Final report

Design of guidelines for the elaboration of Regional Climate Change Adaptations Strategies

Tender DG ENV. G.1/ETU/2008/0093r

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Disclaimer

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Executive summary

Nearly all European regions are expected to be negatively affected by a rapidly changing climate. The need to adapt to a rapidly changing climate is therefore high. Scarcity of concrete adaptation strategies, in most of European regions, suggests that the availability of guidelines for designing Regional Adaptation Strategies (RAS) can be helpful to assist regions preparing their climate adaption strategies. This Policy Guidance is intended to assist regional authorities and other regional bodies in charge in formulating RAS. It draws on the experience of thirty-one regional adaptation strategies, a review of existing guidelines for developing adaptation strategies, and on the results of a stakeholder's workshop that conveyed regional authorities to discuss a draft of this guidance. The following main key issues were identified:

- RAS have a **different geographical scope** (i.e. some countries are planed at municipal level in other countries at regional level). Cross-Europe RAS are in **different policy phases** and some address **both adaptation and mitigation issues.**

- **National strategies often provide a framework** for the development of regional strategies. RAS are often legitimised and included in national adaptation strategies.

- Existing RAS tend to focus in a **patchwork of scientific background information and methods** based mostly on climate variation impacts and less on adaptive capacity. RAS cover a multitude of vulnerable sectors, dependent on the regionally specific context. RAS tend to include stakeholders consultations in the development phase of the RAS, but these processes are not described in detail. Strategic assessments are not widely used to assess RAS.

- Little attention appears to be paid as yet to **implementation issues**, such as implementation policy instruments, assignment of specific responsibilities to different actors at different administrative levels, and costs.

These Guidelines are designed for "hands-on use". They are intended to stimulate and assist planning for climate change adaptation in regional and locally-based administrations, including municipalities, counties and other regional institutions. This guidance is divided into four main steps and three issues that are cross-cutting through the whole process of RAS development and implementation.

Step 1: Prepare the ground. Gaining political backing and embedding climate change adaptation into existing plans, policies and programmes are two key features of this step. The approach suggested starts by securing long term commitment and leadership, appoint the individual or team that will lead the RAS project, gather all relevant information, secure financial resources, identify funding options and stakeholders.

Step 2: Assess vulnerability of the region. Assessing vulnerability includes an assessment of climate and socio-economic scenarios, identification of impacts of climate change, assessment of the vulnerability of key systems and an assessment and prioritisation of risks and opportunities associated to climate change.

Step 3: Set the Strategic Direction. The strategic direction of the adaptation plan is defined. Through defining the scope of the RAS and its objectives, complete a SEA and create monitoring and evaluation frameworks for the RAS.

Step 4: Plan & Implement Concrete Adaptation Measures. Adaptation measures are identified, selected, executed, monitored and evaluated. Primary a catalogue of adaptation options is prepared, then criteria is chosen to guide the selection of adaptation options, follows an agreement on a set of adaptation measures, the design, implementation, monitoring, evaluation and review of the action plan.

The three cross-cutting themes are:

Gather information. It is of particular relevance to inform the initial stages of decision-making, but the process of gathering information is extended to the other 3 steps. As information is constantly updated, exchanged and tested in RAS.

Monitoring, evaluation and review. The RAS process is iterative, meaning that the early stages should be repeated following the evaluation and review stage, based on the results of the evaluation, objectives, measures, implementation strategy may need to be re-assessed**.**

Stakeholder engagement. It is crucial to involve individuals and organisations that will see their activities and stakes affected by a RAS. Also individuals that can support the decision making process with scientific information can provide a rich contribution to the elaboration and review of the RAS. The type of input received from stakeholders will depend on the stakeholder group involved and on the elaboration stage of the RAS.

There is little doubt that regions have a significant role to play for adaptation to climate. As pointed out by the White Paper on Adapting to Climate Change published in April 2009 by the European Commission, the coordination and support of developing and implementing RAS from the EU-level can be beneficial. A comprehensive and coherent adaptation approach across the EU regions would improve the quality of the RAS. It could be reached through:

- **Mainstreaming adaptation into existing EU funding instruments**
- **Facilitate cross-border cooperation and negotiations for developing trans-national RAS**
- **Providing methodological support to the conception and testing of guidance documents and pilot schemes in the regions.** For example: the development of vulnerability indicators to prioritise funds and actions to the most vulnerable regions, create specific tools to support cost-benefit assessment of the adaptation options.
- **Creating platforms for information exchange and networking,** in particular through a Climate Change Impacts, Vulnerability and Adaptation Clearinghouse.

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1 Introduction

1.1 Why developing this guidance?

Climate change is already underway and will increasingly affect all aspects of life, including access to natural resources, ecosystems, food security, agricultural yields and stability of infrastructures. The issue of climate change may seem less important to a regional authority than other pressing issues such as economic downturn or the need to provide good quality health services. However, if left unchecked climate change will cause significant economic and ecological damages. There is clearly a need to place climate change, its impacts and risks into the mainstream of economic and development policies at all level of governance. An informed, better educated population with improved awareness and access to information on climate change is likely to be in better position to cope with the consequences of a changing climate.

Adaptation is requires on one hand to consider long-term changes and has to secure long term protection. On the other hand it needs to deal with new or more often extreme events (disaster management). As shown in Table 1, regional and local authorities have a significant role to play for adaptation to climate change.

Table 1: The role of city/municipal governments in the four aspects of adaptation

Role of city/municipal government	Long-term protection	Pre-disaster damage limitation	Immediate post-disaster response	Rebuilding
Built environment				
Building codes	High		High[1]	High
Land use regulations and property registration	High	Some		High
Public building construction and maintenance	High	Some		High
Urban planning (including zoning and development controls)	High		High[1]	High
Infrastructure				
Piped water including treatment	High	Some	High	High
Sanitation	High	Some	High	High
Drainage	High	High[2]	High	High
Roads, bridges, pavements	High		High	High
Electricity	High	Some	High	High
Solid waste disposal facilities	High	Some		High
Waste water treatment	High			High
Services				
Fire protection	High	Some	High	Some
Public order/police/early warning	Medium	High	High	Some
Solid waste collection	High	High[2]	High	High
Schools	Medium	Medium		
Health care/public health/environmental health/ambulances	Medium	Medium	High	High
Public transport	Medium	High	High	High
Social welfare (includes provision for child care and old-age care)	Medium	High	High	High
Disaster response (over and above those listed above)			High	High

1. Obviously it is important that these do not inhibit rapid responses.
2. Clearing/de-silting drains and ensuring collection of solid wastes have particular importance just before an extreme rainfall; many cities face serious flooding from extreme rainfall that is expected (for instance from the monsoon rains) and this is often caused or exacerbated by the failure to keep storm and surface drains in good order.

Source: OECD, 2009

Adaptation to climate change is complex as the severity of the impacts will vary from region to region, depending on physical conditions, the degree of socio-economic development, natural and human adaptive capacity, health services, and response mechanisms. Some regions and cities have already produced regional adaptation strategies; others are in the process of doing so. However it has been recognised that uncertainties on the scale, timing and consequences of climate change, as well as the lack of information, knowledge and expertise at local and regional level, is, in part, hindering the development of regional climate adaptation strategies in the EU. As indicated in the recently published White Paper on Adaptation[1], the European Commission wishes to mobilise climate change adaptation responses and promote best practise amongst public authorities at local, regional and national level by providing technical guidance, case studies and examples of best practices.

1.2 Main purpose and approach

This Policy Guidance is intended to assist regional authorities and other functional authorities in the regions of the European Union in formulating Regional Adaptation Strategies (RAS). The primary aim of this document is:

- to provide a step-by-step process that will lead to a strategy for reducing regions' vulnerability to climate variability and change
- identifying and prioritising adaptation responses
- where possible, integrating climate adaptation within a wider range of policies, plans and programmes

The Guidance has been conceived as an entry point for absolute beginners, as well as a reference book for experienced practitioners.

It has been developed by a team of experts led by Ecologic and comprising AEA, IVM and Alterra. This Policy Guidance draws on the experience of regional adaptation stakeholders on the ground. This has been achieved through the development of an inventory of regional adaptation strategies already developed in the EU Member States, a review of existing guidelines for the formulation of adaptation strategies within and outside the EU, a stakeholder workshop bringing together regional authorities and a review of information, datasets, tools, approaches and methodologies employed to develop adaptation responses.

1.3 Structure of this Guidance

This Policy Guidance is divided in three parts:

Part 1 (Chapter 2): *Learning from existing regional adaptation strategies and guidelines* presents an inventory of existing Regional Adaptation Strategies in the EU and a review of existing guidance documents for the formulation of adaptation strategies.

Part 2 (Chapter 3): *Policy Guidance on the formulation of Regional Adaptation Strategies* introduces a step-by-step process for the development of a Regional Adaptation Strategy.

[1] European Commission. White paper "Adapting to climate change: towards a European framework for action". Available at: http://ec.europa.eu/environment/climat/adaptation/index_en.htm

Part 3 (Chapter 4): *The role of the EU beyond current status* provides recommendations on EU further action to support the development of adaptation strategies in the EU regions.

2 Learning from existing regional adaptation strategies and existing guidelines

2.1 What to be learned from existing Regional strategies?

Since 2005, eight countries in Europe have developed and adopted formal national adaptation strategies: Finland, France, Germany, Hungary, the Netherlands, Romania, Spain and the United Kingdom (Figure 1 updated from Swart *et al*., 2009). Other countries are in the process of assessing their vulnerability or are currently developing a national strategy. The main objective of these strategies is to raise awareness of the threat of climate impacts and to put climate change adaptation on the political agenda. Doing so can create a means for elaborating on sectoral and/or regional strategies.

