if the focus of the forthcoming National Adaptation Programme of the UK is domestic, international developments will have an impact on the UK, especially in relation to trade, regional security, food production and migration issues. Thus, the National Adaptation Programme will also address international developments when they are of significance for the UK.

The Swedish Government adaptation report has the largest section dealing with climate change impacts in different parts of the world. It discusses how they will affect the Swedish security policy, development co-operation, trade and activities in several other sectors. For example, a reduced supply of food on the world market as a result of climate change may increase the demand for Swedish food production.

Of the countries that are currently in the process of developing their NAS, Portugal will certainly pay attention to the impacts of climate change in other parts of the world, especially in those African countries that have a historical relationship with Portugal as its former colonies. Adaptation-related collaboration with Brazil and other Latin American countries is also planned. One of the stakeholder meetings being organised to support the development of the Portuguese NAS will have a special focus on international co-operation related to adaptation to climate change. These activities will be reflected in the Portuguese strategy.

3.2.5. Overarching paradigms for developing adaptation policies

Developing adaptation policies involves making decisions and choosing between adaptation options. The manner in which these policies are chosen and implemented depends, to some extent, on the underlying philosophy or paradigm being followed to conduct policy making. Several attempts have been made to categorise the different approaches to adaptation. Tompkins et al., (2008) have identified three approaches to adaptation and categorise them as: social vulnerability approach (addressing underlying social vulnerability), resilience approach (managing for enhanced ecosystem resilience) and targeted adaptation

approach (targeting adaptation actions to specific climate change risks). According to Tompkins et al., these approaches differ in their underlying judgments about priorities, and the differences result in trade-offs in policy formulation, resource allocation and policy outcomes. For example, the vulnerability approach tends to put priority on social equity over economic cost, while the targeted adaptation approach values adaptive efficiency over equitable resource distribution. The resilience approach, in turn, prioritises the equity of future generations over the current political agenda. Tompkins et al. argue that the trade-offs should be made explicit during the policy process in order for stakeholders to evaluate policy options. Under each of Tompkins' approaches, a range of adaptation activities can be distinguished, which could be divided into the different UKCIP categories. Table 3.3 presents such a classification of adaptation activities, based on the categories developed by UKCIP (2005) and gives examples to illustrate each.

An example of the first type of approach – living with risks/bearing losses – is the UK managed realignment or managed retreat approach to coastal

Table 3.3 *Types of adaptation actvities as portrayed by the UK Climate Impacts Programme (UKCIP 2005).*

Name of approach	***Living with risks/ bearing losses***	***Preventing effects/ reducing exposure***	***Sharing responsibility***	***Exploiting opportunities***
Short description	*Accepting that pre-impact systems, behaviours and activities can no longer be sustained or pursued. Accepting the loss of assets as they are/will be no longer feasible or worth sustaining.*	*Activity that aims at allowing pre-impact systems, behaviours and activities to continue, by introducing measures to reduce exposure to new risks to an acceptable level. Increasing preparedness and contingency planning.*	*The approach implies sharing the responsibility for financial and social losses or exposure to risk with insurances, sharing the associated costs of adaptive responses and relief efforts.*	*Changing existing activities and introducing new ones to take advantage of the opportunities related to changing climate conditions.*
Examples	*Coastal defence in the UK: managed realignment in some areas subject to coastal erosion. Prioritising coastal defence actions that produce the biggest benefits.*	*Implementing technical solutions in construction and planning that respond to potential climate impacts. Putting in place preparedness plans to improve resilience, such as National heatwave plans in several European countries.*	*Insurance type strategies (e.g. flood insurances) Adjusting premiums according to the probable damage costs associated with climate-related risks.*	*Taking advantage of improving conditions for hydropower production in Sweden, Finland and Latvia. Exploiting new market opportunities for export of expertise in the Netherlands.*

flooding and erosion, as part of the "Making space for water" programme of the UK government (DEFRA, 2005a), which is also referred to in the NAS. Managed realignment refers to a wide range of rural land use solutions such as creation of wetlands and washlands, coastal realignment, river corridor widening and river restoration. Managed realignment is seen as providing both environmental and economic benefits by creating and restoring tidal habitats and reducing the costs of coastal defence. The government will continue to provide funding for the maintenance of existing defences only where the costs are justified by the full range of benefits provided by the defences. Expenditures will be directed to achieve value for money and actions are prioritised to provide maximum benefits that are in line with the new strategy for flood and coastal erosion risk management that will be developed within the "Making space for water" programme (DEFRA, 2005a).

Examples of the second approach – preventing effects/ reducing exposure - include measures that prevent effects or reduce the exposure of vulnerable groups and allow activities to continue in a certain place. The measures can be technical solutions such as flood walls or implementation of new standards and planning practices for e.g. construction, transport and infrastructure, in order to reduce exposure and increase resilience. They might also be softer solutions such as national heat wave plans that have been implemented in several European countries to increase the preparedness of the population and to provide tools to cope with extreme temperatures.

The third type of approach – sharing responsibility – aims at sharing the economic burden within a group that is affected by a particular impact. A typical instrument is insurance (e.g. flood insurance) that enables the sharing of economic losses between the parties involved. In Finland and Denmark, the flood compensation system is currently under revision. In Finland, a government bill is under preparation that will introduce an insurance-based compensation system for flood damage, instead of a state compensation system. The objective of the bill is to streamline the compensation process and reduce costs to the government by sharing them within a larger group of stakeholders (Kaatra et al., 2006; MMM, 2007). In Denmark, a new shared risk system covering at least damages from storm surges and major windfalls is being considered. Another example of sharing losses is a suggestion made by the Housing Corporation in South West England. The risks to small housing associations with properties in vulnerable locations could be shared by merging with other associations with less vulnerable properties (UKCIP, 2005).

The fourth approach – exploiting opportunities – concentrates on the benefits of climate change and implements measures to take advantage of

the positive impacts associated with climate change. For example, increasing precipitation in Finland, Sweden and Latvia has been identified as an opportunity from the point of view of hydropower production, and the countries are likely to take measures to exploit these opportunities, such as increasing the production capacity within existing hydropower plants. Other examples of exploiting opportunities referred to in the NASs are discussed in section 3.2.3.

In practice, a national adaptation strategy will always involve a mixture of approaches, depending on the risk in question, its likelihood, scale and seriousness, as well as the adaptive capacity of the affected community (UKCIP, 2005). However, even if the NASs as a whole do not adhere to a single paradigm in relation to adaptation, different emphases can be noted between countries in relation to how they deal with risk and make decisions about different adaptation options. For example, the UK will undertake a comprehensive, national climate change risk assessment (CCRA) as required by the Climate Change Act. In addition the Government will also undertake a cost-benefit analysis (CBA), which is seen as an exercise to identify, and where possible monetise, the key current and future climate change risks for the UK including risks to the natural environment. This will enable prioritisation, so that the Government can take the necessary steps across all domestic policy areas to address these risks. The CBA will use information from the CCRA on climate change impacts to examine the costs and benefits of adaptation. Both studies will feed into the implementation of the NAS and serve as a basis for prioritising and making decisions between adaptation options.

A combination of different approaches can also be seen in the Dutch method of dealing with floods, whereby a technocratic way of thinking (making higher and stronger dykes) has evolved into a more flexible approach which recognises that there are financial and logistical constraints to engineering solutions. On the other hand, the recommendations given by the Delta Committee to the Dutch Government in 2008 put a rather strong emphasis on massive engineering solutions to improve the flood protection (Deltacommissie, 2008). It remains to be seen how the recommendations will be used in the National Water Plan due to be issued by the Government in 2009. The Dutch NAS stresses that absolute safety cannot be guaranteed and it aims to reduce exposure and limit harmful impacts without compromising the socio-economic development of the Netherlands. The NAS also calls for cost-benefit analyses concerning different adaptation measures.

In the French NAS, prevention of risks is seen as one of the cross-cutting issues. One of its objectives is to reduce inequality in respect of the impacts of climate change, and emphasis is placed on paying special attention to the most

vulnerable members of society when developing adaptation policies, thereby ensuring that responsibility is shared by all concerned. The NAS also emphasises preventative action in areas that will be subject to more frequent extreme weather events in the future, in order to avoid and reduce costs. Different approaches to assessing costs and benefits are put forward, following the three pillars of sustainable development: social (equated to human lives), environmental (biodiversity) and economic. However, the French NAS states clearly that the cost-benefit approach must be considered in a long-term context if the benefits of adaptation are to be fully realised. In general, as countries continue to gain experience in developing and implementing adaptation policies, new insights are likely to emerge which inform the choice between different approaches.

3.3. Conclusions

A broad set of motivating factors for countries starting to develop their adaptation strategies can be identified. These range from involvement in international climate negotiations to national experiences of weather-related extreme events and a growing awareness of the economic costs of inaction. A number of other factors serve to facilitate the process not only in the development but also implementation stage, such as good co-operation between different government ministries or the political will to act, which can also explain the speed and shape of the further development of adaptation policies. On the other hand, the absence of these factors can be an obstacle to developing adaptation strategies.

National strategies generally provide a description of the existing natural and socio-economic conditions of a country, placing emphasis on dealing with the challenges that are most relevant in that country. For example, a strong emphasis is placed on water availability in southern European countries, and flood risk in many central and northern European countries. Because of a generally accepted different balance between positive and negative impacts, potential benefits related to climate change are clearly addressed more in the strategies of countries from northern than from southern Europe. The national implications of climate change impacts occurring elsewhere in the world are addressed by only a few countries, and fairly superficially. Different approaches to adaptation and dealing with risk have been identified. A NAS typically follows a combination of several approaches, as a single approach may not be appropriate for dealing with risks of varying seriousness and likelihood occurring in different sectors or regions. The approach chosen may also depend on the adaptive capacity of the affected community.


DELL

4. The science-policy nexus in adapting to climate change

As illustrated in the previous chapter, scientific research is one of the motivating factors that stimulate political action on adapting to climate change. One of the key facilitating factors for policy action is also the amount and quality of knowledge derived from scientific research and the way it is made available for policy-makers.

In the last decade, along with the urgent drive to develop plans to reduce potential impacts and vulnerability and enhance adaptive capacity, the cooperation between scientists and policy-makers has accelerated (Sarewitz and Pielke Jr, 2007; Smit et al., 1999; Smit and Wandel, 2006) (see also figure 1.1). This gradual shift from pure science towards a combination of pure and applied science or what can be termed "socially robust knowledge" (Gibbons et al., 1994; Jasanoff, 2004; Nowotny, Scott, and Gibbons, 2001) can also be seen in the development of national adaptation strategies. In addition, the increasing complexity of society and the shift from government to governance has extended the range of participants involved in the development of adaptation strategies (Folke et al., 2005). The way in which governments respond to the impacts of climate change is determined to a large extent by the way in which institutions and organisations are structured, and by their values, rules and processes. Organisational structures and modes of operation can vary from hierarchical government to co-produced governance with a focus on competent, cohesive policy, connected to the citizenry.

This chapter aims to illustrate the main research that has assisted governments in the development of the NAS and how science-policy interactions have been or are currently being institutionalized. The first section looks at the scientific input developed within countries or at EU level to support the development of NASs. The second section focuses on how the interactions between science and policy are structured by looking at the institutions and organisations that fulfilled an important role in the development of the NAS.

4.1. Research programmes on climate change adaptation

In all cases, the development of NAS is supported by scientific research. Well before adaptation was considered an urgent policy requirement, research was conducted on the climate system. There has been a growing scientific realisation (e.g. IPCC-TAR) that both mitigation and adaptation measures are needed to reduce the greatest impacts of climate change (Robinson et al., 2006; Swart and Raes, 2007). Since then, a rapidly growing volume of research has been conducted on the fundamentals of the climate system, and on impacts, vulnerabilities and adaptation options. The wide variety of contextual factors that determine the most appropriate adaptation strategies, measures and options required a combination of pure and applied research on climate adaptation (Biesbroek et al., 2009)

- **Pure or fundamental research** is carried out to increase understanding of fundamental principles, such as the cause and dynamics of climate change, and is often curiosity-driven. This type of research results in new insights into the essence of a problem and the complex interactions between their elements. Pure research through data analysis, models and scenarios are invaluable in terms of understanding the principles of the climate system.
- **Applied research** is carried out in order to discover, explore, interpret and develop methods and techniques in support of finding solutions for climate change. Applied research is designed to solve practical problems in society. It is often associated with active stakeholder involvement, multi- or transdisciplinary strategies and problem-driven research approaches. For adaptation practices, measures and options in particular, applied research should provide context-dependent results.

Both pure and applied research is conducted though research programmes and projects with specific overall objectives and targets and at various administrative levels. These research programmes can be subdivided into comprehensive and sector-based research programmes. **Comprehensive research programmes** cover a wide array of topics within one single programme and search for interrelationships between these domains.

These transdisciplinary research programmes are usually coordinated and financed by the national government or by large research funding bodies. This is in contrast to **sector-oriented research programmes** which focus on specific research questions within sectoral domains, and which are usually coordinated and funded by a one or two ministries and/or funding bodies. These are small- or medium-sized, often problem-driven, programmes where research is conducted for specific climate-sensitive domains, such as forests,

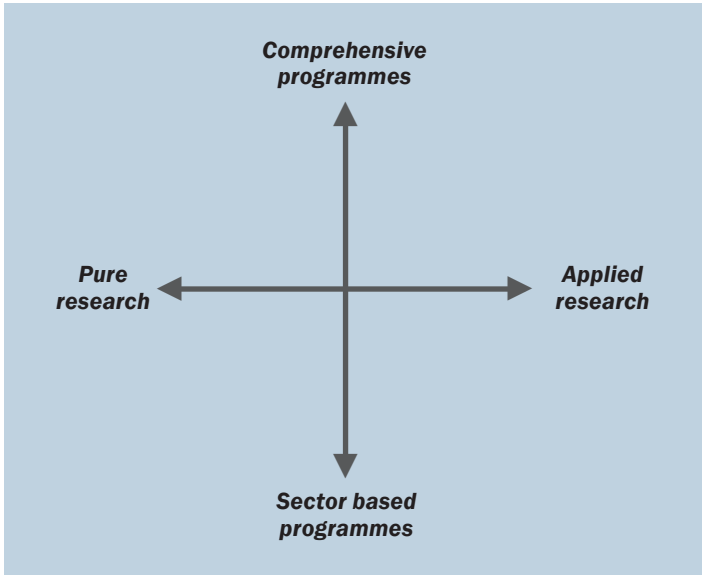


Figure 4.1
Illustration of the relationship between research type and research programme type

agriculture and water management. Although these programmes normally have limited resources, they do provide detailed information on the possible impacts of climate change and options for policy making. As figure 4.1 illustrates, there are strong interrelationships between comprehensive and sector-based research programmes as regards the exchange of information. These coordinating efforts will be discussed in the following section. This chapter looks at the top section of figure 4.1: the comprehensive national programmes and projects for both pure and applied research.

Many countries that currently have a national adaptation strategy have followed a similar path in the development of research. Three types of research programmes and projects can be identified (see also figure 4.2):

1. Climate System Research Programmes
2. Impacts Research Programmes
3. Vulnerability and adaptation research (including at the local/regional level)

These three types form a natural progression (Fig. 4.2), in that vulnerability cannot be assessed and adaptation developed without an understanding of impacts, which in turn requires an understanding of climate change itself. In most countries, impacts research did not become fully established until the mid–1990's and research into adaptation has mostly been developed since 2000 and this development continues. It is important to note that active research programmes into the climate system and impacts continue; this is important

to the successful development of adaptation measures, as both areas contain major uncertainties. There are also examples of programmes and projects which combine elements of more than one type of research.

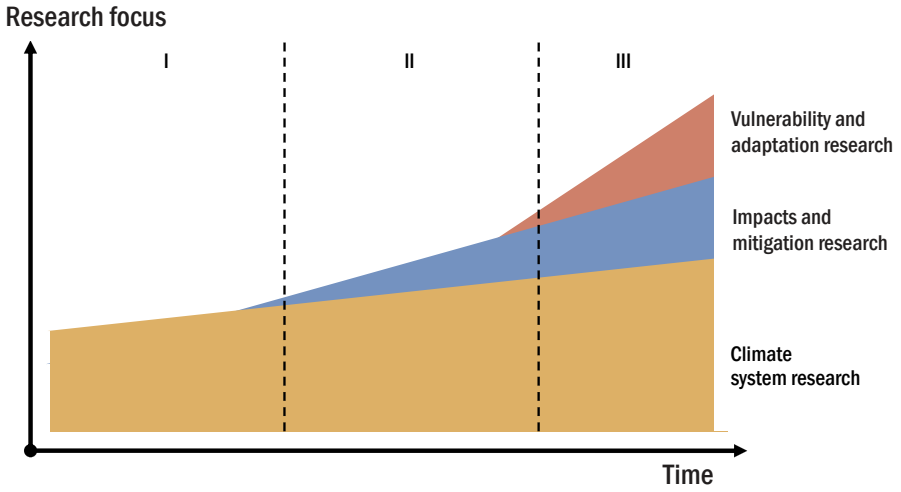


Figure 4.2 *Increase in climate change research over time, from approximately 1980 onwards. Note that this is a stylized diagram. We are not able to quantify the balance between the different types of research with data available to us, nor the overall level of spending on climate change research.*

4.1.1. Climate system research programmes

Research until the mid–1990s focused on understanding of climate system dynamics, on detecting climate change, on the attribution of climate change to natural and anthropogenic causes, on the sources of greenhouse gas emissions and on modelling of future climate. The resulting scientific insights were the starting point for international action on climate change mitigation (e.g. the UNFCCC, see previous chapter), and put climate change on the political agenda. In addition, these scientific insights were and still are used in sequential stages of impacts, vulnerability and adaptation research. The incremental scientific progress in understanding the climate system, for example the role of arctic ice in the climate system, continues to make climate system related research important in assessing impacts, vulnerabilities and adaptation options. Most of the funds for climate research are still reserved for climate system research programmes. Table 4.1 provides an illustration of some of the main climate system research programmes in EU countries.[11]

[11] *More detailed and specific information for each country can be obtained from the respective National Communications under the UNFCCC reporting obligations, see reference list for the specific countries.*

Table 4.1 *Examples of some of climate system research programmes*

Country	Year	Programme	Budget
Denmark	1998– 1998–2003	Danish climate centre (established as a part of the Danish Meteorological Institute) Various Danish climate system research projects	€ 0,6 million/Year €24 million
Finland	1990–1995	Finnish research programme for atmospheric change (SILMU)	€15 million
Germany	1987–1994	Enquete Commission "Schutz der Erdatmosphäre" (a joint committee of scientists and politicians)	Unknown
Netherlands	1989–1995	National Research Programme on Global Air Pollution and Climate Change (NOP I)	Unknown
Sweden	1996–2001	Swedish Regional Climate Modelling Programme (SWECLIM)	Unknown
	1990–1998 2007–	Climate change and UV-B radiation Bert Bolin Centre for Climate Research	Unknown Unknown
United Kingdom	1990–	Meterological Office Hadley Centre (MOHC) for climate prediction and research	£74 million for 5 years (since 2007)
	2001–2007	NERC Rapid climate change (RAPID)	£20 million
	2003–2009	NERC Quantifying and understanding the Earth System (QUEST) programme	£23 million

Many European countries, especially the larger ones, used to have or now have research programmes that aim to increase the understanding of climate change. Often, initial concerns about climate change in many of the smaller European countries originated from research in other countries and international assessments, such as those of the IPCC. The IPCC on the other hand, necessarily based its assessments on the largest research programmes in the world, primarily the United States, Japan, the United Kingdom and some other large European and other industrialised countries.

4.1.2. Impacts research programmes

From the mid–1990s onwards, climate system research expanded because of the growing attention paid to the impacts of climate change and the availability of increased funding for examining options for reducing anthropogenic emissions of greenhouse gases (mitigation). These research programmes often included an analysis of potential impacts on society and ecosystems as a result of climate change at the global level. Following this, interest in the potential impacts of climate change at the national level increased, with an increase in research funding from private or public sectoral sources as well as central government funding. As monitoring began to reveal observed impacts of climate change in the environment, this aspect of potential impact studies began to receive increased

funding. Compared to research on the climate system itself (with expensive climate modelling work), the research budget assigned to impact research is generally smaller. Impacts are dependent not only on climate change and sensitivity, but also on the adaptive capacity of people and ecosystems, but the latter received relatively little attention, at least in the early stages of impacts research, with the emphasis being on potential impacts. Countries continue to invest in impact research. Denmark, for example, does not have a national climate impact programme but expects a strong focus on climate research in 2009 (climate change, impact and adaptation) as a result of the FORSK2015 –survey, which mapped Denmark's strategic research priorities for the next seven years. With the recognition that mitigation alone was insufficient to address the problems created by climate change, more funds became available which increased the information available on potential impacts. Table 4.2 provides an overview of some examples of research programmes and projects.

4.1.3. Vulnerability and adaptation research (including at the local/regional level)

In the last few years, governments have increasingly begun to understand the inevitability of climate change, the vulnerability of their own countries and the associated need to adapt. As a result, the latest national research programmes have began to attach much more prominence to the examination of adaptation options, requiring research into economic, social and behavioural questions as well as into technical innovations. This also requires increased research into the the vulnerability and adaptive capacity of societies and ecosystems. The share of funding for adaptation research from sectoral and regional sources is increasing (e.g. public and private utilities, local authorities, insurance companies, technology companies and organisations). For example, under the Dutch national research programme, Knowledge for Climate, the national government provides some €50 million in funding but demands 25–75% matching funds from other public and private organisations such as Schiphol airport, the Rotterdam municipality and other vulnerable "hotspots". So far, only a few frontrunner countries, such as the UK, Finland and the Netherlands have initiated Phase III-type research programmes, but others are expected to follow suit in the near future (see also table 4.3). These programmes include more detailed assessments which are focused on impacts at the local and regional level or in specific sectors to support the development of context-specific adaptation strategies.

Table 4.2 *Overview of the second phase research programmes*

Country	Year	Programme	Budget
Denmark	1998–2001	Various national and international climate impact research projects	€10 million
Finland	1999–2002	Finnish Global Change Research Programme (FIGARE)	6.7 million
	2004–2005	Assessing the adaptive capacity of the Finnish environment and society under a changing climate (FINADAPT)	€0.3 million[12]
France	1999–2003	Gestion et impacts du changement climatique (GICC) 1	€4.0 million
	2003–2006	Gestion et impacts du changement climatique (GICC) 2	€3.5 million
Germany	2001–2006	DEKLIM – German Climate Research Program	€37 million
	2008–	Federal research programme "Climate Impact and Adaptation in Germany" (Phase I: Development of regional climate scenarios for Germany)	€15 million
	2007–	Federal programme "Klimazwei: Research for climate protection and protection from climate impacts" as part of the FONA programme (research for sustainable development)	€15 million
	2007–	Klimzug – federal funding programme for research on regional climate impacts and adaptation	€75 million
Latvia	2006–2009	National Research Programme KALME: Climate change impact on the waters of Latvia	€1.9 million
Netherlands	1995–2001	Nationaal Onderzoek Programma Mondiale Luchtverontreiniging en Klimaatverandering (NOP II)	Unknown
	2004–2011	Climate Changes Spatial Planning (CcSP)	€100 million
Portugal	1999–2002	Scenarios impacts and adaptation measures (SIAM) I	Unknown
	2002–2006	Scenarios impacts and adaptation measures (SIAM)[13] II	Unknown
Spain	2003–2005	"Assessment report of the preliminary impacts in Spain due to Climate Change" (ECCE)	Unknown
Sweden	2008–	Swedish Research Programme on Climate, Impacts and Adaptation (SWECIA)	€4.3 million
UK	1997–	UK Climate Impacts Programme (UKCIP). Also has elements of 3rd phase programme	£3.8 million for 5 years since 2005
	1992–2002	NERC Terrestrial Initiative in Global Environmental Research (TIGER)	£20M

[12] *As FINADAPT was a project instead of a programme, additional institutional funds for salaried staff are not accounted for in this total; nor is additional funding through the work packages.*
[13] *SIAM is a research project.*

Table 4.3 *Overview of the third phase research programmes*

Country	Year	Programme	Budget
Finland	2006–2010	Finnish "Climate Change Adaptation Research Programme"(ISTO)	€0,5 million/year
Netherlands	2009–2014	Knowledge for Climate (KfC)	€100 million (€50 million subsidy)
Sweden	2006–2012	CLIMATOOLS	SEK 25 million
	2001–2005	Communication, Organisation, Policy Issues and Efficiency (COPE)	Unknown
UK	2000–	Tyndall Centre for Climate Change Research (Also includes mitigation)	£19M to 2010
	Forthcoming five-year programme	Living with Environmental Change (LWEC) Programme	Nominal £ 1billion, but largely redirection of existing programmes

Box 4.1 National research on adaptation: illustrations from The Netherlands, The United Kingdom and Finland.

Between 1995–2001, the Dutch National Research Programme Global Air Pollution and Climate Change (NRP II, Kok et al., 2001) continued to develop a strong emphasis on mitigation policy response, while also addressing national impacts; whereas adaptation received only modest attention (listing options). Following the finalisation of the NRP, the Dutch government initiated the Climate changes Spatial Planning (CcSP) programme which, with a budget of €100 million for the period 2004–2011, aimed to make a scientific input into the development of the Dutch NAS. The CcSP programme is funded from the Dutch "Decision Subsidies Investments Knowledge Infrastructure" funds and aims to study the impact of climate change and ways of coping with its effects, with a particular focus on spatial planning in order to support decision-making on the future development of the Netherlands. By the beginning of 2009, a new €50 million research programme, "Knowledge for Climate" [KfC], will commence. It will begin by assessing the knowledge demands for eight so-called "hotspots" or case study regions. Gaps in knowledge will be identified and addressed by the scientific community. The understanding thus obtained is then made readily available to the hotspot regions with a view to enabling them to adapt to the impacts of climate change. In order to ensure commitment, and increase the overall budget of the programme, each project within the KfC programme should receive co-financing [matching finance] of 25–75 % (dependent on project characteristics) from local and regional authorities/private organisations.

In the UK, the NERC (Natural Environment Research Council) is a key organisation in funding the development of science on climate change impacts

and vulnerabilities; it funds a number of major research programmes and projects. In addition, government departments give direct funding to research programmes such as the Hadley Centre (1990) and the UK Climate Impacts Programme (UKCIP – 1997). An ambitious research programme, Living With Environmental Change (LWEC), was launched by a consortium of UK funding bodies including NERC and the Department for Environment, Food and Rural Affairs (Defra) in June 2008 with the objective of helping people to cope with environmental changes. The nature of this programme is still being finalised – its estimated value is £1 billion over the next 5 years. This will make it one of the world's foremost climate change-related research programmes. It should be noted, however, that the intention is that 90% of this funding should be made available as a result of the realignment of existing programmes14. One of the most recent programmes under this header is the five-year programme, "Adaptation and Resilience to a Changing Climate (ARCC)", which builds on earlier programmes such as the "Building Knowledge for a Changing Climate (BKCC)".

In Finland, the first programme to include adaptation in a comprehensive manner was the FINADAPT project, which started at the same time as the Ministry of Agriculture and Forestry started to draft the NAS. The output of FINADAPT was used to inform the development of the NAS. The Finnish "Climate Change Adaptation Research Programme" (ISTO) – with a yearly budget of € 0,5 million for the period 2006–2010 – aims to fill existing gaps in knowledge and provide new information for policymakers on adaptation to climate change. Experience gained during the FINDAPT project is now being used, and policy makers are being involved in the ISTO Programme's steering group in order to ensure that outcomes are relevant to policy. The research projects in the programme relate to forestry, agriculture, extreme weather events, land use planning and construction, biodiversity, international dimensions, regional adaptation strategies and the presentation of research results. While the budget is limited, this project is a front-runner in systematically exploring new methods and tools for evaluating local impacts and adaptation strategies.

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[14] The LWEC project is a combination of several (existing) research projects. Therefore, some of the projects are realigned to fit within the LWEC objectives. It is estimated that 10 % will be from uncommitted funds (approximately £100 million over 5 years)

4.1.4. European research programmes

At the European level there are several research programmes that have focused on impacts, vulnerability and adaptation to climate change. EU research plays an important role in supporting international negotiations and other initiatives, such as the post-Kyoto climate initiatives and scientific assessment programmes such as the IPCC and the European Climate Change programme (see previous chapter). At the same time, these programmes contribute scientific insights in support of the development of EU sector-based policy (e.g., Water Framework Directive) and of the White Paper on adaptation. In addition, smaller countries are able to benefit from EU-coordinated action on climate change research. Table 4.4 provides an overview of the most important research programmes that have been funded by the EU. The table does not include all programmes comprehensively, for example there are also projects under the framework of INTERREG which include climate change components. While FP6 mainly included phase I and II types of research, the last FP7 call included some explicit adaptation projects; this is expected to increase in future.

Table 4.4 *A selection of European research programmes on adaptation to climate change*

Title of research programme	***Year***	***Funded by***	***Funds available***
Biodiversity Requires Adaptations in Northwest Europe under a Changing climate (BRANCH)	*2005–2007*	*Interreg IIIB*	*Unknown*
Climate Change and Impact Research: the Mediterranean Environment (CIRCE)	*2007–2010*	*Sixth Framework Programme*	*Unknown*
European Spatial Planning Adapting to Climate Events (ESPACE) and extension	*2003–2007* *2007–2008*	*Interreg IIIB*	*€ 4.7 million* *€ 0.57 million*
Adaptation and Mitigation Strategies: supporting European climate policy (ADAM)	*2006–2009*	*Sixth Framework Programme*	*€ 19.2 million*
Adaptation to changing water resources, hydrology, agricultural economy, socio-economic development (HighNoon)	*In prep.*	*Seventh Framework Programme*	*Under negotiation at time of writing*
Bridging the gap between adaptation strategies of climate change impacts and European water policies (ClimateWater)	*In prep.*	*Seventh Framework Programme*	*Under negotiation at time of writing*

4.1.5. Impact and vulnerability assessments

Comprehensive and sector-based research programmes have resulted in scientific insights which have been valuable to policy makers. However, as this sort of information is often highly dispersed throughout institutes and organisations, and provides an enormous amount of complex background information, assessments of the available information have been performed

by practically all of the countries included in the analysis. These assessments evaluate the most up-to-date (scientific) information on the potential impacts on a particular country. Moreover, similar but more detailed impact assessments are currently conducted at the regional and local level to support the development of adaptation measures at these levels. However, although it is often referred to as IVA (Impacts and Vulnerability Assessments), in practice, vulnerability is rarely assessed systematically in scientific research or assessments. Table 4.5 provides a list of the most recent assessments carried out. The list does not include the numerous regional and local impact assessments which have been conducted in the past couple of years or which are planned for the next few years.

Table 4.5 *Recently published impact and vulnerability assessments*

Country	Year	Title of the assessment	Conducted by
European Union	2008	Impacts of Europe's changing climate – 2008 indicator-based assessment	European Environmental Agency
Germany	2003–2005	"Climate Change in Germany – Vulnerability and Adaptation of climate sensitive Sectors"	Potsdam Institute
Netherlands	2006	"Routeplanner" project	National programme "Adaptation to climate change in spatial planning (ARK)" under the Climate changes spatial planning programme
	2006	"The effects of climate change in the Netherlands"	Netherlands environmental assessment agency (PBL)
Spain	2003–2005	Assessment report of the preliminary impacts in Spain due to Climate Change (ECCE)	CEDEX- Centro de estudios y experimentación en obras públicas
Sweden	2007	"Sweden facing climate change – threats and opportunities"	Commission on climate and vulnerability
UK	Proposed for 2011	"Climate Change Risk Assessment"	Defra

In the UK, for example, the development of a Climate Change Risk Assessment of the specific risks of climate change for different regions and sectors is embedded in the Climate Change Bill going through parliament in 2008. This assessment should be presented to parliament in 2011 which will help to set priorities for future adaptation research programmes and provide valuable information for public and private organisations.

4.1.6. Research programmes

The aforementioned research programmes and assessments are important sources of information for the development of National Adaptation Strategies. The extent of the funding available for research projects or programmes is often unclear because co-financing or matching is required in most cases. Funding is usually provided by the national government, funding bodies, the EU and other public and private organisations. Therefore, although the budgets in Tables 4.1–4.5 provide a good overview of the available funds, they underestimate the actual funds on offer. In some countries research on climate change has been placed under the umbrella of large sustainable development research projects – such as the UK's LWEC programme and the German FONA programme "Research for Sustainable Development".

It can be concluded that the focus of research programmes in the countries included in the analysis is shifting gradually from fundamental climate system science towards a combination of fundamental and applied research on the impacts, vulnerabilities and adaptation options. National adaptation strategies are often developed on the basis of phase II-type research on the potential impacts of climate change on a particular country. Arguably, research on the climate system by countries such as the UK, Finland, Germany and the Netherlands could be useful for all European countries. However, it is less likely that information on potential impacts of climate change research (phase II) and vulnerability and adaptation research (phase III) can be transferred that easily to other countries. Nevertheless, pioneering countries such as Finland, UK, Spain and the Netherlands set examples of countries that are in the process of developing National strategies, such as Latvia, Portugal and Norway. While context-specific research results may not be transferable from one country to another, the development of methods and tools may well be.

4.2. Specialised institutions in the science-policy nexus

In the previous section we have described how scientific information relevant to climate adaptation policy in the various countries is being developed. But science and policy do not automatically match. Science does not always result in practicable solutions for policy makers, and policy makers want information that is often perceived as being of little interest from a scientific perspective. This cooperation requires work at the boundary of science and policy. Boundary work is no easy task. It requires common objectives, a shared sense of urgency and perhaps, most importantly, commitment from both sides of the boundary (Hoppe,

2008). Solving "wicked problems" such as climate change, where solutions are difficult to recognise as a result of complex interdependencies, contradictory and often changing requirements, means that efficient interactions between science and policy are highly valuable (Lorenzoni et al., 2007). There are many ways in which institutions can organise these interactions in support of the development and implementation of National Adaptation Strategies. This section focuses on the specific roles that organisations can adopt and the tasks and responsibilities they are allocated in different EU countries. The origin of organisations facilitating the interaction between science and policy differs between countries and multiple roles can be identified for some organisation (see also Table 4.7).

Within the NAS, it is possible to identify several main roles for organisations, which are discussed briefly below:

- Boundary organisations
- Coordinating organisations
- Advisory organisations
- Organisations responsible for drafting the NAS

4.2.1. Boundary organisations

In several countries, specialised organisations have been created or take on the task of facilitating interactions between science and policy for the purposes of developing and implementing NASs. These organisations are often referred to as "bridging organisations" (Folke et al., 2005) or "boundary organisations" (Guston, 1999). Guston (2001) identifies three characteristics of boundary organisations:

- They provide the opportunity to create or use boundary objects and standardised packages (i.e. they have instruments, methods, techniques, mechanisms to mediate between science and policy, for example, through impact assessments).
- They involve participation by both sides of the boundary (and often include professionals to mediate the process);
- Although they operate in two relatively different cultures, they have distinct lines of accountability to each other.

Literature places boundary organisations as intermediary organisations between science and policy. However, particularly as regards adapting to climate change, a third and often unacknowledged dimension has become very important: the role of society (see Figure 4.3) (Gibbons et al., 1994)

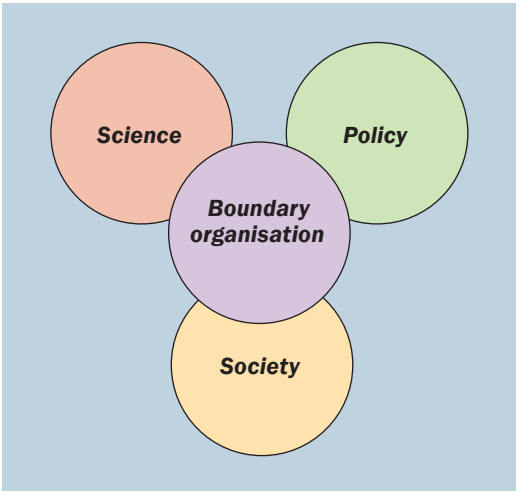


Figure 4.3
Science, policy, society and the role of boundary organisations

First of all, boundary organisations come and go, depending on the need to facilitate interactions between science, policy and society. Although it is sometimes unclear, a starting point can usually be determined. Secondly, the backgrounds of boundary organisations may differ: they may originate from existing organisations, they may be specifically designed for the task, or they may evolve over time. For example, as one of the first boundary organisations to focus on climate change, the UK Climate Impact Programme (UKCIP), based at Oxford University, has operated at the boundary of science, policy and society since 1997 on a wide spectrum of climate-related issues. UKCIP is recognised globally for its innovative approach in fostering adaptation by focusing on the promotion of stakeholder-led assessments, development and implementation in public and private sectors (Lorenzoni et al., 2007). Although the UKCIP is funded by the national government and receives its mandate from the policy community, it liaises with research institutions to provide scientific information on climate change and encourage studies that reflect stakeholder interests. The initial idea was to set up a programme to co-ordinate impacts research by providing a single location for information. Thereafter, the focus shifted towards increasing adaptive capacity and delivering adaptation action, working with stakeholders on adaptation by providing information about the effects of climate change and adaptation options, supported by UK science community. Many people in Europe see UKCIP as a role model of a boundary organisation that promotes bottom-up approaches, stimulates local initiatives and searches for pragmatic solutions. A recent trend, particularly noticeable in the UK, is that successful programmes such as UKCIP have been redefining themselves continually by adapting to their surroundings and by seeking to function as an intermediary between science,

policy and society. They are no longer the same organisations that were set up originally to create awareness of potential climate change impacts.

4.2.2. Coordinating organisations

There are other organisations that work on the boundary between science and policy. These are often mono-functional and one-dimensional (horizontal or vertical). For example, coordinating units coordinate sectoral climate policy processes in an effort to prevent conflicting activity. Often, they also coordinate the distribution and organise the development of knowledge for particular purposes. Coordination units are characterised by their formal institutional arrangements and the way in which they are allowed to fulfil their tasks. As such, these organisations fulfil an important role in both policy development and the implementation process. In most cases, the coordination unit is part of the government, such as the Danish *"Coordination forum on adaptation"*. The main task of this coordination unit is to identify areas of relevance for adaptation, reporting the status of implementation of the strategy to the government, identifying knowledge gaps and providing recommendations for adaptation initiatives to the government. Finally, it should also ensure that there is synergy between sectoral policies. In Germany, the KOMPASS project at the Federal Environment Agency also operates primarily as an interface or intermediary between experts and policy makers working on the development of adaptation policy.

4.2.3. Advisory organisations

A third type of organisation provides advice to the government or other bodies responsible for developing adaptation policy. Such organisations provide the information needed to solve particular policy issues or questions. They can operate from a science background – for example, universities or research programmes; but they can also be established specifically to support policy - for example, assessment agencies. The most prominent example of the latter at the European level is the European Environmental Agency, whose objective is to "provide sound, independent information on the environment". It supports the European Commission as well as national governments by providing policy-relevant information. On climate adaptation, it developed several climate-related policy assessments: for example, *"Vulnerability and adaptation to climate change in Europe"* (2005), *"Climate change and water adaptation issues"* (2007a) and *"Climate change: the cost of inaction and the cost of adaptation"* (EEA, 2007b) and most recently *"Impacts of Europe's changing climate – 2008 indicator based assessment"* (EEA, 2008). At the national level, the Netherlands Environmental Assessment Agency (PBL), aims to support national and international policymakers

Table 4.7 *The roles of organisations and institutions involved in the NAS*

Country	Coordination unit at government level	Established	Role(s) of organisation	Main aim(s)
Denmark	Coordination forum on adaptation	March 2008	Coordination Unit	To identify areas of relevance for adaptation, reporting the status for implementation of the strategy to the government, identify knowledge gabs and provide recommendations for adaptation initiatives to the government.
	Coordination Unit for Research on Climate Change Adaptation	March 2008	Advisory unit	to ensure that the synergy between existing and new research projects is exploited, and to contribute to promoting cross-cutting collaboration and knowledge sharing.
	Information Centre on Adaptation	March 2008	Boundary unit	to raise awareness, ensure information exchange and knowledge transfer on adaptation issues, and to report to the international arena on Danish activities in the area of adaptation
	Cross-ministerial workinggroup on climate change adaptation	October 2005–March 2008	Drafting unit	Prepare and draft a catalogue of impacts, vulnerabilities and adaptation options and subsequently prepare a draft strategy for public consultation
Finland	Coordination group of adaptation to climate change	October 2008	Coordination, advisory	To get an overview on how adaptation is proceeding in different sectors, to undertake an evaluation of the implementation of the NAS during the first half of 2009 and to support the development of future adaptation policies.
	Working group for preparing the NAS	2003–2004	Drafting the NAS	To prepare the National Adaptation Strategy.
France	"Observatoire national sur les effets du réchauffement climatique (ONERC)"	February 2001	Coordinating unit	To collect and disseminate information, studies and research on risks linked to global warming and extreme events and to formulate recommendations on prevention and adaptation measures
	Interministerial delegate for sustainable development	existing	Drafting the NAS	Delegate amongst others installed for the development of NAS
Germany	Kompetenz-zentrum Klimafolgen und Anpassung (KomPass)	October 2006–	Coordination Unit	To support the political process and to organise and coordinate regular scientific input.
	Federal Environmental Ministry Unit on adaptation (responsibility transferred to existing water unit)	Existing	Drafting the NAS	Coordinate the internal and external political process by various instruments of participation and cooperation.
	Interministerial working group on climate adoption	Proposed by NAS	Drafting the implementation action programme	Coordinate the implementation process on federal government level

Country	Coordination unit at government level	Established	Role(s) of organisation	Main aim(s)
Latvia	Climate and Renewable Energy Department (within Latvian Ministry of the Environment)	Existing	Coordination unit, drafting the NAS	To coordinate the NAS development process and support the two working groups that prepare the NAS.
Netherlands	Adaptation to climate change in spatial planning (ARK)	June 2006	Coordination Unit; drafting the NAS	to develop the National Adaptation Strategy and the Adaptation Agenda
	Netherlands Environmental Assessment agency (PBL)	Existing	Advisory organisation	Supports national and international policymakers by analysing the impacts of societal trends and policies on the environment.
Portugal	Comissão para as Alterações Climáticas (CAC)'	2001	Coordination Unit	Initially focused primarily on the development of mitigation strategies. Currently also directed towards adaptation strategies
	Ecoprogresso	Existing	Drafting the report	Assist CECAC with development of Reference Document and Adaptation Strategy
Spain	El Grupo Interministerial de Cambio Climático	2005–		Coordination of activities within the Ministries and responsible for the implementation of the Kyoto protocol
	Oficina Española de Cambio Climático	2001–	Writing the NAS	Coordinating climate related policy
	El Consejo Nacional del Clima	1992	Writing the NAS	
	Instituto Nacional de Meteorología (INM),	Existing	Advisory organisation	Not clear
	Comisión Delegada del Gobierno para el Cambio Climático	2008–	Coordinating the NAS	Not clear
Sweden	Klimat- och sårbarhets-utredningen'	June 2005–	Advisory committee	To assess regional and local impacts of global climate change on society including costs
United Kingdom	Climate Impacts Programme (UKCIP)	1997–	Boundary organisation	To coordinate between science, policy and society, bottom-up approach
	DEFRA	Existing	Government department	Drafting and implementing strategy; coordinating policy
	Climate Change Adaptation Sub-Committee of the Committee on Climate Change	to be established in 2009	Advisory organisation	Advice and review

by analysing the impacts of societal trends and policies on the environment. This is related not only to climate change, but also to other environmental issues such as air pollution and biodiversity (Halffman, 2005). In the period 2003–2005, the German *Potsdam Institute for Climate Impact Research (PIK)* has developed a scientific assessment of the current state of knowledge on climate change research in Germany, focusing specifically on sensitive domains (water, land, biodiversity etc). The project entitled *"Climate Change in Germany – Vulnerability and Adaptation of climate sensitive Sectors"* aims to support the development of a long-term national adaptation strategy (Zebisch et al., 2005).

