Europe adapts to climate change: Comparing National Adaptation Strategies

G. Robbert Biesbroek a,b,*, Rob J. Swart a, Timothy R. Carter c, Caroline Cowan d, Thomas Henrichs e, Hanna Mela c, Michael D. Morecroft d,f, Daniela Rey f

a Earth System Science and Climate Change Group, Wageningen University and Research Centre, Droevendaalsesteeg 4, 6708 BP, Wageningen, The Netherlands
b Public Administration and Policy Group, Wageningen University and Research Centre, Hollandseweg 1, 6706 KN, Wageningen, The Netherlands
c Finnish Environment Institute, Mechninkatu 34 a, 00260 Helsinki, Finland
d Natural England, Cheltenham, Gloucestershire GL50 3RA, United Kingdom
e Department of Policy Analysis, National Environmental Research Institute, University of Aarhus, Frederiksborgvej 399, 4000 Roskilde, Denmark
f Centre for Ecology & Hydrology, Wallingford, Oxfordshire OX10 8BB, United Kingdom

* Corresponding author at: Earth System Science and Climate Change Group, Wageningen University and Research Centre, Droevendaalsesteeg 4, 6708 PB, Wageningen, The Netherlands. Tel.: +31 317 487757; fax: +31 317 419000.
E-mail address: robbert.biesbroek@wur.nl (G.R. Biesbroek).

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ABSTRACT

For the last two decades, European climate policy has focused almost exclusively on mitigation of climate change. It was only well after the turn of the century, with impacts of climate change increasingly being observed, that adaptation was added to the policy agenda and EU Member States started to develop National Adaptation Strategies (NASs). This paper reviews seven National Adaptation Strategies that were either formally adopted or under development by Member States at the end of 2008. The strategies are analysed under the following six themes. Firstly, the factors motivating and facilitating the development of a national adaptation strategy. Secondly, the scientific and technical support needed for the development and implementation of such a strategy. Thirdly, the role of the strategy in information, communication and awareness-raising of the adaptation issue. Fourthly, new or existing forms of multi-level governance to implement the proposed actions. Fifthly, how the strategy addresses integration and coordination with other policy domains. Finally, how the strategy suggests the implementation and how the strategy is evaluated. The paper notes that the role of National Adaptation Strategies in the wider governance of adaptation differs between countries but clearly benchmarks a new political commitment to adaptation at national policy levels. However, we also find that in most cases approaches for implementing and evaluating the strategies are yet to be defined. The paper concludes that even though the strategies show great resemblance in terms of topics, methods and approaches, there are many institutional challenges, including multi-level governance and policy integration issues, which can act as considerable barriers in future policy implementation.

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1. Introduction

It is now widely recognised that even if stringent global emissions reductions and mitigation efforts over the next decades prove to be successful, further climate change seems to be inevitable (IPCC, 2007; CEC, 2009a). The impacts of changes in current climate have been well documented and a growing body of scientific studies anticipate that nearly all European regions will be affected by future impacts of climate change (Parry and Carter, 1989; Rotmans et al., 1994; Beniston et al., 1998; Parry, 2000; Kundzewicz et al., 2001; EEA, 2006; Adger et al., 2007; Alcamo et al., 2007; EEA, 2008; CEC, 2009a). These impacts will be unevenly distributed over European regions and climate-sensitive sectors and will put additional pressures on the existing social–ecological structures and functions (Folke et al., 2005; Eakin and Luers, 2006; Folke, 2006).

Until recently and for a variety of reasons, the primary response to climate change has been mitigation through reduction of greenhouse gas emissions. Since the late 1980s, the European Union has played a prominent role in the international arena to reduce greenhouse gas emissions, particularly through the research and ambitious policy emission reduction targets of several frontrunner EU countries (Schreurs and Tiberghien, 2007). Only with increasing evidence of climate impacts occurring (e.g. with Arctic sea ice and mountain glaciers melting, permafrost thawing, extreme heat waves, floods, storm damage) has adaptation climbed the political agenda. No longer was adaptation regarded as a ‘fatalistic strategy’ (Schipper, 2006; Biesbroek et al.,...
2009) but as an explicit policy response to manage the unavoidable impacts (EEA, 2008). Until the last couple of years, the European Union with the primary focus on delivering the Kyoto targets and mechanisms has played a rather limited role in adaptation. However, with the publication of the European Commission's Green Paper ‘Adapting to climate change in Europe – options for EU action’ June 2007 (CEC, 2007) and the subsequent White Paper ‘Adapting to climate change: Towards a European framework for action’ in April 2009 (CEC, 2009b), the European Commission acknowledged the need for comprehensive adaptation strategies in Member States. In addition, the Commission stressed the importance of an integrated impacts assessment and comprehensive adaptation strategy at the EU level by 2013.

But even before activities started at the European level, since the turn of the century, policy makers at national and lower levels of governance have begun to initiate dedicated adaptation practices to counter adverse impacts. Initially the most vulnerable cities, regions and sectors started to include resilience into their planning activities. These adaptation practices are anticipatory and planned (Smit et al., 2000; Smit and Wandel, 2006) and include both national and regional adaptation strategies as well as practical steps at community level or by individuals. With the science pushing the policy agenda on adaptation, from 2005 onwards EU Member States started to develop and adopt comprehensive National Adaptation Strategies (NASs) to further encourage, facilitate and co-ordinate adaptation within countries.