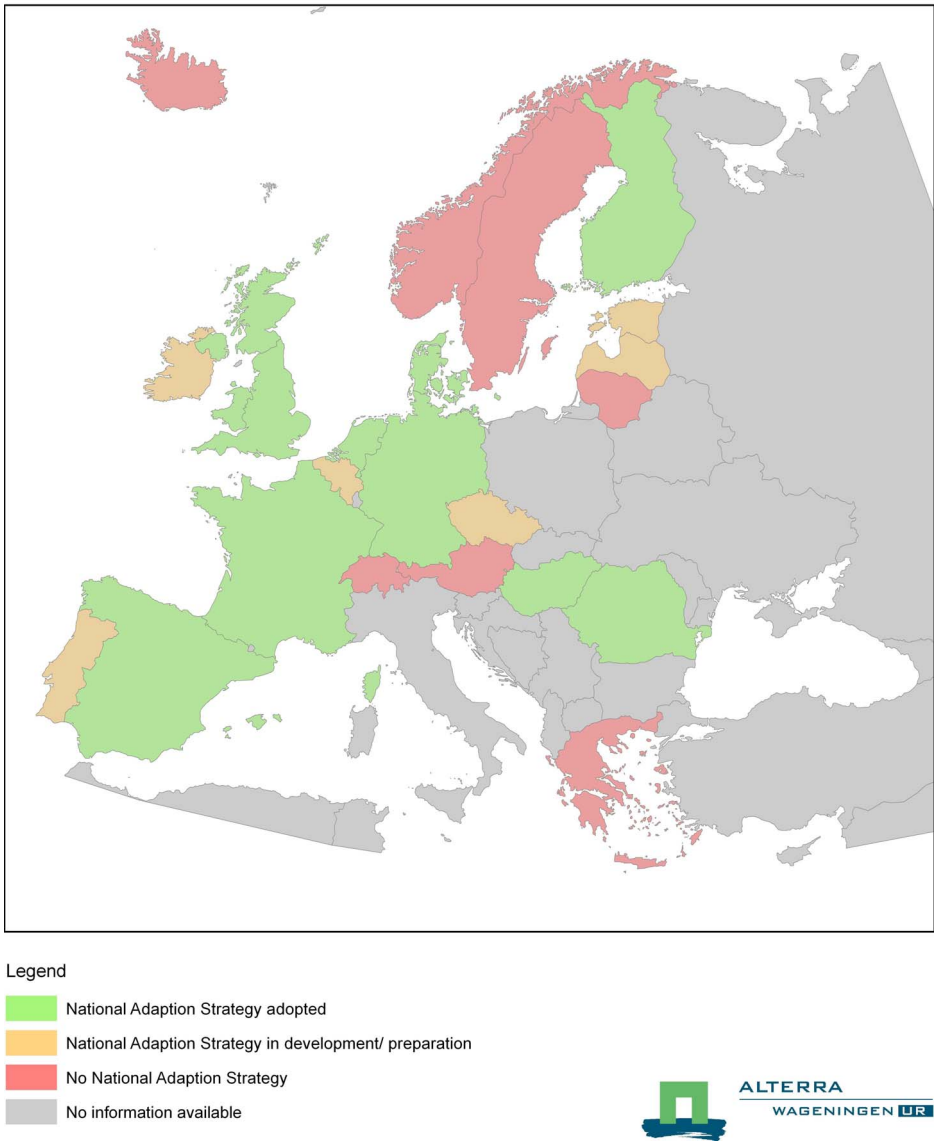


Figure 1: Status of National Adaptation Strategies in Europe (September 2009)[2]

[2] Some countries, such as Sweden and Norway, did perform assessments of impacts and adaptation options and are developing policies, but do not have a formal, politically endorsed National Adaptation Strategy.

2.1. LEARNING FROM EXISTING RAS

Even if the national strategies have not been assessed in the context of this study, they have been used as a starting point for investigating RAS. Further the findings of the assessment of the national strategies have been considered when developing the guidelines.

On the regional level 31 regional strategies targeting climate change impacts were identified in six EU countries (France, Germany, Netherlands, UK, Sweden, Spain) (see Figure 2). Annex I presents methodological details of the assessment.

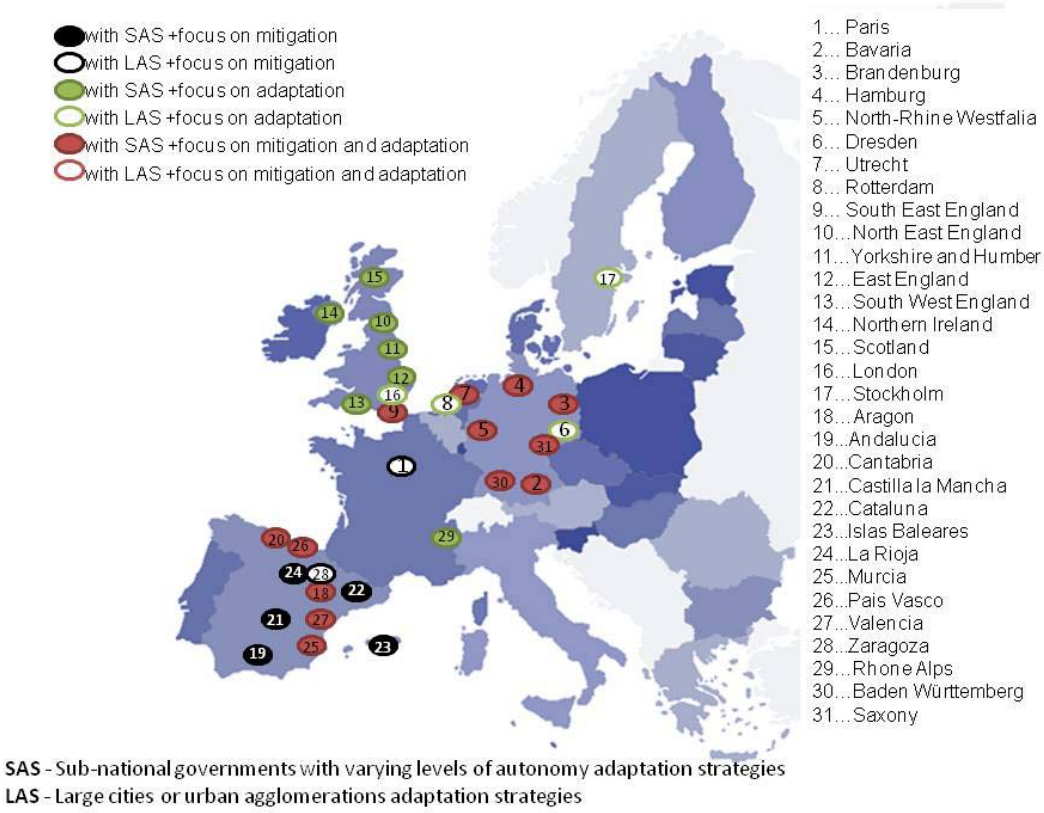


Figure 2: Climate change strategies assessed (showing both municipalities and sub-national government strategies)

When assessing the available RAS the following key issues have been found (for details see Annex II):

- **Different geographical scope of regional adaptation strategies.** We have identified two major types of regions that have created RAS: (a) sub-national governments with varying levels of autonomy, e.g. Länder (Germany), Communidades Autonomas (Spain), countries (in the unitary state of the UK), or provinces (Netherlands), and (b) large cities or urban agglomerations, e.g. Paris, London, Rotterdam. Also, transnational strategies are being developed in shared river basins, but these were not included in this study.

- **Different policy phases.** Across Europe, regions have started to assess their vulnerability in more detail, or have already started developing response plans. The fact that many of the regional strategies that we have identified are in countries that also have a national strategy

suggests that at least informally policy development is evolving in an interactive fashion between the central and regional government.

- **Strategies addressing both adaptation and mitigation**. Many of the strategic plans of regions in Spain, Germany and UK present adaptation and mitigation sections. These strategies seek to optimise resources through looking at actions that can affect improve adaptation and reduce GHG emissions at the same time.

- **The role of national strategies.** Generally, the national strategies in those countries that now have adopted such a strategy provide a framework for the development of regional strategies. The national strategies can include possible legal obligations for such plans (UK), or merely encouragement and information support (most of the other countries). The relative **scarcity of concrete adaptation plans at the regional level** suggests that the availability of guidelines at the national or European level for designing such regional strategies can be helpful, especially for countries which do not have the same capabilities as large countries such as the UK, Germany or Spain.

- **A patchwork of scientific background information.** Regions use whatever information is available to them (e.g. in the selection of climate and other scenarios), which can lead to large differences in the scientific background of their strategies. Generally, the emphasis is on information about potential impacts, with little attention to adaptive capacity. While harmonization of methods, metrics and scenarios across Europe is probably not possible nor desirable, providing guidance to improve the understanding of the implications and limitations of particular choices may be useful.

- **Priority sectors for regional adaptation strategy guidelines.** Regional adaptation strategies cover a multitude of vulnerable sectors, dependent on the regionally specific context. Two vulnerability areas stand out: health (e.g. managing heat stress and new vector born diseases) and landscape management (e.g. flooding, urban water disposal, sea level rise, droughts). As regions differ in their environmental, social and economic structures, the vulnerability of their economic sectors will also differ.

- **Stakeholder involvement.** While not all strategy documents contain information about their development process, most of the regional strategies involved appear to have been developed by one responsible body, usually in consultation with an array of regional, and sometimes local or national actors. Most strategies do not provide details about the organization of the follow-up and turning strategies into action processes. It may be implicit that the same kind of institutional arrangement as was used for the development for the strategy may also be adopted for the implementation phase, which may or may not be the most effective.

- **Strategic assessments** are not widely used to assess regional climate change action plans

- **From strategy to action.** Little attention appears to be paid as yet to implementation issues, such as implementation policy instruments, assignment of specific responsibilities to different actors at different administrative levels, and costs. Similarly, most strategies are silent about the resources required to implement the strategy. Only some mention the commitment of staff to organize the follow up, or estimate the costs of implementation. Finally, the strategies contain as yet no information about monitoring or effectiveness of policy implementation.

2.2 What to be learned from existing adaptation guidelines?

In total, 14 guidance documents have been reviewed. Of these, 10 guidelines were developed within the EU and 4 were developed outside the EU. Table 2 lists the reviewed guidance documents. A description of the methodology employed for this review can be found in Annex III.

Table 2:Adaptation guidelines reviewed in this study

Guidance document	Reference used in this report
Guidance developed within the European Union	
Scottish Local Climate Impacts Profile (LCLIP) Guidance	LCLIP guidance
The Nottingham Declaration Action Plan	Nottingham Declaration
UK Climate Impacts Programme (UKCIP) 'Identifying Adaptation Options'	UKCIP Identifying Adaptation Options
UKCIP 'Adaptation Wizard'	UKCIP Adaptation Wizard
European Spatial Planning: Adapting to Climate Events (ESPACE) programme, 'Planning in a Changing Climate'	ESPACE Planning in a changing climate
ESPACE 'A toolkit for delivering water management climate change adaptation through the planning system'	ESPACE water management guidance
'Towards Climate Change Adaptation Strategies in the Baltic Sea Region'	ASTRA guidelines
NordRegio, 'Climate Change Emergencies and European Municipalities: Guidelines for Adaptation and Response'	NordRegio guidelines
'Climate Change, Impacts and Adaptation Strategies in the Alpine Space'	Alpine guidance
United Nations Economic Commission for Europe (UNECE) 'Draft Guidance on Water and Climate Adaptation'	UNECE guidance
Other guidance	
International Council for Local Environmental Initiatives (ICLEI) guidance 'Preparing for Climate Change: A Guidebook for Local, Regional and State Governments'	ICLEI guidance
The Australian Government's Climate Change Impacts & Risk Management Guide for Business and Government	Australian guidance
The USAID Guidance manual for development planning: Adapting to Climate Variability and Change.	USAID guidance
United Nations Development Programme (UNDP) guidance on 'Formulating an Adaptation Strategy'	UNDP guidance

2.2.1 Key features of existing adaptation guidelines

The common features identified in the guidance documents reviewed are (see Annex III) for more details for each of these issues).

- **Gaining political backing and managerial commitment:** Since adaptation is a multidisciplinary issue that cuts across policy and service areas, gaining political backing and managerial commitment are crucial when developing an adaptation strategy. Gaining backing

from politicians can help get buy-in from the various departments at a regional authority, whilst securing senior management commitment can assist in the development of adaptation responses and help secure funding to implement these actions (Nottingham Declaration, UNECE guidance, ICLEI guidance, ESPACE).

- **Embedding/Mainstreaming climate change adaptation within existing plans, policies and programmes:** Embedding or mainstreaming adaptation into existing and future plans, policies and programmes is considered by most of the guidelines reviewed to be an important step in reducing vulnerability to climate change in all sectors. It also ensures that climate change visions and targets are reflected consistently through all policy including sustainable community strategies, asset management plans, travel plans and procurement policies. In addition to having a stand-alone adaptation strategy, the necessary adaptation actions should be a feature of all policies to help avoid adaptation being viewed as an 'optional extra' (Nottingham Declaration, ASTRA guidance, ESPACE guidance, UNECE guidance, UNDP guidance).