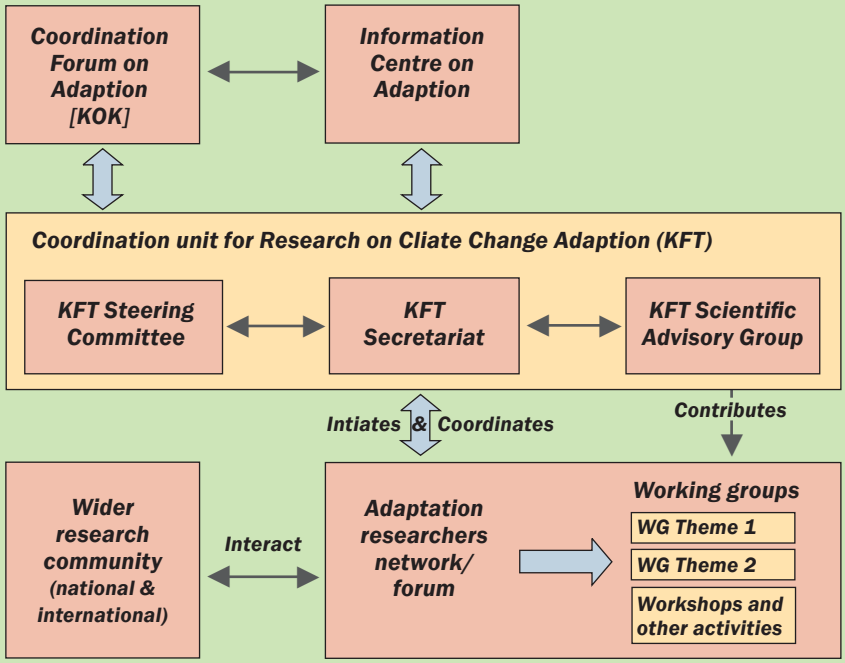
4.2.4. Organisations responsible for drafting the NAS report

In most countries, one or more (usually pre-existing) organisations are responsible for drafting the National Adaptation Strategy. In some cases, these are newly designed and sometimes temporary institutions that are assigned the task of formulating a National Adaptation Strategy, e.g., the the Adaptation, Space and Climate project (ARK) in the Netherlands. In other cases, new responsibilities are added to existing institutions, such as in the UK (Defra) and Germany (FEM and FEA). Portugal's position is unique in that the Ministry of Environment has asked a private consultancy, Ecoprogresso, to take the lead in developing a National Adaptation Strategy before 2010. As Ecoprogresso is outside the government, but has strong links with other private companies, research institutes and other national and international partners, it appears to be well equipped to take on such a challenge.

Box 4.2 The boundary between policy, science and society in the Danish strategy

The organisation behind the implementation of the adaptation strategy in Denmark aims to link the research community (lower level in figure) to the policy level represented by the different ministerial structures in the upper level of the figure. In this case, the Coordination unit for Research on Climate Change Adaptation in Denmark (KFT) is situated at the interface between the scientific community and the policy arena. It provides advice and facilitates transfer of knowledge between the research community and an inter-ministerial Coordination forum on adaptation. In addition, KFT collates authoritative data on climate change and impacts for a web portal; and fosters national and international networks. Representing the sector-ministries, Coordination forum on adaptation identifies knowledge gaps and provides sector-specific input

into the Information Centre on Adaptation and the web portal, via topic groups established.



The "Coordination unit for Research on Climate Change Adaptation" has a three-level management structure: Steering Committee, Secretariat and Advisory Group. The coordination unit refers to the Coordination forum on adaptation, and supports the Information Centre on Adaptation hosted by the Climate and Energy Ministry which interacts with stakeholders, sectors and the different authority levels. The Scientific Advisory Group provides overall guidance and ensures scientific rigour. It comprises 23 leading scientists from a range of disciplines working on climate change adaptation issues. Key tasks of the scientific advisory group are to establish, chair and support "Thematic Working Groups", which address cross-cutting research themes and review and quality assure deliverables from KFT. Finally, it should provide scientifically based advice to relevant research bodies and the wider policy arena.

A "third-phase" national research programme with a focus on climate adaptation are planned to be established under the Strategic Research Council to support implementation of the Danish NAS.

4.3. Conclusions

Analysing climate change research programmes and their links with the organisations that are actively involved with the development of the NAS does not lead to unequivocal conclusions. The fact that all countries take a different approach does not mean that inefficient or ineffective paths have been chosen. Since Finland initiated the first national adaptation strategy in Europe, and the success story of the UKCIP programme, other countries have regarded them both as good examples of adaptation policy and policy support. In the past couple of years, more countries have developed a comprehensive strategy, following a path similar to that of Finland. First, comprehensive research is conducted, often followed by a national impacts assessment, followed by a NAS, which can then translated into local/regional or sectoral strategies, see also the driving forces and facilitating factors for the development and implementation of adaptation policy as defined in Chapter 3. Countries like the Netherlands, France, Denmark and Spain appear to have been inspired by frontrunners such as Finland and the UK, which relied heavily on available research on impacts, to start developing a comprehensive national adaptation strategy. Other countries such as Portugal and Latvia, have already started to adapt at the local level and in various sectors, responding to extreme weather-related events, such as floods and droughts, and less in response to scientific climate change research results. They are currently working on the development of a coordinated strategy to increase coherence between these actions. To some the extent that they have developed sectoral strategies before an overarching national one, they follow the path of the UK, although the UK has funded a number of large research programmes which have informed strategy development. (See also Chapters 6 and 7.)

Notwithstanding these similarities, a closer look reveals that countries are very different. Depending on the extent to which a particular climate-related problem is a political priority and on the availability of (financial) resources, the size/scale of research programmes varies a lot. As a result, the way in which the programming of research is organised varies in different countries according to the influence exercised by policy/society (often government departments) and the suppliers of knowledge (university programmes, national scientific organisations such as National Academies of Science). Countries that are either unwilling or unable to spend a huge amount on climate change research rely to a large extent on research carried out in other, usually larger, countries.

Thus, in most cases, governmental organisations initiate and are responsible for drafting the NAS in a coordinated fashion (with the exception of Portugal). Most are supported by an advisory commission and/or assessment

agencies. Some coordinating institutions have been set up explicitly for this job and have no other function, ARK (NL) and TAK (DK), for example. Boundary, coordinating, advisory and/or assessment organisations are able to combine their primary role with communication to the public (see Chapter 5). Although this chapter has provided some insights in the way countries organise their science-policy interactions, there is no ”best way” in which organisations operate at the boundary of science and policy. Depending on the social and institutional context in which they are embedded, almost all countries have one or more organisation to facilitate interactions between science and policy. Good examples, such as UKCIP, are often heralded for their pioneering role as a boundary organisation in climate change, and many other organisations emulate this programme. Indeed, what we can take from the UKCIP example is the flexibility with which they were able to adapt to the changing demarcation between science, policy and society. There is no doubt that this kind of organisation fulfils an important role, although little is yet known about the effectiveness of its boundary work in terms of the implementation of successful adaptation measures.

5. Communication and awareness raising for adapting to climate change

Climate change is a very complex and pervasive phenomenon, which makes it difficult for lay people to relate it to their daily routines, arguably because climate change cannot be transposed easily into the language of popular culture (Lorenzoni and Pidgeon, 2006; Ungar, 2000). Nevertheless, both policy and science are actively trying to inform the public to be aware and understand the impacts that climate change may have on their daily lives and routines and emphasise their important role to reduce these impacts. To date, the focus of communication and awareness-raising on climate change has been primarily on mitigation.

Three main groups play an important role in the communication on adaptation to climate change: science, policy and society (see figure 5.1). This chapter focuses on the information exchanges between society on the one hand and science and policy on the other. Interactions between science and policy are discussed in Chapter 4. The objective of this chapter is not to fully understand the way in which communication between science, policy and society in adaptation to climate change is organised, but to present an overview of the current activities of EU member states, especially in relation to their National Adaptation Strategies, and identify knowledge gaps. Besides understanding the institutional set-up for communicating to society and the relation to the National Adaptation Strategy, important questions are *what* is communicated, *who* is the receiver, and h*ow does it contribute* to the overall objective of adapting to the impacts of climate change. In addition, the quality of the available information and the way it is presented is important in the communication to the public.

Communication in its most simplistic sense is nothing more than transferring information from a sender through a medium to a receiver. If the receiver wants to respond, the receiver becomes the sender. Sending the message to individuals or specific institutions demands a way of communication other than sending a message to communities or society as a whole. In the latter,

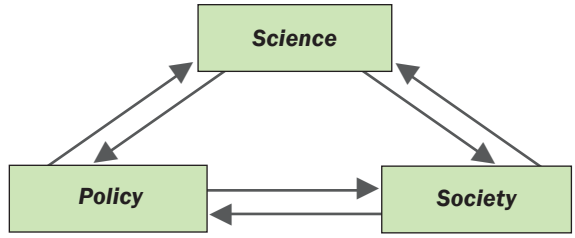


Figure 5.1 *Communication between science, policy and society*

the role of mass media is important (Stamm et al., 2000; Weingart et al., 2000). Mass media communication in the context of climate change is particularly important in encouraging greenhouse gas (GHG) emissions reductions and increasing awareness on potential impacts and vulnerability. In communication studies, there are two lines of thought: the classical ”sending” and more recent ”user” communication model. The classical communication model is described as the ”sending model”: a sender sends a message via a medium to a receiver in order to get an effect, noticeable through the feedback (see figure 5.2). Who is the sender or receiver and what type of medium is used to send the message or receive feedback do not matter. The sender, in the case of adaptation to climate change, is most often the organisation that gathers data, information and knowledge to send to the policy-makers or other groups in society). This is most often seen as a non-interactive process: there is no iterative process of messages to support the effect. With the introduction of new media, such as the internet, a new communication model arose: the ”user model”: The initiative for a communicative event shifts from sender to user (see figure 5.3). In this case, the user seeks answers to questions and requests data, information, or knowledge that is not (easily) accessible or completely new. With each step in the communication, more information is revealed that results in the desired effect. Over the last decades, the role-division of active senders and dependent receivers has become blurred (van Woerkum, 2007). In the remainder of the Chapter, we will explore to what extent the countries apply these two-way communication ideas and associated tools for raising awareness of climate change impacts and vulnerability, strengthening support for adaptation policy decisions, and provide practical information on possible adaptation action.

Figure 5.2 *The ”sending” communication model*

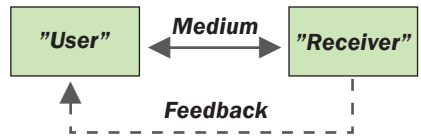


Figure 5.3 *The ”user” communication model*

5.1. Raising awareness in the National Adaptation Strategies

In most countries where adaptation to climate change has resulted in national adaptation strategies or sectoral strategies, enhancing the public awareness of the potential impact of and vulnerability to climate change has become an important issue, (see table 5.1). Most of the strategies mention the importance of awareness raising and communication to a wide audience to create understanding of the problem and getting public support for climate change adaptation policy. For example, in Germany and the Netherlands, the national governments state in their NAS that they will develop a national communication strategy on climate adaptation.

In most countries the characteristics and urgency of the problem and what one can do about it remain unclear to the general public. Most government campaigns about climate change have focused on the problem of GHG emissions and how citizens can help reducing them through increased energy efficiency, green power or other measures that reduce emissions, see also section 5.3. There may be a more limited role for the public to actively contribute to adapting to climate change, especially since not all are (equally) vulnerable, while all contribute to greenhouse gas emissions. Another difference between information in the areas of mitigation and adaptation is that, for mitigation, the messages about what an individual is able to do can be rather generic, while for adaptation effective information is often dependent on specific circumstances, requiring tailored information. Raising public awareness can be aimed at increasing support for certain measures that are taken by the government, enhancing society's risk perception, triggering possible action in the citizens' professional activities, or preparing them for extreme events as a result of climate change.

Table 5.1 gives an overview of the focus of national adaptation strategies on raising awareness or enhancing public understanding of climate change. Countries without a comprehensive adaptation strategy, but following a more sectoral approach, have also developed awareness raising campaigns in some cases. These, however, focus more on specific topics, (see table 5.2). Even though some countries have not yet developed a National Adaptation Strategy, it does not mean they are not focusing on raising awareness or informing the public about climate change risks and options to adapt. Indeed, in countries that may be slow in developing a national strategy, the dominant view may be to put the main responsibility to adapt onto society, the private sector, and municipal governments.

Table 5.1 *Raising awareness in national adaptation strategies*

Country	Strategy	Raising awareness
Denmark	*"Strategi for tilpasning til klimaændringer i Danmark"*	*NAS explicitly highlights communication and raising awareness as one of three main core initiatives. Proposes the establishment of an information strategy and the organisation of a web-portal. Recognises citizens, businesses and municipalities as key players*
Finland	*"Finland's National Strategy for Adaptation to Climate Change"*	*Proposes to conduct further research on public participation in climate adaptation. Recognises that municipalities, regional and sectoral administrations as important stakeholders when developing adaptation policies.*
France	*"Stratégie nationale d'adaptation au changement climatique"*	*Proposes to spread information and pay special attention to making local decision makers aware of the need to adapt to climate change*
Germany	*"Deutsche Strategie zur Anpassung an den Klimawandel"*	*Proposes the establishment of an information strategy and the organisation of a web-portal. Spread information through KomPass (stakeholder dialogues, newsletters, workshops, brochures, risk maps) Recognises that municipalities, regional and sectoral administrations as important stakeholders when developing adaptation policies.*
Netherlands	*"Maak ruimte voor klimaat!"*	*Together with public and private organisations enhance society's awareness and increase its willingness to act; develop a national communication strategy on the impacts of climate change.*
Spain	*"Plan de nacional de adaptición al cambino climático"*	*Although the strategy stresses the importance of good communication, and the Environment Ministry provides some information and links on its websites (primarily linked to mitigation), no comprehensive climate change adaptation communication strategy appears to have been developed.*
United Kingdom	*"Adapting to climate change in England. A framework for Action"*	*Communication is one of the four work streams.*

Although most countries refer to communication of climate impacts and vulnerabilities as one of the most important strategies to increase public awareness and encourage adaptation action, as yet there seems to be little progress on such strategies within governments. These strategies, however, could play a valuable role in the way adaptation policy is communicated and eventually implemented.

Table 5.2 *How other countries emphasise the need to raise awareness*

Country	Strategy	Raising awareness
Austria	*No National Strategy available*	*So far two Stakeholder workshops have been organised by the Austrian Lebensministerium and the Environmental Agency; some supplemental sectoral activities in Oberösterreich and Wien.*
Latvia	*No National Strategy available*	*Informative material produced for different audiences, workshops on adaptation organised by the Ministry of the Environment, small scale campaigns e.g. at schools (climate change day) and coastal zone protection campaigns.*
Portugal	*No National Strategy available*	*Stakeholder meetings, workshops and brochures.*
Sweden	*No National Strategy available*	*Swedish EPA provides information on climate change including adaptation. Information should be interactive, based on dialogue, exchange of knowledge and experiences between sectors and between the different levels of public administration. Media plays an important role in the communication and public awareness raising.*

5.2. Institutional arrangements for communication within countries

Similar to what we have seen in the previous chapter on science-policy interactions, in many countries, specialised units, temporary projects that are part of institutes, research programmes or governments are involved in facilitating communication about climate change. Table 5.3 provides an overview of the main organisations and their role in communicating adaptation information, but it is not an exhaustive list. Different types of organisations provide different types of information about climate change: governments, meteorological institutes, academic institutions, specialised units, and non-governmental organisations.

5.2.1. Governments

Information about climate policy is usually mostly provided by the central government (often Ministries for the environment, agriculture and forestry, water management) in the form of some basic information about climate change, on governmental information websites often with links to more detailed information elsewhere. In Denmark for example, the Ministry of Climate and Energy has the task of raising awareness of the need to adapt to climate change. The National Strategy proposes that a "Information Centre on Adaptation" should be established, a platform where climate-related information is made available to society.

The main institution responsible for disseminating information in the UK is DEFRA through its "Adapting to Climate Change" (ACC) Programme (DEFRA,

Table 5.3 *Organisations for dissemination of information on climate impacts, vulnerability, and adaptation*

Country	Scientific climate information	Operational	Policy information	Raising awareness – tools used
Austria	Central public website	Proposed	Lebens-ministerium ("Life-Ministry") and AU Environmental Agency	Access to all available scientific and political information on CCA; no active communication envisaged so far
Denmark	Information Centre on Adaptation	Operational	Ministry of Climate and Energy	News, cases, sectoral information, as well as entry points for citizens, businesses and municipalities
Finland	Central website	Operational	Ministry of Agriculture and Forestry	Presents the NAS and sectoral adaptation activities, provides links to available scientific information and policy briefs.
France	Central public website	Operational	Ministry of Environment, Ecology, Sustainable Development and Spatial Planning (MEEDDAT)	Gives access to available scientific information / brochures / publications / links to other websites
Germany	KomPass "National Competence Centre"	Since October 2006	Federal Environment Agency	Reports, brochures, briefing papers, quarterly newsletter, database on adaptation, website
Latvia	Central public website	Proposed	Not yet specified	Information on adaptation for different target groups, up to date scientific information
Netherlands	Platform Communication on Climate Change (PCCC)	Since 2003	CcSP program; KNMI and Environment Ministry	Website, factsheets, leaflets and brochures, organises workshops and dialogues where scientific research is combined with topical events in society
Portugal	Central website: Num clima em mudanca	2008	Ecoprogresso	NAS, newspaper articles

Country	Scientific climate information	Operational	Policy information	Raising awareness – tools used
Spain	*Spanish Climate Change bureau*	*1992*	*Ministry of Rural Affairs, Environment and Marine Affairs*	*Access to all available scientific and political information; reports, brochures, database, website*
Sweden	*Central website: Klimat-anpassnings-portalen*	*2008*	*Joint initiative of government agencies amongst others the Swedish Environmental Protection Agency*	*General information on adaptation but also guidelines for governmental authorities and regional authorities, and strategies and responsibilities for dissemination of knowledge/ information*
United Kingdom	*UKCIP; DEFRA website; MO Hadley Centre; and LWEC*	*Since 1997*	*DEFRA; Environment Agency, Natural England, other Government Departments*	*Includes websites (UKCIP, ACC), tools, case studies, leaflets*

2008a). The Programme provides information on climate change risks and impacts and a range of tools and methodologies, all through the *"Adapting to Climate Change in England"* document (DEFRA, 2008a), through the *"Adapting to Climate Change"* website, and through the work of UKCIP.

Although they are rarely mentioned in the National Adaptation Strategies, local and regional organisations can be important sources of climate-related information. The English NAS refers to regional partnerships and local level administrations as sources of information. In some cases specific adaptation projects are carried out that provide valuable experiences for other countries and regions with similar problems. The UNFCCC database on planning and practices under the Nairobi work programme[15], (see also chapter 3), and the UKCIP toolbox[16] illustrate the growing information availability at local and regional level.

5.2.2. Meteorological institutions

Information about climate change itself is often provided by meteorological institutes, but this information – apart from scenarios – is usually not extended

[15] *See website http://maindb.unfccc.int/public/adaptation_planning/*
[16] *See website http://www.ukcip.org.uk*

to include information about adaptation options, see for example the websites of the Royal Netherlands Meteorological Institute (KNMI), the UK Meteorological Office Hadley Centre, the Finnish Meteorological Institute (FMI), the Swedish Meteorological and Hydrological Institute (SMHI), the Danish Meteorological Institute and the German Max Planck Institute for Meteorology (MPI–M).

5.2.3. Academic institutions or research programmes

The large research programmes and projects that are conducted by universities, research institutions, consultancies and NGOs can also be important sources of information. Research programmes that focus on vulnerability and adaptation (see chapter 4) and where stakeholder involvement and public participation are important components of the programmes, often plan to deliver detailed and context-specific information. Earlier (phase I and II, see chapter 4) programmes usually provide information for the public about the results of the research in more general terms. The new adaptation research programmes have explicit objectives to actively inform the public, for example through websites, brochures or presentations. The Finnish ISTO research programme, for example, includes a communication plan to disseminate information through stakeholder discussions and seminars, publications, newsletters and webpages, as well as by organising tailored seminars on climate change for journalists. In addition, the Finnish internet database "Finessi" is an interface for exploring model projections of the possible impacts of future climate change with the aim to let users better understand the sensitivity of different systems to climate change as well as the uncertainty of model projections. The Dutch "Knowledge for Climate programme" includes a so-called "Knowledge Transfer Facility" that aims to make generic scientific information on climate change available for case study regions where stakeholders (NGOs, governmental organisations, private organisations, industries etc.) use this information in specific contexts. Other examples, such as UKCIP, illustrate a variety of ways in which scientific findings can be communicated.

5.2.4. Specialised units

In some cases special units are developed to disseminate information. In almost all cases, the government plays an important role in establishing and financing the institutions or projects. They have great interest in the way scientific information is communicated to a wider audience. After all, in most cases they have financed the scientific research and are searching for societal support to take measures. A wide variety of tools is used by these specialised units to communicate: websites, brochures, leaflets and newsletters. They provide quick and easily understandable

information. For example the Platform Communication on Climate Change is part of the government funded research programme Climate Changes Spatial Planning, the Dutch Met Office (KNMI), the Netherlands Environmental Assessment Agency (PBL) and several Dutch universities. Each year they present a brochure "State of the climate" in which they describe the progress, innovations, and developments in climate policy and research. The target group are public administrators of local and regional governments with little knowledge on climate change. The Kompass competence centre is managed by the Federal Environment Agency and provides detailed information about climate change, potential impacts and adaptation options in Germany at the regional level, including making regional climate scenarios accessible for users.

5.2.5. Non-governmental organisations

Many environmental and other NGOs have been active in communicating about climate change, including Friends of the Earth, Worldwide Fund for Nature (WWF), Greenpeace and the Red Cross. Most of the environmental NGOs focus on mitigation and changing lifestyles. NGOs in the area of nature protection are discussing adaptation activities, but do not emphasise communication with society about adaptation as a major priority. The Red Cross[17] focuses mainly on the vulnerable developing countries, but also to some extent provides useful information for adaptation in industrialised countries, e.g. supporting the elderly in case of heatwaves. The "HIER" campaign in The Netherlands is a coalition of more than 40 NGOs ("from World Wide Fund for Nature to UNICEF, from Red Cross to Greenpeace"), supported by the government and a national lottery. HIER recently added adaptation through the promotion of "climate buffers" – i.e. water retention or protected nature areas to avoid flooding and enhance ecosystem robustness – to their programme, while originally mainly providing information about mitigation.

5.3. Campaigns as strategy to raise awareness

Campaigns are often used by (national) governments to increase public awareness. Campaigns use a wide variety of methods and tools to communicate to their target group. Public involvement (two-way interactions), is generally seen to be highly desirable. Most often mass media communication such as governmental adverts, brochures and leaflets, meetings, discussions and contributions to

[17] *For more information please see the website: www.climatecentre.org*

discussion programmes are the main means of communication. So far, all of the analysed campaigns make use of mass media (internet, television and radio) to communicate to the public. In general, the campaigns have two generic objectives:

- Making people knowledgeable about climate change;
- Provide them with tools/knowledge to do something about it.

Campaigns have focused primarily on mitigation efforts. For example, although the European Commission started the campaign "You Control Climate Change" (IP/06/684) with the intention of creating awareness on climate change and reducing the impacts by social actions, it also contributed to an increased understanding of what could happen if no action was taken. Through its website[18], the Commission has, been informing the inhabitants of the EU about actions that can be taken locally to reduce the effects of climate change, since 2006. They provide education, presentations, brochures and leaflets to communicate their message. Similar initiatives are taking place in the Netherlands with the HIER campaign which aims to make the Netherlands carbon neutral by providing tools and information to increase amongst other things energy efficiency, renewable energy use and compensation of emissions. The HIER climate buffer programme provides information to local governments about "climate buffers" to decrease vulnerability to climate change, a programme in collaboration with a number of nature protections NGO and the government (ARK). In Finland, a very similar campaign (the Finnish Climate Change Communications Programme) was undertaken during 2002–2007. The programme concentrated on mitigation and it served also for coordinating the Commission's EU-wide climate campaign in Finland. In Denmark, the campaign "1 Ton Mindre" (One Tonne Less) focuses on public participation. More than 70.000 Danes have signed up to a pledge of reducing their own emissions by one ton of CO_2. The campaign is well-known amongst Danes and it has recently been decided to extend it for another year.

To date almost all UK campaigns have focused on mitigation as the most important response to climate change, for example the Carbon Trust Campaign "Switch it off" and "Turn it Off" and "Act on CO_2" from the government. There is one campaign that also addresses adaptation, called "Stand Up to Climate Change" (since 2004) from the Environment Agency[19], although here too, mitigation is presented as the principal response to climate change. Each year a new topic is discussed that deals with the impacts of climate change and the

[18] *See website www.climatechange.eu.com.*
[19] *See website www.standuptoclimatechange.org.*

available options. The Swedish "Klimatkampanjen" had three main objectives: 1) to increase knowledge on the causes and effects of the green house gases; 2) increase knowledge of, and changes in attitudes of the citizens' contributions to reduce emissions of GHGs and 3) to obtain increased acceptance of governmental or other policies and legal instruments.

After analyzing several EU countries, there are only a few campaigns that particularly focus on adaptation. It can be expected that as adaptation moves up the political agenda and stays there, this might change. Even if people are not knowledgeable about climate change, they can take action to cope with the impacts at the individual level. Energy savings and emission reductions can, independent of contextual factors, be taken at the individual level. However, the targeted group for adapting to climate change may vary per sector or region.

5.4. Tools to disseminate information: focus on internet

Finally, we will focus on the most commonly used tools in the communication of information about climate change. Participative approaches are discussed in the context of policy integration (Chapter 6). Analysing the NAS, we were unable to identify much information on the usage of tools such as radio and television. In this section we therefore focus on a clear example of the "user" model: the internet. The interactive character of a website makes it possible to search for required information and contact organisations to ask specific questions or clarify certain topics. Websites fulfil a powerful tool in creating awareness, public understanding and informing about climate change impacts and adaptation options. All analysed countries have at least one website where information on climate change impacts is made available. These websites form a portal where information on climate change is distributed. There are at least two types of websites: (a) science-driven websites, that are accessible to the wider public where scientific information (for example, from research programmes) is made available to those who are interested, and (b) policy-driven websites, that focus particularly on informing the lay public on recent developments in action that can be undertaken to adapt.

In most cases, the websites are directly managed by the organisation that is responsible for disseminating climate information, as mandated by the government. However, some countries do not (yet) plan to have a centrally organised institution for communication on climate change outside the responsible Ministry (see table 5.4).

At the international level, mechanisms for climate change adaptation information are currently being discussed or developed. For example, in Europe, a clearing-house for climate change impacts, vulnerability and adaptation with

a strong focus on web-based information, probably hosted by the European Environment Agency is planned. In addition, an interesting example of an interactive platform is weADAPT[20] which is funded by a number of national and international programmes, and aimed primarily at developing countries. Because useful information is context specific, the platform has a strong interactive component, wikADAPT, which is "...an interactive space where users and experts share knowledge and experience on climate adaptation. The wiki contains

Table 5.4 *Websites as a tool to disseminate information*

Country	Operational	Part of	Information	Target group	Portal
Austria	*Proposed/ scheduled for middle/ end of 2008*	*Federal Environment Agency*	*Up-to-date knowledge on the weather, climate change, effects and impacts, adaptation-options, overview of publications*	*Sectoral and regional policy makers, societal actors*	*To be installed*
Denmark	*First draft operational, final version expected by the beginning of 2009*	*Information centre on adaptation,*	*NAS; other publications and sectoral adaptation activities as well as climate models/ scenarios of relevance for decision making*	*Citizens, businesses and municipalities*	*www. klimatilpasning.dk*
Finland	*Since 2005*	*Ministry of Agriculture and Forestry*	*Background information and policy briefs on impacts and adaptation, national adaptation strategy and information on sectoral adaptation activities*	*All public, local, regional and national government*	*www.mmm.fi/ sopeutumis-strategia*
	Proposed, operational expected by 2010	*Climate Change Community Response Portal (CCCRP)*	*Guides potential users of climate information to the most relevant scientific information*	*Local governments and municipalities*	*To be installed*
France	*1992*	*MEEDDAT*	*Access to all available scientific and political information; reports, brochures, database, website*	*Sectoral and regional policy makers, societal actors and stakeholders*	*http://www. developpement-durable.gouv.fr/*
Germany	*Since 2006 (relaunch in 2008)*	*KomPass programme*	*List of projects, climate impact studies, awarding research budget, support development NAS*	*Sectoral and regional policymakers, societal actors and stakeholders*	*www. anpassung.net*

[20] *See website: www.weadapt.org*

Country	Operational	Part of	Information	Target group	Portal
Latvia	Proposed	Not yet specified	Scientific and policy Information on mitigation and adaptation, useful links and a forum for discussion	Broad public	To be installed
Netherlands	2003	Klimaat-portaal, part of the PCCC	Up-to-date knowledge on the weather, climate change, effects and impacts, mitigation and adaptation, overview of publications/FAQ	Policymakers, industries, interest groups, media, and wider public.	www.klimaatportaal.nl/
Portugal	Proposed	Not yet specified	Up-to-date scientific information	Broad public	http://www.numclimaemmudanca.pt
Spain	2000	Spanish Climate Change Bureau	Legal and scientific aspects of climate change, documents published by the Bureau	Broad public	www.mma.es/oecc/
Sweden	Since 2008	Swedish Meteoro-logical and Hydrological Institute (SMHI)	Descriptions of impacts, risk assessments, discusses adaptation plans, examples of integrating adaptation in day-to-day routines	Support those who work with adaptation issues at communal and regional level; within business sector	www.smhi.se/cmp/jsp/polopoly.jsp?d=9315&l=sv.
	Since 2008	CLIMATOOLS	Information as a result of the research programme will be made available	Broad public	http://www.foi.se/FOI/Templates/ProjectPage____5846.aspx
United Kingdom	Since 1997	UKCIP	Information about climate change, vulnerability, option; set of methods and tools	Local authorities, business, NGOs	www.ukcip.org.uk/
	existing	Adapting to Climate Change	Information about climate change impacts, government policies, what everyone can do, links to more detailed information elsewhere	General public	http://www.defra.gov.uk/environment/climatechange/adapt/index.htm

core themes on Framing Adaptation, Risk Monitoring, Decision Screening, and Communication, as well as tools and methods, worked examples and useful guidance to aid adaptation planning and implementation."

While there are some countries that have a central coordinated website to disseminate information (e.g. Netherlands, UK, Germany, Denmark), some

countries are still in the process of developing or initiating such a web-based tool (Latvia, Portugal, Finland), while other countries have no central website, but make the information available on sectoral websites (France, Portugal). It is difficult to assess whether a website is successful in providing the desired information. This of course depends on the target group, the objective of the website and the sources of information. Monitoring of "effectiveness" usually only takes place through counting the amount of visitors on the website and working with internet questionnaires.

BOX 5.1 Internet tools: Comparing the UK, Finland and Netherlands

One of the best examples of internet based tools is provided through UKCIP, which has developed a free-of-charge range of tools to raise awareness and share expertise: (1) the "Adaptation Wizard", that helps organisations determine vulnerability to climate change and develop their adaptation strategy, (2) the "Business Assessment tool" that helps explore the implications of climate change for a particular business or sector, (3) the "Local Climate Impacts Profile", which is a resource that local authorities can use to understand better their exposure to weather and climate, (4) the "Base for Research, Adaptation, Impacts and News" (BRAIN) which holds a collection of significant resources of research activities, adaptation actions, impacts of climate and news of climate change activities to share among stakeholders; and (5) the "Adaptation Actions Searchable Database", which has information on how organisations in the UK are adapting to climate change. It provides learning examples of actions that others can take to reduce their risks and exploit opportunities. The website is accessible for local governments and NGOs who want to assess their vulnerability but also for individuals to ask specific climate related questions and assess their own vulnerability.

In Finland, the Climate Change Community Response Portal (CCCRP) has recently been granted funds from the EU Life+ project and aims to publish a pilot version in 2010. This web portal resembles the UKCIP format as it guides potential users of climate information to four different tools (referred to as Wizards): (1) "Climate Change Explained Wizard" which is an e-learning method to address different aspects of climate change; (2) "Climate Data and Scenarios Wizard" which includes detailed and localised information on the present and projected future climate of Finland; (3) "Climate Impacts Wizard" which provides information on the regional impacts and vulnerabilities of climate change; (4) "Communication Response Wizard" where practical approaches

to both adaptation and mitigation are presented. These wizards are operated by the several (research) institutions that take part in the project. Results from the FINESSI project, (under the ISTO research programme) for example, will be included as one of the wizards. The target group for the CCCRP are the local governments and municipalities.

In the Netherlands, the Platform Communication on Climate Change (PCCC) has since 2003 developed an internet-based portal where scientific information, through a reviewing process, is made available to the public. In contrast to the aforementioned websites, the portal does not present wizards or any other type of support systems for local governments and individuals yet, but only provides scientific information and FAQs. The PCCC is partly funded by the CcSP research project and is supported by several research institutes.

5.5. Conclusions

Communication and raising awareness are important factors for successful adaptation to the impacts of climate change. There are many ways in which raising awareness can take place. National adaptation strategies often refer to communication as an important feature to facilitate successful adaptation practices. However, how this will be done is not explicit in most strategies. In the scientific literature, it is often recognised that the multi-scalar dimension of climate change needs social inclusion in the implementation process (Adger, 2003; Paavola and Adger, 2006). NAS follow this recommendation by including different types of communication, varying from brochures and reports to public participatory approaches and websites. In addition, mass media communication tools such as the internet, television and radio are often (planned to be) used in campaigns and become increasingly important to raise awareness. The focus of most national climate change campaigns is still on mitigation.

Internet tools have proven to be valuable means for communication for many purposes. Computer literacy in Europe is generally high. Although countries use these tools in very different ways, their incentives are the same. There are however large differences in the way the tools are financed (by government, research programmes, sponsored by universities), hosted (ibid) and in the information they provide (impacts information, adaptation wizards, integrative frameworks, etc.).

Coordinating communication initiatives in a central organisation may seem the most desirable approach. It would avoid conflicting messages that

could confuse people and hinder rather than facilitate adaptation action. When comparing the different countries, in most cases one or two central institutions are in charge of the main communication process. In practice however, many organisations take part in the communication process, such as NGOs, businesses, and local governments. Also, communication about climate change is at most coordinated at the national level, often only for particular regions or target groups. Exchange of information about experiences with climate communication, and sharing methods and tools can be very useful. Many countries are interested in knowledge exchange in this area. The EU and the EEA may play a role in this as well, possibly through the proposed clearinghouse on impacts, vulnerability and adaptation information. The fact that most communication is in the native language makes international exchange and collective learning difficult.

6. The governance of climate change adaptation across institutional scales

Adapting to the impacts of climate change is a significant challenge to structures of governance at all temporal and spatial scales. Authority may be shifted upwards (top down approach) or downwards (bottom up approach), but it can also be dispersed across multiple territorial levels and among a variety of private and public actors (Rosamund, 2004: 121). In the case of climate change mitigation, there is undoubtedly a need for a global response where a "top down" approach has taken place (Kaul et al., 1999). But this does not mean that the appropriate scale of governance is global for all related climate change issues.

In seeking the appropriate scale of governance for adaptation, the projected impacts and the nature of adaptation have to be accounted in order to alleviate vulnerability and reduce the threats. Many adaptations to climate change that have taken place are being planned, while others have been reactive and spontaneous to perceived and actual risks in the environment or related to changing economic constraints or opportunities. Adaptation to the impacts of climate change can be based on uncoordinated choices and actions of individuals and stakeholders and/or on collective actions and choices at multiples levels (local, regional, national, supranational (EU) and international). Consequently, climate change increasingly presents itself as a challenge not only of international relations, but also of multilevel governance. The theory of Multilevel Governance emerged as an approach to understanding the dynamic inter-relationship within and between different levels of governance, from a study of EU policy integration by Liesbet Hooghe and Gary Marks in 1990s. The theory conceptualises a system of continuous negotiation among governments at several territorial tiers and describes how supranational, national, regional, and local governments are involved in territorially overarching policy networks. The theory emphasises both the increasingly frequent and complex interactions between governmental actors and the increasingly important dimension of non-state actors. As such,

multi-level governance raises new and important questions about the role, power and authority of scales, creating considerable opportunities to learn from their initiatives and for the development, implementation and integration of policies at every level.

Adaptation to climate change in different European countries is taking place through the involvement of multiples scales of governance, from both "top down" and "bottom up" approach's. Decisions as to whether or not to adapt are taken at different levels, ranging from individual citizens to the international level (Klein et al., 2005). Climate change adaptation has become one of the major concerns at the International and European level, and for national, regional, and local governments (CEC, 2007b). There is a growing recognition that successful implementation requires the integration of adaptation policies across sectors and within the different institutional scales in a coordinated manner (Klein and Smith, 2003).

In this chapter we assess three aspects of multilevel governance in the national adaptation strategies. Firstly, which are the different scales of governance (international, supranational, national, regional, local and individual) that have undertaken responsibility for the development and implementation of adaptation actions? Secondly, how is authority and responsibility distributed between the multiple scales? Thirdly, what are the barriers between the different scales for the successful the development and implementation of adaptation policies?

6.1. Assessment of the multiple scales of governance involved in the development and implementation of adaptation measures

There is a widespread recognition in the NAS that adapting to climate change requires efforts of the whole society and is a concern for the multiple levels of governance. Moreover, this challenge has also called for the involvement of individuals and different stakeholders. This section examines if and how the different NAS consider multiple levels of governance in the development and the implementation of their strategy. The assessment is divided into six levels of involvement: International, supranational (European Union), national, regional, local and individuals/stakeholders (See table 6.1).

6.1.1. International scale

At the highest level of governance, climate change adaptation is governed by international environmental law, predominantly provisions of the UN Framework Convention for Climate Change (UNFCCC), the Kyoto Protocol, decisions of the Conferences of the Parties, international custom and national legislation (CEC,

Table 6.1 *Identified multiple levels of governance over climate change adaptation in the NAS*

Country	International	European	National	Regional	Local	Individual
Denmark		x	x	x	x	x
Finland		x	x			x
France	x	x	x	x	x	x
Germany	x	x	x	x	x	x
Netherlands		x	x	x	x	
Spain	x	x	x	x	x	
United Kingdom	x	x	x	x	x	x

2007b; Melkas, 2002; Verheyen, 2002). This international climate change regime creates responsibilities regarding adaptation. The Convention's Article 4, Paragraph 1(e)–(f) commits the Parties to cooperate in adaptation planning and to incorporate climate change considerations into their economic, social and environmental policies so as to minimise adverse effects on public health, environmental quality and on mitigation and adaptation measures.

The international scale (in Table 6.1) is usually referred to in the NAS, in order to highlight the importance of climate change adaptation and provide guidelines. This is the least mentioned scale, with no clear references of how this scale will be involved in the development or implementation of adaptation policies. The UK, France and Spain are exceptions, which are committed to contribute to adaptation globally. The international scale will be required to interact with the supranational and national scale due to the interconnected nature of a globalised world, specifically to address international trade, regional security, food production and migration issues.

6.1.2. Supranational/European scale

At the European Union (EU) level, attention has been focused primarily on mitigating climate change. Adaptation has risen up the agenda, with the publication of the "EU Green Paper on adapting to climate change: options for EU action" (CEC, 2007b), emphasizing the need of joint efforts to prepare Europe for the impacts of climate change.

The European Commission recognises the emergence of multilevel governance and its important role in the development and implementation of adaptation strategies. While a "one size fits all" approach to adaptation is clearly not appropriate, climate change impacts will not follow administrative boundaries and will need the engagement of each scale. In many areas adaptation will require a cross-boundary approach (CEC, 2007b). Accordingly, the EU Green Paper strongly supports that actions should be taken at the most appropriate

level (subsidiarity principle) and be complementary (proportionality principle) with others developed by different scales. However, it stresses the need to define an appropriate division of responsibilities for the development and implementation of adaptation measures between them.

The EU scale has had a direct influence over the general development of national climate change policy. However the influence of the supranational or EU scale has relatively little influence on the development of NAS. References to the European scale are few and mostly have a small impact over how the different countries will develop or implement their NAS. They frequently mention European Directives on different sectoral issues (for example the Water Framework Directive, the Habitat Directive, and the Flood Risk Directive) but not specifically European legislation directly related to adaptation. There is no mention of the EU's Green Paper on Adaptation in the NAS, except in the case of England. The UK recognises the European Comission's important leadership over all EU adaptation programmes. But the English NAS states that the UK will provide input to the EU White Paper even though national priorities set the framework for the NAS development. On the other hand, Latvia has considered the EU-level when developing their NAS. The Latvian NAS is scheduled to be finalised within one year after the publication of the EU White Paper on adaptation. The content of the NAS will be to some extent influenced by the content of the White Paper, even though national priorities set the framework for the NAS development. The Danish NAS refers to EU regulation within the sectors, where supranational regulation is essential for national adaptation: Agriculture and Fisheries, Nature and Environment (including Flooding and Bathing Water directives).

The German NAS is the only one which states the need to identify requirements for adaptation which cannot be efficiently fulfilled at a regional level and should therefore be taken care of by the national government or at the EU level. In contrast, the Netherlands NAS does not make any references to the activities of the European Union on climate change adaptation. Some references are made to European directives, such as the directive on the assessment and management of flood risk, but not particularly in the context of climate change. Links to EU adaptation policies in the Finnish NAS are few, although some directives are mentioned in an adaptation context. Examples include the Water Policy Framework Directive and the Habitats Directive, which are referred to in the context of conservation and monitoring species.

6.1.3. National scale

Anticipatory and planned adaptation is being developed at the national scale (see chapter 2). National adaptation strategies are creating the environment for

appropriate adaptation by setting out frameworks, removing barriers, creating incentives and coordinating actions between the lower scales. Furthermore, the NAS mostly refers to the national scale as the level responsible for overseeing the development and implementation of adaptation measures, and allocates the responsibility for the coordination of their implementation across the lower scales.

There are differences in the extent to which the national government is identified as being responsible for actually taking adaptive action. For instance, in the UK the role of the national scale is to ensure that local governments, key public authorities and statutory undertakers are taking adaptation actions as well as providing the right institutional environment to enable organisations and individuals to make effective and efficient adaptation decisions. In contrast, Finland's NAS provides that the national scale should undertake the development and implementation of adaptation measures. In Sweden, the Swedish Commission on Climate and Vulnerability notes that the responsibility for adapting to a changed climate is shared between individuals, municipalities and the state. It proposes that the county administrative boards should be given a driving role, and the task of coordinating the climate adaptation work within their respective counties.

Spain has a highly decentralised administrative system composed of seventeen Autonomous Communities (AACC). Each AACC has competences in important matters relevant to the effects of climate change. In accordance with the Spanish Constitution each Autonomous Community has its own executive, legislative and judicial powers, and is comprised of provinces, which themselves comprise local entities.

6.1.4. Regional scale

In addition to the national level (and the devolved administrations in the case of the UK and Spain), which generally take the lead for the development of the NAS, regional, local, and individual scales are mentioned by almost every country.

Adaptation has followed a different approach to climate change mitigation, where the chosen scales of governance have been the global and national level (Adger, 2001), with lower scales participation through local distributive justice of responsibility (See Elster, 1992). Plans for adaptation imply that it is to be mainly governed by regional and local scales, due to the specific and spatial distribution of climate change impacts.

Furthermore, there seems to be a prevailing opinion that adaptation has to be developed mainly at the regional, local and individual levels. In Germany for instance, departments, stakeholders and Länder representatives were involved in the development of the NAS. They are were invited to submit their

views, ideas and interests through open workshops and consultations and are involved in the preparation of the foreseen adaptation action plan. In France, the development of the NAS is the result of large consultation of, obviously the national ministries, national research institutes and agencies, but also national and local associations and public interest groups. The necessity to take more and more into account the minds of regional and local authorities and civil society is clear in the French "Grenelle de l'environnement"[21]. The UK has actively promoted and developed regional, local and individual actions. One example is the Three Regions Climate Change Group, made up of representatives from the East of England's Sustainable Development Round table, the London Climate Change Partnership, and the South East Climate Change Partnership. This Group came together with the aim of encouraging adaptation to climate change in the three regions as the associated risks, opportunities and required adaptation response are often necessarily linked.

Even in Finland, where the development of the NAS has only been done at a national level, the implementation of the strategy frequently occurs in regions and municipalities, especially with regard to flood risk management and spatial planning. In addition, the National land use guidelines were revised in 2008, to integrate climate change adaptation into land use planning at different levels of governance (Council of State, 2008). The new guidelines will thus influence adaptation policies at regional and municipal levels.