There are many definitions and characteristics of adaptation strategies (Carter et al., 1994; Burton et al., 2005). For the purpose of this paper, adaptation strategies in general are 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’ (Niang-Diop and Bosch, 2005, 186). In this paper, the focus is on formalised and comprehensive NASs that have been developed by governments for adoption by national policy makers. The structure and focus of the NASs differs between countries, but often they provide a comprehensive overview of the main impacts and vulnerabilities in a country and propose measures to adapt to the projected impacts. This paper critically analyses the recent developments of those NASs, based on a study performed by six research institutes of the Partnership for European Environmental Research (PEER1) (Swart et al., 2009).

The following section describes the data gathering methods and the analytical framework to analyse and compare the different NASs. Then we discuss the various themes that are covered by NASs in the subsequent six sections. Finally, we synthesise the results in a number of key findings.

2. Method

The main goal of the study was to assess the current status and rapid developments of NASs in Europe, which up until then had only been assessed in a superficial manner (EEA, 2006; Massey and Bergsma, 2008). To compare the efforts of the different countries, a simple inductive framework of themes was applied that were shared in most of the analysed NASs. The project was also intended as a first step in further collaborative research in this emerging area, giving recommendations to improve exchange of experience, establishing a dialogue between countries and enhancing social learning amongst them (Swart et al., 2009). The country selection was limited to European countries with relative high adaptive capacity (Haddad, 2005), which had developed national adaptation policy or were in the process of doing so (Massey and Bergsma, 2008). In addition, the selected countries represent the geographical spread of different types of climate impacts in Europe (EEA, 2006; Alcamo et al., 2007). Several pragmatic criteria were established to select countries, of which the access to primary data sources was most important. Contributing researchers were asked to analyse their own country and select, on the basis of the above mentioned criteria, at least one additional country to analyse in further detail. Table 1 shows an overview of the NASs that were analysed. By early 2009, nine EU Member States had developed a National Adaptation Strategy, whilst several others were in the process of developing one. The draft NAS versions of the UK and Germany were used in the analysis and updated after they received governmental approval. Two countries, Romania and Hungary, have developed a strategy but were not analysed in this study because we were not able to access all of the necessary information. In addition, the study is limited to the comprehensive

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1 These included the following partner institutes (in alphabetic order): Alterra (NL); CEH (UK); CEMAGREF (FR); NERI (DK); SYKE (FI); UFZ (GE), JRC, partner in the PEER network, was excluded from the study due to its links with the EU, rather than a particular country.
NASs at national level. In various European countries a variety of plans exist alongside the NAS which focus on specific vulnerable sectors or regions, such as flood risk or heat wave plans. Sometimes such plans are inspired by the NAS development process, sometimes the NASs build on them. Although we acknowledge their importance they were not included in this study. The issue of mainstreaming climate change concerns in non-climate policy sectors in Europe is discussed by Mickwitz et al. (2009).

Primary data were gathered through policy document analysis, including the National Adaptation Strategies (NASs), sectoral adaptation strategies, impact and vulnerability assessments, third and fourth national communication reports to the UNFCCC, and communication strategies. The policy document analysis was complemented by several semi-structured interviews with government representatives who had been selected because of their active role in developing and/or implementing the NAS. Preliminary results from the inventory and comparative analysis were presented during 2008–2009 at various national and international meetings, providing valuable feedback to improve the analysis. A draft of the full report, including the preliminary findings and conclusions, was scrutinised by 32 international reviewers from the different countries – varying from government and EPA representatives (n = 17) to climate change scholars (n = 15). Finally, the results of an international workshop on “Science–policy interactions in national adaptation policy” held in September 2009 in Netherlands were used for this paper.

2.1. Comparative framework: six key themes in the NAS

Comparing the adaptation strategies from different countries is challenging because of the institutional, legislative, political and cultural differences which are reflected in, for example, the timing, structure, focus and legal status of the NAS and possible follow-up strategies. These differences determined the methodology to compare countries and to interpret the results (Landman, 2000). Because existing frameworks (Burton et al., 2005; Massey and Bergsma, 2008) were found unsuitable for a comprehensive comparison in a specific European context we undertook an initial analysis of the NAS which identified six themes or issues common to all the NASs. The themes were selected after the preliminary policy document analysis to match different stages of the policy process and links with recent discussions in scientific literature on climate adaptation: (1) the motivation behind establishing NASs; (2) the interaction between science-policy and research coordination; (3) approaches to communication and knowledge transfer; (4) the ways in which tasks and responsibilities are distributed between different levels of governance; (5) the institutional arrangements for incorporating adaptation into sectoral policies; and (6) whether and how countries ensure that their adaptation strategies are implemented and reviewed.

3. Factors driving the development of a National Adaptation Strategy

Several supportive or contrasting factors explain why countries decided to develop a National Adaptation Strategy that can be identified based on both document analysis and interviews with policy makers and experts who have taken part in the formulation of NASs. We distinguished between factors that were motivators, levers or drivers in the development of a strategy, and those that were required to facilitate the development processes (Fig. 1). Motivating factors include any pressures, compelling information or key events that in combination persuaded governments and other influential stakeholders of the need for action. These included ongoing international climate negotiations, EU policies such as the EU Green and White papers on adaptation, experience of extreme weather events, examples of adaptation actions in other countries, economic costs of inaction or, in some cases, recognition of the opportunities presented by climate change (Tompkins and Amundsen, 2008). In the UK, Tompkins et al. (2009) identified a large list of climate and non-climate triggers and drivers that directly or indirectly support the development and implementation of an adaptation strategy. In practice, it is often a culmination of different factors that triggers the development – a common hierarchy could not be established. Moreover, the underlying motives to develop adaptation strategies are not always explicitly mentioned. As a result, comparing the motives of the countries becomes difficult since the emphasis of these factors varies by country: for example, the projected impacts on water resources are emphasised in almost all countries, but recent actual drought