- **Developing an evidence base:** A robust adaptation strategy will be based on sound science and the best available technology/information, for example climate change scenarios and risk assessments should be used to identify potential threats and opportunities of a changing climate (UKCIP Adaptation Wizard, Nordregio guidance).

- **Identification of key vulnerabilities:** Vulnerability assessment is a way of measuring the degree to which a community/sector or an asset/resource will be affected by adverse effects of climate variability and change. Issues to consider before conducting a vulnerability assessment include time available, priority planning areas, budget available and which scenarios to consider i.e. best case, worst case or business as usual (ICLEI guidance).

- **Selection and assessment of adaptation options:** Adaptation options can be split into four categories: 'no regrets', 'low regrets', 'win-win', and flexible or adaptive management options (Nordregio guidelines, UKCIP Identifying Adaptation Options). These actions can be further divided depending on whether they build adaptive capacity (planning, research and education) or implement physical measures such as flood and coastal defences (Australian guidance). Mal-adaptation can be avoided by not implementing adaptation options which are likely to increase vulnerability to climate impacts in the future (ASTRA guidance, ESPACE guidance).

- **Stakeholder engagement and communication:** This stage is considered a key to a successful strategy and should effectively engage stakeholders in order to maximise understanding and acceptance of the strategy (Nottingham Declaration, UKCIP Adaptation Wizard, Alpine guidance, UNECE, USAID).

- **Monitoring, evaluation and review:** The purpose of monitoring, evaluating and reviewing the strategy is to determine whether the project or activity delivers the intended benefits and/or creates negative impacts. Evaluation and monitoring activities should be conducted to verify the effectiveness of measures taken and to make adjustments if needed. In addition it allows you to keep up to date with climatic, scientific and technological developments (ASTRA, ESPACE, UNECE).

2.2.2 Gaps and constraints found in existing guidelines

As a result of our review of existing adaptation guidelines, the following features have been identified as gaps and constraints[3]:

- **Objective setting** is a key feature of strategy development, as it allows actions to be benchmarked for review at regular stages in the future. However, this stage is not covered extensively in many of the guidance documents, aside from UKCIP 'Identifying Adaptation Options' and ICLEI guidance.

- **Uncertainty** is one of the key constraints to developing adaptation strategies. It is acknowledged that methods for correcting uncertainties in model projections must be developed and tested in order to derive regional impact scenarios with a high spatial-temporal resolution (Alpine guidance). Doing so will allow for more localised impact assessments and adaptation strategies to be developed.

- **Lack of data** could also hinder the development of adaptation strategies. Hazard maps need to be developed extensively in order to identify where climate risks exist (Alpine guidance). In addition, comprehensive databases to hold all relevant spatial information on a given municipality and sub-local level should be developed – this mechanism could be based on the Climate Change Impacts and Adaptation Clearinghouse being developed by the European Commission.

- **Cooperation and communication** between different regions and countries is another constraint in developing adaptation strategies. Climate change is a transboundary issue. It is, therefore, inevitable that conflicts of interest will arise at all geopolitical levels, from local to international (ASTRA guidance). Cooperation and communication must therefore be maintained in order to minimise potential disputes from arising. There is a need for transboundary, interdisciplinary and intergenerational communication and cooperation, in order to share best practice and develop the right tools to manage and prevent risk and implement adaptation strategies which are useful to all communities (Alpine guidance).

- **Lack of understanding** about what adaptation actually is can be another constraint in the development of adaptation strategies (ASTRA guidance). Often, mitigation is conflated with adaptation, or it is considered to be more important. There is emphasis on the need for continuous dialogue between policy-makers, government, researchers, NGOs and the public to increase understanding, knowledge transfer and ensure all parties are happy with the strategies being implemented (Alpine guidelines).

- **Coverage of sector specific issues highlighted in the Adaptation White Paper has been largely neglected**. Most of the guidelines reviewed address adaptation at a general level, focusing on the key stages of developing a strategy such as gaining political backing and embedding adaptation in existing strategies. Most guidelines do not look at sector specific issues (Nottingham Declaration, UKCIP guidance, USAID guidance). Some sector-specific guidelines were reviewed (Alpine Guidance, UNECE guidance for transboundary water). Recommendations include monitoring zones where impacts are expected to be higher and

[3] It is emphasised that a comprehensive review was outside the scope of this project and guidelines which address the gaps identified may exist.

developing a common transnational plan concerning the assessment of risks (Alpine Guidance). There are further guidelines covering sectoral areas, including Spanish guidelines for the development of emergency plans to cope with drought in urban centres.

Conclusions

The review of existing regional adaptation strategies and guidance documents allowed capturing common approaches and identifying gaps and needs that could be addressed in guidelines specifically developed for assisting the regions in formulating adaptation strategies.

The new policy guidance described in the next chapter builds on these findings and is intended to promote a "hands-on use" approach. In addition the guidance aims to provide further references and links to existing tools and datasets that can support authorities in preparing, developing and implementing their regional adaptation strategies. As language barriers are often major, we recommend translating this document into the national language.

It is expected that the new policy guidance will contribute to the effort of reducing vulnerability to climate impacts across the EU whilst promoting greater cohesion amongst Member States. This will be particularly important in cases where disadvantaged, more vulnerable regions require greater help to adapt to climate change.

3 Policy Guidance for the Formulation and Implementation of Regional Adaptation Strategies

3.1 What are the key factors for a successful RAS?

The successful integration of climate change adaptation into regional policy, plans and programmes depends on a number of enabling conditions, such as:

- **Meaningful and sustained stakeholder engagement:** Developing an adaptation strategy that can deliver successful adaptation will require the involvement of key stakeholders. The main players may include regional development authorities, public administrations, environmental agencies and central-level and local-level bodies responsible for the coordination and implementation of relevant policies. Other important players include local communities, private sector organisations, labour unions and non-governmental organisations (NGOs). All the actors will have a role to play in supporting the development of the RAS and facilitating the integration of adaptation at the regional level.

- **Use and dissemination of appropriate information:** Informed decision making on adaptation should be underpinned by the best available information on the implication of both the current and the future climate. This includes information on current extreme weather events, projections of climate change and assessments of vulnerability, impacts and risks. Several information sources already exist at the global and national level. Weather and historical climate data are available from meteorological offices. Assessment of vulnerabilities and impacts are also available in most EU countries and their results are summarised in the national communications to the UNFCCC[4]. However, translating global and nation information into information relevant at the more local level may be challenging and gathering local information is crucial for the formulation of RAS.

- **Awareness Raising:** Because the success of the RAS is dependent on receiving buy-in from key partners in the region, it is essential to raise awareness early in the process. Leaders should seize opportunities to announce their plans to develop a RAS and concentrate on raising a high profile for the project. Again, close cooperation with stakeholders will help to ensure that the RAS receives the coverage it deserves and will need if it is to help increase the resilience of the regional economy and society.

- **Monitoring, Evaluation & Review:** The relevance and effectiveness of an adaptation strategy can only be assured if there is sufficient monitoring and evaluation Monitoring and evaluation consists of the assessment of progress against set targets and objectives. This means that responsible authorities[5] must commit to monitoring the success of the RAS at it moves from a plan to reality. Also, our understanding of climate change, and experience of how to adapt, is increasing all the time. It is therefore necessary to evaluate and review the objectives and preferred means of implementing the RAS in order to make sure the Strategy is up to date and reflects best practice.

[4] http://unfccc.int/national_reports/items/1408.php

[5] See Steering Group for further information on who should undertake monitoring and evaluation

- **Successful management of multi level governance:** Climate change is a multi-dimensional problem of global scale, but its impacts will be felt locally and at all social, economic and political spheres. Providing consistent policies throughout society is therefore increasingly important and requires multi-level arrangements. Although institutional and procedural settings vary from country to country, a set of common challenges is emerging from the challenge posed by multi-level governance, from supra-national to local level, in designing and implementing RAS.

  This creates the additional challenge of vertical coordination of the various governance levels involved and the horizontal coordination between sectoral interests. Effective co-ordination is vital in order to deliver a successful RAS. As an important component of co-ordination, better communication between levels of governments and effective information provision may help to prevent conflicts and ineffectiveness.

  Coordination is essential between departments within the same level of government (e.g. within regional authorities) as well as between vertical levels. Coordination mechanisms can be either formal or informal, depending on the political and legal tradition and tend to have a more permanent, rather than ad hoc, structure. Strong leadership in the region is a prerequisite to raising awareness at higher levels of governance.

3.2 Overall approach

Building on the review of existing guidance documents, the analysis of the RAS inventory and the experience of the project team, a four step process for developing, implementing and evaluating RAS has been developed (Figure 3).

Step 1: Prepare the ground
Gaining political backing and embedding climate change adaptation in existing plans, policies and programmes.

Step 2: Assess vulnerability of the region
Gaining better understanding of the expected impacts, risks and adaptive capacity of a region to climate change and identifying priorities for action.

Step 3: Set the Strategic Direction
Identifying a set of principles for the adaptation strategy that directly address the region's vulnerabilities.

Step 4: Plan & Implement Concrete Adaptation Measures
Devising a detailed plan of action setting out how, when and by whom specific adaptation measures should be implemented.

Figure 3: RAS schematic diagram

The four step process is described in the following sections. Each Step in the RAS process has been developed in response to six key questions:

- What are the key objectives and principles?
- Which approach should be taken?
- How can barriers be overcome?
- Who should be involved?
- What are the governance and stakeholder engagement issues?
- Where can examples, tools and sources of relevant information be found?

Adapting to climate change is an **iterative process**. Consequently, each of the Four Steps in the process of developing a Regional Adaptation Strategy should be re-visited periodically in order to ensure that that data, assessments and resulting decisions remain valid and up-to-date, capitalising on improvements in climate science and changes in the strategic priorities of the region.

3.3 Step 1: Prepare the ground

Gaining political backing and embedding climate change adaptation in existing plans, policies and programmes are two key features of this step.

3.3.1 What are the key Objectives and Principles?

The objective of this stage is to signal the intent to develop an adaptation strategy and to secure commitment from relevant decision-makers in the region.

Look out 	**DO** • Secure early and long term commitment from leaders and stakeholders, at local, regional and national level • Collect and assess all the relevant information • Secure resources and personnel to start work on the RAS • Publicly announce the benefits of undertaking a RAS **DON'T** • Attempt to start without sufficient agreement on the need to act or financial commitment from key partners and stakeholders

3.3.2 Which approach should be taken?

1. Secure long-term commitment and leadership

It is vital to receive the early and long term commitment of executive leaders in the region to the objective of preparing and implementing a Regional Adaptation Strategy. This commitment should come from the most senior officer in the regional authority (e.g. Major, Director). Commitment may be achieved by holding meetings with senior officials, providing briefings on the need for a RAS and making a business case for adaptation.