6.1.5. Local scale

As at the regional scale, local authorities are frequently instructed or compelled to prepare for climate change impacts in the NAS. The national scales are urging local scales to undertake planned adaptation and are providing them with tools, incentives and guidance. For instance, the UK government plans to work with Communities and Local Government to embed adaptation into key areas of work such as investment in public infrastructure and building planning, procurement of goods and services, and to raise skill levels and work with members on local leadership issues. It has introduced a new performance indicator on adaptation (NI188) in the Local Government Performance Framework, which is helping raise the profile of adaptation. In the Danish NAS, it is clearly stated that sectoral responsibility for autonomous adaptation is a key principle, although municipalities also have a key role within their own jurisdiction (Kommunalt

[21] *Is an open multi-party debate that reunites representatives of national and local government and organisations (industry, labor, professional associations, non-governmental organisations) regarding the development of public environmental policy.*

selvstyre). In addition, it is also stated that private landowners are responsible for coastal protection of their own properties

Although lower scales often seem to be the chosen levels for implementing adaptation plans the need for the higher scales involvement is generally recognised. In Denmark, for instance, the government's strategy builds on the subsidiarity principle, i.e. it emphasises that authorities, enterprises and individuals need to react and adapt to the consequences of climate change at their own initiative and in good time, within the given legislative, financial and technological framework. Nevertheless, it underlines that where autonomous adaptation is not the most optimal approach for society it may be necessary to launch adaptation measures that have been agreed at political level.

6.1.6. Individual/stakeholder involvement

There is a general call in the NAS for individuals, businesses, public and third sector organisations to take responsibility for how climate change will affect them. Businesses are expected take into account climate change impacts when making long term investment decisions, as well as taking advantages of the opportunities they represent. The national scales are generally committed to work with businesses to help them manage risks and maximise opportunities, in particular by providing information, supporting innovation and ensuring that the workforce is appropriately skilled.

6.2. Distribution of authority and responsibility between the multiple scales

As many of the examined NAS have stated, every scale and sector needs to take responsibility for how climate change will affect them. To what extent should each scale take responsibility? Who sets their roles? Questions that must be addressed by each country's NAS, to fulfil the NAS objectives.

The examination of the aspects of multilevel governance over climate change adaptation revealed three important findings. Firstly, while many countries endorse a delegation of decision making authority to local governments and individuals (bottom up approach), others have endorsed a national or "top down" approach. Secondly, the authority and responsibility over climate change adaptation is not concentrated in one level of governance, but has become a shared responsibility between them. Thirdly, while the coordination of adaptation efforts and the division of authority and responsibilities is still under development for many countries, some have appointed coordinating entities to ensure coordination and avoid overlaps and conflicts among them.

6.2.1. Distribution of responsibility and authority over climate change adaptation across scales

The idea of endorsing an appropriate level of responsibility over climate change adaptation is directly related with the concept that "one size does not fit all". The concept implies that adaptation responses should be developed and implemented by the appropriate scales of governance according to their needs and priorities. As a result, some countries have endorsed local and regional responsibility, while others have endorsed a national level of responsibility or have not yet determined it (See Table 6.2). The difference among the countries approaches appears to depend on their political system of internal governance (federal, devolved, or unitary) and the stage of development/implementation of their NAS.

The UK for example promotes actions at a regional and local level, as their projected impacts from climate change will vary even within a relatively local area. However, to ensure that every level is considering the costs and benefits of adaptation in economic, social and environmental terms higher levels of government are being involved. The national level will retain authority and responsibility to provide the right institutional environment to enable lower levels to make effective and efficient adaptation decisions, as it will also address any barriers to adaptation. Additionally, the constitutional arrangements in the UK introduce another level with authority and responsibility over climate change adaptation. The devolved administrations of Scotland, Wales and Northern Ireland have the authority and responsibility over their adaptation strategies, with their own lower administrative and governmental levels taking action in adaptation.

Similarly, Sweden through its Commission on Climate and Vulnerability endorses a shared responsibility between individuals, municipalities and the state. As well, France emphasises the necessity for the involvement of the state, local administrations and individuals. Germany has taken a similar approach aiming – within its constitutional distribution of competencies – at an efficient allocation of tasks and responsibilities whereby all relevant national, regional and local authorities will be responsible for identifying and implementing the appropriate measures.

Alternatively, Finland endorses a national approach as a shared responsibility between all ministries. The Ministry of Agriculture and Forestry has a coordinating role, but no single authority is responsible for the implementation of adaptation measures. Finally, the Netherlands, Latvia and Portugal are countries that have not yet determined responsibility and authority over the implementation of adaptation measures, as they are expected to be included in their National Adaptation Agenda. However the Netherland's NAS refers to a joint effort that will

include all the levels. The final distribution of responsibilities will be included in their national agenda.

6.2.2. Relationship and coordination between scales and actors

The involvement of multiple government levels and actors with shared responsibility for the implementation of adaptation measures may amplify existing conflicts over their own objectives (Adger et al., 2004). Consequently, the NAS have addressed this issue, but it is in many cases still under evaluation (See table 6.2). The complexity of this relationship lies mostly over the distribution of authority and responsibilities between the different levels, which raises new barriers against the successful implementation of adaptation actions. To address this issue, some countries have appointed coordinating entities or authorities to perform coordination and organisational duties between the multiple scales involved (See table 6.2).

For example, in the United Kingdom local authorities efforts are supported and coordinated with other levels and actors through DEFRA, the designated coordinating department. In Sweden they have proposed to give the "county administrative boards" a driving role of coordinating the climate adaptation work within their respective counties; while the Swedish Environmental Protection Agency should be given responsibility for monitoring the adaptation work and reporting.

However, because of the various sectoral areas concerned with adaptation, many countries have taken a sectoral approach within the involvement of multiple scales. In the Danish NAS "Coordination forum on adaptation" enables coordination across levels by representing/involving 9 ministries and the associations of Danish Regions and Danish Municipalities. In the case of Sweden, the Commission proposes additional specific responsibility for the Swedish National Post and Telecom Agency, the Energy Markets Inspectorate, the Swedish Geotechnical Institute and the National Food Administration.

6.3. Identified barriers between multiple scales over the development and implementation of adaptation policies

Although multilevel governance may provide an important contribution to the development, implementation and integration of adaptation policies, it might also raise further complexities and barriers within the different scales of governance. Problems may occur when there is a (1) lack of communication, transparency and coordination between the different scales and sectors; (2) authority and

responsibility are not clearly defined; and (3) financial constraints might limit certain scales ability to take effective adaptation actions.

Table 6.2 *Division of responsibilities and adaptation coordination entities*

Country	***Is there a foreseen division of responsibilities across scales?***	***Is there a foreseen national coordination of the climate adaptation work?***
Denmark	*Yes, sectoral responsibility also applies to adaptation measures including clearly defined municipal responsibilities*	*Yes, the Coordination forum on adaptation is led by the Ministry of Climate and Energy and apart from 9 ministries, it also involves the associations of Danish Regions and Danish Municipalities (KL)*
Finland	*The NAS states that each ministry will be responsible for the sectoral implementation of the strategy. It doesn't deal with regional or local level implementation*	*In October 2008, a coordination group for adaptation was established to evaluate the implementation of the NAS and support future adaptation activities. The coordination group is led by the Ministry of Agriculture and Forestry*
France	*Local authorities are encouraged to develop their own national adaptation strategy but that's it. Other responsibilities are not clearly defined.*	*Yes. The ONERC will be responsible for it.*
Germany	*No definite multi-level-governance strategy; NAS emphasises the superior responsibility of the local and private actors; role of central government basically confined to coordination, regulation of interregional conflicts, external affairs, advice, and – sometimes – fiscal support.*	*Yes. NAS was coordinated by the Federal Environment Ministry; implementation process will be coordinated by a new interministerial working group*
Latvia	*Not specified (No NAS adopted)*	*Yes. The Climate and Renewable Department (within Ministry of the Environment) is responsible for the coordination*
Netherlands	*No. The current NAS emphasises the importance of scales, but division of responsibilities will be discusses in the National adaptation agenda (due beginning of 2009)*	*No. Not a specific coordination unit foreseen. Task of Ministry of Housing and Spatial planning (VROM)*
Portugal	*Not specified (No NAS adopted)*	*Not specified (No NAS adopted)*
Spain	*Not yet specified*	*The OECC will be in charge of coordination.*
Sweden	*Not specified (No NAS adopted)*	*Yes. The county administrative boards*
United Kingdom	*The NAS endorses regional and local actions, while the national government has the role of setting the framework and removing the barriers for the implementation of adaptation measures*	*National adaptation measures are responsibility of the government coordinated with DEFRA. International adaptation measures are responsibility of the new Department for Energy and Climate Change (DECC)*

6.3.1. Lack of communication, coordination and transparency

The multiple scales and actors involved in the decision-making process for adaptation, may have different and contradictory views of the required adaptation measures. For instance, Portugal has a large and complex network of stakeholders with diverse and sometimes conflicting interests, that has complicated the implementation of their adaptation strategy (Ecoprogresso, 2008). Nevertheless, several European countries have attempted to address these challenges through consultation processes, climate change partnerships and commissions, to ensure the engagement, communication and transparency of the advice and views of the multiple scales, sectors and actors involved.

For instance, the UK has established Regional Climate Change Partnerships that are made up of local stakeholders ranging from regional agencies through to small local charities. They work with UKCIP and are now supported by DEFRA in determining the types of adaptation responses that are needed. The German NAS mentions that inter-regional cooperation is crucial to cope with scarce water supplies, flood risk and degradation of biodiversity.

Consultation processes to gather the views of multiple stakeholders have been common. In the EU's consultation on the EU Green Paper "Adapting to Climate Change in Europe" more than twenty country's multiple scales and actors participated. France undertook a large consultation process ("Grennelle de l'environment") which included multiple scales and sectors.

Although several European countries are trying to ensure adequate communication and coordination in the decision making process and implementation of adaptation measures, they must also make sure transparency is taken into account. If the views and opinions of the multiple stakeholders are requested but not included in the decision making process, the engagement of involved stakeholders is at risk.

6.3.2. Financial Constraints

Many regional, local and individual adaptation initiatives will depend on financial resources being made available at national scale. Funding adaptation may become more challenging and complex as it will need to be addressed within relevant policy areas as well. As a result, adaptation strategies must face financial constraints motivated from the competitiveness of different sectors, as well as from the multiple scales and actors involved. Indeed, who will pay for implementing the NAS? Who will control the use of the funds? Some country's NAS have considered adaptation funding but the details are still unclear, while several other countries have not yet taken in it into consideration (See Table 6.3).

For instance, France has separate national, regional and local funds. As a result, if adaptation decision at taken at a national level, local or regional levels will demand to be granted additional funding to undertake those adaptation actions.

Individuals must also face financial costs to adapt. Individual's decisions to take adaptation actions as for example, adapting their existing houses against flooding, water shortages and overheating, may be hindered by financial constraints. The NAS do not generally recognise a need for financial assistance or incentives for individuals.

Table 6.3 *Funding adaptation measures within multiple governmental levels and sectors*

Country	***Does the NAS refer to adaptation funding and if so how?***	***Who (will) pays for the implementation?***	***Who (will) control the implementation and the use of the funds?***
Denmark	*Not specified*	*The different public and private sectors. Data and knowledge building primarily by governmental funding bodies*	*Implementation will be monitored through the Coordination forum on adaptation*
Finland	*The NAS does not explicitly deal with funding.*	*All relevant actors at different levels, through mainstreaming adaptation into existing policies and practises*	*No separate funding is reserved for adaptation. Thus, adaptation is undertaken as part of developing other policies and activities within the different sectors.*
France	*Not clearly*	*Not clearly defined but it should be the French government (the taxpayers), stakeholders, the professional federations, the financial place of Paris, the MEDEF*	*Not clearly defined but it could be the orientation council of the ONERC and the authorities in charge of sustainable development*
Germany	*Not yet specified*	*Not yet specified*	*Not yet specified*
Netherlands	*No reference to the adaptation funding of implementation*	*Both public and private (PPP) at all scales of government*	*Cost-benefit-analysis could determine if actions are needed in a short term.*
Spain	*Not yet specified*	*Not yet specified*	*Not yet specified*
United Kingdom	*Mentions the funding for the regional partnerships and research funding.*	*Not yet specified*	*Not yet specified*

6.3.3. Lack of defined responsibilities

One of the main barriers for successful adaptation is unclear definition of responsibilities of the different authorities and stakeholders. A misunderstanding of the subject, its scale and the speed and diversity of its development makes

the distribution of the responsibilities very difficult. Several European countries have endorsed shared responsibility across scales but only a few have attempted to assign clear responsibilities to each scale and sector. The overlapping of responsibilities and interests in specific areas could lead to ineffectiveness. For instance, in Portugal the division of responsibilities is a point of concern as different sectors such as of housing, agriculture, and water resources are likely to be affected by climate change.

In France different local authorities will be officially responsible for adaptation; but it is unclear whether they will do something about it. In Germany the distribution of tasks and responsibilities to adapt to climate change is strongly predetermined by the federal constitution which strives for an efficient, allocation of competencies. The federal structures bear the risk of parallel work and additional effort. This appears particularly true in regard to adaptation challenges as most of them are of very local by nature whilst most of the federal states are already pursuing an own regional research and adaptation policy. Therefore, it is recognised by the NAS that central coordination of scientific work and professional exchange is helpful and needed in order to avoid unnecessary efforts.

6.4 . Conclusions

We emphasise the existence of multiple levels of adaptation. Adaptation is not an activity that takes place exclusively at international political arenas; it concerns national, regional and local governments, as well as individuals and organisations. The most appropriate level for adaptation responses is often the regional and local levels, but the involvement of the national level is required in setting out a framework, eliminating barriers and creating incentives and opportunities.

Multiple levels of governance over climate change adaptation are taking responsibility and action. Coordination between the scales is not fully addressed, and there is a great need for a clear assignment of responsibilities among the multiple scales and sectors involved. It will also be important to consider how to resolve conflicts of interest over which bodies have the authority to decide and take the lead.

Finally, several barriers are identified that may obstruct the NAS objectives. Funding adaptation may create conflicts in and between multiple sectors and scales. While adaptation actions at every scale may be frustrated as a result of financial constraints.

7. Integrating the challenges of climate adaptation into sector policies

7.1. Challenges and drivers of policy integration from the national strategic viewpoint

Adaptation to climate change is, to a large extent, a challenge of policy integration. Integration of adaptation into different sector policies – like policy integration in general (Lafferty and Hovden, 2003) – is needed for two reasons: First and essentially, with a view to sustainable development, it is necessary to integrate it into all affected sector policies in order to ensure that all responsible stakeholders take appropriate action. This mobilisation challenge applies to both societal and governmental actors (7.1.1). Secondly, adaptation policies have to be coordinated with each other and across sectors in order to avoid contradictions between different policies and to realise synergies where this is possible (7.1.2). From the strategic viewpoint of a national government that is striving to actively support the adaptation process, both activation and coordination require political commitment, integrative organisation and suitable policy instruments (7.1.3). After giving some introductory explanation to the challenges and basic requirements of activating and coordinating adaptation policies, this chapter will analyse how far these requirements of successful policy integration are considered and fulfilled by the existing NAS. The following analysis is, according to the overall focus of this report, confined to the strategic aims, needs and means of national governments that are striving to foster adaptation in all affected sectors. This strategic, strongly political focus is complemented by a second PEER study analyzing the integration and coherency challenges from an empirical, bottom-up perspective (see box below).

Box 7.1 PEER Climate Initiative project, part II: Climate Policy Integration, Coherence and Governance

Aspects of policy integration, coherence and governance related to climate adaptation are analysed by a second PEER (part II) study. The part II study is designed to complement the strategic, top-down focus of this report. It is taking an empirical, bottom-up perspective, based on national case studies. It is analyzing the degree of integration and coherency in different cases and fields of adaptation, using a single set of criteria, providing more detailed insight into the concrete needs, difficulties and catalysts of policy integration. The results of the part-II-study are available as a separate report (Mickwitz et al., 2009).

7.1.1 Activating societal and governmental actors

Activation of sectoral policies and actors is (only) needed where it is unlikely that societal actors will not consider climate impacts and adaptation needs and behave appropriately, by themselves. To ensure adequate policy integration strategy it is, therefore, essential to firstly consider how far voluntary action can be expected by free markets and how far, governmental support or interventions are likely to be needed.

Nearly all NAS emphasise that affected societal actors have a vested interest in adapting to climate change in a timely way. Adaptation could therefore be perceived as a societal challenge that to be left largely to societal actors and free markets. Indeed, it is quite reasonable to expect more voluntary action in adapting to climate change than in many other fields of environmental policy where the protection of external environmental goods is at stake, e.g. mitigation of greenhouse gases. Nevertheless, it is clear – and evidently acknowledged by the NASs – that appropriate and timely adaptation may well fail to be implemented for different reasons and that therefore, governmental support will be needed, in various ways. The most important reasons of such "market-failure" are attributed to

- **lack of knowledge** – The relevant actors are not sufficiently aware of the looming environmental changes, the need to act/adapt and the options they have at hand,
- **lack of capacity** – The societal actors do not have sufficient capacities for timely adaptation, whether in terms of money or workforce,
- **lack of (self-)interest** – due to external effects in subject or in time: External effects in subject exist whenever ability and responsibility to adapt do not lie with those who are eventually struck by the negative impacts of climate change. This is the case, for example, in the field of river flood protection

where retention areas have to be established in order to protect the lower river basin. External effects in time appear if long-term effects are not taken into account due to short-term economic dispositions. As is shown by the flood-prevention example, lack of self-interest can eventually be specifically opposed to the most efficient solution, namely if it is the "cheapest cost avoider" who is missing sufficient self-interest,

- l**ack of consensus** may hinder appropriate action if multiple actors have to cooperate in order to achieve effective results. Absence of a willingness to cooperate will regularly be a consequence of externalities, i.e. the fact that those who are responsible for taking appropriate (cooperative) action have no sufficient self-interest.

In all these cases appropriate governmental interventions are needed. According to the specific sector requirements government should aspire to

- generate the necessary **information and awareness** that timely action is needed
- support the building of adaptation **capacities**,
- internalise external effects and resolve conflicts by effective **regulatory aims, instruments and incentives**.

Thus, adaptation policy ought to be tailored specifically to each sector's readiness to adapt as determined by (1) the degree of existing knowledge and awareness (2) its capacity to act accordingly and (3) its self-interest to avoid the imminent damages. Moreover, the necessity for and type of governmental intervention are determined by the nature of the potential damage. The higher vulnerability is judged to be, the more are effective governmental interventions need to be to prompt timely adaptation. Table 7.1 illustrates this for the German situation as described by the Potsdam Institute of Climate Impact Research (Zebisch et al., 2005).

Table 7.1 *Climate change impacts and sectoral disposition to timely adaptation in Germany*

Climate change impacts	***Sectors affected and societal action needed***	***Vulnerability/ Responsibility***	***Knowledge/ Awareness***	***Capacity***	***Self-Interest & consensus***
Average change in weather- and bio-conditions	*Agriculture*	*Adapt crops and farming methods*			*Partially contrary effects of GAP*
	Forestry	*Change Crops*			*Long-term anticipation required*
	Nature Protection	*Change habitat protection schemes*	*Details widely unknown*		*External effects*
	Tourism	*Positive effects of longer summer seasons*			
Flood risk	*Water Management*	*System of retention areas, dikes*			*External effects*
	Regional spatial policy	*Hold free retention areas; flood proof settlements*			*External effects Contrary economic interests*
Decreasing precipitation, drought	*Water management*	*Water saving, long distance transport etc.*			
	Agriculture	*Adapt cropping system, establish irrigation system*			
	Industry	*Save water, change cooling systems;*			
	Transport shipping	*Shipping restrictions due to low river stages*			
Extreme weather events	*Infrastructure, transport*	*Weather-proof transport and constructions*			
	Private households	*Weather-proof houses; insurances*			
Heat waves	*Health system*	*Early warning systems; medical care*			
	Labour & Industry	*Cooling and AC; adapt operational hours*			
	Buildings	*Adapt construction; air conditioning*			
	Private life	*Adapt behaviour*			
New diseases	*Health system*	*Precaution; new medication; additional capac.*			

Degree:	*low*	*middle*	*high*

This analysis reveals that in many areas, governmental support or intervention would probably be necessary to trigger and maintain the necessary adaptation processes. This, however, requires that the responsible governmental sectors themselves are "activated" in the sense that they become fully aware of their responsibilities and sufficiently committed, interlinked, organised and equipped to fulfill them. As is well known, governmental departments are often strongly focused on and influenced by the interests of those actors they are governing. Governmental departments tend to identify with the business and interests of their "clients" and to disregard contrary interests of other sectors and the and more general considerations. Therefore, organisational and procedural means need to be put in place to integrate those "externalities" into the individual branches of government.

7.1.2. Coordination and coherency of sectoral policies and measures

In order to avoid conflicts between sectoral approaches and realise possible synergies all sectoral policies and measures towards adaptation should be thoroughly coordinated. Examples for possible interrelations between different sectoral adaptation and environmental policies are indicated in table 7.2. Like activation, effective coordination requires complete and up-to-date information about developments in other sectors and about potential negative and positive interrelations. Government can help considerably by providing information and an open exchange platform and by actively informing societal entrepreneurs about specific cooperation needs.

Moreover, governments can provide the capacities, rules and procedures necessary to ensure that interdependent actors actually cooperate with each other and take account of each others' interests. This is particularly necessary if voluntary coordination is hindered by conflicting interests of the parties. Governments can mediate between the actors involved, to find efficient compromises and – if required – enable such compromises by arranging for fair compensation.

Coordination can be promoted by the same organisational links that are needed to activate the various sectors. Coordination, like activation, is mostly about knowledge transfer, interactive communication and sufficient capacity. However, unlike activation, coordination is aiming to address potential conflicts and synergies between policies. This requires awareness of possible contradictions and a political commitment to foster coordination and coherency between sectoral policies and measures. Different countries address links between mitigation and adaptation to a varying degree. For example Finland has acknowledged the

Table 7.2 *Possible internal interrelations between adaptation policies*

	Adapting Agriculture & Forestry	***Sustaining Water Supply***	***Abating Flood Risk***	***Conserving Biodiversity***	***Protecting Public Health***
Adapting Agriculture & Forestry		*Supply concept crucial to A&F in dry regions*	*Agricultural use of retention areas*	*Impacts of (changing) cropping on vulnerable and moving species*	*Sufficient supply of nourishment*
Sustaining Water Supply			*Integrated River Basin Management*	*Impacts of droughts, irrigation and extraction*	*Drinking and bathing water quality*
Abating Flood Risk				*Positive effects of restoring natural basins and retention areas*	*Direct risks of injury and drowning*
Conserving Biodiversity					*Invasion of harmful species*
Protecting Public Health					

interactions between adaptation and mitigation as a specific challenge, but has not yet specified concrete coordination needs. Germany, Denmark, the United Kingdom and The Netherlands are tackling the links as a specific challenge and have identified concrete coordination needs and mechanisms.

7.1.3. Criteria for effective environmental policy integration as reference for adaptation strategies

In the context of environmental policy integration the OECD and the EEA have analysed how governmental and societal actors could and should be activated for the purpose of environmental protection. The criteria identified in both reports are quite similar. Some differences arise from the fact that the OECD-checklist is exclusively aimed at the catalysts of governmental decision making while the more recent EEA report is also looking at the output and the instruments applied in wider society. On the basis of the categories developed by the EEA report the OECD and the EEA criteria can be aggregated as follows:

(1) Political commitment and strategic vision:

- A commitment at the highest level to the development of environmental objectives and strategies is needed (EEA, OECD);
- Sectoral commitments should be furthered by involving the relevant branches in an overarching strategy, on the one hand, and by prompting specific sector strategies and programmes, on the other (EEA, OECD).

- Political commitment should be underpinned by clear (mid- and long-term) objectives and monitoring instruments.

(2) Administrative culture and practice:

- A central institutional catalyst located within the government machinery (e.g. at the level of Prime Minister's Office) should be in charge of enforcing environmental policy integration (OECD);
- Environmental needs should be reflected in the sector administration's internal management regime (EEA, OECD);
- Cooperation and feedback mechanisms between the sectors and the authorities representing environmental needs (EEA, OECD), and between higher and lower levels should be established (EEA).

(3) Policy design and adoption:

- A steady input of updated information should be provided (OECD);
- Environmental/adaptation assessments and broad consultations of all relevant stakeholders should be conducted in advance in order to ensure that the sector gives attention to its responsibilities (EEA, OECD);
- Independent auditing and reporting mechanisms are useful means of promoting environmental policy integration.

(4) Adequate policy instruments (EEA):

- Planning instruments as important drivers and coordination means;
- Assessment and Management Instruments;
- Distinct targets/standards if needed.

(5) Monitoring and learning from experience:

- Sector's progress towards environmental policy integration should be regularly monitored (EEA, OECD);
- Clear targets and indicators and a regular revision of the effectiveness of sector policies can foster and perpetuate the integration process (EEA, OECD);
- Institutional responsibilities for monitoring and revision ought to be identified (EEA; OECD).

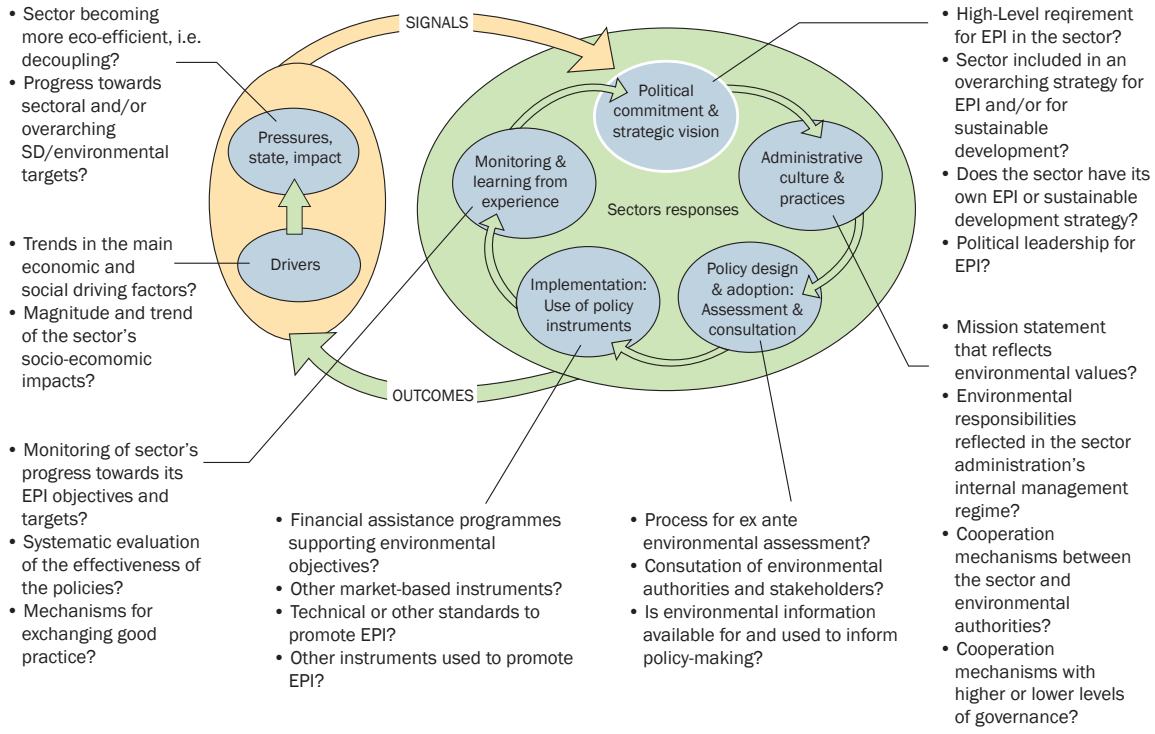


Figure 7.1 *Environmental Policy Integration cycle (EEA, 2005a)*

This comprehensive set of criteria underlines the complexity of the integration challenge. It refers to nearly every aspect of "good governance", including the need to involve all relevant stakeholders, to provide for initial impact-assessments, review and transparency mechanisms. The EEA rightly emphasises the importance of adequate policy instruments and discusses, for example the advantages and disadvantages of regulatory, fiscal or market-based instruments. This broad scope of the EEA and OECD criteria reflects the fact that it is referring to the whole field of environmental protection where cross-cutting and sectoral strategies have been in place and various instruments tested and discussed, for a long time.

Adaptation policy, however, is only at the beginning of an integration process. Therefore, the strategic challenge and main focuses are necessarily somewhat different from those of environmental policy, in general. It is therefore wise to rely more on "soft" procedural and organisational approaches rather than on "hard" objectives and concrete measures (Kabat et al., 2005). Integration of governmental structures and procedures – in vertical and horizontal directions – is an overriding issue at this stage while concrete "political commitment" and "policy design" are mainly to be focused on informing and cautious activation

of sectoral and local decision-makers. Accordingly, the following survey is aimed at the specific strategic challenges at the early stages of national adaptation policies regarding

- Political commitment and strategic vision inclusive of the coordination and coherency needs;
- Administrative integration by organisation, procedure and capacity and;
- Stakeholder participation;
- Essential instrumental levers of policy integration.

7.2. Evaluation of the NAS by core criteria of effective policy integration

7.2.1. Political commitment and strategic vision

Personal commitment and adequate strategic vision of high level politicians is a decisive requirement when it comes to pushing an issue against contrary sector interests. This factor, however, is difficult to monitor and lies beyond the strategic – institutional and instrumental – scope of this survey. We therefore focus on the question as to how political commitment is expressed, substantiated and sustained by the NAS referring to the following criteria: (1) Adoption procedure and formal status of the NAS, (2) the adoption of appropriate objectives and review mechanisms and (3) the initiation of sector plans and implementation programmes.

(1) Procedure and form of adoption

The procedural basis and formal status of the NAS gives expression to the acceptance and seriousness of the endeavour to adapt sector policies. Formal approval by the cabinet and, even more, by the parliament will enhance the political acceptance and impact of a NAS. Therefore, it is interesting to compare the procedural and formal designs of the NAS as displayed in Table 7.4.

Table 7.4 *Adoption procedure and form of NAS*

	Final coordination/adoption
DE	*Cabinet*
DK	*Adopted in Parliament after public hearing*
ES	*National decisions and enacted law 1/2005 Governmental decision*
FI	*Public hearing. NAS adopted by the Government as part of the National Climate and Energy Strategy in 2005.*
FR	*Parliament*
NL	*Cabinet and Parliament*
UK	*NAS adopted by cabinet and by Parliament as part of the Climate Change Bill*

The synopsis reveals that in almost all countries the NAS has been adopted on highest governmental level, at least by the cabinets. In the UK, Denmark, the Netherlands, France and Spain it has also been discussed and adopted by the parliament. This result could be taken as an indicator of high political commitment. However, the formal fact of high level adoption does not necessarily imply that adaptation is given a high substantial priority. In order to evaluate the political priority related to climate adaptation it is necessary to consider the concrete objectives and assignments made by the NAS, as well.

(2) Concrete objectives and assignments

The EEA and OECD criteria put high emphasis on distinct objectives, assignments and related review mechanisms as effective means to encourage action. Concrete targets indicating the "what, who and when" are certainly important guarantors for continuous political commitment. Indicators are discussed in the next Chapter. In order to provide a differentiated and meaningful view of such objectives, it is useful to distinguish between the following types of objectives and commitments:

- **Outcome objectives** describe the aspired factual state which – in terms of adaptation – could be a certain lower degree of vulnerability. As has been explained in chapter 6, such outcome targets are very difficult to define for the purpose of adaptation and are not yet found amongst the existing NAS.
- **Direct output objectives indicating** which measures are to be taken in order to reduce vulnerabilities. One example of such an output objective would be a requirement to heighten all dykes by a certain degree and within a certain time limit.
- **Indirect output or process objectives** refer to a subsequent level of implementation indicating that further measures (to reduce vulnerability to a certain climate impact) are to be designed and introduced by a particular actor within a specific limit. With regard to adaptation, indirect output objectives could be aimed at the revision of the NAS and the development of general, sectoral or regional implementation programmes.
- **Institutional commitments referring** to the institutional and procedural basis of policy integration.
- **Research objectives** should at least indicate the scope of the needed research and the responsible payer. Preferably, funds and time-frames should be indicated, too.
- **Funding objectives** include all concrete commitments in terms of funding and resources.

Table 7.5 below gives an approximate overview of the main focuses and strength of NAS policy commitments.

Table 7.5 *Concrete political commitments embodied in the NAS*

Country	Outcome	Measures	Action Plans	Institutions	Research	Funding
DE	-	-	+	-	+	+
DK	-	+	+	++	++	++
FI	-	-	+	-	++	+
FR	-	+	+	-	++	-
NL	+	-	+	++	+	-
UK	++	++	++	++	++	+

Outcome objectives; Measures: *none (-), one (+), few (++) or many (+++) of such commitments*
Action Plans, Institutions; Research; Funding: *no announcements (-), vague and non-binding (+), some concrete commitments (++); comprehensive set of concrete commitments (+++)*

This coarse evaluation illustrates the fact that the existing NAS contain few operational details and that they are evidently designed to set the initial direction in an ongoing political process, rather than a concrete action plan. Evidently, governments have found it too early to develop concrete outcome targets and to initiate specific action. In general, this cautious assumption appears quite comprehensible and cannot be simply ascribed to a lack of political commitment. Indeed, the discussion about suitable adaptation-aims, indicators and instruments is just beginning and still affected by a high degree of uncertainty. Moreover, in many fields adequate policies and measures can only be designed in consideration of local situations. Therefore, it appears quite legitimate that the first generation of NAS is generally designed mainly as a procedural roadmap for further scientific and political follow-up.

This is not to say, however, that no concrete action could be pledged, at all. Rather, commitments have to be focused on the further development and review of the NAS and the development of subsequent sectoral and regional strategies and implementation plans as well as on further research. Political commitment – in other words – must be primarily dedicated to the establishment of a continuous search and review process on all relevant levels. Accordingly, it is pointed out by the OECD and EEA guidelines that policy integration commitment should be expressed by an assurance to foster the development and regular review of national, sectoral and local strategies. This specific requirement for effective policy integration is valid in terms of adaptation, too. Sector strategies and implementation programmes are an essential means to claim and affirm an adequate commitment of the individual governmental branches. However, as can be seen from the table below, only a minority of the countries have included distinct commitments of that kind in their NAS.

Table 7.6 *Examples of concrete commitments set out by the NAS – subsequent planning & revision*

	Revision of the NAS	***Implementation programme/procedure***	***Sectoral/Regional implementation programmes***
DE	*Revision procedure and time limits announced with regard to the foreseen implementation plan*	*Implementation pan announced in draft version*	-
DK	*The Coordination forum on adaptation reports to the government once a year and feedback might lead to revision*	-	-
FI	*Timetable for revision is proposed*	*Implementation takes place through sectoral adaptation activities led by individual ministries in cooperation with stakeholders*	*Sectoral adaptation programmes prepared within ministries*
FR	*Implementation followed by the Orientation council of the ONERC; Regular meetings are planned with the authorities in charge of sustainable development*	*Translation of NAS into "National Adaptation Plan" officially envisaged*	*Regional and Local Climate Plans are encouraged; guidance on this has been provided by ADEME*[22]
NL	*No fixed procedure*	*National Adaptation Agenda*	*Sectoral, regional and local*
UK	*Revision of the NAS statutory programme and its risk assessment every five years addressing the most pressing climate change risks to England*	*Phase one, from 2008–2011 with the objective to develop the necessary groundwork to implement phase two from 2012 onwards. Phase two objective is to implement a statutory National Adaptation Programme, as required by the Climate Change Bill.*	*Local and regional adaptation policies and actions generally encouraged. Details will only be available with the development and implementation of the NAS by 2012; local government indicator NI 188.*

Concrete follow up commitments regarding evaluation and revision of the NAS itself have been made by Finland and UK. Germany is planning to include a revision scheme in its upcoming NAS, as well. France and Sweden have assigned evaluation to specific governmental bodies without setting out definite time limits or duties. If implementation is not promoted by evaluation and revision commitments, it can alternatively be fostered by subsequent National implementation plans as set out by the Dutch, the French and probably – soon – by the German NAS. The Finnish NAS resorts directly to sectoral action plans.

[22] *Agency for the Environment and Energy Control.*

7.2.2. Integrative administration

Within the administrative system the following catalysts promote effective policy integration (OECD (2002); see Figure 7.2):

(1) A strong leading department/institution. Within the circle of government departments there should be one responsible protagonist clearly responsible for representing and promoting the issue (of adapting to climate change). This leading and activating unit should – according to its general responsibilities – be sufficiently equipped and enabled to commit itself to the adaptation issue without major internal political restraints. If adaptation is assigned to a unit mainly responsible for specific economic interests, it is very likely that the issue (of adaptation) would be regularly undervalued as a social and political demand.

(2) Complementing adaptation units and agents in leading and sector departments: The issue of climate adaptation can be significantly furthered if institutionally represented within the prime minister's office and within all other relevant sector departments, as well. Special units, agents or ombudsmen can foster integration if they are explicitly commissioned to push the issue within sectoral decision making. In both regards it is essential to have sufficient qualified and designated personnel.

(3) Interdepartmental committee/procedure: Continuous inter- and intra-departmental communication and cooperation can be significantly fostered by fixed procedures and – in particular – by special interdepartmental committees responsible for organising and feeding the integration process. EEA and OECD both praise the central role that interdepartmental committees are playing in the development and implementation of national sustainable development strategies (EEA, 2005a; OECD, 2002). This suggests that adaptation-committees could take a leading role in activation and coordination of sectoral adaptation policies. Therefore, it is interesting to examine whether member states do, indeed, resort to such an institutional driver and – if so – how these cooperation platforms are designed and embedded in the administrative context.

(4) Bottom links: Information exchange and bottom-up input of local administrations, NGOs, stakeholders and scientists can also be provided by steady institutional arrangements. Administrative information, participation and advisory platforms have been established in many policy fields on all different levels of government. As has already been shown in section 4.2 some Member States have already dedicated specific boundary and coordinating organisations to the challenge of climate change adaptation.

Figure 7.2 visualises these organisational hubs and pillars of effective policy integration and Table 7.7 gives a comparative overview of how governments are performing in view of these organisational prerequisites of effective policy integration.

Figure 7.2
Institutional drivers for policy integration in the field of adaptation

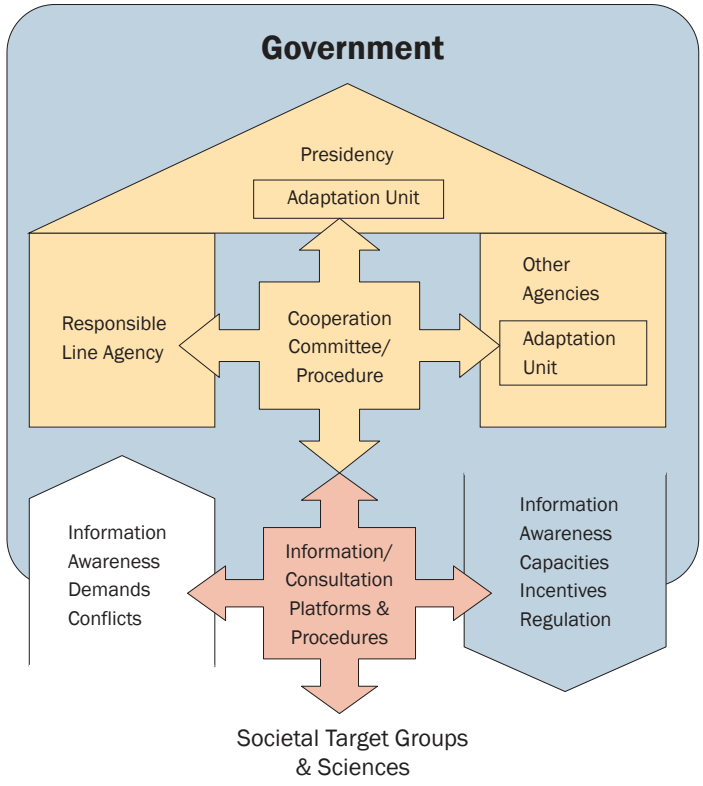


Table 7.7 *Organisational drivers of integration*

	Leading agency and capacities related to adaptation within that unit	***Special adaptation units or agents in sector departments***	***Interdepartmental committee or procedure?***
DE	*Environmental Ministry supported by the Federal Environmental Agency*		*Interministerial working group lead by the Federal Environment Ministery*
DK	*Danish Energy Agency under the Ministry of Climate and Energy*		*Appointment of Information centre on adaptation (cross-ministerial group to ensure that efforts are coordinated between public authorities)*
ES	*Environmental Ministry* National Office for Climate Change		
FI	*Ministry of Agriculture and Forestry*	*No special adaptation units, but individuals responsible for adaptation issues in sectoral department.*	*Inter-ministerial Working Group preparing the NAS*
FR	*Inter-ministerial delegate committee for sust. development: Mr Christian Brodhag* ONERC[23] as part of the Environmental Ministry		*Inter-ministerial committee for sustainable development*
LV	*Climate and Renewable Energy Department, under Ministry of the Environment*		*Intergovernmental Expert Group; Scientific and Stakeholder Committee*
NL	*Ministry of Housing, Spatial Planning, and the Environment. Part of ARK (see following)*	*Climate sensitive ministries are represented in ARK (see next cell) responsible Unit in the water ministry*	*ARK: Adaptation to climate change in spatial planning (includes representatives from ministries, provinces, municipalities and water boards, supported by scientific experts)*
PT	*Portuguese Ministry for Environment, Spatial Planning and Regional Development*		*Executive interdepartmental Commission for Climate Change (representatives of Port. Ministries) headed by EnvMin*
SE	*Swedish Ministry of Environment*		*Commission on Climate and Vulnerability organised by the ministry of environment of over 50 experts*
UK	*DEFRA – Climate Change Committee with an Adaptation Sub Committee envisaged.*		*Cross-Government board will guide the development and implementation of the NAS as to embed adaptation into their PAMs*

**introduced/envisaged by the NAS*

[23] *National Observatory Dedicated to the Effects of Climate Warming*

As a result of this first comparison it can be noted that in most cases the environmental ministries are taking the lead in developing and implementing national adaptation policies. Integration of the other sector departments is mostly driven by interdepartmental agencies. Only a few countries (Germany and Austria) have not yet resorted to such a common taskforce in the development of the NAS. Germany, however, has announced in the NAS that an interdepartmental working group will be established within the federal government which will be responsible for the administration of the implementation process. As regards the integration of adaptation in the organisational schemes of relevant sector departments, only the Dutch have reported on specific adaptation units within a sectoral department (water administration). For the rest, as it seems, there is no internal institutionalized representation of the issue within the leading and the sectoral government departments. As far as we can see from our survey, no country has yet resorted to integrative institutions like special adaptation units, agents or ombudsmen within the relevant sector departments. Rather, they have chosen to include the issue within existing structures and capacities.

In order to support an effective and continuous cooperation with local decision-makers and stakeholders some countries have established special cross-boundary science-policy-organisations. These "boundary" organisations are described in detail in chapter 4.2. As has already been pointed out in this section the UK Climate Impacts Programme can probably be considered as the most ambitious and advanced project in this regard (Lorenzoni et al., 2007). The German "KomPass" (Competence Centre on Climate Change Impacts and Adaptation) and the Danish "Coordination forum on adaptation" are organisations with similar boundary tasks but less capacities and a stronger focus on research coordination and knowledge exchange. For the rest, inclusion of stakeholders is mainly left to sporadic administrative initiatives or informal information exchange and lobbying.

7.2.3. Involvement of stakeholders

Stakeholder engagement or other forms of inclusive governance discourses are often advocated as an essential means of effective and sustainable policy integration processes, especially in the context of climate change adaptation (Few et al., 2007). The increased emphasis on participatory approaches is not surprising, especially when considering that decisions taken to adapt to climate change will affect, in one way or the other, the daily lives of many stakeholders. At the same time, policymaker's responses can benefit significantly from effective engagement with stakeholders which gives them an important role in the adaptation process. In both cases, the participatory approach contributes to the policy integration process by:

- Identifying the most appropriate (and desirable) forms of adaptation (assess viability of options);
- Mobilising tacit knowledge and experiences of stakeholders on local vulnerabilities and impacts;
- Analysing the capacity of stakeholders to cope with the impacts of climate change;
- Building shared understanding of the impacts, vulnerabilities and options of adaptation;
- Enhancing the ability to identify priority areas (what concerns stakeholders most?).

For these reasons, all countries covered by this survey have conducted some kind of stakeholder participation. Table 7.8 gives an overview of the respective national participatory approaches.

The table reveals that most countries have confined stakeholder participation in the development of the NAS to a small circle of experts, government and municipal officials and – sometimes – NGO representatives. Inclusion of stakeholders has been organised as an expert consultation process rather than as an open hearing. This is consistent with the strategic stage which most NAS are at. Further and wider stakeholder participation on subsequent stages of implementation are already envisaged, in some countries. For example, for the development of the Dutch adaptation strategy a participative process of representatives of ministries, national representatives of local and regional governments and of water boards, and experts were asked to participate in interactive workshops where they developed the NAS (ARK, 2006). After intensive consultation with regional representatives, the follow-up step of formulating and implementing the National Adaptation Agenda (beginning 2009) broadens the group of stakeholders to include NGO's local representatives, local governments, water managers etc. In both cases, there are intensive sessions of interactive and functional participation but with different types of stakeholders. Stakeholder engagement is therefore depending on the scale and context in which there is ambition to actively involve the public.