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*Fig. 1. Key drivers and facilitating factors for the development of National Adaptation Strategies (Swart et al., 2009).*

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2 At several occasions during the whole project, and for all countries, we asked the ministries responsible for climate adaptation specific questions about their NAS. In addition, we conducted more extensive, semi-structured interviews in Finland (n = 7); Germany (n = 2); Netherlands (n = 2); and United Kingdom (n = 3). No such interviews were conducted for France, Denmark, and Spain.
events were the prime motivator for action in southern European countries, whereas high profile flooding had a comparable galvanising effect in central and northern Europe. Some countries lean heavily on knowledge developed internationally, or are influenced by international policy processes, while other countries are motivated mainly by domestic concerns. As been highlighted in most interviews, the projected and experienced impacts of the extreme events in combination with the rapid increase in knowledge on region-specific vulnerabilities and impacts have been a major trigger in all countries to develop their NASs.

Equally important, but often poorly understood, are key facilitating factors without which it is unlikely that the motivating factors would be acted upon. These include, for example, political will, human and financial resources, good co-ordination between key actors in different sectors and at different administrative levels, and compatibility with other policies. The timing of the development of NASs may be influenced by other items on the political agenda, and if these are pressing issues, progress on adaptation can be sidelined or delayed. While several strategies cite the possible economic damage of avoided climate change as a major motivating factor for action, no strategy actually presents an analysis of the costs of adaptation but some refer to general assessments such as, for example, the Stern review (Stern, 2006). Also, suggestions from aggregate model studies that the costs are likely to outweigh the benefits appear to suffice to start adaptation policy development. There is as yet no systematic and reliable method to estimate the costs of adaptation for most adaptation options, partly because it is often difficult to separate climate concerns from other factors that influence adaptation actions.

While the motivating and facilitating factors determine if and when a National Adaptation Strategy is developed, the design of the strategies also depends on other influences, described here as framing factors, which affect the eventual identification, evaluation, prioritisation and implementation of appropriate adaptation measures. Five framing questions are identified here: (i) how are future developments characterised (e.g., through scenarios)? (ii) which vulnerable sectors are highlighted? (iii) is climate change primarily perceived as a risk or also as opportunity? (iv) is adaptation framed as a local, national or international problem? and (v) is there an overarching paradigm which dominates the adaptation debate?

Most national strategies appear to be based on a rather general notion of vulnerability derived from international and national assessments, making use of whatever information is available. We did not find any consistent and systematic use of scenarios across the countries studied. As to the sectoral focus, there are a wide range of topics and vulnerable sectors covered in the NASs, 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 (Table 2). Some strategies also address inter-connections between sectors. For example, the Spanish strategy notes that water resources, biodiversity and coastal zones have a major impact on other sectors, such as agriculture, forestry and tourism, whose development is to a large extent dependent on adaptation possibilities in the key sectors (PNACC, 2006). In a slightly different vein, the French NAS makes a distinction between cross-cutting issues like water, health, biodiversity and prevention of risks, and sectoral approaches, such as agriculture, energy and industry, transport, building and housing, tourism, banks and insurance (ONERC, 2007). 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. Some of the topics are more country-specific than others, reflecting local geographical conditions, natural resources and sources of livelihood.

While generally the emphasis is on responding to a risk rather than exploring opportunities, a small number of countries, mainly in western and northern Europe, explicitly take potential benefits into account, such as export of knowledge on water and coastal engineering (Netherlands), reduced winter mortality (United Kingdom), new opportunities for tourism (Netherlands, United Kingdom, Sweden, Finland), increased growing season and yields in agriculture (Sweden, Denmark, Finland, Germany, Latvia), and improved conditions for hydro- and wind power (Sweden, Finland, Latvia, Denmark). These issues can make a difference in transforming barriers to enablers and enhancing public and political action (Burch, 2010).

Interestingly given the historical ties of many European countries with other parts of the world, there is only superficial treatment of the implications of climate change impacts occurring outside Europe, which can have important implications for European economies. Several projects around the world have started working on this topic, including the UK "Foresight project on International Dimensions of Climate Change". 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 Kankaanpaä, in press). Although work is being done at this subject, the NASs make little reference to the international or European level, focussing primarily on local and regional actions.

Finally, the manner in which adaptation policies are designed and implemented depends on the underlying philosophy or paradigm, which varies between countries. Several attempts have been made to categorise the different approaches to adaptation. Amongst others, Eakin et al. (2009) have identified three approaches to adaptation and categorise them as the social vulnerability approach (addressing underlying social vulnerability), the resilience approach (managing for enhanced ecosystem resilience) and the targeted adaptation approach (targeting adaptation actions to specific climate change risks). The UK Climate Impacts Programme identifies four categories: living with risks and bearing the losses, preventing effects by reducing exposure, sharing responsibility (e.g. by insurance schemes), or exploiting opportunities (UKCIP, 2005). In the National Strategies, different paradigms remain implicit, but it is likely that in the implementation phase they will emerge as important factors shaping and prioritising different adaptation options.