2. Appoint the individual or team that will lead the RAS project and secure human resources

Depending on the governance level (local or regional), scope (sector based or cross-sectors) and resources available for the development of the strategy, an individual or a team should take responsibility to design and promote the RAS. For example, the team may be led by the Environment or Climate Change Department or perhaps by a Water, Risk or Planning Department within the regional authority. Adaptation Strategies may be developed as part of a wider Climate Change or Sustainable Development Strategy in order to capitalise on potential synergies with mitigation measures and other sustainable development goals. In this case, the strategy may be developed by an inter-disciplinary team that includes representatives from across a number of policy areas, for example the energy, housing, water, waste, transport and agriculture departments. Some regions appoint an individual 'climate champion' to promote work with the wider community of stakeholders. The Core Team who will design the RAS may include in-house or contracted experts in climate change. However it is most crucial to agree responsibilities and hierarchies among the authorities and experts involved.

There are costs associated with the preparation of an RAS and on the implementation of RAS actions. An important condition for developing and implementing adaptation strategies is that sufficient human and financial resources will be made available. Relevant stakeholders should allocate adequate staff to

the development of the plans, in this preparatory phase, so the leader knows the available resources upon which he or she can draw during Step 1.

3. Gather all relevant information, research and related regional strategies

It is worth investing time in gathering relevant information early in the process. This speeds up the launch of the RAS project and helps to inform the initial stages of decision-making. Regional research into previous weather events and future climate change, existing strategies that may overlap, complement or conflict with the RAS and other information relating to regional strategic objectives and vulnerability should be collected. Relevant information may be gathered through consultation with universities, research centres and hydro-meteorological institutes. Peer-to-peer information dissemination can also be a useful source of information. Table 3 provides an indication of the types of information needed to take decisions on adaptation at the local level.

Table 3: Local information for climate change adaptation

	Information source
Weather forecasts Observed trends Climate projections	Daily and seasonal weather forecasts Extreme events monitoring (heat waves, cyclones, storms, floods) Global circulation models Regional climate models Regional/ local impacts models Local and indigenous knowledge
Environmental assessment and natural hazards	Environment agencies Water management authorities
Vulnerability and adaptive capacity assessment	Vulnerability databases/ Poverty Indices Health records Census information Employment data
Socio-economic analysis	Population projections Regional economic forecasts Scenarios of political organisation, consumption patterns, infrastructure development and market transformation (among others).
Other relevant strategies, policies and plans	Existing flood, storm, heat wave or drought plans. Regional strategies for: • Economic development • Spatial Planning • Water Management (e.g. RBMP[6]) • Disaster Management • Environmental protection

It is recommended to establish a network that ensures that data updates and new scientific knowledge is reported regularly throughout the development and implementation phase and for several cycles.

4. Identify potential funding options

An initial assessment of the likely resources required to deliver the RAS should be made at this early stage. This assessment should be regularly reviewed in order to accommodate changes and unknown costs as more information becomes available. Examples of costs include:

[6] River Basin Management Plans under the EC Water Framework Directive 2000/60/EC.

- Staff costs
- Costs for studies/ research
- Costs for public participation and stakeholder involvement
- Implementation and Operation costs

Based on this initial estimation of costs, appropriate funding sources should be identified and turned into practical use. In this context, regions may qualify for financial assistance in the development of their RAS, in particular linked to EU funding mechanisms. Regions may also look towards their national governments for funding support. The earlier such applications are made, the more likely they are to positively impact the RAS project. Each Step in the process may be eligible for funding from different sources, so multiple applications may be required.

5. Identify Stakeholders and decide approach to engagement

Early stakeholder engagement is an essential component of sound adaptation. It is important to carry out a 'Stakeholder Mapping' exercise before seeking to engage stakeholders in the RAS project in order to identify the full range of relevant groups and individuals. Involving climate change partnerships can be useful in this step of the process. This includes partners from within government (i.e. internal stakeholders) and those drawn from the wider community of organisations in the region (i.e. external stakeholders). It may also be advisable to distinguish between *strategic stakeholders*, who will help to set the direction and oversee the implementation of the RAS (e.g. national Ministry with responsibility for climate change) and *technical stakeholders*, who will help to advise and deliver specific aspects of the strategy (e.g. water companies). Based on the list of identified stakeholders, the availability of resources and preferences or experiences within the RAS core team, an approach to stakeholder engagement should be decided. This would result in the production of an Engagement Strategy, setting out the objectives for and means of stakeholder engagement to support the RAS project. Stakeholder Engagement can be achieved using a number of routes, including:

- One-way engagement via web-consultations, communications and other media
- Two-way engagement via stakeholder dialogue workshops and facilitated fora

Meaningful stakeholder engagement can improve acceptance of decisions and measures under the RAS and thereby increase the feasibility of the Strategy. Evidence and analysis is often more accurate when carried out in conjunction with stakeholders. RAS is likely to be more democratic and representative of local needs and objectives if stakeholder engagement plays a central role. It is therefore best to aim for regular, two-way engagement, where regional resources allow.

3.3.3 How can barriers be overcome?

Insufficient budget to develop the strategy and/or engage stakeholders may require direct financing from national and EU support for the most vulnerable regions.

Conflicts of objective between long-term thinking investments in climate adaptation and short-term economic needs may present a barrier to engagement from public services, regional businesses and residents and communities. Clear and effective communications and stakeholder engagement strategies are the best means for overcoming these barriers.

3.3.4 Who should be involved?

Primarily strategic decision makers, service delivery agents and industry and society representatives. The first step in stakeholder engagement could be to make a public commitment to developing a regional adaptation strategy. The governance framework for the RAS will be decided during this preparatory step. Specific systems of governance will need to be decided at the regional level in order to complement existing structures. However, most RAS will benefit from the existence of a Steering Group.

However the role of regional and local NGOs and other stakeholder groups should be investigated. They might bring detailed knowledge on specific issues as well as human resources. In particular awareness raising is an issue that should be carried out in strong cooperation with NGOs and other stakeholders using their particular communication skills.

3.3.5 What are the Governance and Stakeholder Engagement issues?

The Steering group should explicitly state the roles and responsibilities for periodic Evaluation and Review of the RAS. Evaluation should take place at least every of 12-18 months after the launch of the strategy and involve a wide range of stakeholders in some form, in order to encourage social and institutional learning on adaptation. The review should also be a forward-looking exercise that seeks to apply the findings of monitoring and evaluation for the future iterations of the RAS. Transboundary Adaptation Strategies require a specific mix of stakeholders involved and may require steerage from an international body, such as the EU.

3.3.6 Where can examples, tools and sources of relevant information be found?

For more information on examples and tools please consult Annex VI – Step 1.

3.4 Step 2: How can to assess vulnerability within the region?

Generally, vulnerability assessment is the analysis of expected impacts, risks and the adaptive capacity of a region in the context of climate change.

3.4.1 What are the key objectives and principles?

The objective of Step 2 is to gain a better understanding of how and in what way climate change will affect the services, social groups, economic sectors and assets in the region and to identify the priority areas for action. Vulnerability assessment is a useful way of measuring potential harm using more than just climate impacts information; it includes an assessment of the regional ability to adapt.

Look out 	**DO** • Use the best available information on climate change impacts and vulnerability • Engage with stakeholders: make use of their local knowledge and expert judgement • Base the assessment on current vulnerabilities and current objectives **DON'T** • Ignore uncertainty: pay attention to the quality of information being used and think in terms of risk • Fail to take action because uncertainty remains

3.4.2 Which approach should be taken?

1 Identify 'Key Systems'

There is no single best approach to deciding the key systems that may be vulnerable to climate change in the region. Which systems are key to the RAS will depend on the climatic and socio-economic context of the region, as well as the reasons for undertaking a RAS. If the Strategy is being developed explicitly to implement adaptation in a given sector (e.g. water management), or to a given hazard (e.g. flooding), then the Key Systems may already be defined. If the RAS is being designed to implement adaptation across a region, it will be necessary to explicitly identify the Key Systems whose vulnerability you want to assess. The reviewed guidance documents present various specific contexts: *Key systems* vulnerable to climate change are likely to include:

- **Spatial areas** within the region (e.g. ecosystems, administrative areas)
- **Economic sectors** (e.g. agriculture, industry, waste, services, water, health)
- Different **socio-economic groups** (e.g. age groups, ethnic groups, low income groups)
- **Critical assets and infrastructure** in the region (e.g. power-plants, hospitals, roads)

It may be necessary to produce a long-list of key Systems for the first iteration of Step 2. It will then be necessary to consider whether or not any systems should be added or deleted from this list, based on the initial results of the first assessment.

A complementary approach is to assess the dependence of key systems on ecosystem services and to therefore take an ecosystem-base approach to the vulnerability assessment. Ecosystem based approaches are underpinned by the integrated management of land, marine, fresh water and living resources, promoting sustainable use and conservation of natural resources. Examples include maintaining and restoring natural infrastructure such as wetlands and watershed vegetation in order to reduce vulnerability to storm surge, rising sea levels and changing precipitation and river discharge patterns. This approach would also reduce biodiversity loss, and maintain or enhance ecosystem services.

2 Analyse the impacts of past weather events and recent climate trends

One helpful way of gaining a better understanding of how the region might be affected by climate change impacts in the longer term is to consider how the region is currently affected by weather events, for example heavy rain or hot temperatures. This is a useful starting point for thinking about the exposure and sensitivity of key systems and helps to provide a link between current and projected future climate change. Carrying out a Local Climate Impacts Profile (LCIP) is one recommended way of achieving this. The LCLIP will help to draw attention to the potential impacts of future climate change. As part of an LCLIP, it may be helpful to assess how the region has responded to non-climate events in the past, for example earthquakes or terrorist attacks; this could help to uncover successful or ineffective disaster management responses, with implications for climate change adaptation.

3 Assess possible future Climate and Socio-Economic Scenarios

The extent to which climate change poses threats or opportunities to the region will depend on how the climate, society and economy of the region changes in coming years. The most sophisticated tools for understanding these changes are climate and socio-economic scenarios, which describe different possible future states of the world. Climate scenarios for all European regions are provided by the PRUDENCE project. Higher resolution climate scenarios may have been produced for the region by national programmes or academic studies. Climate scenarios themselves are based on assumptions of how socio-economic conditions will change because these drive changes in greenhouse gas emissions.

Socio-economic scenarios provide plausible descriptions of what society might be like in the future based on the development choices society makes. Socio-economic scenarios can help to show whether society will become more or less capable of adapting to climate change, for example through changes in inequality, population and economic growth. It is potentially inaccurate to base assessments of future vulnerability on climate scenarios alone; changes in socio-economic conditions can have a dominant effect on how vulnerability changes. However, socio-economic scenarios are rarely available at the regional level, in which case, a reasonable prediction of the direction and extent of future change could be made in consultation with the relevant experts and planners at the regional level.

4 Identify the Impacts of climate change

Based on an assessment of changes in climate and the underlying social and economic structure of society, an assessment of likely impacts can be made. This could be underpinned by technical impacts modelling, which will give a more accurate account of potential changes in, for example, flooding, drought, sea level rise or urban heat islands. However, RAS project budgets may not allow impacts

modelling and so a more informal assessment of climate impacts could be made, using expert judgement to identify likely and serious threats.

It is important to clearly acknowledge the uncertainties inherent in modelling future climate scenarios during this stage in the assessment. Whilst models are able to accurately predict most changes in climate systems over long periods, short-term phenomena, tipping points, feedbacks and local climate are poorly represented. It is therefore important to remain open and realistic when using uncertain information as part of the assessment.