7.2.4. Adequate policy design

As has already been pointed out above, adaptation policy will have to mainly focus on cautious activation of sectoral and local policy-makers rather than pressing ahead with general and binding "adaptation-standards". In view of this specific challenge of cautious activation the EEA and the OECD particularly recommend two types of tools, namely (1) assessment and (2) planning instruments. In view of

Table 7.8 *Participatory approaches in adaptation strategies*

	Participation in developing NAS **Which and how were stakeholders involved?**	**Participation in implementing NAS** **Which and how will stakeholders be included?**
AT	*So far, through 2 stakeholder workshops, mainly experts and government officials*	*Not yet specified*
DE	*So far, through 3 stakeholder conferences, mainly experts and government/municipal officials*	*Not yet specified*
DK	*Public consultation process involving more than 40 respondents from a wide spectrum of society*	*Self-mobilisation of stakeholders is advocated in NAS. NGO's are not formally represented in the Coordination forum on adaptation*
FI	*Mainly representatives of ministries, researchers and sectoral stakeholders. Public hearing before NAS was finalised*	*The NAS is implemented in cooperation with sectoral stakeholders, primarily in the form of sectoral strategies and action plans.*
FR	*Stakeholder meetings*	*Not yet specified*
LV	*Mainly scientists, representatives of other ministries, agencies and enterprises. Development in workshops and interactive sessions*	*Not yet specified*
NL	*Mainly ministries, governmental representatives, experts on climate change*	*Regional consultation rounds and workshops with regional and sectoral representatives. Experiments with local interactive participation (B) in "Hotspots"*
PT	*Ministries, governmental representatives, local stakeholders, stakeholders per sector, mainly through workshops and conferences*	*Not yet specified*
ES	*Public consultation process for the adoption of the NAS*	*Not yet specified*
SE	*Participation and consultation processes are advocated in the upcoming climate bill*	*Not yet specified*
UK	*Developing the National Adaptation Strategy is mainly the work of scientists and policymakers.*	*Stakeholders are expected to be involved through the new "Partnership Board" to both advise government on the development of the programme and be active participants in it.*

current integrative activities in several European regions, support and coordination of voluntary local programmes and pilot projects should be considered as another important aspect (3).

(1) Assessment instruments

Assessment instruments are well established and proven within the context of environmental protection. Strategic environmental impact assessment (SEA) and environmental impact assessment (EIA) as set out by European Environmental Law oblige the relevant sectoral and local decision-makers to assess the potential environmental impacts of their decisions and thereby provide the basis for due

consideration and prevention of negative environmental effects. Such assessment instruments could also be useful within the context of adaptation if the potential (effects on) vulnerability of spatial, infrastructural and construction planning would have to be assessed and duly considered before the final decisions are made. Thus, an amendment of these assessment instruments in view of climate adaptation could be set out by the NAS. Moreover, it could be considered to extend the assessment obligations to relevant existing developments, infrastructures and plans that are likely to be negatively affected by the impacts of changing climate. One could make extended use of the already existing assessment tools; only the UK and Denmark have made concrete reference to this option by amending the SEA scheme. However, not all plans and programmes that involve climate risks are required to undergo an SEA or EIA, so there may be a need to develop additional tools. The Netherlands has a so-called Water Test in addition to SEA and EIA, but is also exploring the need for an additional climate test, or evaluation framework. Besides, an obligation to assess compatibility with climate change could as well be combined with sectoral or regional adaptation-planning instruments. At the level of construction designs, climate conditions can be included in building codes.

(2) Planning instruments

As adequate measures have to be selected and designed in consideration of specific local and/or sectoral conditions and options (CEC, 2007b: 3), this cannot be accomplished by a one-size-fits-all national approach. Rather, it is the responsibility of the national government to initiate the drawing up of sectoral and regional strategies (see above 2.1 (2)) and action plans and to ensure that both global adaptation targets and local adaptation needs are duly considered within existing spatial and sectoral planning schemes (EEA, 2005a). National and – in some sectors like water, biodiversity, agriculture, marine protection – even European planning law can well provide for suitable planning obligations and procedures and thus ensure that adaptation needs are duly considered, that all relevant information is collected, that all decision-makers and stakeholders are included and that policies and measures are developed and designed coherently. Moreover, planning obligations are a superior means of flexible multilevel governance in relation to the subsidiarity principle. While aiming at common global (adaptation) targets planning schemes allow for a due consideration of specific sectoral and/or regional needs, circumstances and preferences. Hence, planning approaches are widespread within EU environmental law. National and regional plans are employed as a decisive means of mainstreaming national and regional politics in many target-areas such as cleaning of ambient air, reduction of water

Table 7.9 *Adaptation to climate change by regional and sectoral planning*

	Comprehensive Regional ACC Programmes	***Spatial & Urban Planning***	***Water Management Planning***	***Other sectoral plans (relevant) for adaptation***
DK		*NAS suggests revision of regional development plans*	*NAS proclaims revision of aquatic environment action plans to be drawn up according to EU Water Framework Directive*	*NAS refers to: National Action Plan for Aquatic Environment; National Pesticide Action Plan; Natura 2000 Planning*
FI	*The NAS does not refer to regional programmes*	*Adaptation is included in the new National land-use guidelines (updated in 2008)*	*Workgroups on flood risk management, flood damage compensation and dam safety within the Ministry of Agriculture and Forestry*	*Ministerial action programmes produced within the Ministry of the Environment and Ministry of Transport and Communication*
FR	*Regional and Local Climate Plans encouraged; guidance on this has been provided by ADEME*[24]		*– To reinforce measures dedicated to reduce vulnerability of river basins in terms of flooding – water management shall integrate adaptation needs at the level of the river basins administration*	*A national heat waves plan is already operational*
LV		Rural Development National Strategy Plan 2007–2013 deals with some risks caused by climate change	National Flood Risk Assessment and Management Programme	Concept on Risk Management Policy in Agriculture; National Security Conception
NL	*The "hotspots" in part of the Netherlands as regional case studies (CcSP and KfC research programme)*	*National Spatial Strategy; Randstad Strategic Agenda 2040 (2006); Urgency Programme for the Randstad (2007) Climate Agreement (2007) Municipalities and National Government –setting out options to make spatial planning climate proof*	*National Safety Programme (2008) Water Vision and National Water Plan (2009) Delta Commission (2008), New Water Law (2009–2010)*	*National Plan for Heat Waves*
UK		*The Regional Development Agencies recommended the creation of new regional economic and spatial strategies I order to better integrate regional sustainable development frameworks and support adaptation planning*	*"Future Water"*[25]*: long-term vision for water policy and management, expected by 2030 to have embedded continuous adaptation to climate change throughout the water sector; "Making Space for Water": Government strategy for flood and coastal erosion risk management in the context of climate change.*	*National Heatwave Plan launched in 2004 and updated yearly*

[24] *Energy Development and Management Agency*

[25] *For more details visit: http://www.defra.gov.uk/environment/water/strategy/*

pollution, mitigation of urban noise, management of marine ecosystems and depletion of waste emergence. In all these and many more cases member states are urged to develop their own effective programme of measures in accordance with global integration targets. Likewise, national adaptation policy can extend existing planning instruments – particularly spatial planning schemes – to the adaptation needs and even introduce new instruments like sectoral or regional adaptation plans (CEC, 2007b: 12). As can be taken from the following table most of the Member States' NAS do refer to spatial planning as an essential approach to adaptive management.

No country has so far proposed a special cross-cutting planning instrument that would – similar to e.g. the EC air quality or water management plans – include all relevant sectors on a regional scale and provide a common basis for effective coordination. Rather, existing sectoral planning instruments are referred to and encouraged – mostly in very general terms – to assess whether and how these plans should be adapted. Although many of the relevant planning authorities have already acknowledged the challenge of adaptation this additional encouragement by the NAS is certainly useful. However, much more added value could be expected from the NAS if effective instruments for cross-sectoral coordination were also provided.

With regard to the sectoral and regional sector plans it should also be noted that concrete outcome objectives setting out distinct criteria and precise time limits are very rare amongst the existing NAS. Thus, the references made to regional plans are of an advisory nature. Binding objectives enforcing a timely adaptation of the existing planning machinery are not being considered and, therefore, appropriate action is widely left to the interpretation of regional/sectoral authorities. On a voluntary and incremental basis, however, many local and sectoral actors have already developed their own adaptation to climate change (ACC) programmes, even before the NAS were developed. Therefore, incorporation, further support and coordination of these incremental regional and sectoral PAMs should be considered as another main integrative challenge of the NAS process.

(3) Acknowledging and promoting voluntary local and sectoral policy integration programmes

Voluntary regional and local initiatives for cooperative adaptation can contribute a lot to activating and coordinating local actors. Many regions and municipalities have already initiated their own preliminary adaptation projects, some of which are focused on specific local problems (like flood prevention) and some of which are even designed as comprehensive approaches. Recent pilot projects have

Box 7.2. KLARA-Net – activating local players by voluntary cooperation[26]

In mid-2006, the Chair of Environmental and Spatial Planning of the Technical University Darmstadt started with the research project KLARA-Net which is part of the funding priority of the German Federal Ministry for Education and Research (BMBF) "Research for Climate Protection and Protection from Climate Impacts". The funding priority is embedded in the BMBF framework programme "Research for Sustainability" (fona).

Phase I

Since 1st June 2006, a regional network of stakeholders from the area of Starkenburg has been in operation, actively dealing with the adaptation to climate change in the area. The goal is to develop future-oriented and effective action and implementation strategies for different stakeholders within the network, such as the building industry, agriculture and forestry, tourism and the health sector. The initiatives launched by the project not only illustrate measures to cope with and reduce climate-related damage, but also point out the potential for new products, public services, and business processes, thus realising and taking up the participants' comparative advantages over their competitors. The Max Planck Institute for Meteorology supports the project with appropriate climate models and forecast data.

Phase II

The progress made by the project during the first phase showed the great importance to the region of regional knowledge about dealing with the effects of climate change and also of trend-setting programmes and plans at the legislative level (federal state of Hesse). Both are needed when it comes to initiating rapid adaptation processes to climate change.

Accordingly, in the second phase, strategies are being mapped out to pass on the findings of the thematic groups on regional adaptation requirements to the regulatory and legislative level. In addition, the network is developing appropriate methods in order to accelerate the process of adaptation and implementation within the area under investigation.

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[26] *See: http://www.klimazwei.de/ProjektezumSchutzvorKlimawirkungen/*

already shown that the willingness of stakeholders to set up and participate in local projects and cooperation programmes is quite high. However, few groups have experience of running such voluntary projects or the capacity for programme management. Therefore, funding and guiding local initiatives appears to be a very promising way of activating local players. One example is given by the German KLARA-Net-Project (Climate Adaptation in the Region of Starkenburg – South Hesse).

As can be seen from the KLARA-Net example such local initiatives are of great importance for adequate progress not only on the regional level itself but on the national and European levels, as well. These projects generate the experience and the demand that are needed to explore the resources needed for action and to develop appropriate solutions. The comparison of the NAS reveals that appraisal of local ACC initiatives is quite variable. Some NAS refer only generally to the local level while others put particular emphasis on bottom-up developments, include detailed inventories of ongoing activities and consider concrete possibilities of regulatory and budgetary support. The latter appears to be a sensible approach considering how much the challenge of adaptation is determined by local and regional givens. Strong support and coordination of local initiatives can therefore be considered a crucial key to effective policy integration.

7.3. Conclusions and further research questions

Prompting timely adaptation to climate change is to a large extent a challenge of effective policy integration. A large variety of affected sectors and regions have to be brought together to take appropriate action which they may fail to take by themselves from a lack of awareness, information, capacities or self-interest. Therefore, as the case may be, appropriate action can be enabled by respective governmental support or regulations (activation). Moreover cross-sectoral and interregional coordination can be provided for in view of possible synergies or interferences. Both of these core elements of policy integration, of course, require at first that governmental policies are adequately aware, informed, motivated and organisationally coordinated. At the outset of an integrative adaptation policy the makers of the NAS are therefore facing a twofold integration challenge. First, they have to establish an integrative internal structure in order to enable the needed **activation and coordination** of all relevant **governmental actors**. Second, adequate instruments for the activation and coordination of the **societal actors** have to be put in place. In many regards, activation of the societal actors will have to resort to regulatory means, as – like in the cases of precautionary flood prevention or increased vulnerability of environmental goods – those who

are affected by the impacts of changing climate are not necessarily holding the key to timely and efficient adaptation. In regard to these basic requirements the comparative analysis reveals that

(1) Organisational integration has been improved within the process of developing the NAS in most of the countries included. Except for Austria, all countries have deployed special **interdepartmental committees** as a means to continuously involve all branches and advance the process. We did not find information about organisational measures within the relevant sector departments;

(2) This first generation of NAS takes a rather **advisory approach** towards the political challenge of adaptation. Most of the strategies legitimately focus mainly on knowledge, awareness and first strategic considerations. Therefore, none of the NAS included in the survey will be able, by itself, to effect a high degree of policy integration, straight away. Rather, all the NAS need to be complemented by supplementary **implementation programmes** – be it on a national, sectoral or regional level – in order to fulfill the abovementioned tasks of activation and coordination.

(3) Although concrete action is mostly entrusted to subsequent levels of planning and action only a few NAS provide for an **adequate procedural implementation framework** and time limits guiding this implementation process.

(4) **Planning instruments** are incrementally and rather loosely referred to but not consequently deployed as effective means of activation and coordination of sectoral and – in particular – cross sectoral adaptation PAMs. No NAS has considered the establishment of a special comprehensive (regional) adaptation plan/programme.

(5) As a whole the **appraisal of local adaptation initiatives** is quite variable. Some NAS refer only generally to the local levels and their specific activities while others include detailed inventories of ongoing activities and consider different measures of coordination and funding.


KIDDERMINSTER ROAD
Flood

8. Review and implementation

8.1. Evaluation, revision and compliance instruments as elements of successful strategies

Strategies designed to guide complex and long-term political processes must not be conceived as a static "one-off" conception. The more such strategies have to deal with future projections, factual uncertainties, intricate interactions and political constraints the less likely it is that appropriate, effective and lasting solutions to all relevant questions will be found, from the outset, and the less likely it is that all measures will be fully accepted and easily implemented by their various addressees. Therefore, it is essential that the strategic planning is designed as a continuous and flexible process and subjected to periodic review. This holds particularly true for the process of climate change adaptation as it is still beginning. Projections about specific regional impacts and understanding of how to best respond to these changes are still rapidly evolving. It is evident, that strategies, policies and measures have to be conceived as part of that process and that they should be regularly evaluated and revised in regard to both the

- validity of the underlying scientific assumptions and
- effectiveness and appropriateness of policies and measures.

Implementation instruments are needed, particularly where voluntary action is likely to be hindered by conflicting interests of the relevant actors. In the field of climate change adaptation such motivational hurdles – as is described in Chapter 7 – are to be expected if the negative consequences of mal-adaptation will not affect the responsible actors (external effects). The increased flood risks caused in lower parts of river basins by a narrowing of rivers in their higher sections is one example for such external effects of mal-adaptation. The additional pressures that intensive agricultural land use will put on water availability and quality in periods of drought is another. In such cases, effective compliance instruments are required in order to implement the necessary adaptation measures. Implementation instruments can take different forms, from softer

instruments like financial or other incentives or voluntary agreements, to harder ones like regulatory measures with sanctions or other enforcement mechanisms. Effective implementation, again, implies that adaptation efforts and effects are thoroughly monitored and evaluated on the basis of meaningful objectives and indicators.

The task of monitoring and evaluation must not be exclusively addressed by national governments. Rather, all relevant regional and sectoral actors ought to monitor and evaluate their respective adaptation needs and activities, as well. Within a comprehensive concept of evaluation, review and implementation, the following elements appear to be indispensable or, at least, useful keys for dynamic improvement and successful implementation:

- a review mechanism/institution ensuring that new scientific evidence and experiences from the implementation process will be evaluated by a competent body and accounted for by an updated NAS/programme of measures on a regular basis (8.2),
- monitoring programmes providing for a thorough observation of actual climate changes and impacts as well as progress and shortcomings of adaptation policies (8.3),
- distinct objectives and indicators making it possible to clearly identify the progress made and the remaining need for action (8.5),
- reporting obligations coercing key actors to give an account of the measures they have taken and of the degree to which they have accomplished the aims and/or tasks set out by the strategy (8.4),
- adaption planning instruments requiring regional and sectoral actors to precisely determine and regularly evaluate their specific need for action, adaptation aims and programme of measures (8.6),
- binding legal obligations if voluntary action is hindered by a lack of incentives (see chapter 7.1.1) and measures of (8.7)
- compensation and support as powerful means of proactive enforcement where contrary interests have to be overcome (8.8).

As it seems evident that these instruments of evaluation, revision and implementation are useful – if not indispensable – prerequisites of a successful strategic approach to climate adaptation one would expect them to play a prominent role in the NAS. However, our analysis suggests that is generally not the case. Only a few NAS contain rudiments of an evaluation and compliance strategy. The following sections will, therefore primarily emphasise what could and maybe should be included by a NAS or follow-up implementation plan with regard to the aforementioned instruments of evaluation, review and implementation.

8.2. Review mechanism and responsibility

In order to provide for a regular review it is necessary to determine a concrete date or time frame in the strategy. Moreover, the review would have to be assigned to a responsible body. Interdepartmental bodies like those established in some EU member states to facilitate the initial development of the NAS could be assigned to conduct the evaluation and to submit proposals for a further development of the NAS. In any case, competent bodies need to be established as permanent institutions and sufficiently equipped with resources and influence. Amongst the countries considered in this report only Finland and the UK have set out a time frame for a general revision of their NAS. A mid-term evaluation of the Finnish NAS will be undertaken in the beginning of 2009, and a more comprehensive evaluation of the strategy and its effectiveness is proposed to take place within 6-8 years of the publication of the strategy (i.e. 2011–2013). In this evaluation, further adaptation measures are to be defined and analysed, based on new research and updated information on the impacts of climate change and possible adaptation measures. In the Danish NAS it is implicitly assumed that the strategy, which has a 10-year implementation phase, will be thoroughly reviewed and revised before the end of 2018. Annual reports from the Coordination forum on adaptation to the Danish Government will facilitate this review process

In the case of the UK, the Climate Change Bill states that once a national adaptation programme has been put into place it must be reviewed by parliament every five years to evaluate the most pressing climate change risks for England (i.e. climate change risk assessment). As discussed in chapter 4 several countries have established specific bodies to facilitate a regular input of updated information on new scientific evidence and experiences gained from current adaptation efforts into the policy process. However, none of these bodies are explicitly commissioned to review the NAS. Rather, they are only assigned to monitor the adaptation process in rather general terms.

8.3. Monitoring schemes

Effective and efficient monitoring calls for two basic questions to be answered, in the first place: What has to be monitored (objects and scope) and who has to monitor it (responsibilities)? Therefore, it appears important that monitoring objects and responsibilities are determined by the NAS or by a subsequent programme of measures required by the NAS. The NAS we are looking at, however, include no such monitoring concept. Neither do they specify the objects and scope of monitoring nor do they state clear responsibilities. If at all, monitoring

is only accounted for in rather general terms. For example the UK has created an Adaptation Sub-Committee under a broader Climate Change Committee to oversee the progress of the national adaptation programme and provide advice on the risk assessment.

In the Dutch NAS, it is argued that it is necessary to "actively monitor the adaptation process; both the decision making process on large spatial investments as the physical changes in the Dutch spatial planning." The Swedish Commission on Climate and Vulnerability simply proposes that the Swedish Environmental Protection Agency should be given responsibility for monitoring the adaptation work and reporting. It is not guaranteed that a serious monitoring process will be achieved on the basis of such vague and weak propositions.

8.4. Reporting obligations

A functional reporting scheme is particularly needed where a variety of different regional and local actors are to be guided towards common (environmental) aims. Therefore, reporting obligations are a well-established component of almost every international and European environmental policy (Raustila, 2005). National adaptation policy is shaped by a similar multilevel challenge and relies on various regional and sectoral actors. Therefore the NAS-process – just like most other central environmental policies – is highly dependant on the acquisition of data on regional and sectoral developments. It is important, that such information is regularly made available through a comprehensive reporting programme. A national adaptation strategy could provide the basic framework for the determination of such monitoring responsibilities with effective reporting obligations. However, the available NAS do not take on the need for effective reporting. None of the existing strategies is setting out clear responsibilities, limits and forms for an effective and efficient reporting system. The UK constitutes a exception in so far as its Climate Change Bill grants an "adaptation reporting power" to the government, through which it may require public authorities and "statutory undertakers", such as utility companies, to produce a report on how their organisation is assessing the risks and opportunities from a changing climate and acting on them. The geographical scope of this report is England. Nevertheless, the Bill grants the same powers to the Welsh Assembly and provides that both Governments will work closely to issue joint requests for reports where this is appropriate. Moreover, UK government also has to report regularly to parliament on progress with statutory programme.

8.5. Measurable objectives and indicators

To produce effective evaluation, clear and precise objectives are required, related to meaningful, preferably, quantifiable indicators. Distinct objectives and indicators allow for a pragmatic, empirically-grounded approach to environmental management based on the collection of hard data on actual consequences of decisions. Quantifiable objectives and related indicators can inform subsequent rounds of decision-making "in a continuous information feedback loop that enables dynamic readjustment of policy and practice" (Karkkainen, 2002). Therefore, indicators play an increasingly important role in the global and European evolution of environmental politics and legislation (Barrett and Pascoe, 2003). For the challenges of climate adaptation, as well, indicators seem to be useful and necessary as yardstick of success or failure of different policies and measures. However, as these challenges are many and varied, it is difficult to develop specific, quantifiable indicators.

This is particularly true for the most meaningful type of indicators, the so called "outcome indicators". The most important measure of policy-performance is obviously its final outcome – its effectiveness in meeting the primary objective. Therefore, concrete outcome objectives and indicators are most meaningful and should be established whenever this is possible. Moreover, objectives and indicators directly linked to outcomes are a more appropriate for cautious regulation in accordance to the subsidiarity principle (CEC, 2001), leaving the choice of instruments to the relevant local and societal actors. The quality objectives set out by the EU in its endeavour to mitigate water and air pollution are examples for such an outcome oriented strategy. However, as other fields of EU environmental policy indicate, not every policy aim can be easily translated into quantifiable outcome indicators. The overall objectives of waste policy, for example, cannot be quantified in an abstract, aggregated manner but have to be made operational on a case-by-case basis considering the specific risks of every different sort of waste and every individual management option.

It is not easy, or might not even be desirable to formulate a general climate change adaptation outcome indicator. Rather, every adaptation policy has to be looked at separately in order to see whether meaningful and sensible (sectoral) output indicators can be identified or developed. Considering the complexity and the regional dissimilarity of adaptation activities it is easy to understand that the search for indicators is a very demanding quest. This is, for example, indicated by the bulky research report that the Potsdam Institute for Climate Impact Research (Zebisch et al., 2005) has conducted on vulnerability and adaptation in Germany. In this report, neither vulnerability nor the degree of preparedness could be

measured by quantitative indicators. Instead, the PIK has widely resorted to the highly subjective appraisals of regional authorities and experts, expressly admitting that this is a highly subjective measure.

Therefore, it is not surprising, that in the current NAS there are practically no quantified targets to be found yet, nor are there meaningful indicators suitable to measure the degree of adaptation and vulnerability. Within the array of the NAS analysed in this report it is only the English and the Finnish strategies that acknowledge the need to develop quantitative indicators. In the Finnish NAS It is proposed that some of the indicators which have been developed in Finland for measuring sustainable development as part of Finland's National Strategy for Sustainable Development (Prime Minister's Office, 2006) could be used as a basis for measuring the success of the implementation of the NAS, in addition to new indicators developed for measuring adaptation only. Some examples of the proposed indicators include: food self-sufficiency; use of pesticides, increment of growing stock and total drainage in forests, tree species composition, availability of real-time hydrological information or length of the ice breaking assistance season. However, a recent Government Strategy Report (Prime Minister's Office, 2008), suggests to begin with a smaller set of adaptation indicators. These include: progress made in observation and warning systems as well as research and development, adaptation plans made in various sectors and progress of the first measures taken, and realised flood damage in communities. These indicators will be monitored during the middle and at the end of the ongoing government period, the first monitoring taking place in early 2009. Obviously research for functional adaptation indicators is still at its outset. Initial considerations gathered on a recent EEA workshop suggest that progress could be made in this regard if furthered by the national NAS processes and if, at first, the quest would be concentrated on the determination of "process indicators". Process indicators define and possibly quantify those factual and behavioural changes that – for the time being – appear as necessary steps towards the ultimate adaptation target. In the course of the EEA workshop a set of rather rudimental process indicators has been considered:

- Are climate change scenarios available?
- Is there a vulnerability assessment available?
- Is disaster planning in place?
- Have cross cutting issues been identified
- Is there stakeholder engagement?
- Is there local guidance on adaptation?

These indicator questions refer to basic general approaches to adaptation and do not tell much about specific sectoral measures. However, if the quest for

indicators would be actively promoted, concrete and meaningful sector specific process indicators could certainly be identified. Both general and concrete process indicators just like outcome indicators should have the character of and refer to an intermediary aim, leaving the choice of measures up to the actors. Only if quantified aims cannot be determined can it be necessary and useful to refer to a set of specific measures (e.g. specific restrictions of water and land use) that are considered indispensable means to achieving the desired degree of adaptation. Moreover, such output indicators can refer to adaptive capacities and institutional preconditions of successful adaptation like the existence of a national coordination entity, the adoption of a national implementation programme, a national adaptation funding programme etc. Eventually, any output-oriented evaluation would have to be enabled by effective reporting obligations (see 6.4 above). Whether or not the ultimate aims of adaptation will be actually fulfilled has to be evaluated by a second step of qualitative evaluation.

8.6. Planning instruments

As mentioned above, adapting to climate change is not only a national, but also a sectoral, regional and local task and, thus, it ought to largely be left to local, regional and sectoral actors to identify their specific adaptation needs and obstacles and to tailor an adequate programme of measures. The main role of central government would be to ensure that the various actors will commit to their specific adaptation targets, that conflicts between actors are solved and that they actually define and implement effective measures. The regular institutional way to provide for this is by planning obligations and planning instruments. Only if regional and sectoral players are obliged to account for their approaches within a formal plan will it be possible to identify shortcomings and non-compliance at the outset. Only if the measures which will be taken and when they will be taken are stated in a plan, can effectiveness and compliance can be continuously controlled. Moreover, planning instruments – if well designed – offer a suitable means to provide for:

- an effective assessment of all relevant developments;
- a sufficient involvement of stakeholders;
- the determination of specific regional and sectoral adaptation aims (and possibly indicators);
- the development of a duly coordinated, coherent set of policies and measures;
- a review mechanism (with time frame) comprising;
- a formal basis for regular reporting to the higher governmental levels and;
- a formal framework for continuous monitoring.

As argued in chapter 7, planning instruments offer a strong means of policy integration on all levels of adaptation policy, as well. Given all these advantages, it would be best to use existing or new planning instruments to enable effective activation, information, participation, coordination, review and enforcement of adaptation policies and measures. Primarily, existing planning tools with strong relevance for adaptation needs (e.g., spatial planning, urban planning, river basin management and action planning, flood-prevention planning) would have to be reviewed as to whether adaptation is needed and related assessment, planning and revision tasks could be incorporated. In Chapter 7, we discussed Strategic Environmental Assessments, Environmental Impact Assessments and building codes as means to incorporate climate concerns in the planning of investment decisions. Moreover, it should be possible to establish a special adaptation planning scheme as a means of activating, informing, coordinating and evaluating sectoral policies, planning and measures.

In the existing NAS spatial planning is considered to be an essential lever of adaptation policy and most of the NAS included in the survey do refer to spatial and sectoral plans as levers of adaptation. As an example the Dutch NAS can be cited according to which ”spatial plans will be checked if climate change has been included and if the plan is climate proof”. However, the references made to planning instruments widely remains very generic and vague. None of the NAS contains any specific suggestion as to whether and how planning instruments could be actively used and converted into effective tools for development, integration, evaluation and revision of adaptation policies and measures. The specific potential of planning tools is, therefore, not yet addressed by the first generation of NAS; evidently, this is left to subsequent stages of implementation.

8.7. Fostering compliance

Most of the existing NAS emphasise that adaptation would be primarily a societal process that has to be driven by the various societal actors and does necessarily have to be legally enforced by government. For that reason, it is widely argued that the central government’s role should essentially be confined to auxiliary action like coordination, cooperation and financial and organisational support. At the same time, however, many measures of timely adaptation may not be taken voluntarily by the responsible stakeholders. As has been pointed out above (chapter 7 sec. 1) voluntary action is often hindered by the fact that those who are responsible to act are not (fully) identical with those who have to bear the negative consequences of inaction. As an example, it is very unlikely that residents of an upper river course will voluntarily clear retention areas in order to

prevent floods in lower areas. Likewise, it is unlikely that industries and farmers will voluntarily reduce their emissions into ground and surface water in order to mitigate the increasing concentrations of pollutants in times of drought. Moreover, timely action can be hampered if responsible actors prioritise short-term private interests over long-term public interests and are, thus, not taking into account the costs of non-adaptation. An example is the privatisation of the (internationally interconnected) energy and telecommunication networks in many countries, of which the implications for climate change vulnerability are as yet unknown. In all these cases, compliance instruments are needed to internalize the external effects of non-adaptation and/or to provide for fair compensations between the payers and the profiteers of adaptation action. The level to which the preferred instruments are binding depends on the political culture of the various countries.

Besides, legal obligations – just like process indicators – can serve as functional benchmarks for subsequent monitoring, review and compliance efforts. As stated above, such process benchmarks are particularly needed where outcome-objectives and indicators cannot easily be determined. The need for regulatory instruments is even acknowledged by those NAS that promote a subsidiary approach to national adaptation policies and measures. The French NAS, for example – while strongly emphasizing the auxiliary role of government by its recommendation No. 19 (Axe 7 – Favoriser les approches volontaires) – states in No. 17 and 18 that all relevant environmental and planning laws have to be better enforced and reviewed in view of increasing climatic stresses. These recommendations clearly imply that legal instruments are considered important means of an effective adaptation policy. The same holds true for most of the other national adaptation strategies and policies. Within the German process of developing a NAS – for example – several research projects regarding legal approaches to climate adaptation have recently been awarded.

However, concrete suggestions as to how legal instruments should be used and amended in order to further adaptation are hardly mentioned in any of the NAS. Concrete legal action is – again – basically assigned to the subsequent political process.

8.8. Compensation and support

As mentioned above, compensation – and governmental support – can be (another) suitable means to realise timely adaptation in cases in which "external effects" are to be prevented. In as much as external effects on other individuals/ settlements are at stake (see flood-protection example above) compensation rules can sometimes provide an appropriate tool to balance competing interests

according to the “cheapest cost avoider” principle in a way that measures will be taken by those who are able to achieve adequate adaptation with least effort. The Netherlands already contributes financially to water storage investments in Germany because this would be cheaper than taking measures in The Netherlands itself. If collective goods like – in particular – the environment are to be protected the community may decide to bear (a part of) the costs.

In both regards, one could expect a national strategy to give some strategic guidance and to state, at least, some basic principles and priorities regarding the allocation of adaptation costs. However, none of the existing NAS comprises a comprehensive concept of cost allocation and public support as yet. Considerations about reserving and allocating funds to adaptation actions are as yet very fragmentary. France, for example, incrementally refers to some fiscal instigations and tax exemptions to encourage adaptation in housing and to some already existing civil protection funds (CatNat – catastrophes naturelles) dedicated to support people who accept to leave houses and move out of vulnerable areas in terms of flooding.

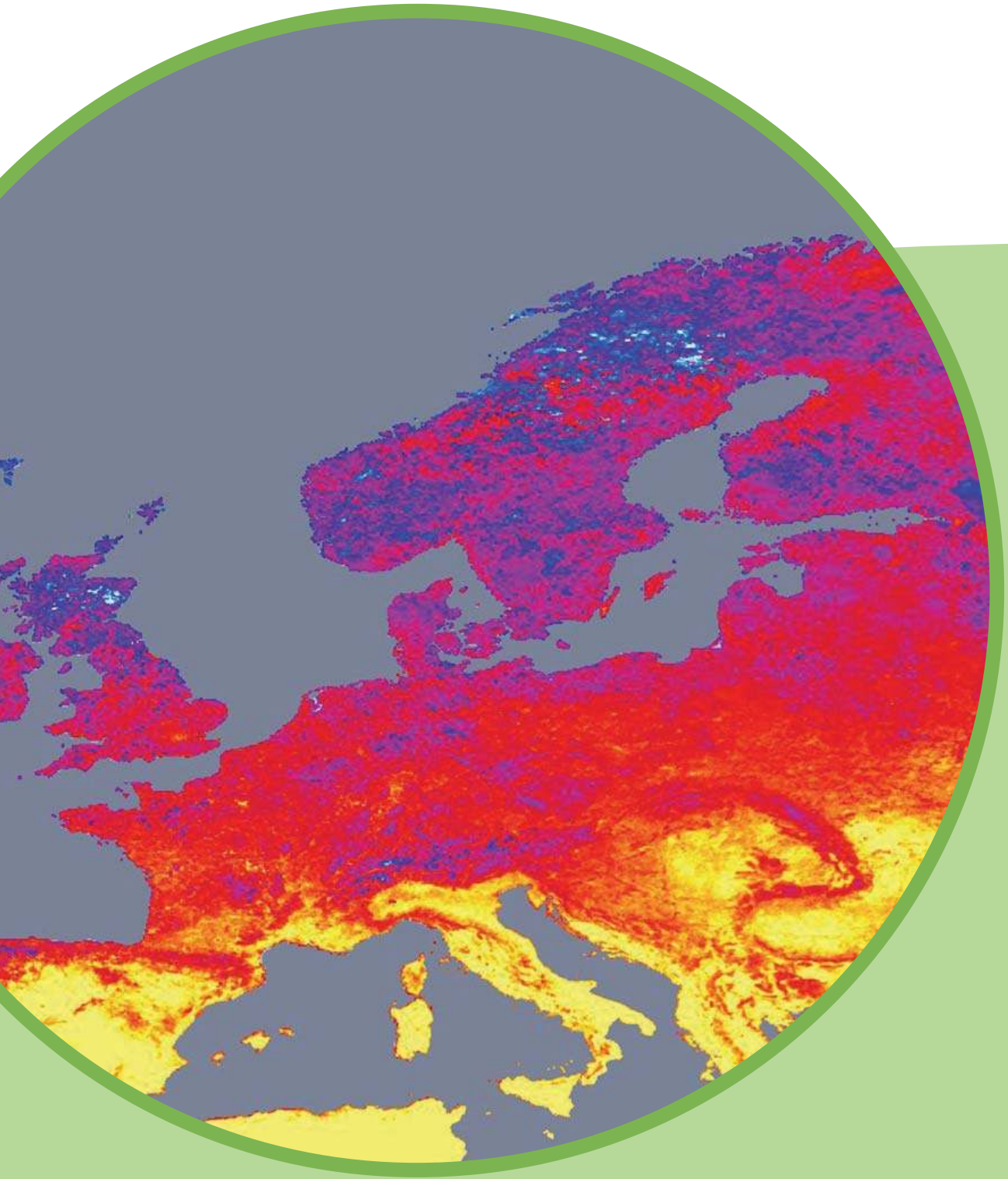
8.9. Conclusions and outlook

To date there are many uncertainties about the way climate will change in Europe, about how these changes will affect people and about the best ways to adapt. Therefore, it appears wise to design adaptation strategies as concepts of political learning and controlled approach (adaptive management). Instruments of monitoring, evaluation and review would, thus, have to play a role in the strategies. Surprisingly, however, this is not yet the case with the current generation of NAS. Evaluation and revision is – with the exception of the Finnish and British NAS – left to the subsequent political processes. None of the NAS makes concrete use of planning instruments as institutional catalysts for an iterative, stepwise response to long-term challenges. None of the NAS yet includes distinct adaptation aims and/or indicators that could serve as preliminary measure and benchmark for a regular review process. The quest for meaningful indicators is not actively promoted by the vast majority of the NAS of the member states. The EEA has started a debate about this at the European level.

The existing NAS are often political consensus documents that mark the first step in a longer process. The fact that they do not always include clear directions for the next steps towards a continuous policy framework appears to be one of the most serious weaknesses of this ”first generation” of NAS and should be seen as a major challenge to the follow up process. For climate change mitigation various types of policy instruments have been studied and experimented with

already for a decade or more, including regulatory and economic instruments, communication and voluntary agreements. For adaptation, both research and policy development is as still in the early stages of the search for effective implementation instruments.

Whether the EU should get involved in terms of evaluation and compliance and develop uniform monitoring, reporting, planning and revision schemes remains to be discussed. The Union has done so in many other fields of environmental protection like e.g. water quality and air quality management, noise protection, waste management, marine protection, nature protection. Climate change impacts and adaptation successes will probably even be detected and included by these sectoral planning, monitoring and evaluation patterns. As the adaptation challenge comprises so many different impacts and fields of action, however, it appears questionable whether it should not as well be tackled by a new cross-cutting EU-evaluation scheme.



9. Main policy findings and recommendations for further work

9.1. Introduction

This report presents a comparative analysis of national adaptation strategies in Europe. The main objectives were to identify policy-relevant findings and formulate recommendations for further research. At the time of writing of this report, the development of national adaptation strategies and of adaptation research underpinning those strategies was accelerating rapidly. In 2004, only Finland had a national strategy, in 2008, six countries have or are about to adopt one, while a similar number is expected to follow suit in the next one to two years. In such a dynamic situation with many uncertainties, countries are very interested in learning about discussions relating to this issue in neighbouring countries. The scientific knowledge base about potential impacts, vulnerability and adaptation options at relevant spatial scales are shallow in most countries.

This report discusses pertinent development in adaptation policy and supporting research in a selected number of European countries. Although the most advanced countries are included, the report does not attempt to be comprehensive. Countries with no or few adaptation activities have not been included. Hungary, which has a formal Strategy, was not included because of the authors' language limitations and time constraints. In all countries, adaptation policy development takes place at the junction of "top-down" activities from the national government and "bottom-up" activities at the local level and in vulnerable economic sectors (see Figure 1.2). Municipalities and sectors which are particularly vulnerable had often already started reducing their vulnerability well before national strategies were being developed. In those cases, the national strategy provides a framework for such activities, and an incentive to further implement and harmonise adaptation actions. In this project, we focused

on national policy development, and only took into account local and sectoral adaptation as far as they were identified in the inventory of National Strategies and useful for illustrating the overall arguments. In the initial stages of the project, while analysing and discussing developments in various countries, it became increasingly evident that the main obstacle to developing effective adaptation strategies may not be a lack of ideas about technical adaptation options, but rather the institutional problems of evaluating, prioritising and implementing a broad menu of adaptation measures.

These factors are the reason why we structured the project in terms of a number of crosscutting dimensions of adaptation rather than taking a sectoral approach. From the analysis of common elements in the National Strategies as well as insights as to what such strategies should cover, we derived six crosscutting themes: (a) motivating factors of adaptation policies, (b) scientific underpinning of climate change adaptation policies ("science-policy nexus"), (c) communication and awareness raising, (d) multilevel governance, (e) policy integration, and (f) review and evaluation. In follow-up projects, we hope that our findings can be elaborated and analysed in more detail for selected vulnerable sectors and locations.

9.2. Key policy findings

Necessarily, findings in the form of policy recommendations would be premature, not only because most countries are only in the early stages of adaptation policy developments and examples of concrete policies are rare, but also because what works in a particular context in one country is not necessarily effective in another context in another country. While (in Table 9.1) we do present results in terms of relative differences between countries, we acknowledge that such a comparison should be interpreted with caution and do not rank countries for that reason, because of the limited comparability of national situations, such as different adaptation policy priorities, different available resources and different political cultures. Nevertheless, based on the experiences in some frontrunner countries, and the scientific and policy discourse that has usually accompanied adaptation policy development in those countries, some preliminary conclusions can be drawn for the themes that we have focused on. These findings could be useful for adaptation policymakers in individual countries, but also suggest opportunities for collaborative actions between countries at the European level. In several cases, we note similarities between actions proposed in national adaptation strategies: this does not imply that these actions may indeed be effective and efficient if and when implemented.

A. Motivating and facilitating factors

We found a broad set of drivers, the balance of which determines the pace and focus of adaptation policy development. They include international UNFCCC negotiations, EU adaptation policies, experiences of national and international weather related disasters, experiences of other countries in developing their adaptation strategies, growing awareness of the economic costs of inaction in relation to climate change, NGO-advocacy, interests of the private sector, role of media in addressing climate change, national and international research on climate change impacts, vulnerability and adaptation, and in some cases recognising opportunities related to climate change. While these drivers determine if and when adaptation enters the political agenda, a number of other facilitating factors explain the speed and shape of the further development of adaptation policies. These include availability of sufficient knowledge on vulnerabilities and adaptation, compatibility with other policies (no major conflicting interests), good existing connections and cooperation between different ministries and governmental sectors, active people with enough expertise taking a lead, political will, agreed importance of the issue, availability of sufficient human and other resources, and suitable timing (linking NAS development with other policy initiatives).

A variety of factors determine how adaptation is framed in different countries. This includes characterization of future developments (e.g, scenarios), the prioritization of vulnerable sectors, perceived opportunities, the global dimension and the overarching paradigm. In terms of assessing future developments and vulnerabilities, NAS developers use what is provided by the scientific community rather than using tailored information. Some countries address all sectors comprehensively, others focus on the most vulnerable sectors. In a limited number of countries, opportunities and potential benefits provided by climate change play an important role in framing the problem. Finally, also in just a few countries the global context is taken into account in the NAS., both in terms of supporting developing countries as well as in terms of recognizing the potential impacts from climate impacts elsewhere on the country, e.g. through trade, security threats, and migration. Finally, different paradigms, or risk philosophies often implicitly underlie the national strategies. This leads to different emphasis on solutions like bearing losses, preventing effects, sharing responsibility or exploiting opportunities. Box 9.1 summarises some policy-relevant findings.

Box 9.1 Policy-relevant findings with respect to motivating and facilitating factors of adaptation policy development

- *Involvement of a broad range of stakeholders benefits the NAS development process by offering views on the different adaptation needs and stimulating commitment and coordination between stakeholders.*
- *Addressing both adverse impacts and potential opportunities related to climate change can be useful from the point of view of developing efficient adaptation policies (turning a threat into an opportunity).*
- *Countries use information that is currently available on future impacts and vulnerability, which is usually not harmonised across countries and not yet necessarily tailored to specific national needs.*
- *Climate change impacts elsewhere in the world may have important implications for European countries and could receive more attention in future NAS development.*
- *Different countries have different overarching paradigms, or risk philosophies, that are implicit in NAS, but influence the menu of preferred adaptation options.*
- *More information on the economic costs of adaptation and inaction is needed to further develop adaptation policies.*

B. Science-policy nexus

All countries depend on scientific information to underpin their adaptation strategies, often provided through advisory commissions. Most countries have performed at least a partial assessment of the vulnerability of sectors and regions within the country. Some countries have small or large designated research programmes, others, usually those with less resources, rely more on international research and assessments, or efforts in frontrunner countries. In general, research programmes have evolved over time. From the 1980s to the mid 90s, research programmes primarily aimed at answering the questions: is the climate really changing, and if so, to what extent do human activities contribute to that change? From the 90s, additional research addressed national impacts and costs and benefits of mitigation. Only well after the turn of the century were potential impacts at the local level and costs and benefits of adaptation added to the research agenda in some countries. The scope of climate change research evolved from being mainly curiosity-driven and dominated by the natural sciences to encompass an emerging complementary kind of applied, demand-driven

Box 9.2 Policy-relevant findings with respect to adaptation science-policy interactions

- *The recently accelerated adaptation policy development in Europe requires a major research effort to timely provide a sound and policy-relevant knowledge base.*
- *Frequent opportunities for countries to exchange experiences on science-policy interactions on climate change impacts, vulnerability and adaptation would be welcome, including collaborative projects, periodic conferences, and new or strengthened European expert networks.*
- *National climate change adaptation research programmes appear to have many generic elements in common. Therefore, enhanced coordination between national programmes, and between national and European research programmes, can strengthen the scope and quality of the research, facilitate international usage of research results (databases, models, scenario results), and increase the efficiency of scarce research funds.*
- *Relevant experience already exists in many countries in sectors that have dealt with climate extremes even before climate change was an issue (heat waves in France, floods in Hungary, coastal protection in the Netherlands). Such countries can take an active role in disseminating knowledge to other countries.*
- *In none of the countries are systematic methods used to better understand, manage and communicate uncertainties in the area of climate change impacts, vulnerability and adaptation. While different countries may prefer different approaches, international comparability would be useful.*
- *Some networks or institutions already exist in Europe to strengthen the communication and coordination between research programmes (PEER, ERA-networks such as CIRCLE). These may be strengthened, e.g. in a closer collaboration with the EEA.*

science on adaptation, with a greater role for the social sciences. The extent to which the emphasis of research programming is changing varies between countries. The relatively late and slow development of targeted adaptation research may be out of phase with the accelerating pace of development and implementation of adaptation policies.