Table 2

<table>
<thead>
<tr>
<th>Vulnerable sector</th>
<th>DE</th>
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<th>ES</th>
<th>FI</th>
<th>FR</th>
<th>NL</th>
<th>UK</th>
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<tr>
<td>Agriculture/nature conservation</td>
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<td>Energy, electricity supply</td>
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<td>Finance and insurance</td>
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<td>Forests, forestry</td>
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<td>Human health</td>
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<td>Construction and buildings</td>
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<td>Tourism and recreation</td>
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<td>Spatial planning, land use</td>
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<td>Communications and infrastructure</td>
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<td>Emergency and rescue services</td>
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<td>Soils</td>
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<td>Foreign policy</td>
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<td>Hunting</td>
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<td>Reindeer husbandry</td>
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PNACC, 2006; a, in press; ONERC, 2007; UKCIP, 2005.
4. Science, policy and societal interactions in the development and implementation of NASs

The development of NASs is triggered and supported by scientific information about the climate system, the potential impacts of climate change in vulnerable regions and sectors, and possible measures to manage the unavoidable impacts through adaptation strategies. There is a need for both fundamental scientific knowledge on the climate system and context-specific knowledge of impacts, vulnerabilities and adaptation options. In general, three phases of research focus can be distinguished across EU countries, each phase building on the previous one in the following sequence: (1) climate system research; (2) impacts and mitigation research; (3) vulnerability and adaptation research (see also Fig. 2). Inevitably, there are exceptions and overlaps, but this framework serves the purpose of demarcating a step change in the programming of climate change research, linked to political developments.

Until the mid-1990s, research on climate change focused almost exclusively on understanding of climate system dynamics, detecting climate change, the attribution of climate change to natural and anthropogenic causes, the sources of greenhouse gas emissions and on modelling of future climate. We refer to these types of programmes as climate system research. Most European countries continue to actively develop this type of research. Examples mentioned by the NASs include the Swedish SWECLIM research programme (SWECLIM; 1996–2003) and the more recent programme in the United Kingdom ‘Quantifying and understanding the Earth System’ (QUEST; 2003–2009). Scientific progress in climate systems has been, and remains, the main motivating factor for (inter-)national action on climate change mitigation and the scientific foundation for other types of research programmes.

From the mid-1990s onwards, climate system research expanded by including research on ways to mitigate climate change to satisfy the greenhouse gas emissions reduction aspirations of the UNFCCC Kyoto Protocol and European Union targets. Initial observations on the potential impacts of the projected climate changes on social–ecological systems began to appear in the scientific literature around this time. As time progressed and more results on the magnitude of potential impacts appear in the scientific literature around this time. As time progressed and more results on the magnitude of potential impacts appear in the scientific literature around this time. As time progressed and more results on the magnitude of potential impacts appear in the scientific literature around this time.

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Following the recognition that mitigation alone is insufficient to prevent impacts, after the turn of the century several national research programmes have been developed that give more prominence to studies of vulnerability and adaptive capacity and associated adaptation options, measures and strategies, including local, regional, and sectoral studies. The nature of the question at hand requires a new type of research programmes in which the relation between science and policy has intensified. This also paved the way for more social science research on, for example, values, norms, institutions, modes of governance, and estimates of the economic costs of implementation, which are increasingly being included in these programmes. This vulnerability and adaptation research includes exploration of the inter-dependencies between climate-sensitive sectors, organisations and other actors, as well as the integration of climate concerns into policy processes at the local and regional scale. The nature of adaptation requires combined efforts of public and private actors at all levels of governance, making it a multi-level governance issue. Examples of vulnerability and adaptation research programmes include the Finnish ‘Climate Change Adaptation Research Programme’ (ISTO; 2006–2010), the German Klimzug programme (KLMZUG; 2008–2014), and the Dutch ‘Knowledge for Climate’ programme (KvK; 2008–2012).

There are strong inter-dependencies between these three broad types of research. Local and regional adaptation options and measures cannot be developed without assessing the vulnerabilities and impacts that can be attributed to changes in the climate system itself. The shift in research focus is accompanied by a shift in approach (from mono-disciplinary to trans-disciplinary), objectives (from scientific understanding to supporting policy making), and ways of funding (from mainly [inter- national governmental sources to shared funding between [inter- national, sectoral and regional sources). The new types of research programmes to conduct policy-relevant research struggle with the duality of producing practical results for policy makers at the same time as maintaining legitimacy and scientific credibility, given the risk of politicisation. The demarcation of science and policy, which was relatively clear for climate system research, has changed into an interdependent relationship. This requires a strong change to the traditional modes in which science and policy have operated in the past, since science and policy do not automatically mesh (Niederberger, 2005; Sarewitz and Pielke, 2007). A common approach to the facilitation of the interactions between science and policy and to cope with this perceived gap is the development of specialist organisations. The most developed
examples can be described as ‘bridging’ or ‘boundary’ organisations (Guston, 2001; Miller, 2001; Hoppe, 2005). These organisations (1) work at the boundary of science and policy; (2) fulfil a co-ordinating role; (3) provide advice on adaptation policy making; and/or (4) can be responsible for drafting the NASs. One of the best known examples is the UK Climate Impacts Programme (UKCIP, 2005), which has operated at the boundary of science, policy and society since 1997. The success of UKCIP can partly be ascribed to the capacity to redefine itself in response to changing circumstances (Lorenzoni et al., 2007a). Equivalents of the UKCIP example are scarce and their role in designing the NAS has been limited. In most instances new organisations are established or existing ones are given the task to fulfil a co-ordinating role in developing the NAS in an effort to prevent conflicting activities between departments.