Impacts should be identified per Key System. Impacts may be categorised along the following lines:

Table 4: Potential impacts

Category	Description
People	Impacts on the workforce, communities and lifestyles
Service Delivery	Changing demand for or disruption to services delivered by the regional authority
Infrastructure & Premises	Impacts on buildings, roads, transport infrastructure, parks, housing maintenance and facilities management
Procurement & Suppliers	Impacts on key sub-contractors, suppliers and implications for how procurement is managed under future climate
Finance	Implications for investment and insurance

5 Assess the vulnerability of the Key Systems

Vulnerability is a measure of potential future harm. It is important to consider that we are interested in the vulnerability *of* something (i.e. a Key System) *to* something, namely a potential climatic event or related harm (e.g. flood damage or drought). Assessments of vulnerability should capture current vulnerability as well as vulnerability to potential future harm. In this way vulnerability assessment shares many similarities with traditional risk assessment; it is important to understand the process by which risks are created. The EC is currently investigating the feasibility of developing Vulnerability Indicators, which in future may be used to map vulnerability to climate hazards. Vulnerability indicators can be used to monitor, communicate and compare vulnerabilities of areas and sectors expected to be hit the hardest by climate change and have limited ability to respond. Vulnerabilities indicators are thus useful tools that may help understand where planned adaptation policy might be needed. A methodology for the development of vulnerability indicators can be found in final report of the Vulnerability Indicators project[7].

It is not only the level of climate change (i.e. exposure) that makes systems vulnerable, but also their sensitivity to those changes and their capacity to adapt to avoid negative consequences. The European Union uses the IPCC (2007) definition of vulnerability, which states that:

Vulnerability = function [exposure (+); sensitivity (+); adaptive capacity (-)]

Various factors influence exposure, including:

[7] Preliminary Assessment and Roadmap for the Elaboration of Climate Change Vulnerability Indications at Regional Level. Reference ENV.G.1/ETU/2008/0092r

- Location in risk-prone areas (e.g. flood zones, urban heat islands, drought-prone areas, mountain areas, coasts and estuaries)
- For households – quality of housing (e.g. high degree of thermal isolation of houses reduce the rate of heat transfer)
- For biodiversity – geographic mobility (e.g. species that are unable to avoid climate hazards such as flood water or soil-drying are more exposed to the impact)

Various factors influence sensitivity, including:

- For socio-economic groups: physical and mental health, age
- For sectors: extent to which products and services are affected by climate stimuli
- For assets and infrastructure: extent to which physical structure and services derived from those structures are affected by climate stimuli
- For ecosystems: the health, connectivity and robustness of the ecosystem will determine its sensitivity to climate impacts

Various factors influence adaptive capacity, including:

- Access and ability to process information on climate change
- Ability to spread risk (e.g. through insurance)
- Resources to invest in adaptation
- Flexibility of system to change in response to climate stimuli
- Willingness to change and adapt within the region but also on the supra-regional and national level
- Ability for species to migrate or for ecosystems to expand/ shift gradually into new zones

As a result, groups and systems that tend to have **low adaptive capacity** include:

- Older people, low income households and ethnic or linguistic minorities
- Enterprises running on a modest working capital and dependent of weather conditions such as small farming and fishing businesses/ families and self-employed professionals
- Fragile and highly specialized ecosystems

Adaptive capacity is generally high in Europe for human systems; however it will vary for different hazards, meaning that some groups or systems will be more vulnerable to some hazards than others. For example Southern Europe and the European Arctic are more vulnerable than other parts of Europe[8]. Knowing the adaptive capacity of key systems in the region will also help to devise adaptation measures; if low income groups are less likely to respond to market incentives to adapt their homes, for example, a narrower range of adaptation options can be considered to improve resilience among these communities.

[8] EEA. (2008) Impacts of Europe's changing climate - 2008 indicator-based assessment. Report No 4/2008. Belgium. European Environmental Agency.

Vulnerability is above all a local concept. It is important to collect regional information, but local knowledge held by local stakeholders should form the foundations for vulnerability assessment, using the information gathered during Step 2 to indicate how conditions will change in future. These key stakeholders will learn from the *process* of assessing vulnerability to climate change, which can be as important as gathering the available data in one place to assist decision-making. It may be helpful to categorise the results of the vulnerability assessment according to themes. The appropriate categorisation will depend on the regional context. For example:

- Water Safety and Supply (including flooding, drainage and sewerage, sea level rise, drought, water quality impacts)
- Health (including heat stress, disease migration, cross-sectoral and secondary impacts on health)
- Landscape Management (spatial planning, building design, biodiversity)

6 Assess and prioritise risks and opportunities associated with climate change

The assessment of the risks and opportunities that the impacts of climate change pose to Systems within the region can be done by following a simple climate risk assessment methodology (e.g. Australian Guidance). However, there may be existing risk assessment methodologies in use at the regional level that are more suitable, or that are more familiar to stakeholders.

The resulting risks and opportunities can also be prioritised using a simple prioritisation matrix. This enables the results of Step 2 to be presented in a meaningful and clear semi-quantitative format that clearly sets out the highest priorities for adaptation.

Given the broad nature of climate change risks and opportunities, it is advisable to carry out assessment and prioritisation with the help of stakeholders, for example by using workshops to discuss and prioritise risks. Climate risks and opportunities should be compared with non-climate risks (which may be recorded in a regional risk register). The focus for adaptation effort should be proportional to the severity of the risk; there are important non-climatic risks that also require attention and investment. Supporting this prioritisation is an economic assessment of the costs and benefits of adaptation, in fact some studies have analysed this costs of climate impacts.

3.4.3 How can barriers be overcome?

Information is complex and highly uncertain. If there is a large and fragmented evidence base on climate change impacts, vulnerability and risks it is often difficult for regional decision-makers to find all the relevant information that may be of use to them. There are several websites that compile information such as ADAM digital compendium and wikiADAPT. Scientific literature can be difficult to digest for the purposes of developing RAS. Working in partnership with local stakeholders in particular research institutions and, where they exist, climate change partnerships may be a very effective way of improving awareness of existing sources of information.

Stakeholder consultation can be difficult because of insufficient budget availability, problems reaching the target audience, the challenges of maintain stakeholders' attention on key issues (willingness to participate) and competing interests among different stakeholders. Stakeholder engagement is also time-intensive, adding to the length of time required to design the RAS. Stakeholder engagement should be designed with a realistic idea of vulnerable stakeholders in mind.

Level of prioritization and awareness of climate change impacts by stakeholders. Stakeholders may disagree on the prioritisation of risks. However, it is more important to consult and involve stakeholders in these processes than to reach overall agreement. Final decisions on prioritisation will be taken by the regional authority and may be influenced by regional political factors. Low awareness of climate change can prevent rapid action in developing RAS. It is advisable to engage with climate change stakeholders early and to rely on regional partnerships and networks (as well as national and European institutions) to raise awareness among stakeholders at an early stage.

3.4.4 Who should be involved?

Primarily technical stakeholders, for example water managers and water companies, coastal engineers, land managers, farmers, forestry authorities, fishing industry, energy companies, spatial planners, transport authorities, emergency services (including the police and fire and rescue service), health services, schools, businesses as appropriate, universities and research centres. NGOs and other social stakeholder groups might also provide data that could be used to assess vulnerability.

3.4.5 What are the Governance and Stakeholder Engagement issues?

In order to achieve buy-in from stakeholders to the results and measures in the RAS, it is critical that they are involved during the stage of assessing vulnerabilities and risks. Early involvement will also serve to raise awareness of climate risks and opportunities among stakeholders, thereby increasing the chances of successfully engaging them in the adaptation response (i.e. capacity building). Given that stakeholders are also delivery partners in adaptation, there are benefits for implementation to early engagement.

- Stakeholders may be able to identify other actors that the RAS Core Team would otherwise miss (e.g. individuals or groups with responsibilities for land management or communities)
- Many stakeholders have expert knowledge of the risks in question (e.g. risks driven by complex series of changes)
- Experts should be involved in assessing the magnitude of risk, based on the Core Team's presentation of climate (and socio-economic) change (e.g. where projected change is likely to exceed certain thresholds)

Stakeholder consultation may take the form of workshops, web-based surveying, public expert discussions or written comments.

As the process of assessing risk can be complex and based on two-way exchanges of information, methods of engagement that maximise dialogue may prove to be most effective (i.e. workshops and face-to-face deliberation).

3.4.1 Where can examples, tools and sources of relevant information be found?

For more information on examples, tools and interesting sources of information please consult Annex VI – Step 2.

3.5 Step 3: How should the strategic direction of the RAS be set?

A common set of planning principles is the need to set a clear strategic direction for the Strategy.

3.5.1 What are the key Objectives and Principles?

The objective of Step 3 is to agree a set of principles for the adaptation strategy that directly address the region's vulnerabilities.

Look out 	**DO** • Use the evidence base produced in Step 2 • Agree the approach and the objectives with stakeholders • Integrate the RAS with existing strategies, policies and plans **DON'T** • Overstretch and attempt to solve all of the region's problems in the first RAS cycle

3.5.2 Which approach should be taken?

1. Agree the scope of the RAS

Based on the evidence collected and analysed in Step 2, the scope of the RAS must be clearly defined. This includes:

- Geographical scope:
  i. If addresses a trans-boundary region
  ii. If crosses important administrative boundaries
- Sectoral scope, for example:
  i. Energy
  ii. Spatial Planning
  iii. Agriculture
- Issue/ Hazard scope
  i. Drought and Water Supply
  ii. Heat and Health
  iii. Flooding and Disaster Management
- Time
  i. Timeframe for implementation of RAS (influenced by existing sector policies)

The scope of the RAS has important implications for how the RAS is designed and managed, and who is involved in the development process. Not all RAS will be able to address the full range of impacts, risks and opportunities posed to a region by climate change. The evidence presented in Step 2 and dialogue with stakeholders should be used to inform the decision and set priorities.

2. Review existing strategies & objectives and integrate the RAS

Consideration of climate risk should ideally be part of all policies. The EU's White Paper mirrors national statements across the EU that adaptation should be 'mainstreamed' into existing plans and

programmes. It is therefore essential that the RAS is integrated within existing strategies. There are some tools to support the integration of RAS into current political strategies. Specifically, it is important to include adaptation to climate change within sustainable development objectives – appreciating that plans will not be sustainable unless they are resilient to future climate change.

European Policies

The European Union has enacted a number of Directives that will help to deliver adaptation, covering sectors such as agriculture, fisheries, water management, flooding, energy systems and biodiversity (see the Adaptation White Paper and its accompanying Impact Assessment for more details). Implementing EU legislation and following EU guidelines is a necessary first step in developing a RAS. Any conflicts between achieving adaptation and implementing EU legislation should be clearly highlighted and communicated directly with EU institutions in order to help mainstream adaptation throughout the suite of EU Directives and guidance.

National Adaptation Strategies

Where a National Adaptation Strategy (NAS) is in place, regions should make sure that the objectives and strategic direction of their RAS complements the national strategy. This does not mean that the priorities at regional level will be the same as at the national level, but information sources, stakeholder engagement and successes and failures should be shared between administrative levels. The objectives of the RAS should not run against the overall objectives of the NAS.

In Spain, for example, there is a group working at national level coordinating and integrating the creation and execution of regional climate change adaptation strategies and action plans. The Environment Ministry is supporting the creation of a network of cities for climate "Red de Ciudades por el Clima". This network ensures that RAS do not run against the overall objectives of the NAS and promotes the execution of a set of adaptation actions across all Spanish municipalities.