Along with this process, new or existing institutions played a role at the boundary between science and policy. In some countries these organisations are closer to the science community, in others closer to the policy process. They

include specific agencies for knowledge transfer, advisory bodies, research coordination institutions, and organisations responsible for the drafting of the NAS on the basis of scientific information. This evolution is not without hurdles, both in terms of timing of results outcomes and policy developments, and in terms of substantial focus. Because of the dynamic nature of the adaptation policy development, flexible arrangements are important.

C. Communication and awareness raising

Practically all national adaptation strategies acknowledge that successful adaptation requires communication of information about climate change vulnerability, impacts and adaptation to vulnerable stakeholders (municipalities, companies, individual citizens), but only a few have already elaborated or implemented concrete plans on how to do this. In many countries, similar government units as have been working on mitigation in the past are spearheading communication initiatives on adaptation. While much can be learned from mitigation communication campaigns, the differences between adaptation and mitigation have to be taken seriously, since the main actors and the characteristics of the problem are often quite different. Initial steps in most countries are usually taken by providing information through web-based systems, since this is relatively easy to do, can reach many people with few resources, and allows for interaction between the users and senders of the information. The current parallel development of communication strategies in different countries suggests a risk of re-inventing the wheel where some countries are more advanced than others. The local nature of adaptation suggests that even if some basic information and methods can be common, different countries may require different methods, tools and contents of the information. This leads to the findings in Box 9.3.

D. Multilevel governance

Adaptation is mostly taking place at the local scale, but the effectiveness of action at this level depends on enabling circumstances at higher administrative and spatial levels. Success depends on collaboration between a variety of stakeholders, including governments, the private sector, and public interest groups. Adaptation at one level can have spill-over effects at another level. In some cases it may be more effective and efficient to implement adaptation action elsewhere (e.g. in higher parts of river basins to avoid flooding of lower areas). As illustrated in Figure 2.1, adaptation takes place at the interface between top-down and bottom-up activities. In many countries, a patchwork of local and regional initiatives is already taking place, which would benefit from some level of integration and harmonization at the national level through the development and

Box 9.3 Policy-relevant findings with respect to adaptation communication and awareness raising

- *Stakeholders: Awareness raising and communication in the area of climate change has so far almost exclusively focused on climate change mitigation. New methods and practice-oriented information are required about what stakeholders (sectoral and regional institutions, municipalities, companies, individuals) can do about climate change adaptation. Innovative approaches taking into account information sharing between local and sectoral actors could be explored (e.g., Wiki-type environments).*
- *Contents: In developing integrated communication activities on climate change, mitigation and adaptation should be clearly distinguished (e.g. between carbon-neutral and climate-proof). Learning from experience in communicating information about climate change mitigation is important, but methods and data provided have to be adapted to the specific needs related to adaptation.*
- *Practical tools: Practical tools and methods are required to evaluate climate vulnerability of plans. In addition to informing stakeholders about the risks, tools should be provided to assist vulnerable groups or areas to assess their vulnerability and the effectiveness of possible measures to reduce it.*
- *International exchange: It would be useful to share experiences with awareness campaigns and communicating uncertainties between countries. Options to use each other's materials or develop materials at the European level could be explored.*
- *Inconsistencies: Awareness raising and information campaigns of different institutions can have overlaps and inconsistencies, leading to confusion and lack of action. In many countries, different government departments at different institutional levels, academic and meteorological institutions, non-governmental groups and specialised organisations can disseminate information about climate change. All these groups have something to contribute, but coordination to avoid inconsistencies is required.*

implementation of a National Adaptation Strategy. Most Strategies acknowledge this need, but this has not yet resulted in clearly defined responsibilities or coordinating mechanisms. The matching of activities at different levels is not without hurdles. EU member states have very different characteristics in terms of mechanisms that are put in place to enhance communication and coordination between the different levels of government, and the effectiveness of this communication and coordination also varies. For countries with regions with high

Box 9.4 Policy-relevant findings with respect to multilevel governance issues related to adaptation

- *In many countries "bottom-up" adaptation action started even before a national strategy was developed as an umbrella. The level of incorporation of these initiatives into a national framework varies between countries. Some NAS refer only generally to the local level, others include detailed inventories of ongoing activities and refer to planning instruments and funding schemes as possible means to enhance such local activities.*
- *To strengthen communication and coordination between different levels, to choose the most appropriate level to take action, and to address conflicting interests (between regions, sectors), the responsibility and authority of each stakeholder should be clear and not overlapping, possibly to be specified in the National Adaptation Strategy.*
- *A number of countries are currently developing mechanisms to coordinate between multiple government levels and actors, sometimes comprehensively addressing adaptation, sometimes taking a sectoral approach.*
- *There are many barriers to adequate development, implementation and integration of adaptation policies, including lack of communication, transparency and coordination between administrative levels, unclear authority and responsibilities, and resource constraints. A systematic analysis of options to overcome these barriers is still to be done.*
- *Exchange of information between organisations at one level is important to enhance adaptation action, e.g. exchange of best practices between provinces, regions, or municipalities.*

autonomy this is particularly difficult. Few Strategies as yet address the potential role of EU adaptation policy or relevant EU sectoral legislation in adaptation. Even fewer include the potentially very significant implications of global developments.

E. Policy integration

Integrating climate change adaptation into sectoral policies is one of the main elements of all European adaptation strategies. Here, we can learn from earlier experiences with environmental policy integration. The effectiveness of environmental policy integration depends on the level of knowledge about climate change impacts and adaptation options, the capacity to adapt, incentives to adapt (e.g., self interest) and consensus about cooperative action. Five conditions can be distinguished for successful policy integration in general: political commitment

Box 9.5 Policy-relevant findings with respect to policy integration of climate change adaptation into sectoral policies

- *The first generation of national adaptation strategies legitimately focuses on knowledge, awareness, political commitment and strategic vision. It is often acknowledged that governmental steering of sector activities is needed but the strategies generally yet lack concrete (e.g., SMART) objectives, targets and measures.*
- *Hence, supplementary implementation programmes will be needed to take on the policy integration challenges, both in terms of establishing appropriate institutional processes and in terms of menus of adaptation options. However, only a few strategies yet include concrete commitments to the development of such implementation plans with planning and policy instruments (from strategy to "plan" or "agenda").*
- *Interdepartmental commissions led and supported by strong institutions have played a central role in the cross-sectoral development of the NAS and could function as a powerful policy integration catalyst in the implementation phase, when allowed to continue as a more stable mechanism.*
- *Most countries involve or plan to involve stakeholders in different phases of the development of the adaptation strategy. How and when to do this in an optimal fashion is yet uncertain.*
- *In most countries no organisational units or focal points have been assigned or established in sectors specifically to deal with climate concerns, although sometimes adaptation is already planned in highly vulnerable sectors, regions or municipalities. The NAS can integrate and harmonise such disperse activities.*
- *Climate resilience and adaptation assessment tools can be very useful to enhance policy integration, but are not yet available in most countries, with some exceptions, like the UK (UKCIP).*

and strategic vision, suitable administrative culture and practices, adequate policy development and adoption process, appropriate policy instruments, and systematic monitoring and learning. We analysed to what extent the current national adaptation strategies meet these criteria (see Box 9.5). We looked at (a) activation of actors and (b) coordination and coherence of sectoral policies. Although private actors play a key role in adaptation, government support or interventions are often needed to trigger and maintain adaptation processes.

These include an integrated structure to enable activation and coordination of all relevant governmental actors, and putting in place adequate instruments to activate and stimulate coordination between societal actors. There is a wide variety of views on what policy integration actually means and how it should be done. In a parallel PEER project this is explored in more detail.

F. Evaluation and review

As most current, "first generation" adaptation strategies are documents to stimulate a process towards developing more concrete plans and programmes, few pay any attention yet to later stages of the policy cycle, notably implementation and review. From general insights and other policy areas, we distinguish seven elements of an evaluation and review mechanism that would allow systematic implementation of adaptation policy over the longer term: the establishment of review mechanisms or institutions, monitoring programmes, reporting obligations, objectives and a set of targeted indicators, the development of flexible adaptation planning instruments, binding legal obligations to overcome lack of incentives, and compensation and support. Several of the current national adaptation strategies seem to have been developed as a "one-off" concept and defer serious discussions about review and evaluation to the later development of adaptation implementation plans and programmes. Box 9.6 provides some general findings in this area.

Box 9.6 Policy-relevant findings with respect to adaptation policy evaluation and review

The absence of attention to evaluation and review of adaptation policies suggests that most countries are yet to consider the introduction of supplemental implementation programmes that can serve as catalysts of progressive adaptation action. These programmes could include:

- *Mechanisms, institutions and criteria for regular evaluation and review of the effectiveness of adaptation policies.*
- *Monitoring and reporting routines.*
- *Clear objectives and indicators associated with concrete plans and commitments.*
- *Inclusion of climate concerns in existing spatial planning instruments or development of new ones (evaluation frameworks).*
- *Development and implementation of regulatory instruments where needed.*
- *Development and implementation of economic instruments, e.g. for compensation and funding.*

Strengths and weaknesses

Above we presented a number of "Europe-wide" insights with regards to national adaptation strategy development for the six themes that were addressed. Evidently, there are large differences between individual countries. Some countries are frontrunners, often from more than one point of view. Other countries could learn from the strengths of these frontrunners. In this section we give an overview of selected examples of strengths, weaknesses, opportunities and threats of the countries that we have analysed. With strengths we refer to characteristics of the countries or attributes of the NAS that contribute significantly to achieving the NAS objectives, i.e. making the country less vulnerable to climate change. In this vein, weaknesses are considered to be national characteristics and attributes of the NAS that do not significantly contribute to, or hinder, achieving its objectives. With opportunities we refer to current conditions or factors which can be built on to accelerate meeting the NAS objectives. Threats are current conditions or factors that can prevent or slow-down NAS success.

These examples are just some highlights as selected by the authors of this report. They should not be interpreted as value judgements about the quality of the national adaptation strategies, but rather as suggestions for readers about interesting aspects of such strategies. Countries can learn from strengths of other countries, they can reflect on weaknesses that their own or other countries may have, they can consider if they can also use opportunities identified in other countries, or they can consider if particular threats are also relevant for their own country.

Table 9.1 provides a very rough and tentative overview of the strong and weak points of the various countries with respect to the six themes of adaptation strategy development that we have distinguished, relative to each other. The fact that a few countries have embarked upon targeted adaptation research is regarded as a strength. Finland was the first country to adopt a national adaptation strategy and initiate a targeted adaptation research programme at the national level. The United Kingdom may not have been the first country with a national adaptation strategy, but, amongst other reasons, through the UK Climate Impacts Programme they have spearheaded activities in Europe to help stakeholders in assessing their vulnerability and developing adaptation action. A forward looking attitude taking into account implementation, legal issues and policy review is also considered to be a strength. The UK appears to be the first country to explore legal mechanisms to promote effective adaptation. A third strength is if countries seriously take up the challenge of integrating adaptation policy into sector policies and across administrative levels. The Netherlands is

Table 9.1 *Overview of the level of development in the six themes in the National Adaptation Strategies in 2008 in countries that have or are developing a National Strategy and are included in this report (based on subjective judgement by the authors on the basis of the reviewed documents and discussions with scientists and policymakers)*

	Drivers & facilitating factors	***Science-policy interface***	***Role of communi-cation***	***Multilevel governance***	***Integration with sectoral policies***	***Monitoring & review***
Denmark						
Finland						
France						
Germany						
Netherlands						
Spain						
UK						
Countries without a National Strategy as yet:						
Portugal						
Latvia						

Legend

	Broad national political support and commitment, broad stakeholder involvement	*Research programme for adaptation and well-organised interface*	*Implemented a communi-cation strategy, established info portals on adaptation*	*Explicit multi-level governance and coordi-nation for adaptation measures in place*	*Adaptation measures explicitly integrated in most sectoral policies*	*Explicit monitoring and review mechan-isms for strategy*
	Average national political support and commitment, some stakeholder involvement	*Some research on adaptation; interface partially organised*	*Communi-cation strategy exist, established info portals on climate change*	*Explicit multi-level governance and coordi-nation for adaptation measures planned*	*Adaptation measures only partially integrated in sectoral policies*	*Implicit monitoring and review mechan-isms for strategy*
	Limited national political support and commitment, only limited stakeholder involvement	*Interface not transpar-ent or non existent*	*No explicit communi-cation strategy, no info portals*	*Only implicit multi-level governance and coordi-nation for adaptation measures*	*Integration of adap-tation measures in sectoral policies is exception*	*No monitoring and review mechan-isms for strategy*

also amongst the forerunners, mainly through sectoral action related to water safety and integrating adaptation through spatial planning. The Netherlands has set up mechanisms to coordinate adaptation action across administrative levels, while in the UK mechanisms have been established to coordinate action within such levels. The three countries mentioned here appear to have moved furthest

beyond the stage of impact assessment and have or are setting up mechanisms to implement adaptation action. Other countries can build upon the experiences in such countries and define their own research strategies.

The table also highlights some common weaknesses. In most countries, but especially in countries with a high degree of regional autonomy like the UK and Spain, but also France, the assignment of clear and complementary cross-sectoral responsibilities to authorities at different administrative level is a key problem. In countries where sectoral adaptation can be relatively strong, coordination and integration between sectors can be weak, as, for example in France. In some countries the involvement of stakeholders, an important condition for effective policy integration is as yet organised weakly, even if they have the final responsibility to adapt to climate change.

Table 9.1 suggests that, in very general terms, most countries included have committed to address climate change impacts, to set up scientific support mechanisms and to develop communication programmes. They are less advanced in terms of putting the strategy into action by concretely integrating climate concerns into sector policies, by arranging for coordination between administrative levels, and by developing implementation instruments and review procedures. The strengths and weaknesses of countries give rise to a diverse number of opportunities that would allow countries to make significant advances in the near-term future to advance the development and implementation of adaptation action and become less vulnerable to the potential impacts of climate change. But there are also threats that may have a negative effect on the effective elaboration of adaptation strategies if not addressed adequately.

Opportunities and threats

Several opportunities relate to strengthening and exporting knowledge. Relatively advanced countries can export knowledge, possibly even commercially. Countries which are less advanced can learn from other countries, perhaps leapfrogging the early stages of knowledge development as well as learning from others' failures. The EU can play a key role in international knowledge transfer, as already highlighted in the Green Paper. A second type of opportunity can be linked to the lack of coordination both within and between administrative levels, a major problem in many countries not only for climate change adaptation. Climate change adaptation may serve as a lever to improve coordination also in a broader sense.

In several countries a variety of threats can be identified. Integration of adaptation into sector policies is a key condition for the success of many adaptation options, but can be hindered by lack of sectoral interest or involvement. A second threat is that a lack of coordination between sectors or administrative levels and

possibly conflicting views or priorities between different parts of government and stakeholders can reduce the effectiveness of adaptation action. Thirdly, lack of adequate financial resources is a major threat: none of the reviewed National Strategies has assessed the costs and benefits of adaptation in a comprehensive fashion nor do they commit resources or specify who will pay. A low public awareness may hinder implementation of adaptation measures. Finally, a very uncertain factor is to what extent climate change impacts elsewhere will affect the ability of EU member states to adapt. A few countries identify effects on issues like world trade in agricultural and forestry products, international security, and migration as an uncertain, but potentially significant threat.

Table 9.2 summarises some typical strengths, weakness, opportunities and threats for the current stage of adaptation policy development in EU countries. In the next section we address the question to what extent research may provide information that helps to exploit opportunities, mitigate threats, capitalize on strengths and address weaknesses.

Table 9.2 *Some generic strengths, weaknesses, opportunities and threats that are typical for several National Adaptation Strategies in EU countries*

	Contributing significantly to achieving the NAS objectives	***Hindering the achievement of the NAS objectives***
Related to historical conditions and institutional development of the NAS	• *targeted adaptation research* • *planning for implementation, review and funding* • *coordination between sectors and administrative levels* ***STRENGTHS***	• *lack of coordination between sectors* • *lack of stakeholder involvement* • *unclear responsibilities between administrative levels* • *lack of specialised knowledge* • *scientific uncertainties* ***WEAKNESSES***
Related to current and future conditions and developments external to the NAS	• *development and export of knowledge* • *spill-over of policy integration and multilevel governance for non-climate policies* ***OPPORTUNITIES***	• *cross-level conflicts* • *cross-sectoral conflicts* • *lack of resources* • *lack of public support* • *global impacts* ***THREATS***

9.3. Main knowledge gaps

The second objective of the report was to identify gaps in knowledge to support the development of an adaptation research agenda for the participating PEER partner institutes, where possible for the national research agendas in their countries, but also possibly even for the European research agenda. Specifically, the participation of Alterra in the project was supported financially by the Netherlands Knowledge for Climate programme to support research

programming, and the participation of SYKE was supported by the CIRCLE ERA-Net, a network of research funding agencies on climate impacts and adaptation, to support their transnational research coordination efforts. We identified gaps in knowledge partially through the NAS documentation itself and partially through the analysis of and discussions about the six crosscutting themes of the NAS in the project team.

In all countries many research questions have to do with the specific situation in the countries where adaptation action is to be developed at the local, regional or sectoral level. We did not focus on such questions, but made an attempt to identify more generic questions that appear to be relevant for more than one, if not most countries in Europe. We hope that this does not only lead to research recommendations at the level of the PEER-centres or the individual participating countries, but also offers opportunities to develop transnational research collaboration across Europe on issues of common interest. This is in line with the EC efforts to stimulate joint research programming in Europe in addition to the Framework Programmes (CEC, 2008). If several countries have a strong common interest in particular knowledge questions, joint or coordinated research projects would offer added value as compared to single-country research. Rather than trying to be exhaustive and present long shopping lists of research questions, we have tried to limit the questions to the ones that we judged to be the most relevant for the six themes. Our research recommendations may inform or complement the research agendas that are currently being developed in the EU member states.

A. Motivating factors

In different countries the balance of the drivers of national adaptation policy development is different. Usually, the start of the discussion about the development of national adaptation action is related to the performance of a systematic assessment of the vulnerabilities of the country. Above, we have discussed the various drivers. From a practical perspective, it is less relevant to understand what the drivers are than to understand how the process of development of a national adaptation agenda can be made more effective, and which information is needed and by when to support the process. In Box 9.7 we list some research questions that arise from the analysis of national adaptation strategies.

Box 9.7 Motivating factors: relevant research questions

- *Can we develop common methodologies to analyse how future impacts and vulnerability to climate change varies regionally at the sub-national scale across Europe, including ways to manage and communicate uncertainties?*
- *How can harmonised scenarios be developed that integrate climate change effects, vulnerability and impacts in order to address uncertainties in vulnerability to climate change impacts at different scales?*
- *There are limits to which societies and ecosystems will not be able to adapt. What are these limits and to what extent are they common across Europe to justify action at the European level to avoid exceeding such limits?*
- *Which methods are available to analyse the costs of inaction and the costs and benefits of adaptation options in a way that would allow for international comparability?*
- *How can systematic risk mapping be undertaken to survey potential future inundation due to inland and coastal flooding under a range of scenarios for informing spatial planning policy?*
- *How do different paradigms or risk philosophies influence the selection and design of adaptation options?*
- *How do climate change related developments (impacts, international agreements/legislation) in other parts of the world affect vulnerability of European countries, e.g. through trade effects, migration, and security concerns and how can this be taken into account when designing national adaptation policies?*
- *How do the main differences in adaptation priorities across Europe affect the need for and design of European adaptation policies across sectors?*

B. Science-policy nexus

As discussed under the ”motivating factors” section of this report, scientific information is one of the important drivers of national adaptation strategy development. Some countries which have more resources than others, rely to a significant degree on own research, while others have to base their activities on results of international research. In practically all countries that we have considered, the intent is to develop adaptation policies interactively between government, societal stakeholders and the scientific community. This is in line with considering climate change as a ”wicked” or “unstructured” problem. Over the last decades, interdisciplinary climate change research has increasingly complemented disciplinary efforts. This happened still predominantly in a

Box 9.8 Science-policy interactions: relevant research questions

- *How can climate change impacts, vulnerability and adaptation research (which is mostly still oriented towards understanding potential climate impacts) be developed or redirected to match current climate adaptation policy-questions (which are often action-oriented)?*
- *Which types of knowledge can best be generated locally or nationally, and which types of knowledge should preferably be developed at the transnational or European level?*
- *What are the advantages and disadvantages of special boundary organisations as compared to commissioning existing academic and/or policy institutions to play the interface role? Do their roles in the different phases of adaptation policy development and implementation change?*
- *How can science-policy interactions best be organised, both horizontally (science-government-private sector-social groups) and vertically (from European to national to local knowledge exchange)?*
- *How can intensive science-policy interactions be made more rewarding for both scientists (who are traditionally primarily judged by their – disciplinary – publications) and policymakers (who are judged by their contributions to the political debate)?*

closed community, from which only a small group participated in policy-oriented assessments and communication with policymakers. For effective adaptation research, the scientific community has to open up further to society. This is necessarily a slow learning process. How to accelerate this process and make it more effective leads to a number of questions, the most important ones of which we identified are listed in Box 9.8. Note that these do not include the many important subject-specific questions.

C. Communication and awareness raising

Most adaptation strategies in the EU member states include plans for communication of information about climate change, impacts and response options to societal stakeholders. Very few have yet been developed and put into practice. Generally the role of the government in adapting to climate change is limited in the sense that adaptation action is taking place at the local scale by municipalities, companies and communities and individual citizens. This means that communication and awareness raising are important, and that information

Box 9.9 Communication and awareness raising: relevant research questions

- *Who receives: Should communication about climate change adaptation be designed differently from mitigation and if so, how? Mitigation is mainly aimed at citizens and companies (individual level), while adaptation is aimed at local governments or economic sectors (collective level).*
- *Who sends: Who should be involved in communication about climate change adaptation with society and in which way (academic institutions, government departments, meteorological offices, consultants, NGOs)? Should communication be centrally coordinated or is it better to have regional or sectoral interest groups play the key role? What is the appropriate role of the European Commission complementing and supporting communication at the national level?*
- *What: Which kind of information is required at which stage (about risks, about costs and benefits of adaptation options)? For stimulating mitigation action, generic risks of climate change are relevant, for adaptation, information about specific impacts is required. How can uncertainties about climate risks, vulnerabilities and adaptation options be best communicated?*
- *How: Which communication tools are most effective for communicating information about adaptation for different stakeholder groups (internet, media campaigns, participatory activities)?*

should be targeted to the needs of the vulnerable groups, in contrast to mitigation for which most of the options are similar for different groups. Most countries have some experience in communication and awareness raising about climate change problems and mitigation, which is often taken as a starting point for thinking about communication about adaptation. Box 9.9 provides some relevant research questions about the effectiveness of communication activities.

D. Multilevel governance

Issues related to the different responsibilities for climate change adaptation at different spatial levels and the coordination between the levels emerged as one of the major problems for effective development and implementation of adaptation action in several countries. As a consequence, it is also an area where research can help to address emerging questions. A general question that may be partly addressed by the upcoming White Paper is in which areas Europe-wide policies can facilitate adaptation action at the national and local level.

Box 9.10 Multilevel governance: relevant research questions

- *How could the European Commission facilitate enhance enabling circumstances for adaptation by local authorities?*
- *Could the European Commission help to devise standards or evaluation frameworks that allow for application in different member states with so many differences and needs?*
- *Which options are available to arrange for appropriate funding of adaptation at different spatial levels and as a consequence encourage adaptation action? What are the possibilities for joint public-private partnerships in financing adaptation?*
- *How can responsibilities of different actors at different levels be clearly assigned for effective adaptation action?*
- *Which mechanisms are available to increase transparency concerning information about adaptation action and responsibilities between the different scales?*
- *How to avoid or reduce the implementation of conflicting measures at different spatial scales?*

E. Policy integration

Integrating, or mainstreaming, climate change concerns into other sectoral policies is one of the main ways of developing adaptation action. Dependent on the status of those policies (existing, under development), different strategies are possible. As was established above, only a few examples exist where national adaptation strategies incorporate concrete proposals on how adaptation can effectively be addressed in sector policies. Lack of knowledge is one of the obstacles for adaptation policy integration. Box 9.11 provides some pertinent knowledge gaps that should be filled in order to optimize effectiveness of adaptation policy integration.

F. Implementation and review

For most European countries, national adaptation strategies are not yet available and sometimes being planned, while existing strategies are usually of a rather general nature, aiming at putting climate change on the agenda rather than including concrete policy plans. Therefore, as yet little thought has been given to the implementation and review of adaptation policies when they are put in place. This early stage of policy development implies that there is still room for

research to analyse which tools and mechanisms could be used for this purpose, learning from experiences in other areas but taking into account the specific characteristics of climate change adaptation.

Box 9.11 Policy integration: relevant research questions

- *Adaptation obstacles: to what degree is timely climate change adaptation hindered in vulnerable sectors by lack of awareness, capacity, and incentives?*
- *Inattentive sectors: which sectors lag behind in adaptation planning, why, and how can this be ameliorated?*
- *Policy coherence: what are relevant interferences between adaptation and other policies: mitigation, other environmental policies, non-environmental policies? How is development and implementation of adaptation influenced by policies in other areas and how can the timing and coordination be enhanced?*
- *National instruments: what are the pros and cons of different regulatory, economic and planning instruments for climate change adaptation?*
- *EU instruments: how could integration of adaptation into sectoral policies be advanced by EU instruments (integration of adaptation into EU policies and legal instruments)?*
- *Local planning and investment: how can spatial planning be used as an appropriate means to prompt integrative local climate change adaptation at local and regional level, and how can the emerging patchwork of local actions be coordinated and harmonised at the national level?*

Box 9.12 Implementation and review: relevant research questions

Monitoring and reporting system:

- *What are the pros and cons of different national systems versus a system that is harmonised or at least coherent at the European level?*
- *How can monitoring and reporting systems be based on existing reporting systems or are new and additional reporting systems required?*
- *How can the responsibilities and coordination of monitoring systems be organised?*

Indicators:

- *Which combination of process and outcome indicators would be suitable for evaluation and review of progress of adaptation policies?*

Policy instruments:

- *Which evaluation frameworks are possible for evaluation of the climate-resistance of plans and programmes?*
- *How can climate factors be incorporated into existing planning instruments such as SEAs, building codes, and other instruments?*
- *Would a formal national and/or regional adaptation plan, possibly initiated by European law, be a necessary and helpful tool for encouraging development and implementation of adaptation action?*
- *Which regulatory, economic or other instruments can be developed to support implementation of adaptation policy?*
- *Should implementation and review instruments be developed and applied in an integrated national manner, or separately for different sectors?*

9.4. Follow-up work

Because of the fact that in this project we focused on a comparative analysis of national adaptation strategies (the ”top-down” perspective), the above gaps in knowledge are formulated at the national, generic level. Further work is needed at the level of local, regional and sectoral adaptation to be able to identify more specific research questions addressing particular vulnerable sectors or localities. Some countries have formally adopted national adaptation strategies, others are in the process of doing so, but almost none of the countries are already implementing adaptation strategies comprehensively across all vulnerable sectors and relevant geographic and administrative levels. Only a small number

of countries are as yet developing research programmes specifically focusing on climate change adaptation. As a consequence, the policy and research landscape will continue to change very rapidly in the next few years, and the associated research questions will evolve accordingly. Therefore, the current comparative analysis can be regarded as a first step in a process. There is a need for follow-up work looking in more detail at the knowledge gaps in particular research areas (regional, sectoral).

Box 9.13 Recommendations for follow-up comparative analysis

- *Sectoral cases. Perform a comparative analysis of sectoral adaptation strategies and associated research agendas in different countries with similar vulnerabilities, e.g. drought and flood management, coastal zone management, nature protection, urban areas, tourism.*
- *Regional hotspots. Perform a comparative analysis of cross-sectoral integration of adaptation measures in vulnerable areas, e.g. boreal, Mediterranean, Baltic, or floodplain areas in Europe (European climate change "hotspots")*
- *Good practice. From such a comparison, develop examples of good practice across Europe, taking into account the appropriate context which determines the potential for transferring experiences to other situations.*
- *Assessment methods. Enhance the collaboration and coordination between the EU member states and with EU institutions (e.g., EEA) in the area of development of tools and methods for assessing impacts, vulnerability and adaptation options, such as methods for costs-benefits and cost-effectiveness analysis, downscaling climate model results, stakeholder involvement methods.*
- *Research coordination. Enhance the research collaboration between EU member states, using existing mechanisms such as ERA-CIRCLE and PEER, but also explore the desirability of new mechanisms for research collaboration.*
- *Types of adaptation options. Development of inventories of adaptation measures/strategies to provide examples for different sectors of contrasting types of adaptation (sometimes mentioned explicitly in NASs), including anticipatory versus reactive adaptation; spontaneous versus planned adaptation, adaptation decisions based on monetary and non-monetary valuation approaches; "no/low regrets" and "win-win" adaptation; integrated approaches to adaptation and mitigation.*

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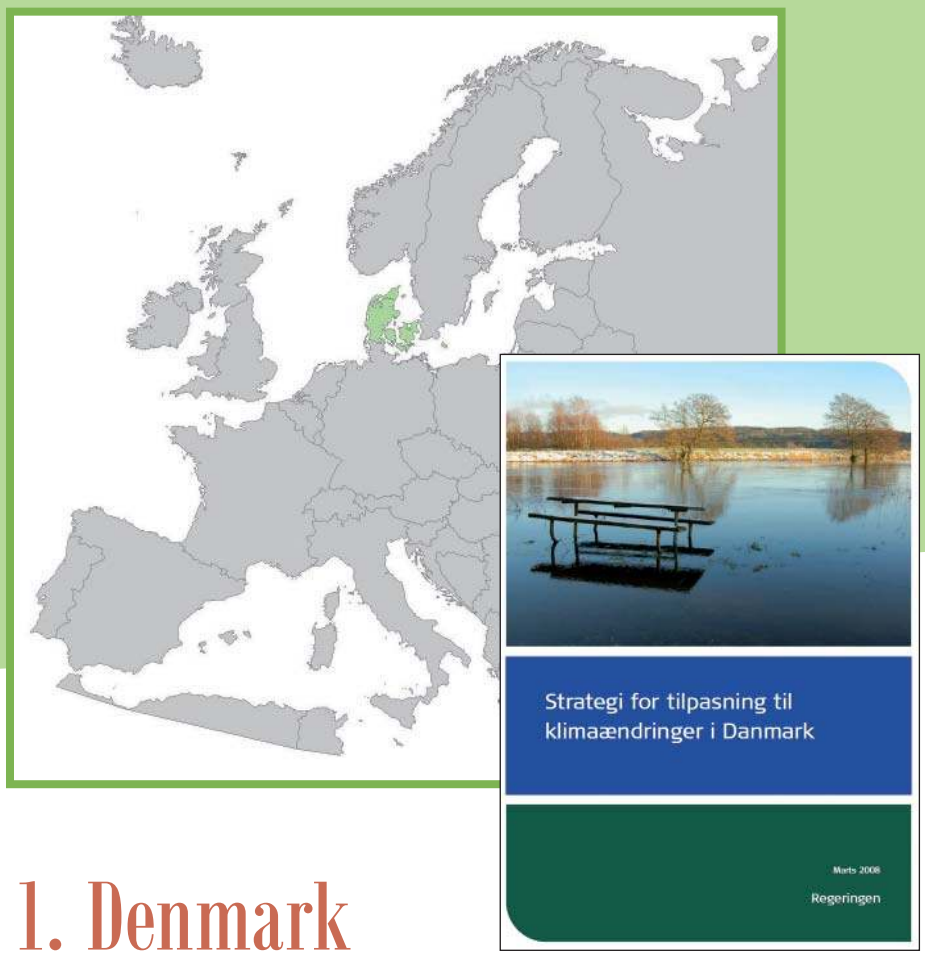
PART B

ANNEXES

Comparing National Adaptation Strategies in Europe



1. Denmark

1.1. The Danish national adaptation strategy

In March 2008, the Danish government introduced its 52-page *"Danish strategy for adaptation to a changing climate"* (Danish Energy Agency, 2008a, 2008b). The strategy focuses on what will be appropriate for implementation within the next 10 years.

With this strategy, the government emphasises the importance of timely adaptation to meet climate changes. The government stresses that it is important that, as far as possible, adaptation to climate change is autonomous, in the sense that the authorities, enterprises and individuals at their own initiative react to the impacts of climate change at an appropriate time in due time, within the given legislative, financial and technological framework. Furthermore, it underlines that where autonomous adaptation is not the best possible approach for society it may be necessary to launch adaptation measures that have been agreed centrally at a higher political level.

In this respect, the Danish government calls for the implementation of information initiatives and for the area to be organised with a view to ensuring that climate change is included in future planning and development steps, so that authorities, industry and individuals have the best possible foundation for considering whether or not to include adaptation. As cornerstones to this approach the strategy includes the following initiatives:

- Setting up a cross-ministerial Coordination forum on adaptation to 1) evaluate the progress in implementation of the strategy and report to the government; 2) monitor and share knowledge about climate adaptation as well as share experiences with climate adaptation between sectors, and authorities at all levels.
- Establishment of an information centre on adaptation under the Ministry of Climate and Energy to communicate the strategy, current knowledge and data of relevance for adaptation to society primarily through a climate adaptation web portal hosted by the information centre.
- Establishment of a Coordination unit for Research on Climate Change Adaptation to 1) promote cooperation and knowledge sharing among national and international research centres; 2) provide climate data and state-of-the-art climate research results of significance to the climate adaptation web portal.

The strategy outlines vulnerable sectors and highlights initiatives that have already been taken for ongoing adaptation and considers what might encourage this process. The sectors outlined are coastal management, buildings and infrastructure, water supply, energy supply, agriculture and forestry, fisheries, nature management, land use planning, health, rescue preparedness and insurance. The need for socio-economic modelling and the evaluation of measures is thematically emphasised across all sectors.

1.2. Drivers for climate adaptation policy

The development of the national adaptation strategy is led by the government. It was driven mainly by the "Ministry of the Environment". However, with effect from 2008, the activity was moved to the new "Ministry of Climate and Energy". The strategy was developed by an inter-ministerial working group led by the Ministry of the Environment. The adaptation work was initially inspired by adaptation work already under way in neighbouring countries (Garnak et al*., 2006*). The inter-ministerial working group prepared a catalogue assessing the impacts, vulnerabilities and adaptation options as basis for the subsequent development of a draft strategy for public consultation. The adaptation strategy is motivated by

the mounting evidence that climate change is a scientific fact (as documented by the IPCC's assessment reports). As a common denominator for the strategy, and to show the uncertainty range of expected future climate changes, three scenarios are introduced: The IPCC's A2 scenario (as a medium-high emission scenario) and the IPCC's B2 scenario (as a medium-low emission scenario). In addition, a third scenario is described, based on the EU's goal of limiting anthropogenic-induced climate change to less than 2 degrees Celsius compared to pre-industrial levels.

Main concerns highlighted by the strategy with regard to changing climatic conditions include increased precipitation (especially in winter), milder winters, warmer summers, sea-level rise, stronger winds and increased occurrences of extreme weather events. These changes are seen to have potentially disruptive effects on a number of societal sectors, i.e. coastal management, construction, energy supply, water supply, agriculture and forestry, fisheries, nature and nature management, planning, human health, emergency and rescue services, and insurance. Potential opportunities include increased agricultural production, new crops, a reduced need for heating and increased potential for wind-power generation.

1.3. Science-policy interactions

The Danish adaptation strategy stresses the need for better information about climate change and its consequences and suggests that a research strategy be developed to support this, building on the following five general areas of cross-cutting issues:

- Research providing basic background knowledge
- Research on the potential impacts of climate change
- Research on adaptation to climate change
- Research on the mitigation of anthropogenic climate change
- Research into robustness, uncertainty and synthesis

In recent years there has been increasing focus on the climate question and a number of Danish research centres have come into existence. New initiatives have been launched to enhance Danish climate research using various existing research programmes or research funds. By far the majority of previous research efforts have been aimed at understanding and describing the changed climate conditions, including possibilities for limiting climate change caused by human activity. There has been only a limited focus on the challenges linked to adapting to and preparing for future climate change.

It is recognised that there is a need to increase the focus on the question of how we should adapt. Adapting to climate change must be made an integral part of the remaining research agenda in order to secure a more coherent climate research output. A number of strategic research programmes touch upon issues relevant to climate change adaptation. Thus the Danish council for strategic research hosts dedicated programmes on the marine environment (20 mio. DKK), environmental technology (31 mio. DKK), and water as a resource (52 mio. DKK), and a food research programme (32 mio. DKK) run by the Ministry of Food, Agriculture and Fisheries focuses on climate change adaptation in agriculture. Furthermore, the parliament has taken the initiative in strengthening strategically important research areas in its so-called FORSK2015, which suggests prioritisation in 21 areas. One such area is "The climate of the future and adaptation". However, no dedicated research programme yet focuses on adaptation issues.

To strengthen the research agenda on climate change adaptation the strategy calls for the establishment of a *"Coordination unit for research on climate change adaptation"* to ensure that the synergy between existing and new projects is exploited, and to contribute to promoting cross-cutting collaboration and knowledge sharing between research environments. The "Scientific Advisory Panel" under this coordination unit would also function as an advisory body and facilitate the transfer of knowledge between the research community and the governmental "Coordination forum on adaptation". In addition, the coordination unit would collate authoritative data on climate change and impacts for a climate change adaptation web-portal hosted by an "information centre on adaptation" located within the Ministry of Climate and Energy.

1.4. Knowledge transfer and awareness raising

To ensure knowledge transfer and awareness raising, an *"information centre on adaptation"* is proposed by the strategy. This centre would be tasked with raising awareness and ensuring information exchange and knowledge transfer on adaptation issues, and with reporting to the international community on Danish activities in the area of adaptation. This information centre would be situated within the Ministry for Climate and Energy. The main task of the information centre would be drafting a communication strategy and to communicate:

- The government's strategy for adaptation to climate change
- General knowledge about adaptation to climate change with reference to the sector-specific need for further information

- General results from research in climate change adaptation with reference to the sector- specific need for further knowledge

The information centre's other tasks would include international reporting of Danish climate change adaptation efforts and the sharing of knowledge through participation in international meetings and forums.

The strategy calls for the establishment of an internet-based "adaptation portal" at www.klimatilpasning.dk, which would should offer access to various types of information on climate change – including climate data, oceanographic data, groundwater data and geodata. In addition, regional and local case studies are to be made available to illustrate current (or best) practice as regards adaptation. The portal would be a place where members of the public, authorities, business people and specialists can find updated information on adaptation to climate change. The strategy suggests the use of a common geographical basis for all data to ensure the efficient compilation and usage of data across geographic and administrative borders. The information centre is tasked with the establishment and management of the portal.

The strategy calls for autonomous adaptation actions by those at risk. It sees the role of the national government primarily in framing and information provision. The adaptation portal is an important tool to achieve this.

A preliminary version of the "adaptation portal" at www.klimatilpasning.dk is operational; a revised version is expected later in 2009.

1.5. Multi-level governance

The government's strategy builds on the subsidiarity principle, i.e. it emphasises that authorities, enterprises and individuals need to react and adapt to the consequences of climate change at their own initiative and in good time, within the given legislative, financial and technological framework. A sectoral responsibility for autonomous adaptation is the key principle in the strategy although municipalities also have a key role within their own jurisdiction. When autonomous adaptation is not considered to be the best possible option, it may become necessary to launch adaptation measures that have been agreed at a higher political level.

At the national level, coordination of climate adaptation work is coordinated by the "Coordination forum on adaptation". This forum is led by the Ministry of Climate and Energy and includes nine ministries as well as Local Government Denmark (LGDK) (the interest group and member authority of Danish municipalities) and "danske regioner" (the interest group representing Danish

regional authorities) and finally the "Coordination Unit for Research in Climate Change Adaptation". The "Coordination forum on adaptation" does not currently have any legal/formal authority or responsibility; authority and responsibility follow the already-established sectoral structure/line, e.g. water supply management is the responsibility of municipalities. The municipalities are then expected to adapt this area according to the current/state-of-the-art knowledge/data/scenarios available – preferably from the web-portal – which aims to provide the "authoritative data sets" needed for decision making.

The governmental "Coordination forum on adaptation" should ensure that adaptation policies 1) are developed or implemented according to the strategy; 2) are being coordinated within or across the range of governance; 3) build on the data, knowledge and recommendations present on the web-portal. Currently, budgets for adaptation investments should be found from within the various sectors.

Links to European Union adaptation policies are only through reference to directives that are thought relevant for adaptation (e.g. the Water Framework Directive and the Directive on Assessment and Management of Flood Risks).

1.6. Policy integration

The strategy stresses that the responsibility for ensuring necessary sector-specific adaptation to climate change lies with the relevant ministries and should be made on the basis of existing regulations. Nevertheless, by means of the strategy, the government encourages all sectors to unite in the efforts undertaken, and to this end proposes a cross-ministerial Coordination forum on adaptation. The overall objective of the Coordination forum on adaptation is to ensure that the government's climate adaptation strategy is implemented and to enable cooperation and coordination across sectors and authorities. Nine ministries are represented in the Coordination Forum (Ministry of Environment, Ministry of Climate and Energy, Ministry of Finance, Ministry of Transport, Ministry of Economic and Business Affairs, Ministry of Health and Prevention, Ministry of Food, Agriculture and Fisheries, Ministry of Defence and Ministry of Science Technology and Innovation), as well as representatives from Local Government Denmark (LGDK) and the Danish regions' interest groups and the member authority of Danish municipality and Danish regions respectively. The Coordination Unit for Research in Climate Change Adaptation is also represented in the Coordination Forum. Currently, three working groups on adaptation have been established by the Coordination forum, focusing on 1) the requirements for socio-economic analysis in adaptation; 2) the requirements for research to provide state-of-the-

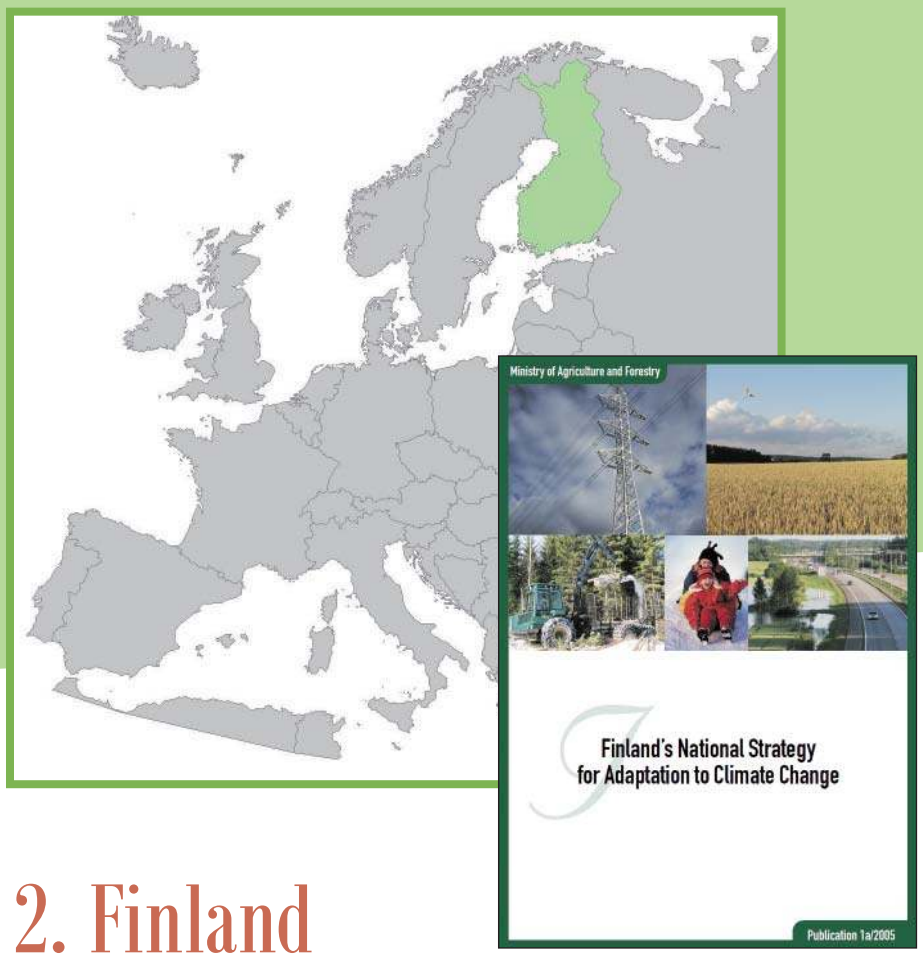
art knowledge for future adaptation; 3) providing input in terms of data, maps, research results and cases on adaptation into the adaptation web-portal: www.klimatilpasning.dk. The representation of "Local Government Denmark (LGDK)" "Danish regions" and the "Coordination Unit for Research on Climate Change Adaptation" in the "Coordination forum on adaptation" and its working groups constitute an operational platform to enable for reference to, as well as integration and dissemination of, results from local projects.