There are significant institutional differences in political priority, availability of resources, size and scales of research programmes, institutions and organisations already in place and the external pressures of public and private organisations (Swart et al., 2009). What has become clear, though, is that countries which have contributed substantially to research on the climate system in the past are now taking the lead in climate adaptation research. Particularly the UK, Netherlands and Germany, where adaptation ranks high on the political agenda and many motivational and facilitating factors are in place, large research budgets are made available by governments and public organisations for regional and local vulnerability and adaptation research. Other countries with less financial resources also have dedicated research programs that specifically look at vulnerable sectors or regions and may benefit from EU framework programme projects and research from other countries. However, most NASs have been developed on the basis of national impact and vulnerability studies and did not include the results of the ‘third generation climate research’. Many of the adaptation options, measures and strategies presented in the strategies are not a direct response to scientific results but form part of an overall vision of how adaptation could be dealt with. Many of the strategies, therefore, argue for more region- and sector-specific research on vulnerabilities and adaptation but do not commit themselves to financial resources yet.

5. Information dissemination and awareness-raising for adaptive practices

In general, NASs are long-term visions that include both hard and soft measures, with the purpose of reducing climate change impacts and vulnerabilities and enhancing the adaptive capacity of society (Kabat et al., 2005; EEA, 2008). One of the soft sets of measures proposed is to raise awareness and communicate about the possible individual and collective adaptive actions (Moser, 2010). Lay people often lack a clear understanding of the climate problem and the potential impacts and consequences for their daily routines, something which despite the recent attention on climate change is still seen as a major barrier to adaptation (Lorenzoni and Pidgeon, 2006; Lorenzoni et al., 2007b). All strategies emphasise the importance of raising public awareness through information provision, but only a few countries have developed or are intending to develop a specific national communication strategy on adaptation. In most cases, the NASs propose organisational structures to include the dissemination of adaptation information, measures and strategies, together with other information (e.g. on mitigation and energy efficiency). The dissemination of climate information, both research and practice, is poorly co-ordinated within countries with a large number of different organisations contributing knowledge in an ad hoc fashion. Most information on climate change adaptation activities is presented by the national government or the ministry responsible for adaptation, often the environmental ministry. Basic information on the challenge of climate change and governmental responses is provided with links to more detailed information sources. More specialised information on national climate scenarios and potential impacts is often made available by meteorological organisations such as the Royal Netherlands Meteorological Institute (KNMI) and the Swedish Meteorological and Hydrological Institute (SMHI). Other sources of detailed information are the various research institutes and programmes (e.g. the UK’s Living with Environmental Change Programme and the Dutch Knowledge for Climate Programme). In particular the new types of research programmes on adaptation and vulnerability pay considerable efforts in disseminating their information through stakeholder discussions, workshops, conferences, seminars, publications, newsletters and web pages. In some cases, special organisations are established to make information available in a more coherent manner. The Danish Information Centre on adaptation, established under the Danish NAS and co-ordinated by the ministry of Climate and Energy, has the objective to provide access to scientific information on adaptation, policy strategies, news items and frequently asked questions and is an entry point for citizens, businesses and municipalities. Finally, non-governmental organisations including Friends of the Earth, Worldwide Fund for Nature and Greenpeace make information on climate change available, but these mainly focus on mitigation, with the exception of organisations involved in nature protection.

In addition to disseminating information, NASs refer to raising awareness amongst the public. Suggestions in the strategies include educational programmes, campaigns, stakeholder platforms and events as interactive communication modes which enrich the process of double loop learning in society. One of the main tools mentioned in the NASs of Northern and Western European Countries are web-based tools. As computer literacy in Europe is generally high, information can be cheaply and easily stored and updated, and the Internet is globally accessible. For example, UKCIP provides tools and wizards for regional and local governments and individuals, including information on vulnerabilities and options and government responses. In Finland, the ‘Climate Change Community Response Portal’ (CCCRP) guides potential users of climate information to the most relevant scientific information and, similar to the UKCIP website, will include tools and wizards to assist local and regional governments and individuals. There are large differences in the way the tools are financed (by government, research programmes, universities), where they are hosted (by government, research programmes, universities), the information they provide (impacts information, adaptation wizards, integrative frameworks), and their intended audiences (local and regional governments, individuals, private organisations). Although some are perhaps more effective than others, all communication modes play a considerable role in climate adaptation by increasing general understanding of the climate problem, enhancing response capacity and motivating people to actively participate in adaptation practices (Moser, 2010).

6. Multi-level interactions in developing and implementing NASs

Adapting to the impacts of climate change is a significant challenge at all relevant administrative, temporal and spatial scales (Adger et al., 2005; Urwin and Jordan, 2008). Although climate change mitigation may be suitable for top-down approaches such as the Kyoto targets and other emission reduction objectives (Sovacool and Brown, 2009), bottom-up approaches are likely to be more appropriate for adaptation, given the multitude of
variables, context dependencies and cultural settings (Hulme, 2008). At the same time, it requires the involvement of a variety of public and private actors in the problem-solving debate. Multi-level governance, in the context of climate change adaptation, raises new and important questions about the role, power, authority and responsibility of actors operating at different scales, creating considerable opportunities to learn from earlier initiatives and for the development and implementation of adaptation policies at every governance level (Mickwitz et al., 2009). There is a growing recognition that successful adaptation practices require the integration of adaptation strategies across sectors and within multiple governmental scales in a co-ordinated manner (Biesbroek et al., 2009). This is one of the reasons why comprehensive NASs were developed in the first place. Nevertheless, the NASs offer few clues on how governments can facilitate the multi-level governance of adaptation in practice.