Germany adopted its NAS in 2008. It provides a conceptual framework and a first *status quo* analysis of adaptation activities. It will be complimented by an Adaptation Action Plan in 2011. The NAS aims to support the development of regional and sectoral adaptation strategies by providing information and additional sources of financing. It also intends to ensure a common framework for adaptation activities especially regarding climate modelling and by developing a common set of adaptation indicators. However, due to its federal structure, the federal states are responsible for identifying and implementing detailed adaptation activities.

Ecosystem-Based & transnational strategies

Some ecosystems are highly sensitive to climate conditions (e.g. costal zones, alps, Nordic circle). In order to address these ecosystems some regions have combined their efforts and developed an ecosystem-based strategy. An example, for:

- **Mountain areas**, is the INTERREG III B Project CLIMCHALP (Climate Change, Impacts and Adaptation Strategies in the Alpine Space) to research ways to support Alpine communities to cope successfully with the impacts of climate change.
- **Costal areas** (Economics of adaptation to climate change in EU costal areas)[9] or
- **River basins** (River Basin Management Plans)

[9] See EU study about the Economics of adaptation to climate change in EU costal areas, http://ec.europa.eu/maritimeaffairs/climate_change/executive_summary_en.pdf

These provide a context for transnational adaptation approaches which should be reflected the strategic direction for the regions involved. The measures taken should therefore seen in the context of this overlaying transnational adaptation approach.

Disaster management plans

Hydrometeorological hazards such as floods, droughts and heat waves already afflict many regions of Europe. Climate change threatens to heighten these impacts in many areas, both by changing the frequency and/or intensity of extreme events and by bringing changes in mean conditions that may alter the underlying vulnerability of populations to hazards. In order to address the current situation several regions have already taken action and developed disaster management plans or risk maps. For example under Directive 2007/60/EC the assessment and management of flood risks requires Member States to assess the risk of flood, to map risk areas and resources. Artemis is a EU financed fire risk management project is calculates risks of fires in different regions in the EU. These plans can be easily adjusted to deal with future climate change and should be consulted when developing a strategy.

Another useful tool in disaster management plans is the creation of risk transfer tools such as insurance schemes. However Werner et al. (2009) claim that insurance on its own is not the solution. Insurance could fail to reduce risk and to advance adaptation unless it is implemented along with disaster risk reduction measures. Werner et al. (2009) identify some considerations for designing insurance programmes that promote risk reduction. These include careful planning and close coordination in the implementation of insurance with disaster risk reduction measures; raising community risk awareness; investing in the gathering and dissemination of risk information; government regulation to ensure a longer term focus on risk reduction from insurers; and government regulation to ensure insurer solvency, licensing and insurance distribution.

Non-climate Regional Strategies

At the regional/local level several policy initiatives help to reduce vulnerability to climate change without necessarily being classified or identified as ‘adaptation’. It is therefore essential to communicate with other policy departments in order to fully understand current initiatives that may help (or hinder) the reduction of vulnerability and management of climate risk. Relevant cross-sectoral regional strategies may include:

- Water (e.g. River Basin Management plans)
- Housing (e.g. refurbishment of social housing programmes)
- Planning (e.g. spatial development plans, urban regeneration strategies)
- Health (e.g. heat-wave plans, disease outbreak response plans)
- Emergency services (e.g. flood response plans)
- Social services (e.g. identification of vulnerable groups)
- Nature and Biodiversity (e.g. strategies to increase green spaces or manage Natura2000 sites)
- Transport (e.g. new infrastructure projects such as new train lines or urban rail/ tram projects)
- Energy (e.g. renewable energy investments dependent on wind, solar, bio-energy or hydro power)

- Tourism (e.g. strategies to boost regional economies through the development and support of tourism ventures and SMEs)

- Regional economic strategies (e.g. plans to boost investment in regional economies and stimulate economic growth through incentives and infrastructure development)

Cross-sector strategies such as river basin management plans should be considered. A number of European regulations and funds are designed to stimulate adaptation planning across sectors, see for example the ESPACE guidance on water management. An assessment of these cross-sector regional strategies will help to inform and focus the strategic direction of the RAS within the regional context.

Climate Change Mitigation Strategies

Many sectors and regions have developed strategies for reducing greenhouse gas emissions (mitigation), which should also be considered when developing the RAS. Whilst there is a close conceptual relationship between mitigation and adaptation, actual actions and strategies often vary between the two agendas and are sometimes managed by different groups of decision-makers. There are potential synergies between adaptation and mitigation that should be exploited in RAS. Likewise, adaptation measures that increase GHG emissions must be avoided, as must mitigation measures that increase vulnerability to climate change (see mal-adaptation).

The most important issue in this context is that any response to climate change, whether mitigation or adaptation, is embedded within the wider context of sustainable development, contributing to a combination of economic, environmental and social well-being both now and in the future. Following the Impact Assessment guidelines will help to ensure that this goal is achieved. The AMICA guidance provides a matrix for exploring how to integrate climate change mitigation and adaptation to climate variability at the local to regional level. Integration measures focus on the energy, construction and spatial planning sectors. There are over 40 integration measures, which are assigned according to mitigation and adaptation benefits. For example in the energy sector, district heating systems are recommended as a measure to provide mitigation benefits such as energy efficiency and adaptation benefits such as thermal comfort. Clicking on a single measure provides a detailed description of the measure, images, further references and downloads.

Bringing all this information together is a difficult and time consuming task. However this information is highly valuable when developing a consistent adaptation strategy and allows in combination with geographical information to identify potential land use conflicts.

3. Set objectives and undertake a Strategic Environmental Assessment of the adaptation strategy

1. State the problem that RAS is designed to solve

The outcomes of Step 1 and Step 2 will be used to state the problem, i.e. the hazards and risks posed by climate change to the regional economy, society and environment.

2. State the objectives of the RAS

Objectives will relate to the problem e.g. to reduce vulnerability to identified hazards, to seize opportunities and to create a resilient regional economy, society and environment. In this way, the objective may be elaborated to include more fundamental notions of sustainability.

RAS Objectives may elaborate on general adaptation goals, such as:

- Increase adaptive capacity
- Minimise losses
- Reduce risks
- Increase coping capacity in relation to extreme events
- Seize opportunities

RAS Objectives should reflect existing regional objectives (e.g. reducing inequality or stimulating sustainable economic development) and support current political strategies, but also locally specific objectives such as to increase investment in an ex-industrial zone, where the RAS objective would be to ensure that this investment was resilient and appropriate in the face of climate change. RAS are more likely to succeed if the objectives of RAS are aligned with the objectives of existing national, sectoral and regional strategies (see Review existing strategies, objectives & integrate the RAS).

3. Consider alternative options

How else might this objective be achieved? Systematic consideration should be given as to whether there are alternative mechanisms within the regional apparatus to achieve the objectives of the RAS. This may include mainstreaming adaptation into existing strategies directly or undertaking isolated measures to reduce specific vulnerabilities. However, the social learning, multi-sectoral and multi-stakeholder aspects of adaptation are likely to warrant some sort of integrated adaptation strategy. The process of considering alternative policy interventions may be useful in making clear exactly why RAS is such an important undertaking at the regional level.

4. Carry out a Strategic Environmental Assessment

The use of Strategic Environmental Assessment (SEA) is strongly recommended during the process of developing a RAS (see SEA Directive 2001/42/EC). A SEA is a process to prepare evidence for political decision-makers on the advantages and disadvantages of possible plans and programmes by assessing their potential impacts on the environment. SEA is also a useful tool for assessing the interaction between the proposed plan or programme and the environment, including environmental change such as climate change. A SEA will also be useful to highlight possible conflicts with other existing regional/national plans/programs, which then need to be addressed by setting clear priorities and accepting trade-offs[10]..

SEA is usually conducted before a corresponding Environmental Impact Assessment (EIA) is undertaken. Once specific adaptation options have been identified (Step 4) it will be necessary to assess in more detail the economic, social and environmental impacts of each option, in order to ensure that the RAS helps to achieve sustainable development within the region (see Impact and feasibility assessment).

4. Define Success and Set targets for the RAS

[10] Study concerning the report on the application and effectiveness of the SEA Directive (2001/42/EC) Final report January 2009, http://ec.europa.eu/environment/eia/pdf/study0309.pdf

When deciding the strategic direction for the RAS, it is essential to define what 'success' means. Success is likely to reflect the objectives, but may incorporate wider concepts such as equality, efficiency and effectiveness. Some examples of tools for defining success and set targets. Defining success and set targets may reduce the chances of Mal adaptation. Defining success will be helpful for designing the framework for delivering the RAS and will be key to monitoring and evaluation.

Targets should be linked to specific objectives. Monitoring and Evaluation are tied directly to the targets, which should therefore be measurable and precise. Targets may range from numerical (e.g. % households covered by insurance, land area of new green spaces in cities or EUR invested in certain defence) or process based (e.g. to roll out a heat risk awareness programme or to have assessed risks to a certain group of vulnerable people).

5. Design a monitoring and evaluation framework & assign responsibilities

Objectives and Targets should be used to monitor progress towards implementation of the RAS. **Adaptation Indicators** can be used to assess progress with implementing adaptation strategies and measures. Two categories of indicators have been defined[11]:

- **Process based indicators** are designed to assess progress in building adaptive capacity. 'National Indicator 188' in the UK is an example of a process-based indicator, used to assess preparedness for managing climate change by identifying risks and proposing adaptation measures at the local level[12].

- **Outcome based indicators** are designed to measure the effectiveness of adaptation policies and measures the attainment of desired outcomes, which is mainly expressed in terms of reduction of vulnerability.

A periodical evaluation of the RAS is also essential in order to incorporate new climate (and other) information and to re-assess priorities, objectives and delivery mechanisms –in this way adaptation is an iterative process.

Clear responsibilities for monitoring should be agreed and assigned. It is likely that the Steering Group will take the lead in this task, but other agencies and stakeholders could be involved. Monitoring and evaluation are most likely to be successful where they are designed to coincide with other routine policy monitoring and evaluation exercises.

6. Explore and secure financial resources

The task of ensuring sufficient financial resources is first addressed in Step 1, however it is in this step that the objectives, targets and responsibilities of the strategy are assigned and financial resources are first required to cover the administrative and organizational demands of the project.

3.5.3 How can barriers be overcome?

If key stakeholders are not able to be involved in the initial objective setting, their buy-in and commitment to the RAS may be negatively affected. Check step 1 how to address this barrier.

[11] See http://air-climate.eionet.europa.eu/reports/ETCACC_TP_2008_9_CCvuln_adapt_indicators

[12] More information and guidance on NI188 is available at: http://www.defra.gov.uk/environment/localgovindicators/ni188.htm

Climate change scepticism may prevent or stall implementation. It is important to present climate science in an intelligent, partisan way, being open about uncertainty and to cite the concerted efforts of EU and national governments in addressing climate change. Emphasising the potential opportunities that can be achieved via adaptation is also a technique for overcoming scepticism.

Departments of central and regional government often work in thematic 'silos' and can find it difficult to integrate and work together, or in wider partnerships. Early, well-facilitated engagement and dialogue is essential to achieve the level of stakeholder participation and partnership working that adaptation requires.