In addition, for the sectors addressed (see above), the strategy highlights existing activities and/or policies that possibly need revision in order to include adaptation aspects (e.g. action plans for the aquatic environment – 2005–2015 in accordance with EU Water Framework Directive; the future EU Floods Directive; the national pesticides action plan 2004–2009 and guidelines for environmental impact assessments. It is also proposed that climate change adaptation be integrated into the Natura2000 planning process and taken into account during the evaluation of action plans targeting the agricultural sector. In addition, the INSPIRE Directive will come into play, as the geo-data formats are being developed on the web portal.

The strategy was developed by an inter-ministerial working group led by the Ministry of Environment (now Ministry of Climate and Energy). It was presented at a public hearing before being adopted by the Parliament.

1.7. Compliance and evaluation

The strategy does not include concrete measures or indicators geared towards compliance and evaluation of its implementation. However, the Coordination forum on adaptation refers and reports to the government once a year, and governmental feedback might lead to the revision of the strategy.



2. Finland

2.1. The Finnish national adaptation strategy

The development of a National Adaptation Strategy in Finland arose out of Parliament's response to the first National Climate Strategy that the government had prepared and submitted to Parliament in 2001. In its response, the Parliamentary Environmental Committee recognised a need to address adaptation to climate change in addition to mitigation, and suggested that a national strategy for adaptation be prepared (Marttila et al., 2005; YmVM, 2001). A working group was set up to prepare the National Adaptation Strategy (NAS). The group consisted of representatives from several ministries: Agriculture and Forestry (coordinator), Environment, Trade and Industry, Transport and Communications, Foreign Affairs and Social Affairs and Health. In addition, two research institutes – the Finnish Environment Institute and the Finnish Meteorological Institute – were represented in the working group (Marttila et al., 2005).

The preparation of the strategy began in the latter half of 2003 with seminars on the expected impacts of climate change in different sectors and how to adapt to them. A large number of leading Finnish researchers into climate change and its impacts, other experts and representatives of different stakeholder groups were involved in preparing the strategy, which took just over a year to complete. As the process of developing the strategy was rather rapid, the strategy is relatively general, serving as a basis for more detailed preparation of sectoral adaptation policies rather than presenting specific policy measures. It was the first attempt to conceptualise what kind of policy measures might be needed to adapt to climate change in various sectors, and to identify those areas of further research that will help to fill in existing knowledge gaps. Thus, the strategy can be seen as a trigger for a policy process that is now in progress at the sectoral scale in different ministries as well as at regional and local scales.

A draft of the NAS was presented at an open seminar in October 2004, after which several more stakeholders commented on the draft before the final document, *Finland's National Strategy for Adaptation to Climate Change*, was published in January 2005. It is available electronically in three languages: Finnish, Swedish and English with a printed version in Finnish (Marttila et al., 2005). The key proposals of the NAS were included in the government's report to the parliament on energy and climate policy that was presented in November 2005 (MTI, 2005).

The strategy describes climate change vulnerability and potential impacts in a range of different sectors and suggests measures to improve adaptive capacity in these sectors. The sectors covered in the strategy are: agriculture and food production, forestry, fisheries, reindeer and game husbandry, water resources, biodiversity, industry, energy, transport, land use and communities, building, health, tourism and recreation, and insurance. The objective of the National Adaptation Strategy is to reduce the negative consequences of climate change as well as to take advantage of its potential opportunities (Marttila et al., 2005).

2.2. Sectoral adaptation policies

Ministries are responsible for the implementation of the NAS in their own fields of activity. Some ministries have started to prepare sectoral assessments and action plans to include adaptation into policies that fall within their responsibility. The following sections describe the sectoral initiatives that have resulted from the NAS.

Adaptation to climate change in the Environmental Administration – An action programme for the implementation of the National Adaptation Strategy

The Ministry of the Environment is the first ministry to have prepared a detailed action programme for implementing the NAS in its own field of activities. The programme includes the following sectors: biodiversity, recreation, land use and communities, buildings and construction, environmental protection and water resource management (YM, 2008). The action programme was prepared in cooperation with the Ministry of Agriculture and Forestry, which was responsible for the parts dealing with water resource management. The programme includes over 40 concrete recommendations for adaptation measures to be undertaken within the environmental administration during the next few years.

Pre-studies of adaptation in the Ministry of Transport and Communications

The Finnish Road Administration and Rail Administration, which operate under the Ministry of Transport and Communications, have both undertaken pre-studies on their capacity to adapt to climate change. The reports are fairly general in their content, identifying major adaptation challenges for road and rail transport and outlining preliminary recommendations for measures to be undertaken (Saarelainen and Makkonen, 2007, 2008). A similar assessment is to be undertaken by the Maritime Administration during 2009, and the Aviation Administration Finavia is also about to begin an adaptation study (Long-term Climate and Energy Strategy, 2008).

Working groups on flood risk management in the Ministry of Agriculture and Forestry

In the water sector there are several examples of adaptation-related activities. During the last few years, the Ministry of Agriculture and Forestry has set up working groups on flood risk management. In 2007, the ministry set up a flood risk working group to prepare the implementation of the EU Floods Directive as well as to identify other needs for developing legislation related to flood risk management in order to improve the capacity to adapt to changing climate conditions and an increased risk of floods (MMM, 2007). The work is a continuation of the previous analysis undertaken by a working group on extensive floods in 2003 (Timonen et al., 2003). Many of the recommendations of the earlier working group have already been implemented, at the same time contributing to the implementation of the flood directive (MMM, 2007).

In addition, a government bill on the renewal of the compensation system for flood damage is currently under preparation. The bill is based on a report prepared by a flood damage working group set up by the Ministry of Agriculture and Forestry (Kaatra et al., 2006). The idea of the bill is to replace the state compensation system for flood damages with an insurance-based system.

2.3. Drivers for climate adaptation policy

There is no particular reason why Finland should be the first country to adopt a national adaptation strategy; it was largely a timely coincidence of events. However, some of the factors that have contributed to the NAS development can be identified on the basis of discussions with people involved in the process.

Parliament's environmental committee, when responding to the National Climate Strategy in 2001, saw it as a considerable weakness that the strategy did not address adaptation at all. As the committee suggested in its report that a national adaptation plan (later called a National Adaptation Strategy) should be prepared, it referred to the IPCC and its recommendation that strategies for adapting to climate change should be prepared and implemented as soon as possible. The committee's report emphasised the importance of timely adaptation in order to minimise the negative impacts of climate change and take advantage of the positive ones (YmVM, 2001). The requirements set for adaptation within the UNFCCC were also an important argument used for starting to prepare the strategy, as well as the economic reasons for adaptation. It was recognised that early action to improve preparedness for climate change could result in long-term economic benefits. The potential opportunities arising from climate change were also recognised in the discussions from the outset, even though they were not a major driver of the process.

Research on the impacts of climate change can also be seen as a factor in putting the adaptation issue on the political agenda in Finland. The first research project concentrating on adaptation, FINADAPT, started a little earlier than the preparation of the NAS. In 2003, the project had already prepared a preliminary paper setting out some of the key research issues related to climate change impacts and adaptation (Carter and Kankaanpää, 2003). The then ongoing international assessment of climate change impacts in the Arctic (ACIA, 2005) was also referred to in the discussions when starting to develop the NAS.

Preparations for the strategy took place against a backdrop of widely reported extreme weather events (e.g. the European heatwave in 2003, storm damage in Sweden in 2004 and flooding in Finland in summer 2004), even though extreme weather events are not explicitly referred to as motivators for developing

the NAS. However, one of the sectoral adaptation assessments (Saarelainen and Makkonen, 2007) lists three damaging weather events in different parts of Finland that have served as the main motivating factor for preparing the adaptation report. These events (floods and heavy rain) offered concrete examples of the vulnerability of the road administration in extreme weather conditions.

One of the factors identified in the interviews as facilitating the development of the NAS in Finland concerned cooperation between different governmental sectors, which was perceived as good and efficient and may have served to smooth the path towards preparing a comprehensive, cross-sectoral strategy.

2.4. Science-policy interactions

Existing research knowledge on climate change in Finland and on vulnerability in different sectors was an important contributary factor in the development of the National Adaptation Strategy, and researchers played an active part in the preparation process (Marttila et al., 2005).

The first focused attempt to address climate change adaptation in Finland was undertaken in FINADAPT (assessing the adaptive capacity of the Finnish environment and society under a changing climate), a research consortium participating in the Finnish Environmental Cluster Research Programme, coordinated by the Ministry of the Environment (Carter, 2007). The objective of FINADAPT was to produce a scoping report based on literature reviews, interactions with stakeholders, seminars and targeted research.

The FINADAPT project was a major source of information relevant to the development of the NAS. FINADAPT began its work at about the same time as the Ministry of Agriculture and Forestry-led working group began drafting of the NAS (Marttila et al., 2005). In reporting the results of FINADAPT, the strategy document was used as a starting point. Research into adaptation usually presumes some basic knowledge about the impacts of climate change, but this information had been lacking in Finland on issues such as human health, tourism and recreation and electricity distribution, and this was refelcted on those studies, which had a substantial focus on impacts. A set of socio-economic scenarios produced for the NAS was developed further and a preliminary assessment was made of the order of magnitude of the costs and benefits of climate change for Finland. Other studies were able to use the conclusions of the strategy report as material for stakeholder discussions, which also offered some opportunities for a critique of the strategy. The relationship between mitigation and adaptation is touched upon in the strategy and was taken up as a land management and planning issue in various studies. Finally, all studies were able to reflect on the major gaps

in knowledge that currently impede the development and implementation of adaptation strategies in different sectors and regions.

One of the key recommendations of the NAS that were included in the government report to the parliament on energy and climate policy in 2005 (MTI, 2005) was the establishment of a research programme on adaptation. As a result, the five-year Finnish Climate Change Adaptation Research Programme (ISTO) was initiated in 2006. The objective of ISTO is to fill existing gaps in knowledge and provide relevant knowledge on adaptation for policymakers.

When ISTO was initiated, policymakers were actively involved in setting the research questions. Policymakers are also well represented in the programme's steering group. During the first half of the programme, the focus in many projects has been on the impacts of climate change, as there are still gaps in knowledge that need to be filled in order to concentrate on adaptation research. During the latter half of the programme, the focus will move towards adaptation research in support of policy-making. The research projects in the programme relate to forestry, agriculture, extreme weather events, land use planning and construction, biodiversity, regional adaptation strategies, international dimensions and development of a tool for presenting research results (Valli and Sierla, 2008).

There are still many gaps left in adaptation-related knowledge. The FINADAPT research project identified a number of these and summarised them in the report for policymakers (Carter, 2007). Some gaps will be filled by the research results of the ISTO programme, but there is a need for further research to support adaptation-related decision-making. Climate change is a priority topic of the new ministry funding mechanism for sectoral research, which is under development and due for release in 2009. Furthermore, the Academy of Finland is putting the finishing touches to plans for a major research programme on climate change from 2010. In addition, at the end of 2008, ISTO launched a new call for research proposals, looking for projects that will further support the development and implementation of adaptation policies in different sectors.

2.5. Knowledge transfer and awareness raising

The NAS recognises that successful communication is important in raising people's awareness of climate change and thus increasing their capacity to adapt to its impacts. Following its publication, an open seminar was held to communicate the new strategy to the media and stakeholders. One of the key elements in the communication of climate change adaptation in Finland is the ISTO research programme. For example, the programme coordinator and researchers have participated in several stakeholder events involving municipalities and enterprises,

providing them with access to research results and offering information about adaptation needs. ISTO has a communication plan that lists planned activities and the people responsible for them. Important means of communication that have been identified in the plan include stakeholder discussions and seminars, meetings with the media, publications, newsletters and webpages. One of the communication activities within the programme has been to organise a seminar on adaptation targeted at journalists. The mid-term evaluation of the programme reports that there has already been active participation in these events by the coordinator and researchers as well as good coverage in various national and professional journals (Valli and Sierla, 2008).

The adaptation action programme of the Environmental Administration states that there is a growing need for information related to adaptation. A communication plan on adaptation that takes into account the different needs of stakeholder groups is to be prepared. The most important target groups for communication are identified as the Regional Environment Centres and the Association of Finnish Local and Regional Authorities, which is the representative organisation for the municipalities. However, the methods of communication and the content of information for each target group have yet to be specified in more detail (YM, 2008).

2.6. Multi-level governance

The National Adaptation Strategy recognises the importance of regional and local level actors such as Regional Environment Centres and municipalities. In practice, the actual implementation of the strategy frequently occurs in the regions and municipalities, especially with regard to flood risk management and spatial planning. However, links to the regional level are more visible in sectoral adaptation policies than in the NAS; for example, Regional Environment Centres have a key role in implementing the adaptation action programme prepared by the Environmental Administration (YM, 2008).

So far there has been little or no attention paid to adaptation in regional and local plans and strategies. However, there are some examples of adaptation activities at the municipality level. At least one municipality has undertaken an assessment of its adaptive capacity and adaptation needs (Soini, 2007), and there are a few examples of others that are currently in the process of preparing their climate strategies, which will also include some aspects of adaptation. Adaptation at an individual and company level is considered to some extent in the NAS, which provides examples of possible adaptation measures to be taken by citizens and companies in the context of each vulnerable sector analysed. On the

other hand, the strategy anticipates that these measures will only be put in place at a later stage, some time in the future.

Links to European Union adaptation policies are few, though some directives are mentioned that are thought relevant for adaptation. Examples include the Water Policy Framework Directive and the Habitats Directive, which are referred to in the context of conservation and monitoring of species. The strategy argues that the directives support adaptation activities and improve the prospects for survival of some endangered species in a changing climate. The implementation of the Floods Directive in sectoral policy-making is closely linked to other adaptation activities within flood risk management. The Finnish NAS was published before the development of the EU Green Paper on Adaptation.

2.7. Policy integration

Adaptation is increasingly being included in different policies that deal with sectors and systems that are sensitive to a changing climate. The Government's Long-term Climate and Energy Strategy, which was submitted to the parliament in November 2008, puts a considerable emphasis on adaptation, even though its main focus is on mitigation. The strategy outlines the key objectives and measures of Finland's climate and energy policy. It also gives an overview of current adaptation activities in different sectors (Long-term Climate and Energy Strategy, 2008). Adaptation will also be addressed in the government's foresight report on climate and energy policy, which is currently under preparation and due to be submitted to parliament in spring 2009. The aim of the report is to serve decision-making in various sectors. The report will cover both mitigation of climate change and adaptation to its effects. It will outline long-term climate and energy policies and propose measures to be undertaken.

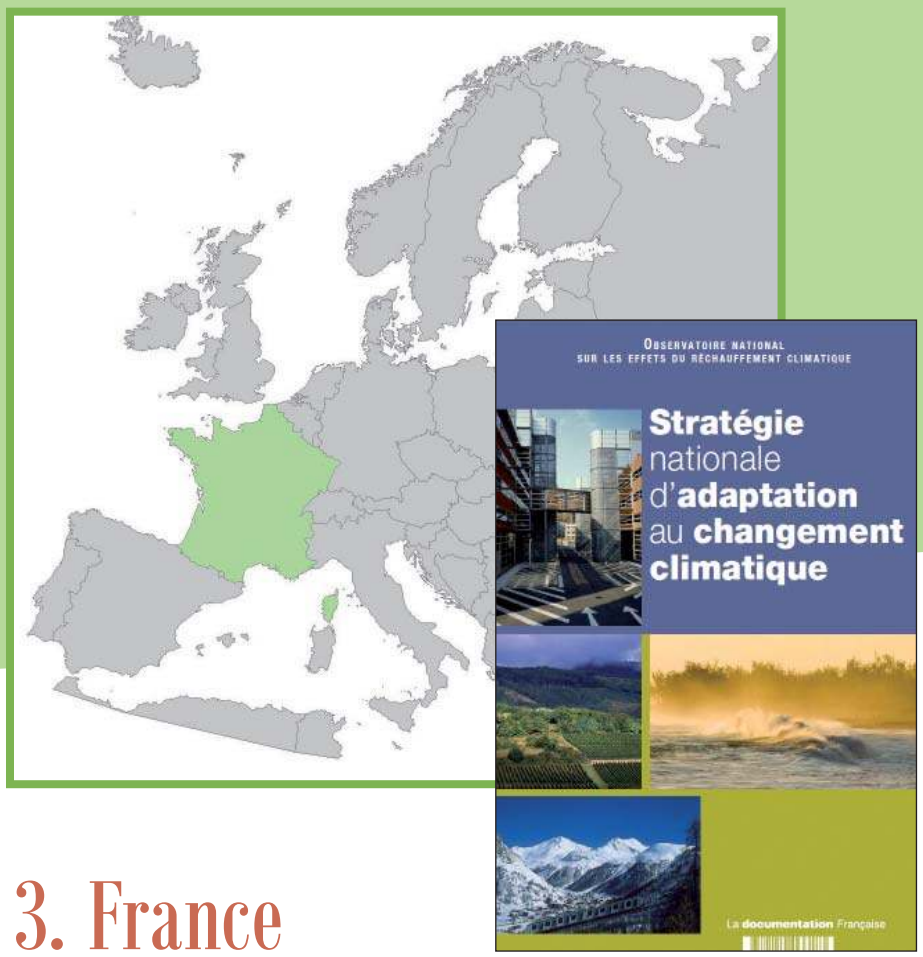
One of the policy initiatives for mainstreaming adaptation into land use planning in Finland is the updating of the National Land Use Guidelines, which was completed in November 2008 (Council of State, 2008). The guidelines are mainly implemented through regional planning procedures, where national, local and regional objectives are harmonised during the drafting of regional land use plans. These regional plans also help to ensure that the national guidelines are duly considered in land use planning at the municipal level. The inclusion of climate change mitigation and adaptation in the National Land Use Guidelines was one of the main reasons for their updating, and the new guidelines provide guidance on how adaptation issues should be taken into account in land use planning at different levels. The new guidelines will enter into force in March 2009. Examples of other policies where adaptation to climate change is included, though only to

a small extent, are the National Forest Programme 2015 (MMM, 2008) and the Development Policy Programme 2007 (ForMin, 2007).

2.8. Compliance and evaluation

It is proposed in the NAS that an evaluation of its effectiveness should be undertaken within six-eight years of publication. The evaluation process has already begun, and a coordination group for adaptation was set up by the Ministry of Agriculture and Forestry in October 2008. The group will undertake a mid-term evaluation of the NAS during the first half of 2009. The evaluation will provide an overview of the current stage of implementation of the NAS as well as support the development of further adaptation activities. It will also place Finnish efforts in the context of adaptation policy development in Europe. The coordination group is led by the Ministry of Agriculture and Forestry. Other members of the group will consist of representatives from several ministries, research agencies (the Finnish Environment Institute and Meteorological Institute), funders of research (Academy of Finland and the Finnish Funding Agency for Technology and Innovation) and the Association of Finnish Local and Regional Authorities. A more comprehensive evaluation of the implementation of the NAS is planned for 2011–2013.

Different indicators of progress in the achievement of environmental policy are already in use in Finland. For example, indicators of sustainable development in different sectors have been developed over several years, and are an important part of the follow-up of Finland's National Strategy for Sustainable Development (Prime Minister's Office, 2006). The National Adaptation Strategy proposes that some of these indicators could be used as a basis for measuring the success of the implementation of the strategy, in addition to new indicators specifically targeted at adaptation. Some examples of the proposed indicators include: food self-sufficiency, the use of pesticides, increment of growing stock and total drainage, tree species composition, the availability of real-time hydrological information, the length of the ice-breaking assistance season, the number of snow plough deployments and de-icing salt applications on roads (Marttila et al., 2005). However, a more recent Government Strategy Report (Prime Minister's Office, 2008) suggests that a smaller set of adaptation indicators should be used to start with. These include: the progress made in observation and warning systems as well as research and development, plans made in various sectors for adapting to climate change and the progress of the first measures taken, and =actual flood damage in communities. These indicators will be monitored during the middle and at the end of the ongoing government period, the first monitoring taking place in early 2009.



3. France

3.1. The French national adaptation strategy

Although the Northern European countries are well known as forerunners when it comes to tackling environment issues, France did not lag behind in publishing its NAS. Indeed, this National Adaptation Strategy, written by the National Observatory (ONERC) and dedicated to the effects of climate warming, was published in 2007 after validation by the inter-ministerial committee for sustainable development on 13th November 2006. This strategy is the result of an extensive consultation in which representatives of different activities and civil society were involved.

The NAS clearly highlights France's main priorities and aims in terms of adaptation. These are the following:

- public security and health;
- social aspects – inequality as regards facing risks;

- limiting the costs of climate change, and taking advantage of changing conditions; and
- protecting the natural heritage.

The adaptation strategy seems to be quite exhaustive in terms of subjects covered. There are 43 recommendations split into four main paragraphs. The first one is important as it sets the strategic directions which combine goals, objectives and activities: to develop knowledge, to improve the observation system, to inform and train all stakeholders and to make them aware of the adaptation's stakes, to develop adapted approaches for territories, to finance adaptation actions, to use legal and regulation tools, to put forward determined approaches and dialogue with private stakeholders, to take into account specifics of overseas territories and, finally, to take part in international exchanges. After this first classification, there are cross-cutting approaches in particular through water, risk prevention, health and biodiversity. Some recommendations related to sector-based perspectives are then allocated between agriculture, energy and industry, transport, building and housing, tourism, banking and insurance. A final approach through landscapes is proposed with recommendations on towns, coastlines and seas, mountains and forests.

The National Adaptation Strategy contains only recommendations, which will probably be translated into a real National Adaptation Plan, comprising concrete proposals for measures and action in 2010 or 2011. However, that is not yet the case. In fact, the evaluation of the costs due to the impacts and the adaptation to climate change should end in March or April 2009. The final goal is to have a list of concrete policies and measures, which can be carried out at different levels of decision making.

Conclusions of the "Grenelle de l'environnement" (2007)

The grenelle de l'environment is a national government initiative, launched by French President Nicolas Sarkozy after the last presidential election. This "reflection group" is composed of representatives from five different stakeholder entities: NGOs, employer representatives, trades unions, representatives of territorial authorities and members of the government. The group worked on six main objectives, which were:

- to address climate change issues in terms of managing energy needs;
- to retain biodiversity and natural resources;
- to develop a respectful environment in terms of health;
- to develop sustainable means for production and consumption;
- to build an ecological democracy; and

- to ensure ecological development which supports employment and competitiveness.

The first theme is the main one for this analysis. However, it seems to be important to emphasise the fact that 80 pages (of these conclusions) of fewer than 90 are about mitigation. It clearly reveals the limited attention paid to adaptation in France. This underlines the fact that French government favours short-term measures, i.e.,action on mitigation. Concrete measures and policies should have been developed by mid-March 2008, in order to complete the 2008 spring law project. However, this work has yet to be done, largely because the looming economic recession hampers the implementation of such costly mitigation measures.

Cross-cutting policy document

A specific part of the French finance bill 2008 is dedicated exclusively to climate change. However, once again, the major part of this cross-cutting document deals with mitigation. Nearly all of the topics covered are developed in the NAS, in the Grenelle's conclusions or in both, with the exception of the financial action linked with the meteorology programme.

3.2. Drivers for climate adaptation policy

Partly thanks to the UN Framework Convention on Climate Change (1992), France started to become aware of climate change issues and about the need to adapt. In fact, this convention (UNFCCC) specified that the different countries must develop different measures in order to facilitate an appropriate adaptation to climate change; and that the developed countries must help developing countries to adapt.

The European Climate Change Programme, Working Group II – Impacts and Adaptation, the development of the EU Green Paper on Adaptation as well as the conclusion of the European Council (22/23 March 2005), or the COM 35 (02/2005), "Overcome global climate change", have been helpful in the French debate on adaptation to climate change. Also relevant are the ESPACE programme of DG Regio, and the various reports of the EEA, such as "Impacts of Europe's Changing Climate" (2004), or "Vulnerability and Adaptation to Climate Change in Europe" (2005).

The NAS states that it is very important to take part in and finance research programmes with Southern countries (such as AMMA: Multidisciplinary Analysis of the African Monsoon) and to facilitate the implementation of collaboration

projects (such as RIPIESCA: Interdisciplinary and participative research on the interactions between climate and the western African ecosystems and societies).

This adaptation strategy was almost certainly conceived of because climate change, and especially adaptation, is a scientific issue which must be supported by the government if it is to succeed. Even if different scenarios are envisaged (IPCC's A2 scenario, the pessimistic one, the IPCC's B2 scenario, the optimistic one and the IPCC 2001d scenario), many stakeholders are aware of the need to carry out research and adaptation actions. The European scenarios concerning the increase of GHG are also taken into account, as well as the European projects Eclat, Prudence and Ensembles.

This NAS was launched by the government. It has been led by the National Observatory, which is dedicated to looking at the effects of climate warming (ONERC) and part of the ministry responsible for the environment and planning. Even if the ONERC is leading, the large consultation of which the NAS is the result stresses the fact that climate change is such a relevant topic that everybody is directly concerned and has to take part. Moreover, if we consider the few measures which are currently implemented in France, we have to emphasise the fact that lots of different ministries are therefore involved. Actually, adaptation to climate change is such a huge issue in all the different fields that the priorities have to be translated into different sectoral policies. The documents dealing with climate change are mainly dedicated to mitigation, but adaptation is not forgotten.

The main issues of concern are extreme events, increases in temperature and decreases in precipitation in summer, droughts, rising sea levels, the shortage of snow and coastal erosion. The main risk philosophy is to reduce inequality in terms of facing risks, to reduce costs, to try to take advantage of the projected changes, and to ensure public security.

3.3. Science-policy interactions

The National Research Agency (ANR) is conducting several research projects on climate change. However, these projects are related not just to adaptation; they are more generally dedicated to mitigation as well as adaptation, and in actual fact often to global change, and are financed by the government through the ANR.

There is also a specific French programme wholly dedicated to climate change impacts and management (GICC: Gestion et Impacts du Changement Climatique). It was launched in 1999 by the Directorate for economic studies and environmental evaluation (Ministry for Environment, Sustainable Development and Territories Planning). The main aim of this programme has always been to develop knowledge to support the implementation of public policies on climate

change impacts and adaptation measures. It tries to combine different fields of study: on the one hand, physics and biological sciences in relation to impacts; and, on the other hand, human and social sciences in relation to the development of adaptation measures. Half of this programme deals with adaptation and the other half with mitigation. However, in both cases specific attention is paid to broadcasting the results to policymakers. Some meetings are organised specifically to deliver the results and to discuss them with scientists, policy makers and so on. A special committee, composed of specialists from different fields, must decide on the next calls for proposals. This committee is supposed to establish the link between the European and/or ANR project (dealing with uncertainty or scenarios) and the GICC programme, which is also supported by the national government.

It should also be noted that some scientists are involved in the "Grenelle de l'Environnement" in their capacity as experts, so they can have an impact on public policies, or at least make the policymakers aware of the different issues and insist on one way of solving them.

Finally, the NAS insists that indicators obviously need to be defined and modified as a result of scientific knowledge. However, it also notes that local decision-makers must be involved and their views taken into account. The NAS emphasises the importance of updating these indicators so as to give better help to the decision makers.

3.4. Knowledge transfer and awareness raising

The National Adaptation Strategy is available on a French government website [27]. There has been mention of climate change in the media following the publication of *"Grenelle de l'Environnement"*. Most of it deals with mitigation, however. As far as the French government is concerned, short-term actions are of primary importance – action on mitigation, in other words. Most information on adaptation broadcast on TV, for instance, is dedicated to housing adaptation. At a different level, however, the broadly based Grenelle consultation (NGOs, employer representatives, trades unions, representatives of territorial authorities and members of the government) also contributes to knowledge transfer.

[27] *http://www.ecologie.gouv.fr/IMG/pdf/Strategie_Nationale_2.17_Mo-2.pdf*

Obviously, ONERC, its website and the GICC programme also contribute to the process of knowledge transfer, but they cannot be said to be developing the awareness of society as a whole.

In the NAS, some recommendations insist on the need to spread information and to pay special attention to local decision-makers, who are not always convinced about the need to adapt and do not necessarily have the capability.

3.5. Multi-level governance

Climate change is a challenge which requires effort by the whole of society. In view of the "Grenelle de l'Environnement", the need to involve as many representatives of the different stakeholders as possible clearly reveals that climate change, and especially adaptation, is a cross-cutting issue. When considering adaptation, societal perceptions are becoming more and more relevant in France. Not enough to lead to a real policy, however. Such a huge consultation can result in a failure to deliver something truly concrete, thus hampering a proper translation into policy. Validation by parliament is often influenced by lobbying and obviously depends also on the budget available.

In order not to be so dependent on parliamentary decisions, the bottom-up approach should be more efficient. In the NAS, the implementation of local climate plans is clearly encouraged. Moreover, formal planning agreements between state and territorial authorities already exist in different fields, and they can be very useful as far as adaptation is concerned.

Finally, the NAS emphasises the fact that all the different local levels have to be involved. The NAS speaks of the need to develop an "adapted governance system" in order to involve the state services, the local authorities and, increasingly, civil society as well. The main aim is that local authorities will become able to develop their own adaptation strategies. It is quite a good position because the need and the means of adapting can differ from one area to another.

3.6. Policy integration

A cross-cutting policy document has already been added to the bill of finance. It is dedicated exclusively to climate change and is entitled, "The Fight Against Climate Change". In the French finance bill, each sectoral policy refers to a specific programme and each part of it is specified and split into different measures, which are financed. As can be seen, even if mitigation and adaptation requirements have been put forward by the Ministry for Environment, these are issues that have

to be taken into account by nearly all the different ministries. Climate change is a big issue which involves all parts of society.

In the NAS, it is specified that a general, well-balanced climate policy must be composed of policies on mitigation as well as adaptation. Even if the two are separated, it is very important to pay detailed attention to their linkages. Currently, it is thought that there might be some inconsistencies in respect of sustainable development, which must be resolved.

These inconsistencies could be resolved at a local level. In fact, in 2005, the Energy Development and Management Agency (ADEME) published a guide to developing territorial climate plans which would complement the national one. Once again, French specific policies are developed taking into account global concerns. In actual fact, the French political structure places responsibility on the central government. Given the importance of climate change, however, decentralised governance has to be developed.

3.7. Compliance and evaluation

The NAS states that some changes in values are needed in order for the county to adapt. The characteristics of French society, however, and the changes needed cannot be implemented by decree. Adaptation efforts cannot be simply the result of regulatory constraints or subsidies. Various means have already been implemented, such as some fiscal measures and tax exemptions to encourage adaptation (in housing for instance), as well as specific funds, such as "CatNat" ("catastrophes naturelles"), which exists thanks to a tax on housing insurance. There is a law which allows money from this fund to indemnify people to leave their homes in areas vulnerable to flooding. It is considered to be an adaptation measure. It is also necessary to develop private foundations dedicated to adaptation.

The European Union, in its COM(2005)35, emphasised the obligation of Member States to create a solidarity fund to counter the anticipated inadequacy of private insurance in the future. The NAS stresses the need to develop this to a much greater extent.

In studying the French cross-cutting policy document, it can be seen that there are some inconsistencies between measures and their associated indicators. For the policy document entitled "Settlement of agriculture risks insurance and compensation systems", for instance, the proposed indicators might not be consistent with adaptation objectives. In fact, the aim of the indicators is for more and more farmers to decide to take out insurance for their crops. That is why this indicator cannot be considered to be one of adaptation. Indeed, instead of being a

public policy, adaptation would in this case become a "private" decision. It should be noted that, even if more and more farmers subscribe to private insurance, this may not lead them to adapt their activity.

However, if there are more and more extreme events, the cost of insurance will increase. That could be the reason for adapting their activity. In any case, it would be due to an adaptation policy! So, although it is not absolutely clear in the NAS, it is important to think about those indicators and to make them coherent in terms of measures and adaptation aims. However, ONERC should first start by evaluating the costs of the NAS before being precise about the indicators. In fact, in order to implement indicators, so as to establish some priorities, it is necessary to know how much money is available and how it will be allocated to the NAS.

The NAS suggests as a starting point that control and sanctions be reinforced in order to ensure efficient implementation of the environment code, which is not yet the case at all, as was shown to be the case in a report published in 2005 by the inter-ministerial inspection mission.

4. Germany

4.1. The German national adaptation strategy

The German NAS was adopted by the Federal Cabinet on 17th December 2008. The NAS provides a strategic framework for adaptation to climate change in Germany. It is designed to establish a transparent and structured mid-term process which, in conjunction with all relevant actors, will progressively ascertain action needs, define objectives, identify and resolve conflicts, and develop and implement potential adaptation measures. The NAS aims to integrate the work already in progress in various ministries in a common approach. It is composed of five chapters.

The first chapter sets out the *"aims and basic principles of the NAS"*. The overall aim of the strategy is to reduce vulnerabilities and increase the resilience of natural, societal and economic systems. In order to achieve this, the following measures are intended:

- identify and communicate dangers and risks, i.e. ensure transparency of probabilities, damage potential and uncertainties;
- create awareness and raise the sensitivity of actors;
- provide a basis for decision making that enables the various actors to take precautions and gradually incorporate the impacts of climate change in their private, business and public planning and activities;
- indicate action options, coordinate and define responsibilities, draw up and implement measures.

The adaptation process should – according to the NAS – be guided by six principles as indicated by the following keywords: (1) openness and transparency, (2) flexible precautionary approach, (3) subsidiarity and proportionality, (4) integrated approach, (5) international responsibility and (6) sustainability.

The second chapter, *"climate is changing"*, gives an overview of the changes in climate parameters both worldwide and for Germany. A comparative evaluation of the results of four existing regional climate models is also provided, allowing for reasonably robust statements about the ranges of change that can be expected. The report clearly refrains from putting forward a single scenario which the various actors could use as a basis for developing their individual adaptation strategies and measures. Rather, it is recommended, that an assessment of opportunities and risks should always be based on the entire spectrum of future climate developments as indicated by various emissions scenarios and climate models.

In the third chapter, *"What are the major impacts – what can be done?"*, the impacts of climate change that can be expected are displayed and possible measures of adaptation are considered with regard to the following vulnerable sectors: health, construction, water management and flood protection, soil, biodiversity, agriculture, horticulture, fisheries, energy, finance, transport, industry, tourism and spatial planning. Furthermore, examples for an integrated regional adaptation approach are provided, possible synergies between adaptation and mitigation are assessed and the recent state of adaptation research evaluated. As a whole, this evaluation of risks and opportunities, approaches and measures and of the gaps between existing knowledge and research appears quite detailed and advanced in comparison to most of the other NASs covered by this report.

The fourth chapter, *"Adaptation worldwide – the German role"*, deals with the German role in the external, worldwide adaptation process. It is considered necessary to take due account of the possible implications for development, migration and security policy that could be associated with the impacts of climate change. Development policy measures should – according to the NAS – be

generally geared to supporting adaptation strategies in the countries affected. A "climate check" for all development policy programmes and measures is declared and it is stated that Germany will play an active part in the development of relevant concepts, particularly under the Framework Convention on Climate Change.

The fifth chapter, *"The German NAS – Process and next steps"*, describes the subsequent concrete steps to be taken in the national adaptation process. These include in particular:

- a national action plan to be delivered by 2011 setting out i.a.
  - principles and criteria for prioritising requirements for action
  - prioritisation of federal measures
  - an overview of concrete measures by other actors
  - information about financing, especially through integration of adaptation in existing assistance programmes
  - suggested concepts for progress review
  - further development of the strategy and next steps
- new governance structures as catalyst for an integrated adaptation approach (i.a. an interministerial working group)
- an extended participation process which increases integration between industry, local authorities and other actors from the various fields by means of discussions between specialists, conferences, consultative bodies, expert committees
- improvement of the knowledge base by an extensive research programme comprising i.a. the development of meaningful vulnerability indicators and, subsequently, a comprehensive monitoring system that integrates existing systems of bio- and soil monitoring

In addition, a compilation of recent actions by the German Länder and regions is provided in an annex attached to the NAS.

4.2. Drivers for climate adaptation policy

The climate in Germany is mild and the landscape is as diverse as it is moderate. As a consequence, the impacts of climate change appears similarly varied but mostly rather moderate. On the basis of a 1.6–3.5°C warming until 2070–2100, the following major risks and adaptation needs have been predicted:

- **Health**: Climate warming is most likely lead to a dispersion of vectors and causative organisms from warmer regions and intensify hygiene risks. Medical research, food and the health system will therefore need to be adapted to these additional health risks. As a consequence of rising temperatures there

is a considerable risk that, as in most regions, heatwaves will occur more frequently. Although the severity of such events will be significantly lower than in southern countries, they must also be considered to be a health problem. It is acknowledged, for example, that the heatwave of 2003 caused approximately 7,000 deaths in Germany. In 2005, the German Meteorological Service introduced a heat-warning system as a first measure of adaptation. Other measures were only discussed for the most part and are far from being implemented. As a whole, the need to adapt buildings, infrastructure and behaviour to increasing temperatures in terms of health and wellbeing is not yet fully recognised as a public issue.

- **Flood Risk**: In the months of winter and spring the risk of flooding will probably further increase due to higher frequency and intensity of extreme rainfall events. Alpine regions and highly built-up regions without sufficient flood-retention areas are at particular risk. Significant efforts have already been taken to lower the risks of flooding since the Elbe flood catastrophe of 2002. This flood event has not been attributed to climate change in the public's opinion, however.
- **Water Supply**: Germany is a country rich in water; 2.2 % of its surface area is covered by water. Only approximately 24% of available water resources are used for human purposes (UBA, 2001). Annual precipitation is expected to change only slightly, while summer precipitation will probably decrease by 4.9–33.3% and winter quantities are predicted to rise by 6.6–29.6%. AS a result of changing precipitation patterns, the risk of summer drought will increase, particularly in central eastern parts of Germany. While major constraints on the drinking water supply are not expected, such droughts will mainly affect the agricultural sector. In dry periods, cooling water for large power plants may run short. In the drought period of the summer of 2003, the extraction of cooling water had to be reduced in some regions. The general conclusion of the Potsdam Institute for Climate Impact Research (PIC 2005) was that the German water sector should be able to adapt to future climate impacts, since a full range of sufficient adaptation options are available. However, there "is a clear need for a well-balanced adaptation strategy, which includes storage, limitations in water demand and alternative sources of water".
- **Agricultural and Forestry**: Decreasing summer precipitation will probably lead to degraded agricultural conditions especially in central eastern and south-western regions, which already suffer from unfavourable water balances under present conditions. Moreover, nationwide yield losses are most likely be caused by the expected increase in climate variability and by the increase in weather extremes. However, the adaptation capacity of the German agriculture sector is considered fairly high. In particular, the use of new cultivars and new, adapted

cultivation methods that maintain soil fertility and save water are promising options for addressing a wide range of uncertain impacts of climate change. The forestry sector's situation is very similar to that of the agricultural sector. Rising temperatures, increasing drought and extreme weather events will strain forests and necessitate changes in forest composition and maintenance. However, adaptation appears feasible and higher temperatures even bring about some chances to increase yields and introduce new tree species.

- Biodiversity: Like elsewhere, climate warming is very likely to accelerate biodiversity loss in Germany, and shifts in species distribution to the North and to higher altitudes, as well as changes in plant phenology and animal behaviour, are to be expected. Regionally, the Alpine area is particularly impacted, because of its abundance of endemic plants and animals, many azonal biotopes and unique climatic locations. A reduction of vulnerability requires an adaptation of existing nature conservation management schemes to take account of migratory movements and adaptive developments within regions and species.

4.3. Drivers for climate adaptation policy

Although the need for governmental action has been clearly visible for some years, German politics have been somewhat reluctant to take on the challenge of adaptation as a public, political issue. The political background has long been dominated by the perception that climate policies should concentrate on mitigation. Adaptation had been considered an inadequate surrender to the causes of climate change. At the same time, the extensive efforts taken to flood-proof Germany after the thousand-year-flood of 2002 have not expressly been associated with global warming and climate adaptation.

The intention to draw up a national adaptation strategy was first announced officially by the 2005 German Climate Change Mitigation Programme (Bundesregierung, 2005). After two years of inaction the German Government was eventually called upon by the environmental ministers of the German States (Länder) to bring forward the development of a national strategy as a basis for further regional planning and action. Then, in 2007 and 2008, the NAS was developed under the auspices of the Federal Environmental Ministry in cooperation with the Federal Environmental Agency. Ministries of the German States (Laender) and stakeholders were included in the process by stakeholder conferences and countless informal consultations.

4.4. Science-policy interactions

4.4.1 Scientific knowledge basis of the NAS

In comparison with the other European Member States the scientific knowledge basis appears quite sophisticated in Germany. Research on climate change mechanisms, impacts and adaptation needs and options has been strongly furthered by federal and state governments for a long time. However, in its earlier stages, research had been quite diverse and often somewhat uncoordinated. Today, a large share of the federal funding is aggregated in the current "high-tech strategy on climate change" of the Federal Ministry for Education and Research and associated research programmes, and several coordinating institutions have been established.

As regards the development of regional climate scenarios and projections, a special Service Group Adaptation (SGA) of the Max-Planck-Research-Centre in Hamburg was commissioned in 2005 to continuously screen and improve methods and data for regional modelling. In the meantime, this Service Group has also taken over important advisory functions and it is consulting stakeholders on matters of risk assessment and the development of specific climate impact projections.

Over the past decade, the focus of German climate research has gradually been expanded from the causes and mechanisms of climate change to impacts and adaptation. This shift has been strongly promoted i.a. by the federal 2001–2006 DEKLIM research programme, which put greater emphasis on impact and adaptation (37 million euros). Moreover, the Federal Environmental Agency and the Potsdam Institute of Climate Impact Research have taken an early lead by commissioning/conducting the first comprehensive national study on vulnerabilities and adaptation needs and options. In a bulky Report of 2005 (PIC, 2005), the PIC compiled all available knowledge about the potential national and regional impacts of climate change and about possible means to prevent or mitigate negative effects.

Since the release of that study, a variety of further projects have been launched which go more deeply into specific regional and/or sectoral impacts and adaptation options. Many of these projects are funded under the framework of the federal "Klimazwei" programme, which was given a budget of ca. 15 million euros and tendered as a part of the FONA (Research for Sustainable Development) 2006–2009-Programme. Other important research initiatives are as follows:

- KLIMZUG (Federal Ministry of Education and Research, 2008–2013, 75 million euros) on regional adaptation management.
- GLOWA (Federal Ministry of Education and Research) on impacts of climate change on water bodies water supply and water management.

- KLIWAS (Federal Ministry for Transport, Construction and Urban Development) on impacts of climate change on shipping and waterways.
- Adaptation Strategies for spatial impacts of climate change (Federal Ministry for Transport, Construction and Urban Development) on the development of planning instruments for climate adaptation.

In due course, these initiatives will be complemented by various institutional research activities e.g. by the German Weather Service (DWD), the Helmholz Society and the Max-Planck Society.

In order to provide information about and coordinate all these research efforts a special adaptation focal point – KOMPASS – was established in 2006 under the auspices of the German FEA. KOMPASS maintains on its website[28] a comprehensive list of all completed and ongoing climate impact and adaptation studies, and it plays a leading role in awarding the respective research budget of the Federal Environmental Ministry. KOMPASS is also consigned to further the exchange between scientists, stakeholders and political players. For that purpose, KOMPASS organises workshops and conferences and publishes a newsletter, displaying the latest findings and developments regarding climate impacts and adaptation. Moreover, a number of regional and sectoral communication platforms have been created on the state-level in order to boost awareness, research and knowledge transfer in these respective fields (INKLIM, KLIWA, GLOWA).