The development of NASs is generally not an inclusive governance approach but most often only involves a small circle of experts, governmental and societal representatives. Although the NAS is a central government document, its ultimate objective is to enable adaptive practices at multiple levels of governance through time and space. Unless they are organised at the national level, local and regional representatives are most often neglected even though there are considerable benefits in including stakeholders in the development of the National Adaptation Strategy for example by: (1) identifying the most appropriate (and desirable) forms of adaptation and their viability; (2) mobilising tacit knowledge and experiences of stakeholders on local vulnerabilities and impacts; (3) analysing the capacity of stakeholders to cope with the impacts of climate change; (4) building shared understanding of the impacts, vulnerabilities and options of adaptation; and (5) enhancing the ability to identify priority areas. For example, in the Netherlands a national programme has been set up in which national, provincial and municipal representatives, together with representatives from water boards and experts regularly discuss the multi-level dimension of adaptation issues. Participatory approaches in implementing NAS have also been mentioned in other strategies (e.g. Denmark, Finland, United Kingdom), but they describe no concrete strategy for action. All strategies stress the importance of taking measures at the most appropriate scale of governance: regional, local or individual. The strategies of Denmark and the Netherlands in particular argue that an appropriate setting should be created at the local level by stimulating social learning, self-organisation and mobilisation within the given legislative, financial and technological frameworks.

How do the NASs describe the division of responsibility and authority between the various levels? In order to enable lower levels to make effective and efficient adaptation decisions, some strategies foresee an important role for the national government to keep influence and responsibility and provide the right institutional settings. The UK NAS, for example, explicitly mentions the removal of any formal or informal barrier that might hinder the development and implementation of adaptation strategies. Most NASs do not clearly specify the roles and responsibilities at regional and local scales. In the Netherlands, the division of roles and responsibilities for implementation will be included in their follow-up ‘National Adaptation Agenda’. Similarly, only a few strategies have attempted to assign clear responsibilities to sectors. Finland by exception has implemented the NAS by drawing up several sectoral adaptation strategies that build on existing institutional settings. Unclear and overlapping divisions of responsibilities complicates the implementation of the NAS, not only through conflicting incentives, but also through the financial constraints and competition for resources between sectors. Although mainstreaming of adaptation into new and existing policies is proposed by most countries (e.g. Finland and France) and others have opted for a public–private-partnership approach (e.g. the Netherlands), none of the national strategies considers how the implementation of the NAS should be financed, maybe because still little is known about the actual costs and the potential effectiveness of possible financing mechanisms and instruments.

7. Policy integration and coherence in NASs

Integration or ‘mainstreaming’ of adaptation into new and existing sector policies is a common feature found in all adaptation strategies. Creating coherence and integrating adaptation into climate-sensitive policies in and between governmental scales requires an active role for the national government, as most strategies confirm. Another approach, e.g. in Denmark, argues that vulnerable actors have a direct incentive to adapt, and adaptation could be treated as a societal challenge to be left largely to individual actors and free markets. There are several reasons why this market approach could fail (see amongst others Berkhout, 2005):

- Lack of knowledge – if relevant actors are not sufficiently aware of the looming environmental changes, of the need to adapt or of the available options.
- Lack of capacity – if the societal actors do not have sufficient capacities for timely adaptation, whether in terms of money or workforce.
- Lack of (self-)interest – if ability and responsibility to adapt do not lie with those who are eventually struck by the negative impacts of climate change, or if long-term effects are not taken into account due to short-term economic dispositions.
- Lack of consensus – if multiple actors have to cooperate in order to achieve effective results.

In these cases appropriate governmental interventions are needed. According to the specific sector requirements government can generate the necessary information and awareness that timely action is needed, support the building of adaptive capacities, internalise external effects and resolve conflicts by effective regulation, instruments and incentives.

The OECD (2002) has defined four prerequisites for effective policy integration for sustainable development. We used this framework in the context of National Adaptation Strategies. First of all, there should be a strong leading department, ministry or institution that takes up the challenge to initiate and develop the National Adaptation Strategy. In almost all Member States this is the ministry that holds the environmental or affiliated portfolio. In some cases this leading ministry is actively involved in writing the strategy or chairing the (inter-ministerial) working group that is responsible for drafting the strategy. However, in some instances it is unclear who leads the adaptation dossier. For example the Ministry of Transport, Public Works and Water Management and the Ministry of Housing Spatial Planning and the Environment in the Netherlands both contributed substantively to the discussions on climate adaptation, leading to political competition. Second, (sub)units on adaptation in leading vulnerable sector departments should be established in order to strengthen the inclusion of adaptation in decision making. Third, interdepartmental units can have a valuable role in managing the integration of adaptation into sectoral policy within the context of comprehensive NASs. Fourth and finally, as discussed earlier, the (bottom-up) input from other scales of governance should be included for coherent and integrated adaptation strategies. All these four organisational issues suggested by the OECD to enhance policy integration are reflected to differing degrees by the NASs: several strategies have indicated new organisations (e.g. Denmark, UK), commitments/
legislation (e.g. UK), additional research (e.g. Germany, Netherlands) or policy instruments to strengthen policy integration and coherence (Netherlands). One of the measures to strengthen adaptation in existing policy development (at any level) is to include adaptation in assessment instruments (e.g. strategic environmental assessments, environmental impact assessments) or specific planning instruments (e.g. water assessment tests, building codes). Some strategies, including the Danish and Dutch, suggest revising existing policy instruments to include adaptation. In addition, most of the Adaptation Strategies make reference to spatial planning activities within their countries to operationalise adaptation (e.g. UK, Netherlands, Germany, Finland) – most planning activities are also co-ordinated by environmental ministries; spatial planning has a long tradition in weighing different interest between sectors and scales; and many of the adaptations take place in the spatial realm (Campbell, 2006; Biesbroek et al., 2009; Davoudi et al., 2009).

8. Implementation and review of NASs

Most of the NASs mark the beginning of a process rather than the end, putting the issue on the national policy agenda but often without elaborating concrete proposals or processes for implementation and monitoring effectiveness of the NAS. Flexible mechanisms to implement, evaluate and revise adaptation strategies will be required, including metrics to gauge progress and policy effectiveness, as well as sets of regulatory, economic and other instruments.