3.5.4 Who should be involved?

Steering Group/ strategic partners, business, NGOs, social stakeholder groups.

3.5.5 What are the Governance and Stakeholder Engagement issues?

The purposes of engagement during Step 3 are to:

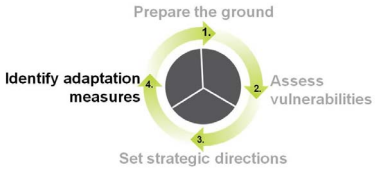
- Agree the scope of the RAS and achieve buy-in from all key delivery agents
- Assess the strategic and environmental implications of the RAS
- Discuss delivery issues when setting the monitoring and evaluation framework

If stakeholders do not agree with the scope or monitoring framework they are likely to object, and possibly de-rail the RAS, at later stages. It is therefore essential to achieve buy-in and to explain the reasoning behind any contentious decisions at this stage.

Businesses may be key delivery agents of the RAS. At the same time, businesses will adapt independently, in response to market signals (e.g. from insurers or commodity prices) and their own strategic objectives. This means that 'autonomous adaptation' from the private sector may differ and potentially conflict with the objectives of regional adaptation under the RAS. For example, companies may seize the opportunity to expand production of energy intensive air conditioning, which may conflict with the region's objective of stimulating 'sustainable (i.e. low-carbon) adaptation'. It may therefore be necessary to deliberately engage and monitor adaptation activity in the private sector, in order to realise the stated objectives of the RAS.

3.5.1 Where can examples, tools and sources of relevant information be found?

For more information on examples and tools please consult Annex VI – Step 3.



3.6 Step 4: How do we plan concrete adaptation measures?

Devising a detailed plan of action setting out how, when and by whom specific adaptation measures should be implemented is crucial to achieve action on the ground.

3.6.1 What are the key objectives and key principles?

The objective for Step 4 is to devise a detailed plan of action, setting out how, when and by whom specific adaptation measures should be implemented. These measures will be thoroughly appraised and endorsed by key actors in order to ensure that they play to the strengths of regional partners and that they will help to achieve a sustainable future for the region.

Look out 	**DO** • Consider a wide range of options • Assess options thoroughly, giving consideration to potential social, economic and environmental impacts • Select measures that suit the regional context **DON'T** • Pursue options without consulting the partners who will be affected or involved in delivery

3.6.2 Which approach should be taken?

1. Develop a catalogue of adaptation options

A catalogue of previous adaptation measures could be created based on previous RAS in similar regions or in response to climate hazards and vulnerabilities identified in Step 2. Adaptation options may include the option to accept losses (i.e. do nothing). Multiple options for achieving the same result should be considered at this stage.

There are various typologies of adaptation options, for example, grey and green infrastructure construction measures or non-structural soft adaptation options. They are:

- **Grey infrastructure** is physical interventions or construction measures that use engineering services to make buildings and infrastructure resilient to extreme weather
- **Green infrastructure** is using the functions and services provided by ecosystems to achieve more cost-effective and sometimes more feasible adaptation solutions. The Green infrastructure approaches contribute, for example, to wider sustainability objectives, such as halting biodiversity loss and the degradation of ecosystem or restoring water cycles
- **"Soft" non-structural approaches** relate to policy incentives such as land-use controls, information dissemination, and economic incentives to reduce or prevent disaster vulnerability

It is important to consider all of these options, in particular as they represent different solutions to a problem. Direct and indirect benefits and costs might vary widely and some of these measures also

require a change of behaviour of people concerned by the measures. This should be considered, assessed and discussed with stakeholders before taking a decision. Thereby it is crucial to agree on a common understanding about costs and benefits and how they are assessed.

2. Assess the Impact and Feasibility of the adaptation options

This is the key stage in Step 4; suggested options must be assessed to determine their suitability to the regional context, their effectiveness in reducing vulnerability or enhancing resilience and their wider impact on sustainability. The objective is to avoid decisions that lead to mal-adaptation.

The following criteria should be considered as part of an Impact and Feasibility Assessment (i.e. the process of selection, assessment and prioritization of the measures collected in the catalogue):

- The **impact that the option would have if implemented** (see Annex V - Criteria for assessing the impacts of adaptation actions). Decision makers should aim for 'win-win', or at least 'no-regret' options. The impact assessment should focus on the following forces:

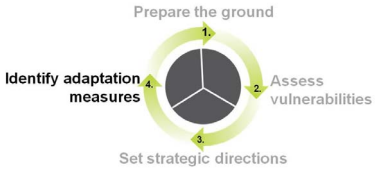
    - *Social*
      Influence of the option on equality, social inclusion and cohesion. Options that have wider ancillary benefits should be appraised favourably.

    - *Economic*
      Ideally a full cost-benefit analysis should be carried out. Given the uncertainty and long time scales of adaptation, traditionally CBA is not always possible or appropriate. UKCIP Guidance exists to help decision-makers appraise the economic impacts of options. Explicit consideration should be given to the distribution of costs and benefits across social groups and regions.

    - *Environmental*
      Options should be appraised for their impact on the environment, including their contribution to improving or worsening GHG emissions, water quality, soil quality and biodiversity. The Environmental Impact Assessment (EIA) Directive (85/337/EEC as amended by 97/11/EC and 2003/35/EC) provides a framework for undertaking an assessment of a concrete adaptation project's environmental impact.

        - Screening: for the purposes of assessing adaptation options in the RAS process, it should be assumed that environmental assessment is worthwhile
        - Scoping: defining the barriers of the assessment
        - Consideration of alternatives
        - Impact Analysis: assessing the 'significant' impacts of the proposal on the local and global environment
        - Options for mitigating the negative impacts of the proposal
        - Non-technical summary of the proposal, its negative environmental impacts and any actions suggested for mitigating these impacts

      According to the EU guidelines, public participation should play a key role during the EIA process. In the RAS design process, stakeholder engagement should be a core element of the selection and assessment of adaptation options.



As such, it is important to assess the measure's complimentarily with sustainable development goals, for example synergies with climate change mitigation measures, social equality or sustainable water management.

- The **urgency of the potential climate hazard or risk** that measure aims to mitigate. Some adaptation measures will be suited to implementation in the short term to address urgent risks or opportunities; others will require significant preparation and planning. The RAS is likely to be most successful if it contains a mix of short-term, high-impact measures and preparatory steps towards implementing longer-term options. Systematic consideration of the timescales for implementation of various options will help decision-makers to decide.

- **Deliverability and feasibility** options that score highly in the impact assessment, but which are hard to deliver, will not always be preferred. Particular consideration should be given to the strengths of delivery partners within the region so that preferred options can be easily and quickly implemented.

- The **governance implications of the measure**. For example the requirement or interaction with existing governance structures. Several policy initiatives help to reduce vulnerability to climate change without necessarily being classified or identified as 'adaptation'. It is therefore important to communicate with other policy departments and stakeholders in order to fully understand current initiatives that may help (or hinder) the reduction of vulnerability and management of risk and identify synergies with regional, national and European policies.

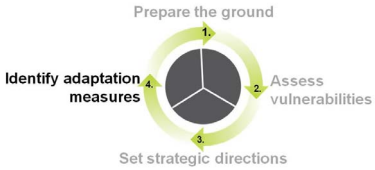
- **Trans-boundary issues**. Decision-makers should revisit the transboundary impact of adaptation measures, especially where there are significant potential impacts on natural resources or economies that are closely tied to neighbouring regions and countries.

- **Financing**. How easy is it to finance the option? Stakeholders may be ablel to co-finance or arrange financing through existing funding streams. Alternatively, EU (see role of the EU), national government or private investment may be available to cover the costs of implementation. Options for joint-funding should be explored and exploited. In these ways, the Impact and Feasibility Assessment should ensure that the RAS does not lead to **Mal-adaptation.** 'Mal-adaptation' is a term used to describe adaptation measures that bring about negative side effects, or that fail to achieve their objectives in some way. We can think of mal-adaptation as adaptation that is inefficient, ineffective or unequal:

- **Inefficient** adaptation is that which costs more than the value of benefits it delivers, or a measure that is less cost-effective than an alternative. When selecting adaptation options it is important to give consideration to the likely costs and benefits of various options.

- **Ineffective** adaptation is that which does not achieve its aims, or which does so only by causing side-effects that impede adaptation elsewhere or in the future. For example, increasing the use of air conditioning as an adaptation to higher temperatures in the workplace will cause further climate change[13] and is therefore an ineffective solution in the long term.

[13] Where the air conditioning unit is powered by fossil fuel-derived energy.



- **Unequal** adaptation is that which distributes the benefits of adaptation un-equally across society, especially that which exacerbates existing social inequalities. For example, where water pricing is used to promote efficiency, but the costs of water disproportionately impact low-income housing, exacerbating inequality within the region.

See here for examples of tools used to select and assess adaptation options.

3. Agree a set of Adaptation Measures

Based on the results of the Impact and Feasibility Assessment, a preferred short list of adaptation measures should be agreed with stakeholders, including the Steering Group and the technical stakeholders that may be involved in implementing the measures or affected by the results. This group should include communities and residents. This step has to be carried out as an iterative process with the selection of measures.

4. Design an Implementation Plan

Once the short list of measures has been agreed, the RAS Core Team and delivery partners should agree a plan for their implementation. An implementation plan must clearly state who has responsibility for implementation, who will fund implementation and exactly when and how implementation is to be achieved. For an example consult USAID guidance. Given the partnership nature of many adaptation measures, the development of a clear plan of ownership is potentially complex and will require significant investment and dialogue.

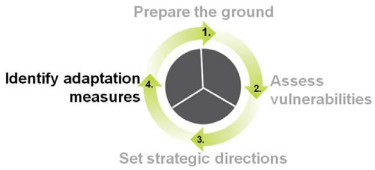
5. Launch and implement

The RAS is now complete and its measures must be implemented. Many authorities chose to publicly launch the Strategy to draw attention and enthuse stakeholders to begin implementation. Actions are executed by a combination of the lead regional authority and various key stakeholders that will be involved as implementation partners. Depending on the Member State in which the RAS is being developed, guidance for the launch and implementation of the strategy may already be available via climate change partnerships or central government adaptation divisions.
The Steering Group (or equivalent) will now take charge of monitoring progress and carrying out evaluation.

6. Monitoring, Evaluate & Review

The objectives set out and the targets identified earlier in Step 3 can be used to evaluate the progress of the strategy regularly. Progress should also be measured against mal-adaptation criteria. It is essential to establish whether or not there are any unanticipated side-effects resulting from the implementation of adaptation measures.

Evaluation should take place within the context of routine assessments by the leading regional authority. Evaluation and review should follow the principles of participatory decision-making and seek to involve a wide range of stakeholders. Lessons should be learned and successes celebrated and shared with other regions. The RAS process is iterative, meaning that the early stages should be repeated following the evaluation and review stage, based on the results of the evaluation, vulnerabilities and risks should be re-assessed, which could entail a re-assessment of objectives, measures, implementation strategy to complete the cycle.



3.6.3 How can barriers be overcome?

- Resource constraints restrict implementation of the RAS or prevent thorough appraisal of options, thus it is important to secure funding early in the process and to arrange long-term funding structures to underpin the development of the RAS. The process can of course be tailored to budgetary requirements, as long as the available budget is guaranteed for the duration of the development process (typically 6 –12 months).