4.4.2. Research and science-policy-nexus in the NAS

The NAS does not develop an entirely new research agenda. Rather, it is basically making reference to existing research programmes and institutions and thereby complementing a few new research topics/projects. In particular, the development of meaningful vulnerability indicators and of an effective monitoring system is proclaimed as one additional focal point of research and special funding under the German NAS.

Furthermore, the NAS underlines the need for better coordination of the diversity of research activity. To this end, it is announced that the new Climate Service Centre (CSC) at the GKSS-Research Center in Geesthacht will be extended and commissioned to coordinate research, disseminate available knowledge and promote sectoral and regional risk assessment and adaptive management.

In spite of an earlier intention, no specific advisory council on climate change has been included in the proposed institutional research framework. Instead, it

[28] *www.anpassung.net*

has been announced that the existing advisory councils (German Advisory Council on the Environment, German Advisory Council for Global Change) will be asked to give due attention to climate change impacts and adaptation.

4.5. Knowledge transfer

The NAS emphasises the need to further and improve knowledge transfer by specific institutions and tools. In this regard, the above-mentioned Climate Service Centre and the competence centre KomPass have been given prominent roles. These institutions are commissioned to be the central knowledge transmitters. As regards the modes of knowledge transfer, all types of communication (see report, chapter 5) are being referred to by the NAS and the development of several new tools for knowledge transfer and adaptive management (Fachinformations-system Klimafolgen und Anpassung) have been announced. In this regard, the UK CIP and its "Adaptation Wizard, "Business Assessement Tool" and "Local Climate Impacts Profile", are expressly mentioned as references for and examples of good governance.

In comparison to other political branches, one proven tool whereby science and policy can be linked has not yet been established within the NAS framework: There is no frequent scientific report – like the IPCC-report – that would from time to time inform decisions about scientific developments, about progress, flaws and shortcomings in the adaptation process, and give scientific advice with a view to further strategic decisions and measures. German environmental policy has a long-standing tradition with advisory reports informing not only the government but also the public, thereby contributing to a general awareness. A frequent report on climate change and adaptation in Germany could be derived, however, from the monitoring and review system that will need to be established according to the NAS.

4.6. Multi-level governance

For the purposes of distributing tasks and competencies efficiently between the different levels of governance, it appears necessary – from the perspective of a national government's strategy – to identify clearly any requirements of adaptation which cannot be efficiently fulfilled at a regional level and which should therefore be taken care of by the national government or even at the EU level. Moreover, it is important to provide effective coordination between the different levels in order to avoid duplication of effort and inconsistencies.

The German NAS does not comprise a definite multi-level-governance strategy. It is explicitly stated in the introduction to the NAS that this strategy focuses only on the federal level and that it will be confined to the potential contributions of the national government to the various challenges of adaptation. At the same time, the NAS strongly emphasises the greater degree of responsibility held by local and private actors. In Germany, as in other countries, there seems to be a prevailing opinion that adaptation should be dealt with mainly at the local and private level and that the main role of central government would be coordination, advice and – sometimes – fiscal support. On the other hand, it is clearly acknowledged by the NAS that inter-regional cooperation and consensus about aims and approaches are crucial in coping with general problems such as scarce water supplies, flood risk and soil degradation, water quality and biodiversity. As a consequence, various federal measures inclusive of legal standards are taken into consideration particularly as regards the common level of precaution and the instruments of cooperative (spatial) planning. In Germany, spatial planning and spatial planning laws play a dominant role as instruments for multi-level governance; they set out common aims and methods of cooperation and coordination where this appears necessary while leaving the details and concrete action to the relevant regional or local authorities. It comes as no surprise, therefore, that the NAS refers to planning instruments and advocates a revision of these instruments with a view to integrating adaptation needs.

4.7. Policy integration

Most of the different aspects, prerequisites and approaches for effective policy integration identified in chapter 7 of the report are picked up by the German NAS. Initially, the "integrative approach" is clearly identified as one of the central principles of the NAS, whereas integration is mainly understood as coordination. The NAS states that the various sectoral adaptation strategies, policies and measures should be well coordinated in order to avoid conflict and interference and to enable the exploitation of possible synergies (chapter 1). Similar demands are drawn up on the basis of the principle of sustainability, which is also identified as a guiding principle of the German NAS. Mindful of the principle of sustainability, the NAS states that there should be a close link between the NAS and the Sustainable Development Strategy as well as relevant sectoral strategies – in particular, the strategies on biodiversity and on the development of rural areas. Moreover, potential conflicts and synergies regarding mitigation are considered and the need for due coordination in this regard is also asserted (chapter 3.4),

accompanied by examples of both synergies and conflicts between adaptation and mitigation measures.

As regards the second aspect of policy integration – namely, activation of sectoral and regional/local actors – the German NAS is covering most of the prerequisites and approaches set out in chapter 7. On the governmental level, the political commitment of all relevant ministries has been sought and promoted by means of formal adoption by the cabinet. In future, the NAS will seek to enhance participation and coordination between different parts of the governmental by announcing the establishment of a permanent interdepartmental working group, while the environmental ministry will maintain its lead in developing further policies and measures. Moreover, a frequent exchange between federal and state governments will be institutionalised within the existing sectoral cooperative bodies/committees.

Stakeholder participation is generally considered to be an important means of ensuring that action is taken, and openness, transparency and cooperation are cited as guiding principles of the NAS. To that end, it is announced within the NAS that the federal government will intensify its dialogue with municipalities and private stakeholders. According to chapter 5.2, a large stakeholder conference in May 2009 will launch a series of conferences, meetings and hearings.

In terms of policy instruments, particular importance is attributed to "soft" auxiliary measures such as research, knowledge dissemination, awareness raising and capacity building. However, significant organisational and steering measures are considered necessary, as well. Above all, the NAS places considerable emphasis on the importance of spatial planning – as a means of making a thorough assessment of all relevant adaptation needs within individual regions and a formal platform on which all actors can present their interests and develop a coherent spatial structure and an integrated programme of measures. According to chapter 3.2.14 of the NAS, the spatial planning system will be adapted and activated in numerous areas (climate-proof infrastructure, flood protection, water management, heat, agriculture, forestry, habitat protection etc.) for the purposes of climate change adaptation.

In addition to adaptive spatial planning, given the increase in environmental risks and vulnerabilities, the NAS envisages the adoption of new regulatory standards of environmental protection, water management and plant safety. These considerations remain somewhat abstract in the NAS, however, and the necessary regulatory measures will need to be made substantive during later stages of the adaptation process. In order to ensure that such concrete measures will actually be taken in the follow-up period, the NAS includes several commitments on implementation, monitoring and evaluation (see below).

4.8. Compliance and evaluation

In order to arrange for timely follow-up and implementation, the NAS states among other things that the federal government will develop and submit an adaptation action plan by April 2011. This plan must comprise an evaluation of the latest developments and a set of concrete measures to be taken at the federal level. In addition, the NAS includes a schedule which sets out the ”milestones” of the further mid-term process:

- Cabinet to report on the German NAS – December 2008;
- interdepartmental working group on climate adaptation to be appointed – first quarter of 2009;
- initial stakeholder conference to be held in preparation for the national action programme – May 2009;
- first draft of the action programme to be presented by the interdepartmental working group – April 2011;
- first mid-term review on the implementation of the action programme – April 2013.

The NAS also states that a meaningful set of indicators and a monitoring system will be established in the near future. Research initiatives on indicators and monitoring systems will be launched by the Ministry for Education and Research in 2009.

5. Latvia

5.1. The Latvian national adaptation strategy

Latvia does not yet have a National Adaptation Strategy (NAS) but is at the stage of beginning its preparation. An advisory report on adaptation needs and preliminary suggestions for further policy development (Ministry of the Environment, 2008a), was accepted by the Latvian government in August 2008. The report serves as a basis for the development of the NAS. It deals with climate change impacts and vulnerabilities in different sectors, gives an overview of relevant research at international and national level and details the most important international policy initiatives related to adaptation. The report describes the current situation in Latvia, presents what has already been done concerning adaptation and outlines recommendations for future adaptation measures to be taken.

The advisory report was prepared by the Ministry of the Environment of Latvia, in close cooperation with researchers and representatives of other ministries. The NAS itself will be developed by two working groups. One group will

be an inter-governmental expert group, consisting of representatives of several ministries, while the other group will include scientists, specialists from different agencies and representatives of companies and the insurance sector. The NAS preparation process is led and coordinated by the Climate and Renewable Energy Department within the Latvian Ministry of the Environment. The NAS is planned to be finalised within one year of the delivery of the EU White Paper on adaptation, by the end of 2009. It will promote the integration of adaptation into existing policies in a more systemic way as well as the creation of new adaptation policy measures. The tasks of the two working groups are complementary. The inter-ministerial working group focuses on the revision of policy planning documents and legislation to account for adaptation, while the expert working group concentrates on existing knowledge on impacts and adaptation as well as needs for further research. The groups meet periodically to present their findings to each other. Members of the two groups are also welcome to participate in each others' meetings.

5.2. Sectoral adaptation policies

There are several examples of recent sectoral policies in Latvia in which there is some account taken of adaptation. In the water sector, a National Flood Risk Assessment and Management Programme for 2008-2015 has been prepared. The programme takes into account the requirements of the EU Flood Directive. It identifies flood risks in Latvia, prioritises risk territories and gives suggestions for flood protection measures and further research. The programme also considers the effects of climate change on the production of hydroelectric power (Ministry of the Environment, 2008b).

In the agriculture sector, a Conception on Risk Management Policy in Agriculture has been prepared. The main task of the policy initiative is to establish a public/private partnership principle for compensating damages to farmers caused by adverse weather conditions. The initiative suggests the creation of an agricultural risk fund, together with other measures and regulations to improve risk management in agriculture (Ministry of Agriculture, 2007).

There are also examples of legislation under preparation that take some accounts of adaptation. These include laws on regional and spatial planning. In addition, the Rural Development Programme for Latvia 2007–2013, which was adopted in 2006, deals with risks caused by climate change, including flooding and drought (Ministry of Agriculture, 2006). However, adaptation to climate change is not explicitly mentioned in the plan. Other sectoral initiatives that consider adaptation include the National Security Conception, which deals with

risks caused by climate change in addition to other risks (Ministry of Defense, 2008) and the Latvian Sustainable Development Strategy up to 2030, which is currently under development. The strategy is planned to be accepted by the Latvian Government during 2008.

5.3. Drivers for climate adaptation policy

In Latvia, some of the motivating factors that have been used in the policy discussions for developing the National Adaptation Strategy relate to concerns about increasing temperatures, an increasing risk for coastal erosion as well as changes in hydrological processes, of which there is already experience. Changes in the water cycle have implications for hydropower, which is an important source of electricity in Latvia. In the adaptation policy discussions it has also been recognised that there can be potential benefits related to climate change, especially concerning agriculture and hydropower production. In addition, reference has been made to the economic costs caused by extreme weather events in 2005 and 2006. Outcomes of scientific research concerning the impacts of climate change in Latvia have served as a reference when discussing the development of the NAS.

5.4. Science-policy interactions

Several research projects and programmes related to the impacts of climate change have contributed to the development of Latvian adaptation policies and will also support the development of the NAS. One of the most important research programmes contributing to adaptation policy development is the national research programme "KALME" which focuses on the impacts of climate on water[29]. Other research projects that have contributed to the development of adaptation policies include, for example, the international ASTRA project[30], as well as national research projects related to the impacts of climate change on forests, agriculture or geological coastal processes in Latvia. The outputs of these research projects feed into the development of the NAS. Researchers are also involved in one of the two working groups that are set up for preparing the NAS, thus contributing to its content.

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[29] KALME programme "Climate change impact on the waters of Latvia" (2006–2009). For more information, see: http://kalme.daba.lv/en

[30] ASTRA "Developing Policies & Adaptation Strategies to Climate Change in the Baltic Sea Region" (2005–2007). For more information, see: http://www.astra-project.org/0_home.html

5.5. Knowledge transfer and awareness raising

It has not yet been defined how the NAS will deal with knowledge transfer and awareness raising. However, there have been several activities related to raising awareness on climate change. For example, the Climate and Renewable Energy Department (within the Latvian Ministry of the Environment) has organised several workshops on adaptation issues. In addition, before starting work on elaboration of the NAS, a public discussion was organised at a web portal on public policy in the context of a new Latvian Environmental Policy programme for 2008–2015, which includes a chapter on climate change and adaptation[31]: The outcomes of the discussions and workshops will be used when preparing the NAS. Establishment of a national web portal for climate change and adaptation has also been discussed in the context of the NAS, but no decisions have yet been made. In general, several publications on climate change impacts and adaptation in Latvia have been produced to raise awareness about the issue among different audience groups. An important actor in raising awareness about climate change issues has been the National Research Programme KALME (see section 5.4 on science-policy interaction), which has a separate work package on communication.

5.6. Multi-level governance

During the process of preparing the NAS, regional and local governments will be consulted and will thus provide an input. Adaptation at the regional and local levels is also addressed in the sectoral policies described in section 5.2. The NAS process in Latvia also has a link to EU adaptation policies. The EU's White Paper on adaptation that is scheduled to be published in early 2009 will serve as a reference for the Latvian NAS and have some influence on its content, even though national priorities are a key driving factor for its development.

5.7. Policy integration

Adaptation was already integrated into various sectoral policies before the development of the NAS, as described in section 2. These sectoral policies are not motivated only by climate change, but address the relevant impacts of climate change within the sector in question and give recommendations for measures to

[31] *POLITIKA.LV a web portal on public policy. For more information, see: http://www.politika.lv/en/*

be undertaken to adapt to these impacts. One of the objectives of the forthcoming NAS is to promote a systemic mainstreaming of adaptation issues into existing and future legislation and sectoral planning and to provide a framework for future adaptation policies.

5.8. Compliance and evaluation

Evaluation of the implementation of Latvian NAS has not yet been decided upon, as the preparation of the strategy is still in its early stages. Evaluation will be one of the issues to discuss within the two working groups preparing the NAS.

6. Netherlands

6.1. The Dutch national adaptation strategy

Throughout its history, water has played a major role in the development of the Netherlands. The Netherlands is a small country of approximately 34,000 km^2, located within the deltas and flood plains of the rivers Scheldt, Meuse, Rhine, and Ems. At present, almost one-third of the country is located below average sea level (much of which is land reclaimed from the sea), while a further third has to be protected against flooding by rivers in periods of high river discharges (van Koningsveld et al., 2008). With most of the economic activities situated in this largest delta region of Europe and alongside major rivers, the impacts of climate change could be disastrous for the Dutch society and economy.

In the decades following a large flood disaster in 1953, the country was protected against high water levels by a series of large infrastructural works, e.g. the Deltaworks. When near floods occurred in the Rhine river basin in 1993 and 1995, questions were raised as to whether traditional technological interventions,

such as dike reinforcements and pumping water out of polders, would be sufficient to counter the effects of weather, sea level and river flow extremes in the long run (de Vries, 2006; Voogd, 2006). As a result, in the first half of the 1990s a new discourse of "accommodating water" emerged that became the incentive for the current "room for the river" policy concept (Wiering and Immink, 2006). Still, the increasing threats of floods, that may be exacerbated by climate change, make the Netherlands one of the most vulnerable regions in Europe (EEA, 2008; VROM, 2007b). As a result, the Netherlands' adaptation focus is very much on water management, coastal protection and spatial planning.

However, the effects of climate change in the Netherlands will not only increase river discharge and sea level rising, but will also create longer periods of droughts, increase the urban heat islands effect and the probability of urban floods due to increased precipitation (Kabat et al., 2005; MNP, 2006).

The National Adaptation Strategy (2007)

It is perhaps somewhat surprising that although climate change will most certainly have a large impact on Dutch society, the National Adaptation Strategy has only been developed well after the turn of the century. In the period before, the political and scientific focus was almost exclusively on mitigation. In 2007, a formal Dutch National Adaptation Strategy entitled *"Make Space for Climate!"* was agreed, consisting of a short political document endorsed by all relevant ministries and other governmental bodies, and a more detailed background document. During the conference *"Make Space for Climate"* on 27 November 2007, the NAS was discussed by politicians, scientists and representatives of society. The strategy documents are the starting points to formulate more concrete climate adaptation policy in the Netherlands as they identify bottlenecks, opportunities and threats related to climate change and provide options that can help to make spatial planning in the Netherlands climate proof.

The focus of the document is primarily related to spatial measures, although raising awareness and identifying knowledge gaps are part of the strategy. The NAS is an effort of the national government that does not contain very specific measures yet. The implementation will be the responsibility of all involved stakeholders, for example through public-private partnerships. Inter-sectoral and integrated solutions should be the result of cooperation between governmental organisations, private businesses, NGOs and the scientific community. In addition, the NAS describes which parts of the strategy can deliver short-term results and identifies where further study is required (VROM, 2007b). However, the NAS concludes that limiting the emissions of greenhouse gases is the best option for adaptation: the more GHG emissions can be reduced, the less

adaptation in required. Energy, for example, has not been included in the NAS as this lacks a clear spatial dimension. The Ministry of Housing, Spatial Planning and the Environment initiated a work programme in 2007 entitled *"Clean and Efficient: New Energy for the Climate"*. The programme aims to develop one of the most efficient and clean energy supplies in Europe by the year 2020 and may include attention to adaptation as well, as renewable energy and construction can have adaptation dimensions (VROM, 2007c). But no concrete evaluation of the possible synergies and trade-offs between adaptation has been made to date. After publishing the NAS by the end of 2007, regional meetings with stakeholders are held to include initiatives from the regions to formulate tailor-made policy strategies. The combination of these outcomes and NAS will form the National Adaptation Agenda (NAA). It is expected that this agenda will be made available somewhere in the beginning of 2009 and provide executive actions for the period 2009–2015.

The Dutch cabinet set up a second *"Delta Commission"* in September 2007, following the Delta commission that was formed after the 1953 floods. The Commission has the objective to assess how the Netherlands can be made climate proof for the periods 2050–2100–2200. In their report, published September 2008, the commission made several recommendations to increase water safety by a factor of ten. To make the twelve major recommendations operational (and acquire the necessary funds) the commission proposed; a *Delta law* (in which the tasks and responsibilities are described), *Delta director* (who is responsible for coordinating the execution of the plan) and *Delta funds* (in which each year €1–1.3 bn is deposited by the national government to pay for the implementation) (Deltacommissie, 2008).

6.2. Drivers for climate adaptation policy

Main driver for action: Political drivers

Following a growing body of scientific evidence of a changing climate over the years, the motion "Lemstra" (2005) in the parliament marks the start of the political process of developing a national adaptation strategy. It calls for integrated long-term visions and strategies, in line with the National Spatial Strategy, where long-term challenges such as climate change are to be included. The NAS, initiated by the Ministry of Spatial Planning, Housing and the Environment, is the direct response to that question. The national programme *"Adaptation to climate change in spatial planning"* (ARK) was initiated to coherently develop the NAS. In addition, the IPCC–AR4 has given new impetus to the discussion on climate change, placing it high on the Dutch political agenda. As a result, major developments

have started, for example the €100 million research project *"Knowledge for Climate"* (of which €50 million is governmental subsidy) (2009–2014) and the *"Delta commission"* (200–2008).

Weather and climate impact drivers

The vulnerability to (coastal, river, urban) flood events is the main driver for adaptation policy. In an assessment on the main impacts of climate change, the ARK programme argued that the impacts on water, nature, agriculture, energy, transport, housing and infrastructure, health, leisure and tourism will be hardest and are therefore drivers to formulate an adaptation strategy (Routeplanner, 2006). Notwithstanding this broad set of drivers, when discussing climate change in the Netherlands, it is inevitably about water management, especially flood risk management and coastal protection.

Risk perception

Over the last decade, the dominant perception of climate change as a risk that has to be reduced or managed has been complemented by a view of climate change as a source of opportunities and innovation. Not only is this induced by the interest in exporting expertise and technology, but also by the strong desire to keep the low-lying areas of the Netherlands an attractive place for labour, living and leisure, and thus for economic investments.

Scenarios and long term projections

In 2006 the KNMI published climate scenarios for 2050 and 2100. As it is highly uncertain if and how air circulation patterns will influence global warming, the KNMI chose to make two sets of scenarios: one which includes changes in air flow patterns compared to the current situation and one which does not. Within each set, there are two scenarios that include an increase of the world average temperature by 1 and 2 °C respectively, compared to the 1990 situation. This is to some extent reflecting the range of IPCC scenarios, but without a direct link with the IPCC's socio-economic scenarios (SRES). According to the KNMI, it is 80 percent certain that the average temperature during winters will increase between 0.9 and 2.3 °C and sea levels will rise between 15 and 35 cm in 2050 compared to the 1990 situation (KNMI, 2006). The Delta Commission, making use of up-to-date scientific knowledge and climate projection models, argued that 0.5–1.3 meters sea level increase for the 2100 are not unthinkable.

6.3. Science-policy interactions

In the Netherlands, the political debate on climate change is generally well supported by science, but up to recently this was mainly focusing on mitigation. Since the 1990, with the "National Research Programme Global Change" (1990–2000) the focus has been on the human footprint on climate change, and inevitably, the potential impacts on the Netherlands. Recently, four research programmes started that are taking climate change impacts and adaptation as their main research focus: "Living with Water", "Habiforum", Climate changes Spatial Planning (CcSP), and the most recent one, Knowledge for Climate (KfC). Most of these programmes are financed through the national research stimulation fund "Bsik" (Decision Subsidies Investments Knowledge Infrastructure) which aims to lay the foundation for high-quality knowledge economy in the Netherlands. The research projects are developed by the conjoined effort of universities and other private knowledge institutes. The latter two research programmes are the most recent and relevant for the development of the NAS and its follow-up.

National Research programme "Climate changes Spatial Planning"

The national research programme "Climate changes Spatial Planning" (2004–2011) has the objective to study the impacts of climate change and the way to cope with the effects, focusing on spatial planning, to support decision-makers on the future development of the Netherlands. During the seven years of research, with a total budget of €100 million, the main body of research is conducted within five research themes for which knowledge gaps were identified: Climate Scenarios, Mitigation, Adaptation, Integration and Communication.

National research programme "Knowledge for Climate"

The second national research programme is the recently approved "Knowledge for Climate" which aims at developing applied knowledge through cooperation between the Dutch government, the business community and scientific research institutes. It has a total budget of €100 million for the period 2008–2014. The research programme aims at the development and transfer of scientific and applied knowledge on climate in its relation to spatial planning, infrastructure and sustainability, for government and business sectors towards "climate proofing" the Netherlands.

This research programme has three parts:

1. Hotspots programme lines: aims for the development of regional adaptation strategies in eight case study areas that are particularly vulnerable to the impacts of climate change.
2. Climate Knowledge Facility: develops generic knowledge and models on climate change impacts and adaptation options and feeds the hotspot teams with specific scientific data and information.
3. Knowledge Transfer, including international hotspots: serves as intermediary between the Climate Knowledge Facility, the hotspot teams and third parties which are interested in the exchange of knowledge.

The Dutch National Environmental Assessment Agency (PBL, formerly known as MNP), is an independent advisory organisation that develops policy assessments on the impacts of climate change, e.g. (MNP, 2006). They are an important link between the scientific research and the policy development in providing up-to-date information.

The national programme "Adaptation to climate change in spatial planning" (ARK) is an intermediary national programme that operates between the research community and policy-making with the objective to make the spatial planning in the Netherlands climate proof. This programme involves the scientific community, governmental organisations[32] and ministries[33]. The outcomes of the aforementioned research programmes are gathered in the scientific part of ARK called *"Routeplanner"* that provide input to adaptation policy (ARK, 2006). With the Ministry of Housing, Spatial Planning and the Environment taking the lead, two documents were produced at the end of 2007, a background and policy document, that form the National Adaptation Strategy. With the acceptance by the parliament, ARK is currently developing a National Adaptation Agenda entitled "The National Implementation Agenda Make Space for Climate", that most likely will include more detailed information on the implementation of the NAS. The NAA is expected in the first months of 2009.

The state advisory commission (Delta Commission) report (see also introduction) has developed advice to the national government on sustainable coastal zone management, river management and other water related issues.

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[32] *Inter provincial cooperation (IPO); Association of Dutch municipalities (VNG); Union of Water Boards (UvW)*

[33] *Ministry of Housing, Spatial Planning and the Environment, Ministry of Transport, Public Works and Water Management, Ministry of Agriculture, Nature and Food Quality, Ministry of Economic Affairs*

This report stresses the importance of coordinated governmental action and proposes to initiate a delta law.

6.4. Knowledge transfer and awareness raising

Adapting to climate change is more than taking spatial measures; it involves public and private organisations, NGOs and the rest of society. It is important to create general public support to take action and implement strategies. To adapt to climate change means to start rethinking our activities and take the impacts into account in our everyday lives. One of the main issues in the National Adaptation Strategy therefore, is to raise awareness on the impacts of climate change and the opportunities this offers for society. The NAS argues that distributing knowledge is a necessity and, therefore, argues to construct a broad communication strategy on the impacts of climate change and the options for adaptation to inform society (VROM, 2007b).

The Platform Communication on Climate Change (PCCC) is currently the main national source of information about climate change for the general public and stakeholders. It is an initiative from the Dutch research institutes and universities[34] to communicate research outcomes to the general public. PCCC operates a website[35] where, in an integrated manner, up-to-date knowledge on the weather, climate change, effects and impacts, mitigation and adaptation are made available to policymakers, industries, interest groups, media, and other public. In addition, the PCCC creates factsheets, leaflets and brochures and organises workshops and dialogues where scientific research is combined with topical events in society. The PCCC is funded partly by the CcSP research programme and partly by additional funds from the national government. The objective of the PCCC is to enhance the quality, efficiency and effectiveness of the communication on Dutch climate change research.

Many other organisations offer information about climate change on their websites, including both governmental and non-governmental organisations. For example, the "Living with Water" research programme has an interactive website where information related to water management and extreme weather events as a result of climate change are communicated. With short animated

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[34] The PCCC is a conjoined effort of the Netherland Environmental Assessment Agency (PBL), the Royal Dutch meteorological office (KNMI), the Netherlands Organisation for Scientific Research (NWO), Wageningen University and Research centre (WUR), University of Utrecht (UU), Energy centre of the Netherlands (ECN) Free University of Amsterdam (VU)

[35] http://www.klimaatportaal.nl/

commercials and comic strips, the Dutch government tries to inform society on the impacts of climate change, particularly in relation to flood risk. Knowledge transfer and communication is one of the key elements of the Knowledge for Climate programme as well, but this programme still has to be developed.

6.5. Multi-level governance

The National Adaptation Strategy "Maak ruimte voor Klimaat!" (2007) does not make any reference to the division of responsibilities between the parties that are involved in the adaptation process. It argues that conjoined efforts of public, private and science is needed to reduce vulnerability and enhance the coping capacity. According to the NAS, the best geographical scale would be the regional level since "...the regional scale is the best platform to link knowledge and experiences as well as bringing together the actors that are willing to test an innovative approach in concrete projects" (translation from Dutch). The NAS has explained some of the actions the government and decentralised authorities will undertake (amongst others):

National government	***Decentralised governments***
Assess the vulnerability of the national spatial development plan	*Integrate climate change in provincial structure visions (spatial planning)*
Assess the impacts of climate change in water context (see policy integration)	*Integrate climate change in new and existing research programmes on provincial level*
Finance knowledge development (case studies)	*Investigate the possibility to develop adaptation funds to finance adaptation measures*
Risk assessment, early warning systems, and methods to increase social awareness	*Conduct small – medium sized case study projects*
Actively monitor the adaptation process	
If needed adjust the policy instruments (law-regulations) and frameworks	

The distribution of responsibilities (e.g. who will pay, who takes action) will be further assessed in the proposed National Adaptation Agenda (beginning of 2009).

Europe

The NAS does not make any references to the activities of the European Union on climate change adaptation, such as the Green Paper (CEC, 2007c). Some reference is made to European directives, such as the directive on the assessment and management of flood risk, but not particularly in the context of climate change (CEC, 2007a). It is yet to be seen to what extent European climate

adaptation policy, e.g. as proposed in the White Paper planned for 2009, have on national and local adaptation planning. Large EU INTERREG and Framework research programmes provide funds for local and regional case studies, such as the ESPACE and BRANCH projects.

National Government

The NAS does not specify tasks and responsibilities: adapting to climate change is something that requires efforts of society. Joined efforts of the scientific community, policy, NGOs and the rest of society make the Dutch process of adapting to climate change a transdisciplinary challenge. The Dutch climate adaptation efforts are an example of combining top-down and bottom-up approaches to make adaptation work. The NAS is a clear example of a top-down approach; scientific research from research institutes has been translated by policymakers into climate policy for the national level. The follow-up after the NAS, however, includes stakeholder meetings at the regional level, where specific measures can be included in the National Adaptation Agenda.

Provinces

Provinces and municipalities as well as water boards and other stakeholder groups are currently in the process of developing adaptation strategies. One of the most prominent developments at the provincial level is the CCsP and interprovincial cooperation (IPO) project "klimaatschetsboeken", in which more detailed assessments of the climate change impacts are portrayed for specific provinces particularly to support the design of spatial and water management plans. Large climate datasets are coupled to national and regional socio-economic and spatial datasets. This project is the first step in the development of adaptation measures and assessment frameworks for spatial development in provinces to assist in provincial and local governments in taking no-regret strategies. In a follow-up project the "klimaatschetsboeken" are translated to "klimaateffectatlassen" where the effects of measures are further developed. The province of Groningen has started to develop a specific adaptation strategy. However, due to a number of political reasons the strategy did not pass the board of the province. As a result, in preparation of the new spatial planning vision of the province, climate change will be mainstreamed in a separate chapter.

Regional and local

The new "Knowledge for Climate Programme" will provide options for applied case study analyses: the so-called hotspots. These eight hotspots cover the

most vulnerable regions in the Netherlands. Within these hotspots, a continuous interaction is foreseen between the knowledge demand (stakeholders in hotspots) and supply (scientists participating in the Climate Knowledge Facility), facilitated by knowledge transfer specialists. The national government has already taken a head start for implementing the NAS by signing the *"Climate agreement municipalities and national government 2007–2011"* on 12 November 2007, to make the Netherlands climate proof and aim for sustainable development (VROM, 2007a). Although the focus in this agreement is mainly on energy and resource management, a section is specifically devoted to adaptation. Art. 17 argues that both the national and local government together will:

- Identify the adaptation measures that are needed in spatial planning, water management, health and urban development of municipalities (in context of ARK programme);
- Identify additional research on the missing adaptation options for municipalities (missing knowledge);
- National government reserves € 1 million for pilot studies and additional research;
- The pilots should be linked to the KfC programme.

6.6. Policy integration

Climate change was included in many sectoral policy domains before the National Adaptation Strategy was finalised in 2007, particularly in water management and spatial planning. Several of the climate sensitive sectors had already formulated policy strategies to cope with the impacts of climate change. Although this has not been elaborated in the NAS in detail, it is most likely that measures will be mainstreamed in existing and new sectoral policies. The NAS, however, argues that besides mainstreaming options at the national level integration will take place at the subsidiary local and regional levels. The NAS argues that spatial planning will fulfill an important role in integrating measures and aim for sustainable development.

The NAS looks primarily at the water dimension with reference to the programme *"National Safety"* (2008) where climate change is one of the themes, In addition, reference is made to policy strategies such as the *"Water vision"* (2007)[36] in preparation of the *"National Water Plan"* (2009) and the policy

[36] *Report can be downloaded from the website: www.adviescommissiewater.nl (in Dutch)*

document *"Water safety 21st century"* (2008)[37]. Special reference is made to the advisory commission *"Sustainable coastal zone development"* or *"Delta Commission"* to give input to the National Water Plan and think about what the Netherlands will look like beyond 2100. Furthermore, the adaptation strategy makes refers to the "National Spatial Strategy" (2006)[38], the "Randstad Strategic Agenda 2040" (2006)[39] and the "Urgency programme for the Randstad" (2007)[40] as possible instruments to include climate change.

6.7. Compliance and evaluation

The National Adaptation Strategy does not yet include indicators to monitor and evaluate the effectiveness of the strategy or adaptation policy in general. However, there are some indications that suggest the need for indicators to monitor effectiveness. For example, the NAS argues that spatial plans will be checked if climate change has been included and if the plan is "climate proof". Traditional social cost benefit analysis alone will not be sufficient to monitor effectiveness. The NAS also argues that it aims to "...actively monitor the adaptation process; both the decision-making process on large spatial investments as the physical changes in the Dutch spatial planning. Potential bottlenecks in the current governance structure will be assessed" (translation from Dutch) (VROM, 2007b).

Although some countries are actively searching for indicators for monitoring the effectiveness of policy, there are no indications that such a process has started Netherlands. However, discussions have started on policy appraisal frameworks (Routeplanner, 2008). Especially for the environmental impact assessment, water test, and building decree are important instruments (see below);

- **Environmental impact assessment:** Following the EU guidelines, the EIA is an important instrument following a mandatory process for specified plans and programmes, including examination of alternatives, public involvement in the scoping and review phases and review of the quality of the information by the independent Commission for Environmental Assessment (NCEA).

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[37] *For more information see website www.waterveiligheid.unitedknowledge.org (in Dutch)*
[38] *Additional information on the National Spatial Strategy "Nota Ruimte ruimte voor ontwikkeling" see the website www.international.vrom.nl/pagina.html?id=7348*
[39] *See website www.international.vrom.nl/pagina.html?id=10714*
[40] *See website www.vrom.nl/get.asp?file=docs/publicaties/w947.pdf*

- **Water test:** a legal instrument that policymakers can use to have climate change aims integrated in plans and projects. The Water test is an important instrument for provinces and water boards to have influence on spatial plans seen from a water point-of-view. The objectives of the Water test are to guarantee that water interests are taken into account in spatial and land use planning, so that negative effects on the water system are prevented or compensated for elsewhere.
- **Building decree:** a legal instrument that policymakers can use to have climate change aims integrated in plans and projects. The technical building regulations in the Netherlands are laid down in the Building Decree (or Building Code; Dutch: "Bouwbesluit"). These are uniform and performance-based regulations on the national level, which all structures must comply with.

7. Portugal

7.1. The Portuguese national adaptation strategy

In spite of the uncertainties in future predictions, in most climate change scenarios the Mediterranean region and Southern Europe are expected to be strongly affected by future climate change. Because of its localization in the South of Europe, Portugal is considered to be one of the countries that is particularly vulnerable to climate change, especially because of the occcurence of extreme climatic events. Over the past years, this vulnerability has been illustrated by a series of (record-breaking) climatic extremes. The heat waves of 2003 and 2005, the droughts of 2004 / 2005 and 2007 / 2008 and the floods of 2008 were among the worst that Portugal had ever experienced. The same accounts for the forest fires of 2003 and 2004 that resulted, at least partly, from the extreme droughts.

The extreme events from the past years are indeed consistent with the findings of a comprehensive research programme undertaken between 1999 – 2004 in Portugal. The SIAM, "Climate change in Portugal – Scenarios, Impacts and Adaptation Measures" research project, had already illustrated the vulnerability of Portugal and put climate change on the agenda. Nowadays, climate change is increasingly at the centre of attention, including at government level. Where the original focus was mainly on mitigation, following the agreements made at international level (e.g. Kyoto), the concern for adaptation strategies is now growing. The Ministry of Environment, Spatial Planning and Regional Development in 2007 commissioned the development of a Reference Document for the definition of a National Adaptation Strategy for Climate Change. This Reference Document supports the development of a National Strategy for adaptation to Climate Change, which is due to be approved by Government in the spring of 2009. At time of writing, no (draft) strategy was available. The Strategy will be strongly based on the active involvement of and commitment from stakeholders from different sectors such as agriculture, tourism, insurance companies, water companies, health sector etc., and will set the frame for concrete, on-the-ground policies and measures to be concluded until the end of 2011.

This process is led by the interdepartmental Commission for Climate Change's (CAC, first installed in 2001) Executive Committee, supported by Ecoprogresso[41]. In the meantime, several regional and sectoral actors and institutes have already started to take climate change into consideration in their sectoral plans. Some examples of these sectoral developments are: the National Heat Waves Contingency Plan, the installation of the Commission for Droughts, the Icarus alert system for the city of Lisbon, the Adaptation Measures in the National Forest Strategy and the related Plan against Forest Fires. Thus, the much desired "mainstreaming" of climate change adaptation strategies that is at the heart of the Portuguese adaptation strategy is beginning to take shape.

Portugal is building on the findings and experiences from other countries. Especially the experiences from the UK (UKCIP) and Spain (Oficina Espanola de Cambio Climatico) seem to function as important references. The EC's Green Paper on adaptation is also an important reference as will be its follow-up document.

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[40] *Ecoprogresso is a Portuguese consultancy organisation which has developed the Reference document on the National Climate Adaptation Strategy for the Portuguese Ministry of Environment. Ecoprogresso officially started in 2003 with some of its members already having participated in the SIAM research project that ran between 1999–2003.*

7.2. Drivers for climate adaptation policy

In general, it is the results from the extensive SIAM Research project (1999–2006), in combination with the extreme climatic events in recent years including droughts, floods and heat waves, that can be seen to have triggered the current focus on climate change and the climate change adaptation strategies. Consciousness is growing that Portugal is especially vulnerable to the consequences of climate change, mostly with respect to extreme events (droughts, floods, fires etc.) and that action is urgently needed.

SIAM I ran from 1999 until the end of 2001. The objective of the proj-ect was the realization of the first integrated evaluation of the impacts and adaptation measures concerning climate change in Portugal in the 21st century. The studies were based on future climate scenarios that were drawn from general climate change models and projected onto a set of socio-economic sectors and biophysical systems. The SIAM project was divided functionally into 10 groups and an integration team. Seven groups worked on climate change impacts and adaptation measures for specific sectors (impact groups): water resources, coastal zones, agriculture, human health, energy, forests and biodiversity and fisheries. The remaining groups worked on climate and climate scenarios, socio-economic scenarios and a sociological analysis of climate change issues in Portugal. To facilitate integration across sectors, all groups used the same set of climate data (observed and scenarios) and socioeconomic scenarios. The main results of the project were presented in an executive summary and conclusions, published in October 2001. The results were communicated in Portuguese and in English to the general public, decision-makers and other scientists. Throughout the assessment process there were many consultations / interviews with experts (international and national), stakeholders, and with the other SIAM project groups to discuss cross-sector issues. SIAM I was financed by two foundations. The first one, the Foundation for Science and Technology, is comparable to the Dutch NWO. The second one, The Foundation Calouste Gulbenkian is a private foundation.

The second phase of the SIAM project (SIAM II) started in January 2002. This second phase focused on the case study of the Sado Estuary as well as a widening of the studies to the regions of Madeira and the Azores. SIAM II also included a so-called outreach component with the objective to divulgate the results from SIAM I to a wider public and to obtain inputs for SIAM II through the organisation of meetings to which representatives of different sectors were invited. The results from the second phase were published at the beginning of 2006 in the book entitled: "Alterações Climáticas em Portugal. Cenários, Impactos e Medidas de Adaptação – Projecto SIAM II", F.D. Santos e P. Miranda editores, Gradiva, Lisboa,

2006. SIAM II was financed by the Instituto do Ambiente (Environmental Institute), and the Portuguese Ministry for Cities, Spatial Planning and Environment.

The Portuguese climate scenarios that are backdrop of adaptation policy are mostly based on IPCC General Circulation Models (GCM IS92a) of which the potential consequences at regional and sectoral level have been analysed throughout several SIAM research projects. However, the real life events in recent years have probably been far more telling and influential than any model or research project could ever be. Extreme climatic events are are at the core of risk analysis of climate change, being the risk philosphy in the first place to develop more resilience and flexibility in strategic plans at regional and sectoral level. In general, the main governmental concern is to have adaptation strategies adopted and implemented at regional and sectoral level thus realising the so-called mainstreaming of climate adaptation strategies.

Formally there is a Commission for Climate Change (CAC) at ministry level, installed in 2001, and including representatives of the different ministries. The Executive Committee of the CAC was installed in 2006 and is composed by a representative of seven ministries. It is coordinated by a representative from the Ministry for Environment, Spatial Planning and Regional Development and its main tasks are: to stimulate, elaborate, coordinate, manage and evaluate practical actions in the field of mitigation and adaptation of climate change effects.

7.3. Science-policy interactions

Science has played an important role in awareness raising about climate change and the development of scenarios, mostly through the SIAM I & II projects (1999–2002 / 2002–2006). The SIAM II project completed the SIAM I project with information about Madeira and the Azores as well as a detailed case study for the Sado river estuary and more information about the effects of climate change on tourism. Some follow-up projects can be identified (e.g. CLITOP / PORTCOAST). However, the current focus of the CECAC is on stakeholder involvement and implementation and on application of adapatation strategies. The motto is: "From studies to partnership action".

Follow-up research is being seen as useful, especially concerning the downscaling of impacts / scenarios but it is not seen as a priority. Most research taking place now is on an individual scale through Phd theses, often funded by the Foundation for Science and Technology (FCT). Sporadically, Ecoprogresso does offer support and information to individual Phd students. However, the current proces of developing a National Adaptation Strategy, following the Reference Document and including regional and sectoral stakeholders, might bring up new

research questions. Thus, the current perspective on research is that it should be stakeholder-led.

7.4. Knowledge transfer and awareness raising

This is the main issue in Portugal at the moment. The Reference Document developed for the Ministry of Environment supports the development of a National Strategy for Adaptation involving both public and private stakeholders. In order to do that, a series of actions is scheduled until mid–2009, which is the approval deadline for the Portuguese Strategy on Climate Adaptation. This initiative, a public-private initiative between Ecoprogresso (coordinator), the Ministry for the Environment, Spatial Planning and Regional Development and the British Embassy in Lisbon, has the following main objectives:

- To facilitate Portugal becoming a reference on adaptation to climate change and contribute to sharing knowledge with the poorest countries, in particular the Portuguese speaking countries;
- Encourage the integration of impacts to climate change in decision-making processes;
- Decrease the vulnerability of the main socio-economic sectors through integration of adaptation measures in planning and investment projects.

The actions include:

- A starting conference (In a Changing Climate) on 23 June 2008 for a series of experts and stakeholders from different sectors and (governmental) levels. This can be considered as a first attempt to reach (top-down) the main actors at different levels, hoping for a trickle down effect (http://www.numclimaemmudanca.pt/).
- A series of 12 workshops concerning different themes and sectors and involving specific actors from each sector, aiming at a more horizontal approach and involvement of stakeholders. Stakeholders will be widely invited both at national and regional level according to each specific theme for the workshops (Water, Spatial Planning, Tourism, Bank and Insurance, Agriculture and Forests, Energy, Human Health, Biodiversity, Natural Disasters, Coastal zones, Cooperation and International Investment).
- A large campaign to reach a broader and more general public.
- The creation of a website / blog which offers room for public to discuss and exchange ideas and strategies.

- There is the intention to obtain high public involvement in the development of the Portuguese NAS.

The outcomes of the different actions will be used for the development of the adaptation strategy which has to be finished by the end of 2009.

Another specific field of knowledge transfer (or rather exchange) is related with the field of development co-operation. Portugal is assuming a responsibility to exchange knowledge, share experiences and contribute to the development of adaptation strategies in developing countries. Those are mostly countries in Africa with a strong historic relationship with Portugal such as Mozambique, Angola, Sao Tome & Principe but Portugal is also looking for increasing collaboration with Brazil and other countries in Latin America.

7.5. Multi-level governance

This is one of the current challenges for adaptation strategies in Portugal. In the ideal scenario, different actors and sectors integrate the relevant adaptation measures in their mainstream strategies. "Mainstreaming" is the central concept in the Portuguese Adaptation Strategy. This also explains the current investment in involving the different stakeholders through the conference, workshops, campaigns etc. With some sectors, already positive forms of cooperation exist (e.g. Institute for Water). Still, the division of tasks and responsibilities is a point of concern, especially in those areas where many interests and responsiblities overlap. The coastal areas, for example, are especially important for tourism, housing, agriculture, water resources etc. and are likely to be affected by climate change. At the same time, the network of stakeholders is large and complex thus complicating the implementation of adaptation strategies.

7.6. Policy integration

An important instrument to stimulate the incorporation of adaptation strategies into sectoral policies is through horizontal involvement of the main actors within each sector / theme. Through the concept of "mainstreaming" the whole focus of the Adaptation Strategy is to stimulate stakeholders from different sectors to incorporate adaptation needs into sectoral policies. Mainstreaming is one of the main goals of the current "campaign". However, so far there is not really an institutional set-up to facilitate or regulate this implementation.