In order to provide for a regular review, a specific date or time frame can be included in the strategy and the review assigned to a responsible body. Competent bodies need to be established as permanent institutions and sufficiently equipped with resources and influence. Amongst the countries considered, only Finland, Germany and the UK have set out a time frame for a general revision of their NAS. A mid-term evaluation of the Finnish NAS undertaken in 2009 (MMM, 2009), and a more comprehensive evaluation of the strategy and its effectiveness, is proposed to take place within 6–8 years of publication (i.e. 2011–2013). 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. In the case of the UK (specifically, England), the Climate Change Act states that once a national adaptation programme has been put into place it must be reviewed by parliament every 5 years, taking into account the updated climate change risk assessment that must also be carried out (UK OPSI, 2008).

8.1. Monitoring, reporting and indicators

Effective and efficient monitoring calls for two basic questions to be answered: What has to be monitored (objects and scope) and who has to monitor it (responsibilities)? Therefore, it becomes important that monitoring objects and responsibilities are identified by the NAS or by a subsequent programme of measures. The NASs included in our study, however, generally include no such monitoring concept or clearly defined responsibilities. The UK perhaps comes closest to defining a monitoring framework in that a legal mechanism has been established to enable it and the Government is required to report to Parliament on progress being made to tackle climate change risks. There is also an Adaptation Sub-Committee under a broader Climate Change Committee to review the progress of the national adaptation programme and provide independent advice on a national risk assessment. The Dutch NAS recognises the need to “…actively monitor the adaptation process; both the decision making process on large spatial investments as well as the physical changes in the Dutch spatial planning’ but provides no clues how to undertake this. In Sweden, a country which is preparing adaptation action but does not have a NAS, the Commission on Climate and Vulnerability simply proposes that the Swedish Environmental Protection Agency should be given responsibility for monitoring the adaptation work and reporting without setting stringent timeframes. For the challenges of monitoring climate adaptation, indicators would be useful as yardstick of success or failure of different policies and measures. However, as the challenges are many and varied, it is difficult to develop specific, quantifiable indicators (Eriksen and Kelly, 2007; EEA, 2008). 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. Moreover, objectives and indicators directly linked to outcomes are more appropriate for cautious regulation in accordance with the subsidiarity principle, leaving the choice of instruments to the relevant local and societal actors. Within the array of the NASs analysed in this study, only the UK and Finnish strategies acknowledge the need to develop quantitative indicators. In Germany, a consultant has been assigned to propose indicators for the main components of the NAS. Research for functional adaptation indicators is still at its outset. Initial considerations gathered during a 2008 European Environment Agency workshop suggested that progress could be made, concentrating initially on the development of “process indicators” (Harley et al., 2008). 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, such as the availability of climate change scenarios, vulnerability assessments, adaptation guidance and disaster plans, the identification of cross-cutting issues, and the engagement of stakeholders.

8.2. Implementation and compliance instruments

Policy instruments (regulatory, economic, voluntary, and communication-related) are necessary to implement adaptation measures, but relatively little progress has been made towards developing them. Such instruments are particularly necessary where voluntary action is likely to be hindered by conflicting interests of actors. This is 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 of 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 will be 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 such as regulatory measures with sanctions or other enforcement mechanisms. Compensation – and governmental support – for adaptive practices can be another means to realise timely adaptation in cases in which “external effects” are to be prevented. The Netherlands already contributes financially to water storage investments in Germany because this is cheaper than taking measures in Netherlands itself.

Planning obligations and instruments are important tools that can help local, regional and sectoral actors to identify their specific adaptation needs and obstacles and to tailor an adequate programme of measures. Existing or new planning instruments can 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
9. Reflections and discussion

In this paper we have analysed the recent, rapid development of National Adaptation Strategies in Europe. The study looks at six cross-cutting themes and shows that EU countries are taking a variety of approaches to developing adaptation strategies, in part reflecting their own cultural norms, political systems and assessment of climate risks, but also that a number of common themes can be identified across all NASs. A number of general observations can be made.

First of all, there is the issue of timing and scales. Several NASs have been developed well before the EU published its White Paper on adaptation. Some countries, like Latvia, purposefully waited for these European initiatives to conform to future European standards, but most countries clearly preferred to develop a policy framework at an earlier stage. How the European Commission’s proposals to mainstream adaptation into EU policies and to push governmental initiatives to start adapting will enable or constrain national adaptive practices remains to be seen. Most strategies, however, pay little attention to the potential role of the EU, focusing on problems within the national borders. In addition, well before NASs were even considered, some vulnerable regions and sectors already started to adapt and learning experiences can be used in other sectors and regions.

Secondly, the NASs show great resemblance in terms of topics, methods and approaches addressed. This can partially be explained by the projected impacts on climate-sensitive sectors, even though the severity might differ between countries. But it is also caused by our current limited scientific and political understanding of what adaptation implies in practice. Knowledge on impacts and vulnerabilities does not necessarily lead to the most cost-effective and efficient adaptation policy decisions, partly due to the context specificity of adaptation which makes detailed planning at national level challenging. The uncertainty that surrounds climate change combined with the long-term time frame and lagging scientific research offers policy makers little guidance for short-term action. Science on adaptation is moving fast, but the governance of adaptation is moving even faster. The strategies therefore remain rather abstract and facilitate a discussion on adaptive practices rather than impose particular solutions.