This involvement / mainstreaming will be triggered by a series of workshops in the coming 18 months. (Provisional) themes include: Water, Spatial Planning, Tourism, Bank and Insurance, Agriculture and Forests, Energy, Human Health, Biodiversity, Natural Disasters, Coastal zones, Cooperation and International Investment. Research is seen to be an integral part of each of these themes.

Examples of sectoral initiatives concerning Climate Adaptation are:

PNA National Water Plan (special attention for Climate Adaptation)
PDFSP National Forestry Strategy (special attention for Climate Adaptation)
PCOC National Contingency Plan for Heatwaves
IUCN Adaptation to Climate Change in Mediterranean Forest Conservation and Management
PNDFCI National plan for the defense of the forests against forest fires

7.7. Compliance and evaluation

It is still too early to judge on this. Focus is now on developing an adaptation strategy followed by an on-the-ground set of policies and measures. The strategy and the P&Ms will obviously have a monitoring, review and implementation component to assess progress and correct course as appropriate. Stakeholder involvement will feature preeminently here as well.

8. Spain

8.1. The Spanish national adaptation strategy

Spain's geographic situation and socio-economic circumstances make it very vulnerable to climate change. Spain signed the Kyoto protocol in 2001 and subsequently developed its National Adaptation Strategy, called the National Plan for Climate Change Adaptation (Plan Nacional de Adaptacion al Cambio Climatico, PNACC), which sets out a framework of coordination between the different parts of the public administration.

The PNACC was presented to the Commission in charge of Coordinating Climate Change Policies, to the National Climate Council and to the Environment Sectoral Conference (February, 2006). The Plan was reviewed through a public consultation process in which only around 50 enquiries were received. The Plan provides the framework for action on adaptation to climate change for the several autonomous communities taking part, as well as for governmental and non-governmental organisations. It was given final approval in July 2006.

While mitigation actions require a coordinated international response, Spain recognises that because of projected local impacts, adaptation actions and initiatives must be developed and implemented at a national or subregional level.

The PNACC argues that climate change adaptation is inextricably linked to mitigation policies. The NAS states that mitigation policies determine and influence greenhouse gas concentration levels, and that planning a strategy for a two-degree increase in temperature is very different from planning for a four-degree increase. The design, development and implementation of an adaptation strategy therefore requires a signficant degree of coordination in respect of mitigation measures.

Spain's NAS also states that climate change adaptation requires sectoral or multisectoral, regional, vertical and horizontal approaches. The NAS aims to embed adaptation in the decision-making processes of different sectors and systems, to comply with Spain's international commitments and to provide the tools which enable adaptation measures to be taken. The NAS should be sufficiently flexible, therefore, to be able redefine its specific objectives according to the research and information gathered.

The Spanish Office for Climate Change (Oficina Espanola de Cambio Climatico, OECC) is responsible for the coordination and generation of information, tools and data to enable the development of impacts evaluation and to facilitate participatory processes. This office will create and maintain a database which maintains all of the information that will be generated in the National Plan for Climate Change Adaptation.

8.2. Drivers for climate adaptation policy

The main drivers for adaptation in Spain are the country's intrinsic problems: a period of severe drought (the driest in the last 78 years) and an increase in temperatures (around five degrees in two decades). This has caused several problems which have resulted in the establishment of new institutions and decrees on mitigation and adapting to climate change.

The OECC has an obligation to promote climate change policies and measures in Spain. The NAS must therefore comply with international commitments and with national adaptation requirements. It has drawn on other countries' experiences as well as research undertaken within Spain.

The NAS aims to provide information and guidance; to design mechanisms to cope with the change already under way; to gather information on regional and sector-wide impacts; to determine the most pressing needs in R&D; and to

include all stakeholders in the information and decision-making processes as well as in evaluating the measures implemented.

8.3. Science-policy interactions

Spain has a number of research institutions and organisations which evaluate climate change impacts in different sectors and systems. A project to evaluate and revise these different studies was set up – the Effects of Climate Change in Spain project (Efectos del Cambio Climatico en Espana). Its final report was published in 2005 – "Preliminary Evaluation of the General Climate Change Impacts in Spain" (Evaluacion Preliminar General de los Impactos de Espana por Efecto del Cambio Climatico) – and provided a basis for the development of the NAS.

The NAS states that climate change impacts research provides it with essential scientific knowledge for the purposes of implementation, monitoring and evaluation.

Global and regional climate change scenarios are regarded as indispensable. In Spain, the National Meteorological Institute is responsible for providing such information.

Examples of climate research in which Spain has participated include PRUDENCE (Prediction of regional scenarios and uncertainties for defining European climate change risks and effects). On thebasis of that project, a Preliminary General Evaluation of Climate Change Impacts for Spain was published (2005). Another project in which Spain participated is ENSEMBLES (Ensemble-based Predictions of Climate Change and their Impacts). The NAS also mentions UKCIP02 and the work of the Hadley and Tyndall centres.

8.4. Knowledge transfer and awareness raising

Public participation is a significant part of the NAS; it is regarded as a helpful way of integrating multiple sectoral policies.

The NAS states that stakeholders must be clearly identified and should participate in the first stages of the development of adaptation policies for each sector. It mentions the need for transparency and the assignment of clear responsibilities. They are and will continue to participate through workshops, meetings, seminars, presentations, etc.

They cite as an example the work of UKCIP, which has achieved broad participation (195 actors) since it was first established.

The NAS includes a table (see p.47) which identifies institutions and stakeholders with a general interest in climate change adaptation. The NAS plans to develop a detailed and complete list. Between 23rd February and 23rd March 2006, the NAS was open for public consultation. Only around 50 people reacted but their suggestions were subsequently included in the NAS (Manez et al, 2009).

Spain already plans to communicate and raise awareness over climate change adaptation using the following means, among others:

- agreements with the media to communicate and increase sensitivity;
- distribution of materials and information regarding adaptation;
- NAS newsletters and technical reports;
- creation of methods/programmes/organisations responsible for the exchange of information and experience.

8.5. Multi-level governance

Multiple levels of governance as well as numerous stakeholders are involved in the development and implementation of the NAS. The national government sets up the framework for action, while the autonomous communities/regional levels are expected to carry out the adaptation measures.

The NAS states that Spain has used both "top-down" and "bottom-up" approaches: "top-down" to develop the strategic framework and sectoral planning; and "bottom-up", or decentralized, for the different Spanish regions.

8.6. Policy integration

The NAS states that many sectors are vulnerable to climate change to varying degrees; and the evaluation of this vulnerability is one of the NAS's objectives. The sectors included in the NAS are biodiversity, water supply, forestry, agriculture, fisheries, planning, human health, coastal management, construction, industry and energy, tourism, insurance, land use, building, mountains, hunting and fishing. Each of these sectors is and will usually be interconnected. Climate change adaptation in the different sectors must therefore be integrated between different sectors and levels of governance. The Spanish NAS also emphasises that the timetables for the embedding of adaptation within the various sectors differs significantly in many cases. For example, in the case of biodiversity, the plans range from 10 to 100 years, while the plans for hunting and fishing range from five to 25 years.

8.7. Compliance and evaluation

The evaluation of the NAS will be done through the general annual Work Programmes (Programas de Trabajo), which include the delivery of annual reports that indicate each of the activities involved and progress made to date. This evaluation will be followed by a specific report which details the main results achieved and identifies future deliverables. The OECC will prepare both reports, on the basis of which Spain plans to assess the National Adaptation Plan every four years by means of an OECC report. The second working programme was published on the internet in November 2008.

9. Sweden

9.1. The Swedish national adaptation strategy

Sweden does not have a dedicated national adaptation strategy and it is still not clear whether one will be developed. A continuation of integrated and coordinated cooperation between the various vulnerable sectors is also possible. On 1st October 2007 the "Klimat- och sårbarhetsutredningen" (i.e. the Swedish Commission on Climate and Vulnerability) presented its final report, "Sweden facing climate change – threats and opportunities". This 680-page report summarises the challenges Sweden faces, focusing on key sectors (i.e. communications, technical support systems, development and buildings, rural businesses and tourism, the natural environment and environmental goals, human health, changes in the world around us and their impacts on Sweden). It also outlines the information needed to help reduce vulnerability and offers a set of concrete proposals.

This report will be subject to a public review and will serve as one of the inputs to a forthcoming climate bill in 2009. Important inputs to the climate bill are:

- The Swedish Commission on Climate and Vulnerability's report (see above, SOU 2007:60)
- The all-party Climate Committee final report (i.e. Swedish Climate Policy, SOU 2008:24)
- The Scientific Council on Climate Issues report (i.e. A Scientific Basis for Climate Policy, 2007:03)
- Energieffektiviseringsutredningens delbetänkande SOU 2008:25
- The grid connection enquiry (Nätanslutingsutredningens slutbetänkande) 2008:13
- The Development of the Swedish Climate Strategy (Den svenska klimat-strategiens utveckling) ET 2007:29
- The European Commission's proposals on the climate and energy package
- Four dialogues on Swedish climate and energy policy involving the business sector, government agencies and other organisations held in spring 2008.

The Swedish government is also providing the areas of climate and energy with a further SEK 1 billion for the period 2008 to 2010. These measures will be implemented in policies related to the environment, forestry, agriculture and energy (mostly in support of mitigation, but also on issues such as "sustainable cities").

9.2. Drivers for climate adaptation policy

A Commission on Climate and Vulnerability was appointed by the Swedish Government in June 2005 to assess the regional and local impacts of global climate change on the Swedish society including the costs involved. The commission was organised within the Ministry of Environment, and Bengt Holgersson – Governor of the County Administrative Board in the region of Skåne – was appointed as head of the Commission. A total of over 50 experts took part in the various working groups. The Commission found: "It is necessary to make a start on adapting to climate change in Sweden. The principal features of the climate scenarios, despite uncertainties, are sufficiently robust to be used as a basis."

Key threats and opportunities are identified in following areas: an increasing risk of floods, landslides and erosion; increasing rates of forest growth; improving conditions for agricultural production; reduced needs for heating and increased hydropower potential; risk of dramatic changes in ecosystems in the Baltic Sea;

adverse impacts on water quality in lakes and watercourses; possible negative effects for the reindeer-herding industry and mountain tourism; an increased number of deaths because of heatwaves and the increased spread of infection because of a warmer climate, etc. In addition, the report of the Commission on Climate and Vulnerability addressed impacts outside Sweden and highlighted their relevance for Swedish security policy, development cooperation, trade and activities in other sectors such as food supply etc. In addition, the Swedish government has put in place an International Commission on Climate Change and Development in October (similar to the above-mentioned Commission on Climate and Vulnerability). Outcomes are expected for spring 2009 (see www.sweden.gov.se/sb/d/3102/a/101305).

9.3. Science-policy interactions

The Swedish Commission on Climate and Vulnerability notes that there is a real need for research and knowledge development relating to a changed climate, effects and adaptation measures. Furthermore, it calls for a new institute to focus on climate research and climate adaptation. No such institute was mentioned in the recent research bill (November 2008). However, the budget for climate research has been increased by a proposal to grant this institute an additional sum of approximately 15 million euros per annum.

The climate science and policy research information portal (www.sweclipp.se) – a collaboration between the Swedish Environmental Protection Agency, the Swedish Energy Agency and the Foundation for Strategic Environmental Research, MISTRA – gives overviews of the funding by these organisations of climate policy-oriented socio-economic research programmes. The objective of sweclipp is to fund research that supports the Swedish climate strategy and around five million euros are allocated annually to research activities.

The sweclipp information portal highlights the following on-going major research programmes:

- The Swedish Climate Modelling Resource at the Rossby Centre (develops climate scenarios);
- CLIMATOOLS Programme (a five-year, multi-disciplinary research programme that started in late 2006; it aims to provide decision-makers with guidelines and tools as helpers in their work on climate impacts and decisions on what and where to adapt, five-year duration, 25 million SEK funds in total);
- MISTRA's Climate Policy Research Programme (this focuses on knowledge in climate policy and international negotiation, and on the role of emissions trading in climate policy) (http://www.clipore.org/);

- MISTRA's SWECIA programme launched in January 2008. Mistra-SWECIA is a research programme on climate, impacts and adaptation. It extends and transcends research on climate science, biology/ecology, economics and social sciences. Total funds available are stated to be 40 million SEK. The overarching aim is to create a capacity for advanced analysis and consistent assessment of climate, economy and impacts. Global and regional models of climate, economy and impacts are the main tool, together with data on natural and human processes and systems. The application of this capacity involves also a strong line of research on the adaptation process itself, focusing on learning from experience, putting new knowledge into use, identifying bottlenecks and opportunities. www.mistra-swecia.se.

The Bert Bolin Centre, funded by FORMAS (established at Stockholm University in 2007). This Bert Bolin centre focuses on multi-disciplines within climate change, their aim being to "provide new knowledge about climate-influencing processes, over a range of time-scales and subsystems". The centre conducts a 10-year research and research environment-building programme http://www.bbcc.su.se/.

In addition, several other funding bodies as well as private businesses and research councils contribute to and support various research activities on climate change and adaptation. Finally, the Commission on Climate and Vulnerability finally suggests that Sweden should work to ensure that the EU's research funding includes research into adapting to climate change, including reviewing and monitoring.

9.4. Knowledge transfer and awareness raising

SMHI, the Swedish Meteorological and Hydrological Institute (i.e. a government agency under the Ministry of the Environment), hosts a Klimatanpassningsportal (i.e. an information portal for climate adaptation), established as a joint initiative by the Swedish Environmental Protection Agency, the Swedish Rescue Services Agency; the Swedish Geotechnical Institute and the National Board of Housing, Building and Planning and SMHI. This portal presents summary descriptions about the potential consequences of climate change, reflects on risk assessments, discusses adaptation plans and shows examples how adaptation measures can be integrated into day-to-day routines. The aim of the portal is to support those who work on adaptation issues at the local (municipality) level, regional level or within the business sector. The portal's address is: www.smhi.se/cmp/jsp/polopoly.jsp?d=9315&l=sv.

The report, "Sweden facing climate change – threats and opportunities", published by the Swedish Commission on Climate and Vulnerability has a chapter on information and educational needs. In this report, the following major initiatives are proposed:

- Information should be focused and differentiated – meeting the structural differences within different sectors. In particular, vulnerable sectors dominated by small enterprises/actors should be offered proactive information campaigns and education/courses. Examples of vulnerable sectors dominated by small enterprises are forestry, tourism and the agricultural sectors.
- Information should be interactive, based on dialogue so as to exchange knowledge and experience between sectors and between the different levels of public administration. The existing "communication links/channels" between relevant actors (governmental institutions, actors within the public and private sectors should be improved so as to optimize the dissemination of knowledge.
- The media should preferably be the most important source of information for the public.
- The climate adaptation web portal ("Klimatanpassningsportalen") should be supported and further developed by integrating with or linking to other websites of relevance for adaptation.

The report also suggests that responsibility for climate adaptation is included in the guidelines for governmental authorities and regional authorities which also contain strategies and responsibilities for the dissemination of knowledge/information.

Regarding awareness raising, the Swedish EPA initiated a "climate campaign", Klimatkampanjen, in 2002 that was initially planned to continue for three years. The main objectives of the campaign were to: 1) increase knowledge on the causes and effects of greenhouse gases based on the conclusions of the IPCC; 2) increase knowledge of and changes in attitudes in contributions by the public to reduce emissions of greenhouse gases and 3) obtain increased acceptance of governmental or other public/offical policies and legal tools. A final report on this campaign "Den svenska klimatkampanjen - en del av Sveriges klimatstrategi. Slutrapport. Naturvårdsverket 2004" is available on: www.naturvardsverket.se/Documents/publikationer/620-5365-5_1.pdf. EPA leads or coordinates several other initiatives including web based information services: www.naturvardsverket.se/en/in-english/menu/ and publication of the monthly newsletter on Global News on Climate Action http://www.anp.se/newsletter/444B594277474B5A4B7940/0.

Public participation in support of the forthcoming climate bill is primary ensured by either functional participation or participation by consultation

9.5. Multi-level governance

The Swedish Commission on Climate and Vulnerability notes that responsibility for adapting to a changed climate is shared between individuals, municipalities and the state. It proposes that the county administrative boards should be given a driving role, and the task of coordinating climate adaptation work within their respective counties, and the Swedish Environmental Protection Agency should be given responsibility for monitoring the adaptation work and reporting. Furthermore, the Commission proposes additional responsibility for the Swedish National Post and Telecom Agency, the Energy Markets Inspectorate, the Swedish Geotechnical Institute and the National Food Administration. Finally, it is proposed that many sectoral authorities to be given clearer responsibility for climate adaptation within their areas of responsibility.

9.6. Policy integration

The Swedish Commission on Climate and Vulnerability details an array of possible ways – sector by sector – of reducing the vulnerability of various sectors, by developing new guidelines or altering existing policies.

9.7. Compliance and evaluation

The Swedish Commission on Climate and Vulnerability proposes that the Swedish Environmental Protection Agency should be given responsibility for monitoring the adaptation work and reporting.

10. United Kingdom

"As to complement our mitigation efforts, the UK will develop a robust approach to domestic adaptation to climate change, shared across government" (Government's Delivery Agreement)

10.1. The national adaptation strategies in the United Kingdom

In July 2008 the UK published its first National Adaptation Strategy (Adapting to Climate Change: A Framework for Action) (DEFRA, 2008a). The framework sought to bring together a variety of adaptation activity that had been taking place through a number of programmes and initiatives, to provide a coherent and coordinated approach to adaptation for the UK.

The development of a NAS by the government has been preceded by four key stages:

1. The establishment of the UK Climate Impacts Programme (UKCIP) in 1997. This programme was set up with the intention of coordinating impacts research in the UK, but it has since developed to provide support and advice for organisations to scope the impacts of climate change and develop adaptation strategies. UKCIP has played a major role in increasing awareness of the need to adapt and driving forward action on the ground.
2. The UK Climate Change Programme (2000, updated 2006) set out the government's intention to develop a "comprehensive and robust approach to adaptation in the UK" through an Adaptation Policy Framework. It sets out its policies and priorities for action in the UK and internationally (DEFRA, 2006; DETR, 2000).
3. The publication of the Consultation over the Adaptation Policy Framework (DEFRA, 2005b) which gathered views on whether stakeholders thought a NAS would be a useful and necessary tool, and information regarding climate change adaptation activities across the UK.
4. The adaptation provisions within the Climate Change Bill (DEFRA, 2008b). The Bill sets out a statutory framework for legislation in the UK and will require the government to develop a statutory adaptation programme to address the risks identified in a national climate change risk assessment. This will be reviewed on a quinquennial basis.

The cross-government "Adapting to Climate Change" (ACC) Programme is led by the Department for the Environment, Food and Rural Affairs (Defra) and will be developed in two phases. The objectives of Phase 1 (2008–2011) are to develop the necessary groundwork to implement Phase 2. Specifically, Phase 1 must: (1) provide more evidence about climate impacts and their consequences on the UK, (2) raise awareness on the need to take action and help others take action, (3) develop ways to measure success effectively (indicators) and (4) work across government at a national, regional and local level to embed adaptation into government policies. The objective of Phase 2 is to implement a statutory National Adaptation Programme, as required by the Climate Change Bill. Starting in 2012, the programme will report progress to Parliament on a regular basis.

10.2. Drivers for climate adaptation policy

Concerns about climate change have a large measure of cross-party support in the UK. Reductions in the emission of greenhouse gases and mitigation measures

have been the main focus of activity so far, but UKCIP has been proactive in encouraging a range of sectors to consider the issue for several years and the new climate change bill has raised adaptation up the agenda. The key drivers for adaptation in the UK are related to weather events, general risk assessments, government policy initiatives, financial cost assessments and political will (Tompkins et al., 2005).

The identified drivers can be categorized as follows:

Weather and Climate Impact Drivers

a) Flood management: in recent years there have been some notable flooding incidents, which cannot be reliably attributed to climate change but have nevertheless raised public and political consciousness of the issue. During the UK floods of summer 2007, about 48,000 homes and 7,000 businesses were flooded leaving almost half a million people without mains of water or electricity (Pitt, 2007). These floods, and the subsequent inquiry played an important role in raising awareness of the need for adaptation and helped focus attention on the issue during Parliamentary debates on the Climate Change Bill.

b) Water resources: particularly maintaining water supplies during summer droughts. This is particularly a problem in South East England. Water use is generally higher here than in other areas of the UK and demand for water resources may be difficult to meet if summer rainfall is lower and more variable than at present – as most scenarios indicate (DEFRA, 2008d).

c) Coastal erosion: being an island this is a major issue, in particular on the eastern and southern coastlines which are already subject to strong natural erosion processes which will be exacerbated by climate change. The debate about the extent to which sea defences should be strengthened or "managed realignment" planned for has been very controversial in some places. Managed realignment is already starting to be adopted in areas with low population density (DEFRA, 2008a).

d) High Temperatures: The 2003 heatwave in South East England led to the development of the first heatwave plan (2004) to enhance resilience in the event of a heatwave. The plan has been annually reviewed (2005, 2006, 2007 and 2008).

e) Biodiversity Conservation: there is strong public interest and involvement in nature conservation. This has often focused on restoring traditional management practices to preserve or recreate habitats which declined during the 20th century. However, this "turning back the clock" approach is

increasingly seen as untenable and nature conservation bodies are working together to develop alternative approaches to conservation, with more emphasis on the dynamic nature of ecosystems.

General Risk Assessment Drivers (Vulnerability):

The main driver in this category is the availability of climate information and adaptation tools such as those provided by UKCIP: The international (IPCC) and national research (Met Office Hadley Centre, Tyndall Centre and the UK Climate Impacts Programme) in climate modelling and impacts projections have played an important role in increasing awareness of the threats that climate change poses for the UK.

Related Policy Initiatives as Drivers:

a) Climate Change Mitigation policies: include directives, reports, policy guidance, research projects, collaboration with UKCIP, etc. that have influenced certain sectors' policy planning and strategies (Tompkins et al., 2005). For example in the construction sector, the importance of adapting existing homes while reducing GHG emissions has been highlighted (See report of Three Regions Climate Change Group, 2008).

b) United Nations Framework Convention on Climate Change (UNFCCC): the UK is working to develop a coherent international response for adaptation through the UNFCCC (DEFRA, 2008e; UNFCCC, 2007b).

c) Sustainable Development (SD): the new Framework for Action sits within the context of an SD framework (2005) seeking to ensure the UK remains within environmental limits and promote social equality, while ensuring adaptation responses are proportionate to the risk.

Financial Drivers

a) Economy: many aspects of the UK economy have been identified as sensitive to climate. Climate change and weather events can disrupt businesses and indirectly alter market demand and supply, as the Stern report (2007) has clearly pointed out. As a result, the government is planning to undertake a national cost-benefit analysis of adaptation that will complement the climate change risk assessment (DEFRA, 2008a; Stern, 2008)

b) Insurance: The large economic losses following flooding and storm events have brought to attention the need for proper financial arrangements to insure against economic losses. The Association of British Insurers (ABI) and the UK government have agreed to develop measures to enable flood insurance to continue to be widely available, without distorting the market (Association of British Insurers, 2004).

Political Drivers:

Since at least 1995 the UK government has displayed consensus and leadership on the importance of climate change and the need to adapt. The report "Measuring progress: preparing for climate change through the UKCIP" of June 2005 shows the progress the UK has made in preparing for the impacts of climate change. Additionally, the work of government officials (especially, Ian Pearson MP Minister of State for Climate Change and Environment) has influenced the rise of adaptation policies and the development of a national strategy. Furthermore, the UK government states that the ACC Programme will take the lead in coordination with other UK administrations, in providing input to the EU White Paper and trying to help the EU embed adaptation in its wider policy areas (DEFRA, 2008a)

10.3. Science-policy interactions

The UK has been active in research on climate change and impacts assessment from an early stage. Government funding of scientific research in the UK comes through two main routes: research councils and government departments. The research councils fund research from the standpoint of developing science itself. This includes both "national capability", which has strategic importance to a range of research and policy agendas and "blue skies" research funded on the basis of scientific merit alone. Universities and research institutes, such as NERC Centre for Ecology & Hydrology are funded by the research councils. The Natural Environment Research Council (NERC; www.nerc.ac.uk) has been particularly important in developing the science of climate change and impacts, funding several major programmes and numerous individual projects. Government departments and agencies fund research to directly meet the needs of policy-making. The government directly funds the Hadley Centre (MOHC), part of the UK Meteorological Office which is a leading centre for research on climate change and impacts and the UK Climate Impacts Programme.

To assess how climate change will affect different sectors, in 2004 DEFRA commissioned a £400,000 programme of cross-regional research on impacts and adaptation focusing on six priority topics: (1) planning and the built environment, (2) business, (3) water resources, (4) countryside and the rural economy, (5) quantifying the cost of impacts and adaptation, and (6) linking adaptation research and practice. These projects have now been completed and the final reports are available at: http://randd.defra.gov.uk.

An important development at the present time is the establishment of the Living with Environmental Change (LWEC) programme[42]. This is a collaborative initiative between the major funders of environmental research in the UK (20 partners by the end of 2008, including DEFRA and NERC) launched in June, 2008. Its objective is to help people find ways to cope with environmental changes, including climate change that affects their wellbeing and livelihoods. This programme is large, being valued at £1bn over 5 years. Approximately 90% is expected to be provided by the realignment of existing programmes to fit LWEC objectives, with a further 10% from previously uncommitted funds.

10.4. Knowledge transfer and awareness raising

Communication of research results and raising awareness of the changing climate are key elements of the UK national adaptation strategy, as they encourage adaptive behaviour to reduce potential impacts and take advantage of any opportunities.

The ACC Programme has a major role in raising awareness and providing the right institutional environment for organisations and individuals to take adaptation actions (DEFRA, 2008a). It provides information on climate change risks and impacts and a range of tools and methodologies through the "Adapting to Climate Change in England" document (DEFRA, 2008a), the "Adapting to Climate Change"[43] website, and the work of UKCIP.

The UKCIP has developed a free of charge range of tools: (1) the "Adaptation Wizard", that helps organisations determine vulnerability to climate change and develop their adaptation strategy, (2) the "Business Assessment tool" that helps explore the implications of climate change for a particular business or sector, (3) the "Local Climate Impacts Profile", which is a resource that local authorities can use to understand better their exposure to weather and climate, (4) the "Base for Research, Adaptation, Impacts and News" (BRAIN) which holds a collection of significant resources of research activities, adaptation actions, impacts of climate and news of climate change activities to share among stakeholders; and (5) the "Adaptation Actions Searchable Database", which has information on how organisations in the UK are adapting to climate change. It provides learning examples of actions that others can take to reduce their risks and exploit opportunities.

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[42] *For further details see http://www.nerc.ac.uk/research/programmes/lwec*

[43] *For more information visit http://www.defra.gov.uk/environment/climatechange/adapt/index.htm*

10.5. Multi-level governance

Multilevel governance can provide an important contribution to the development, implementation and integration of adaptation policies. Adaptation to climate change is taking place at different administrative or management scales, including: International, European (EU), National, Devolved Administrations (Scotland, Wales and Northern Ireland), Regional, Local and Individual.

International

The UK Government is taking many adaptation actions at the international level primarily to contribute to adaptation globally (DEFRA, 2008e):

- Helping developing countries to prepare for the impacts of climate change;
- Scaling up efforts to integrate adaptation into efforts to reduce poverty, for example, the UK is spending £50m to raise the homes of 32,000 families in Bangladesh above the "1 in 100 year" flood level and improve their livelihoods;
- Increasing research and knowledge on how to adapt, for example, £74 million to research and improve adaptation to climate change in Africa, Asia and Latin America;.
- Spending £20 million for UN Special Funds to help developing countries adapt to climate change, making the UK the largest donor;
- Undertaking research to understand how climate change interacts and links in with other key social, economic and political trends.

Embassies and consulates around the world are working on finding ways and measures to address their vulnerabilities over energy supply, trade, conflict and migration, all which will be impacted by climate change with potential consequences for the UK (Defra, 2008b).

European

The UK recognises the important leadership role the European Commission must play to ensure that all EU programmes and policies take account of the changing climate. The EU Commission Green Paper on "Adapting to climate change in Europe – options for EU action" has been an important driver of action in the UK in terms of EU involvement.

One programme the UK has been involved at the European level is ESPACE (European Spatial Planning: Adapting to Climate Events), a project on planning and adaptation in regions around the North Sea, and the second European Climate Change Programme, which now has an adaptation component. The focus of the ESPACE project was to promote awareness of the importance of adapting to climate change and to recommend that it is incorporated within spatial planning

mechanisms at local, regional, national and European levels. Focusing on North West Europe, ESPACE Part I (Sept 2003 – June 2007) looked at how to manage our water resources and plan for a future with a changing climate. The project was lead by Hampshire County Council and included researchers from the UK, Germany, Netherlands and Belgium. At the conclusion of ESPACE Part I further funding was obtained to build on the work undertaken and develop some of the ideas and challenges that have been uncovered. Through a combination of research and case studies ESPACE Part II (2007 – July 2008) examined why policies at higher levels promoting adaptation fail to be translated into actions on the ground and developed an *Organisational Change* Tool to give organisations a clear understanding of the things that need to work together and be supported for them to be able to respond to climate risks. Additionally, UKCIP has contributed to the debate around the European Commission's Green Paper on Adaptation.

Devolved Administrations

In the UK constitutional arrangements have become more complex in recent years with the introduction of devolved governments in Scotland, Wales and Northern Ireland (England, the largest part of the UK, where 85% of the population live, is governed directly by the UK government). Many environmental issues are dealt with by different bodies in different parts of the UK (e.g. the Environment Agency is responsible for water resources and flood defences in England and Wales, but not Scotland, where the Scottish Environmental Protection Agency takes on this role). The ACC programme is primarily responsible for England's coordination work on adaptation. However, to ensure coherence across the UK's administrations, they are committed to work closely together to ensure sharing of best practices and cross-border initiatives.

Northern Ireland

In Northern Ireland, the Department of the Environment (DOE) takes a lead on climate change issues through their Climate Change Unit. It works closely with DEFRA in London and with colleagues in the devolved administrations of Scotland and Wales. On 30 January 2007, the Scotland and Northern Ireland Forum for Environmental Research (SNIFFER), launched a report called *Preparing for a Changing Climate in Northern Ireland* (SNIFFER, 2007). Published on behalf of DOE and the Environment and Heritage Service (EHS), this report examines the ways in which Northern Ireland must prepare to meet both the opportunities and threats presented by the potential impacts of climate change across a broad range of sectors. The study examines what adaptation progress has been made in Northern Ireland and considers what else may be required to adapt to these

impacts. The report concludes that the success in meeting this challenge depends on the development of actions in partnership across the region. The Northern Ireland Climate Change Impacts Partnership was set up following the launch of the report to bring together key stakeholders in Northern Ireland with the aim of securing a shared goal of building resilience and readiness to meet the threats and opportunities presented by a changing climate. Northern Ireland expects to link its partnership with similar partnerships in the UK and with the Republic of Ireland, so that it may benefit from best practices elsewhere.

Scotland

Tackling climate change is largely a devolved matter and the Scottish government has committed to playing its part in rising to the challenge that climate change poses. Through its "Government Economic Strategy"[44] and "Scottish Budget SR 2007"[45] the Scottish Government has set out its climate change commitments, including proposals to consult on a proposed Scottish Climate Change Bill which will set the ambitious target to reduce emissions by 80 per cent by 2050. There is also a commitment to develop Scotland's first climate change adaptation strategy that will identify priority adaptation action required in Scotland and clarify roles and responsibilities in achieving this action. On June 24 2008, the Scottish government published a consultation "Adapting our ways: Managing Scotland's Climate Risk"[46]. The consultation is seeking views to inform Scotland's Climate Change Adaptation Framework that will identify strategic principles and priority actions as a means of providing leadership, guidance and consistency of approach to government and non-government decision-makers. It will also seek to identify roles and responsibilities for public and private decision-makers in Scotland. The consultation will run in two stages. The first stage of the consultation (closes October 31, 2008) will connect with the current stakeholder debate on climate change adaptation, while recognising that the final Framework will need to be informed by several crucial developments occurring in late 2008 and early 2009, including the Scottish Climate Change Bill coming before the Scottish Parliament. The second stage of the consultation will be launched in 2009. Scotland's Climate Change Programme[47], published in 2006, sets out the existing policies being pursued to reduce emissions and adapt to climate change. A progress report[48] on

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[44] *Available online at http://www.scotland.gov.uk/Publications/2007/11/12115041/0*
[45] *Available online at http://www.scotland.gov.uk/Publications/2007/11/13092240/0*
[46] *Available online at http://www.scotland.gov.uk/Publications/2008/06/23113244/0*
[47] *Available online at: http://www.scotland.gov.uk/Publications/2006/03/30091039/0*
[48] *Available online at: http://www.scotland.gov.uk/Publications/2007/03/08105454/0*

Scotland's Climate Change Programme was laid before the Scottish Parliament in March 2007. The Scottish Climate Change Bill, which is expected to be introduced into the Scottish Parliament in 2009, will strengthen the Scottish government's response.

Wales

The Wales Climate Change Strategy is currently under consultation. It sets out how the Welsh Assembly Government will deliver its commitments to set targets for emissions reductions and adaptation to the impact of climate change. The Welsh government created a "Climate Change Commission" to build on the work of the "Cross Sector Climate Change Group", which was established in October 2006. The Climate Change Commission has the objective to ensure the engagement and active participation of the public sector, businesses, the voluntary sector, and Non-Governmental Organisations as well as drawing on expert advice from key environmental organisations. The Commission will be the main driver for action, providing strategic leadership, direction and a cross-Wales consensus. It will be supported by four thematic sub-groups, one which addresses Adaptation. This "Adaptation Sub-Group" will make best use of the UK Climate Impacts Programme 2008 (UKCIP08) data in Wales; communicate and support action for an issue which is essentially about risk and where there is uncertainty; develop adaptation actions for Wales; and inform Assembly Government proposals on adaptation.

Regional

At a Regional level climate change adaptation has taken place across the UK, through regional climate change partnerships, government offices, regional development agencies, and regional assemblies.

Regional Climate Change Partnerships

Each English region has already established an independent Climate Change Partnership (RCCP). The RCCPs are made up of local stakeholders, ranging from the regional development agencies through to small local charities, and work very closely with UKCIP. They investigate and advise on the impacts of climate change regionally, assessing how this may affect regional economic, social and environmental well-being. They also share experiences and work together on joint projects, like the "Checklist for Development"[49] produced by the East of England, London and the South East through the Three Regions Climate Change Group.

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[49] *"Adapting to climate change impacts – A good practice guide for sustainable communities" available online at http://www.ukcip.org.uk/images/stories/Pub_pdfs/Good_practice.pdf*

Furthermore, the government has also set up a Regional Climate Change Adaptation Partnership Board which will include representatives from bodies at the regional level to develop a framework of support by bringing together existing adaptation programmes, case studies and assessing gaps in skills and awareness.

Government Offices

The Government Offices (GOs) have built up a network of adaptation in each region, whose aim is to build adaptation knowledge and capacity, and to coordinate and join up work at the regional level. Their work has led the negotiations on the new local government performance indicators including the new indicator on adaptation, and will continue to work with partners to improve adaptive capacity

Regional Development Agencies

They work with partners to strengthen regional economies, guided by the principles of sustainability. This includes tackling climate change – through mitigation and adaptation. They are involved with Regional Climate Change Partnerships.

Regional Assemblies

They are the Regional Planning Body for each region (with the exception of London) with a duty to prepare the regional spatial strategy which includes the regional transport strategy and the regional waste strategy. They have a role as the voice of the region and can prepare regional strategies such as regional sustainable development frameworks (RSDFs) that in some cases have started to involve climate adaptation.

Locally

The Nottingham Declaration[50] is probably the largest driver for local action in climate adaptation in the UK. Launched in October 2000 in Nottingham, it was signed by 100 councils up to its relaunch in December 2005. The Declaration has now been signed by more than 270 Councils in England as well as all Welsh and Scottish councils who have signed their own versions. Other sectors are also beginning to produce their own versions of the Declaration. To support this commitment, the Nottingham Declaration Partnership has developed the Nottingham Declaration Action Pack[51] (NDAP) that provides guidance for producing Action Plans covering both mitigation and adaptation to climate

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[50] *Available online at http://www.energysavingtrust.org.uk/housingbuildings/localauthorities/NottinghamDeclaration/EST_NDec_cert_HR.pdf*

[51] *Available for request at http://www.energysavingtrust.org.uk/housingbuildings/localauthorities/NottinghamDeclaration/*

change. On the other hand, UKCIP is in the process of developing a pilot Local Climate Impacts Profile with Oxfordshire County Council that demonstrates how local authorities can use Local Climate Impacts Profiles as a basis for exploring the impacts climate change might have on their business and for developing their adaptation responses. One of the cities with the largest adaptation efforts is London. The Mayor of London has just published a draft adaptation strategy which addresses flooding, overheating and limited water resources. It also has a strong Climate Change Partnership (LCCP). The Partnership is a stakeholder group coordinated by the Mayor of London, consisting of over 30 key organisations with representation from government, climate science, domestic and commercial development, transport, finance, health, environment and communication sectors. The objectives of this partnership are to embed adaptation into London's policy documents, to raise awareness of climate risks and opportunities across all sectors, to commission research and develop adaptation guidance, and to increase the level of adaptation in new developments and existing build (Three Regions Climate Change Group, 2008).

Individually

The UK encourages all scales of adaptation actions ranging from business to individuals.

The UKCIP "Business Areas Climate Impacts Assessment Tool" (BACLIAT)[52] is being used by businesses to assess the potential impacts of climate change and its implications for their logistics, finance, markets, process, people, premises and management. It encourages the consideration of both threats and opportunities. The "Changing Climate for Business" (CCFB) project brings together UKCIP with trade associations and professional bodies to help build the capacity of UK business to respond to unavoidable climate change. The second CCFB partnership ran throughout 2007 and the third is now underway focusing on engineering and the built environment. UKCIP also works with UK trade associations and professional bodies to assist them in embedding climate impacts and adaptation considerations into their activities. The Trade Association Forum[53] (TAF) together with UKCIP and the Energy Saving Trust (EST) has developed a declaration on climate change, the "TAF Declaration"[54] for their members to sign up to. Through

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[52] BACLIAT tool was developed in partnership with representatives from a range of trade associations and professional bodies. It can be found in the publication "A Changing Climate for Business." Available online at http://www.ukcip.org.uk/images/stories/Pub_pdfs/CCFB_report.pdf

[53] Trade Association webpage available at http://www.taforum.org

[54] TAF Declaration is available online at http://www.taforum.org/index.pl?n=5000;section=84

the TAF Declaration, Trade Associations can publicly declare their commitment to action on climate change including both reductions in greenhouse gas emissions and adapting to the unavoidable changes. UKCIP provides a programme that addresses the adaptation considerations, while EST assists with mitigation.

10.6. Policy integration

Climate change adaptation policies and measures are expected to continue to be embedded in various sectoral strategies and plans, including water resources, flooding, biodiversity and planning. There is a risk that adaptation will develop along narrow sectoral lines leading to potential conflicts, such as between building hard sea defences and protecting biodiversity. One of the key roles of the NAS is to provide coherence across Government as it takes forward adaptation measures and to support mainstreaming of adaptation into policy, investment and decision-making. A number of mechanisms exist to promote and facilitate this.

A cross-Government working group is examining whether additional Treasury Green Book[55] guidance is required to enable climate change adaptation to be built properly into decision-making processes for future spending and investment proposals. Furthermore, the ACC programme will work with the Office of Government Commerce to ensure that public sector procurement guidance helps organisations to understand how climate change may affect them and what actions they can take to reduce risks and maximise value for money.

A new "Cross-Government Programme and Board" was created to ensure that all government programmes consider climate change risks at policy and delivery stages and are planned accordingly.

Impacts assessments that are generally used in the policy-making process will need to consider climate impacts as well. The ACC programme will work with the Better Regulation Executive to determine how Impact Assessment tools may need to be amended to ensure that climate considerations are taken into account.

Sustainable Development Action Plans (SDAPs) will need to embed adaption to climate change (DEFRA, 2008a).

The major challenge for government departments and the private sector is to review their policies and operations to face the risks of climate change and consider the options for adapting. This has been happening for several years in some sectors. A good example is the approach to flood risk management in

[55] *The Treasury Green Book is the central point across Government for guidance on the economic assessment of spending and investment.*

the planning system. This demonstrates an "adaptive management" approach that makes sequential decisions based on the best available information and allows scope for measures to be reviewed and extra measures to be put into place when new information on climate risks arises (Planning Policy Guidance 25: Development and Flood Risk). Other examples of actions taken by government departments in integrating adaptation into their policies are: producing "hazard maps" highlighting vulnerable areas in the rail network to be used as a basis for adaptation action; setting out a cross-Government strategy for flood and coastal erosion risk management in England called "Making Space for Water"; implementing a heatwave plan with health and social care services; and publishing guidance principles for conservation managers to help biodiversity plans and projects take into explicit account the impacts of climate change.

10.7. Compliance and evaluation

The Climate Change Bill will make the UK the first country in the world to adopt a legally binding framework that addresses mitigation and adaptation to climate change (DEFRA, 2008a). In order to fulfill its adaptation commitments, the Climate Change Bill proposes monitoring and evaluation mechanisms that can provide evidence of their implementation progress. The Climate Change Bill currently proposes:

a) Regular Progress Reports to Parliament to ensure transparency and enable the government to be held to account.
b) The National Adaptation Programme must be put in place and reviewed every five years to address the most pressing climate change risks to England.
c) The creation of an Independent Committee on Climate Change with an Adaptation Sub-Committee to oversee progress on the Adapting to Climate Change Programme and advise on the risk assessment. This new expert body is expected to be set up by mid-2009.
d) "A Reporting Power": The Climate Change Bill will allow the government (Secretary of State) to require local governments, key public authorities and "statutory undertakers"[56] to provide an assessment of the risks that climate change poses to their organisations, and develop an action plan. The government will be required to publish a strategy outlining how this new power will be used, and identifying the priority organisations that will be

[56] *The term "statutory undertakers" covers some public and some private bodies that provide essential services to the public, such as utilities and communications companies.*

covered by it. The government expects to use this power only in exceptional circumstances, but it might be exercised where a body is seen to have specific vulnerabilities but has not taken account of adaptation issues (DEFRA, 2008a). The consultation is expected to take place in the summer of 2009 and the strategy published by the end of 2009.

Other compliance measures

a. Indicators of successful adaptation: Indicator "NI 188" is one of the National Indicators for local authorities and Local Strategic Partnerships (UKCIP, 2005). It is based on the process of embedding adaptation into the work of the authorities' existing key objectives and ensuring planning processes and evidence are based on an understanding of a changing climate. Local authorities report on their progress and are assessed by the Audit Commission (an independent body). Additionally, Local Strategic Partnerships will bring together local authorities, public, private and third sector partners to agree n Local Area Agreements (LAAs) with the central government. Currently, approximately one third of the 150 LAAs in England have included the new adaptation indicator or have it as a local target.

The Comprehensive Spending Review of 2007 Public Service Agreements (CSR07 PSA) is linked with the Climate Change Bill and its indicators. It included the objective to develop a robust approach to adapting to climate change in the UK (DEFRA, 2008c). It established an outcome indicator for sustainable water abstraction as an exemplar and proxy indicator. As the government's adaptation programme develops, the aim will be to develop broader and more outcome-based indicators of adaptation.

b. Creation of a Partnership Board: this board may "challenge the Government to make progress on implementation" of adaptation measures (DEFRA, 2008a: 42). The partnership board will involve a wide range of external stakeholders in developing the ACC Programme.

List of photos

Front cover, top, Drought fields, United Kingdom © Natural England

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Over the last few decades, European countries have focused on the questions of whether human-induced climate change is real and how we can mitigate it. Now, not only has a human cause been confirmed, but actual impacts of climate change have also been observed and more are anticipated. As a response to this, many countries have started to develop national adaptation strategies. This report, "Europe Adapts to Climate Change: Comparing National Adaptation Strategies", describes how countries have undertaken this task, identifies some research gaps and policy needs that still exist and indicates the types of new information that will be required for the continued development of adaptation policies in Europe.

The report concludes that the factors driving the development of adaptation policy vary across European countries, but a common element is that developments have been fast. At the same time, there is an urgent need for new climate adaptation research that connects innovative science with local, regional and sectoral policy needs. However, with a few exceptions, such research is yet to begin. The report identifies a variety of opportunities to address these research needs in an internationally co-ordinated fashion, allowing for better informed adaptation policy development. Communication and awareness raising will be important to ensure public support for measures, and to help stakeholders to adapt.
The report also summarises strengths and weaknesses of the current strategies in the countries studied. It points out that institutional barriers are likely to be more important impediments to adaptation than the technical feasibility of specific adaptation measures.

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ISBN 978-952-11-3450-0