Financing adaptation in the NASs is most often not addressed, costs being largely unknown for many of the adaptation options, and funding is left to follow-up action. Also financing research, setting up new institutions and organisations, and supporting the continuity of the policy process are issues that yet have to be organised in most countries. One of the causes is the lack of generally accepted instruments to implement adaptation and the lack of indicators to measure the effectiveness of adaptation policy.

These observations in this paper raise the question about the role the NAS fulfils in the wider governance of adaptation. Do they really co-ordinate and integrate adaptive practices between various levels of government and do they stimulate and enable local initiatives? Are they strategic policy documents to maintain the political momentum on adaptation? Are they simply there to raise awareness and show that the government recognises the projected impacts? Are they anticipating future EU policy? Are they developed because other countries have them as well? We argue that positive responses to all of these questions suggest valid roles of the NAS in the wider process of adaptation policy – but with a different emphasis between countries.

9.1. Strengths, weaknesses, opportunities and threats

Based on the comparison of the six themes we can identify some shared strengths and weaknesses between EU countries. Potential threats and, in many cases, similar opportunities can also be distilled from the analysis (see Table 3). To exploit the opportunities and strengths and to reduce the weaknesses and threats within the countries, exchange of experiences and results of adaptation practices between countries can be very useful. Countries can learn from innovative strategies, approaches and measures to cope with the impacts of climate change in other countries.

Our discussions about the NASs with various experts and policy makers across Europe suggest that for delivering many adaptation actions, institutional problems such as multi-level governance and policy integration may be a greater challenge than finding technical solutions. It is generally acknowledged that adaptation cannot be delivered in isolation – it must be an integral part of all relevant policies (i.e. mainstreamed) 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 hence undertaken voluntarily. Although the relevance of improved climate projections is often recognised to enhance effective policy making, most barriers to actual

Table 3

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<th>Contributions significantly to achieving the NAS objectives</th>
<th>Hindering the achievements of the NAS objectives</th>
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<tr>
<td>Related to historical conditions and institutional development of the NAS</td>
<td>Strengths</td>
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<td>Targeted adaptation research</td>
<td>Planning for implementation, review and funding</td>
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<td>Coordinating between sectors</td>
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<td>Related to the current and future conditions and developments external to the NAS</td>
<td>Opportunities</td>
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<td>Development and export of knowledge</td>
<td>Spillover of policy integration and multi-level governance for non-EU policies</td>
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adaptation appear to be related to policy co-ordination and implementation, i.e. pertaining to how adaptation actions can be designed, organised and financed. Hence, not only uncertainty about the substance of the problem becomes important, but also uncertainties regarding the strategies of stakeholders in the adaptation process and the institutions involved (Koppenjan and Klijn, 2004). Government is seen as fulfilling three main roles: providing information and raising awareness, supporting the development of adaptive capacity, and ensuring that public goods are integrated into cost–benefit analyses through regulation, instruments and incentives. A crucial challenge still to be confronted in all NASs is policy integration, with few measures yet in place to ensure effective co-ordination of adaptation policy throughout government. Indeed, most strategies can be regarded as just the start of a policy process rather than its culmination. Their achievement has been to place adaptation on the national policy agenda. However, most strategies still lack concrete proposals or processes for enhancing adaptive capacity, implementing adaptation actions, ensuring that policy integration actually happens or measuring policy effectiveness. With knowledge of vulnerability and adaptation options increasing over the coming years, effective implementation of NASs will require the deployment of flexible mechanisms to exploit this new knowledge.

9.2. Knowledge gaps

It appears from our analysis that there are many knowledge gaps, uncertainties and policy questions related to the six themes of this study. We have condensed these here into ten generic recommendations for the programming of meaningful climate change adaptation research in a European context and the sharing of results with potential users (Swart et al., 2009):

- Carefully design a flexible mechanism for science-policy interactions.
- Connect research to local, regional and national policy needs.
- Analyse the role of institutions in climate change adaptation.
- Exploit different options to share knowledge internationally.
- Develop systematic ways to analyse, manage and communicate relevant scientific uncertainties.
- Analyse options to address mechanisms and responsibilities involved in effective multi-level governance.
- Develop frameworks for evaluating adaptation policies, with a supporting toolbox of methods and metrics.
- Analyse the applicability of different types of policy instruments for adaptation policy.
- Perform comparative analyses of sectoral and cross-sectoral adaptation in vulnerable regional hotspots.
- Analyse national adaptation in the context of European and global developments.

9.3. Europe and the wider world

The rapid development of NASs across Europe provides a very valuable first step in managing the unavoidable impacts of climate change both at the national and European level. Moreover, recent developments at the European level, such as the White Paper on climate change adaptation, support these developments and stipulate the need for more research and knowledge exchange with regards to adaptation strategies. We identified a large need and urgency for exchange of knowledge and experiences between countries. At the time of writing this paper, other industrialised countries have also started to develop adaptation strategies, in particular Canada and Australia, which consider themselves very vulnerable. For example, the Council of Australian Governments (COAG) endorsed a National Adaptation Framework in 2007, with a long-term goal to position the country to reduce the risks of climate change impacts and realise any opportunities, and a medium-term goal (5–7 years), to build capacity to deal with climate change impacts and reduce vulnerability in key sectors and regions through targeted strategies (COAG, 2007). In the USA and Japan, impact assessments are currently paving the way to develop adaptation strategies. Sharing knowledge between European and these other industrialised countries would provide opportunities for learning from each others’ experiences. The rapid pace of policy development suggests that this is urgently needed to decrease the risks of mal-adaptation. Moreover, while acknowledging the vast differences, experiences from the industrialised countries may be useful for furthering the adaptive capacity of the developing countries, who need it most.

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