- In some circumstances it can be difficult to reach consensus when stakeholders with different interests are involved. This is unavoidable and is best managed through clear communications and active and early engagement.

3.6.4 Who should be involved?

All stakeholders that will be impacted by measures.

3.6.5 What are the Governance and Stakeholder Engagement issues?

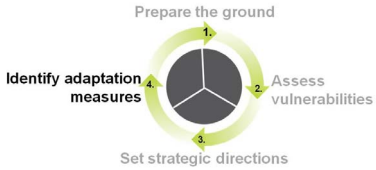
Assessing the governance implications of the possible adaptation measures must be taken into consideration before the final decision of adaptation measures. Adaptation sometimes requires novel approaches in regional governance, for example new partnerships between authorities and third sector groups to engage vulnerable communities in reducing vulnerability. Governance implications should be considered for each proposed action:

- How will this action be delivered?
- Who will have responsibilities?
    - At which administrative levels
    - Which stakeholders?
    - Are there any legal or accountability issues that need to be considered?
- What barriers to governance can be identified and removed?

A proper assessment of governance implications should not dissuade regional authorities from implementing the RAS. Instead, early and thorough consideration of governance issues will prevent costly delays to implementation and help to avoid politically difficult back-tracking or reconsideration at a later date. A creative approach to this task can help to strengthen novel approaches to adaptation at the regional level, especially where the action requires the involvement of unfamiliar or multiple stakeholder groups.

3.6.1 Where can examples, tools and sources of relevant information be found?

For more information on examples and tools please consult Annex VI – Step 4.



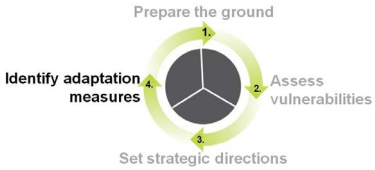
3.7 Where to find a forum for exchange?

The Commission notes that while a considerable amount of information and research already exists, it is not being shared across member states. The EU executive is thus proposing to establish of a 'Clearing House Mechanism' to serve as "an IT tool and database on climate-change impact and vulnerability, and best practices on adaptation". As the Clearing House is not expected to be ready before 2011 other fourums for exhange might be considered. Currently three main networks have been identified, addressing the issue of adapation:

- ENCORE “Climate Change” working group: Encore stands for the Environmental Conference of European Regions. They have a working group working on climate change. There are sixteen participant EU regions. They are: city of Vienna, city of Salzburg, Styria, Häme and Päijänne Tavastia, city of Hamburg, Saxony, Schleswig-Holstein, Tuscany, Province of Drenthe, Province of Gelderland, Province of Limburg, Aragon, Basque Country, Catalonia, Jämtland, Aberdeen.
  To present regional activities in the field of climate change; to provide a platform of communication between regional experts and decision makers; to extend and intensify networking and co-operation between regions; to share best practice; to develop and refine Regional strategies. The work of this group focus in three themes: a) Renewable Energy and Energy efficiency, b) Transport, b) Adaptation to Climate Change Effects in the EU regions. A website (http://www.regional-climate.eu/) is used to share the initiatives of their members regarding climate change impacts, mitigation and adaptation actions. The network also organises symposiums to shares information on best practice and identify projects with a common interest. The website offers:

  - Information on education and support programmes and projects of the region
  - Best practice examples
  - Information on regional adaptation strategies
  - Contact information and links to climate protection experts and institutions of the regions
- Three regions climate change group (UK based): It is a partnership between the London, South East and East of England regions. It is a Climate Change Partnership, coordinated by the Government Office for London. It involves the following key stakeholders: Defra, Communities and Local Government, Greater London Authority, London Development Agency, Environment Agency, Thameswater, Building Research Establishment, Housing Corporation, London Sustainability Exchange, Association of British Insurers, Department of Health, London Councils. To develop guidance and encourage delivery of adaptation to climate change within the built environment.

- Eurocities: Include 33 major European Cities (Amsterdam, Belfast, Birmingham, Cologne, Copenhagen, Dublin, Frankfurt, Gothenburg, Helsinki, Istanbul, Leipzig, London, Lyon, Madrid, Malaga, Manchester, Munich, Nantes, Newcastle-Gateshead, Nuremberg, Oslo, Oulu, Rotterdam, Sheffield, Stockholm, Sunderland, Tampere, Tbilisi, The Hague, Varna, Vienna, Zagreb and Zurich). Within the environmental objective of the EUROCITIES network there is a group working on climate change, air quality and energy efficiency. Their main objectives are: a) exchange of knowledge and good practices; b) lobbying for climate adaptation measures, c) preparation of a response to the European Commission on its Communication on climate change and energy use.



Currently the website provides no examples of projects taken to adapt to climate change. Other projects related to climate change are: a) the development of a local government climate roadmap; b) the 'Covenant of Mayors' which is a European Commission (DG TREN) initiative to go beyond the EU 2020 energy targets; c) the project "Partnership Energy Planning as a tool for realising European Sustainable Energy Communities", which aims to support the development of sustainable energy communities by improving energy planning methodologies and developing techniques to facilitate the involvement of politicians, citizens, market actors and other key stakeholders.

4 The role of the EU

Regions have a very significant role to play for adaptation to climate and the co-ordination of these initiatives at the EU-level may be beneficial in order to avoid major gaps between trans-national linkages, to provide common strategic direction ensuring a comprehensive and coherent approach to adaptation across the EU. This chapter is divided in existing EU processes promoting the development of RAS (mainly financial) and possible future options to promote RAS in the EU (supporting the development of tools, organise and disseminate information and amend policies).

4.1 Existing tools supporting RAS development

Stern report shows that globally the costs of adaptation and corresponding needs for financial support could be of the order of several billion Euros per year in the next decade. The costs of adaptation in regions will account for a significant proportion as building local, new and resilient infrastructure might be necessary so that the region can adapt to climate change. EU regions will be affected differently by climate change but they do not have the same financial capacity to adapt. Funding from the EU level could balance the disparities between regions with different economic abilities.

Funding for adaptation under existing EU funds

One of the emerging questions is where EU adaptation finance be sourced from, how can it best be delivered and sustained? Another challenge is working out how to structure climate related finance in a way which is effective - particularly which activities to focus on and how to coordinate efforts between different actors. Different activities involving different actors in the context of adaptation can be funded, such as:

- Knowledge development
- Testing and validation of knowledge development
- Monitoring the adaption process
- Implementation of measures
- Generation of awareness

A significant share of the total Community budget is currently allocated to the attainment of the objectives of the Common Agricultural Policy (CAP), the Common Fisheries Policy (CFP), and the Community environment policy. Mainstreaming of adaptation into these policies is a current effort being taken the EU and Member States.

- **Regional development, economic and social cohesion funds** together correspond to more than a third of the budget of the Union. The objective of EU funding under regional policy is to promote solidarity and to reduce the gaps in development among the regions and disparities among the citizens in terms of well-being. Regional assistance aims to help lagging regions to catch up, restructure declining industrial regions, diversify the economies of rural areas with declining agriculture and revitalise declining neighbourhoods in the cities. It sets job creation as its primary concern and it seeks to strengthen the economic, social and territorial ‘cohesion' of the Union. The particular funds are:

- The **European Regional Development Fund (ERDF)**[14] promotes public and private investments helping to reduce regional disparities across the Union. The ERDF support programmes addressing regional development, economic change, enhanced competitiveness and territorial co-operation throughout the EU. Adaptation and mitigation to climate change is within the funding priorities including investments prevent risks, including development and implementation of plans to prevent and cope with natural risks. Other possible investments are research, innovation, environmental protection and risk prevention, while infrastructure investment retains an important role, especially in the least developed regions.

- The **Cohesion Fund**[15] contributes to interventions in the field of the environment and trans-European transport networks. It applies to Member States with a Gross National Income (GNI) of less than 90% of the Community average which means it covers the new Member States as well as Greece and Portugal. The Community strategic guidelines on Cohesion 2007 – 2013[16], which were adopted in October 2006, set out three general priorities for the targeting of the funding resources:
  - Improving the attractiveness of Member States, regions and cities by improving accessibility, ensuring adequate quality and level of services, and preserving their environmental potential;
  - Encouraging innovation, entrepreneurship and the growth of the knowledge economy by research and innovation capacities, including new information and communication technologies; and
  - Creating more and better jobs by attracting more people into employment entrepreneurial activity, improving adaptability of workers and enterprises and increasing investment in human capital.

  One of the main aims of the funds is tackle regional disparities and support regional development through actions including the development of infrastructure. Such regional disparities clearly exist also with regard to climate change impacts and adaptive capacity. Climate change impacts and adaptation measures will be beneficial for some regions and individuals and disadvantageous for others. One of the challenges of adaptation policy is to identify, protect and compensate those who will suffer damaging impacts, and to support those regions where particularly severe impacts are to be expected.

- The **European Social Fund (ESF)** was set up to reduce differences in prosperity and living standards across EU Member States and regions, and therefore promoting economic and social cohesion. The ESF is devoted to promoting employment in the EU. It helps Member States make Europe's workforce and companies better equipped to face new, global challenges. Funding can be used to develop the relevant skills to adopt to climate change.

[14] Regulation (EC) No 1080/2006 of the European Parliament and of the Council of 5 July 2006 on the European Regional Development Fund and repealing Regulation (EC) No 1783/1999.

[15] Council Regulation (EC) No 1084/2006 of 11 July 2006 establishing a Cohesion Fund and repealing Regulation (EC) No 1164/94.

[16] Council Decision of 6 October 2006 on Community strategic guidelines on cohesion (2006/702/EC).

- **Rural Development Fund (RD-Fund)**. The Fund aims to contribute to improving i) the competitiveness of agriculture and forestry; ii) the environment and the countryside; iii) the quality of life and the management of economic activity in rural areas. The Fund complements national, regional and local actions and is co-funded by Member States and private actors. Member States can select from a set of 37 measures, several measures that can contribute to adapting to climate change (e.g. afforestation, modernization of farms). In December 2008, the European Council agreed under the "Health check" of the CAP on an indicative list of measures to address new challenges including climate change and risk management[17]. These measures specifically focus on adaptation and mitigation of climate change. Member States are now in the progress of adjusting the national/regional application rules (Rural Development Programs) in order to make use of these new measures.

- **European Fisheries Fund (EFF)** provides financial assistance to help implement the common fisheries policy (CFP) and to support the restructuring of the sector. Climate change is considered an added stress on marine ecosystems, as overfishing results in ecosystems that are more vulnerable to climate change, a reduction of fishing pressure is seen as a way to enable adaptation of the Maritime ecosystem to climate change. The EFE finances initiatives involving preparations, monitoring, administrative and technical support, evaluation, audit and checks needed to prevent overfishing. In addition, the EFF supports measures and initiatives aimed at diversifying and strengthening economic development in areas affected by the decline in fishing activities.

- **LIFE+** It is financial instrument supporting environmental and nature conservation projects throughout the EU, as well as in some candidate, acceding and neighbouring countries. A total amount of €250 million is available for the 2009 call for proposals. LIFE+ replaces the LIFE, Urban, NGO and Forest Focus programmes managed by DG Environment. Climate change is a principal objective for co-funding under the new LIFE+ programme, which runs until 2013. Under the "LIFE+. Within the theme "Environment Policy and Governance", the program finances projects addressing the issue of adaptation to climate change. The program is divided into three thematics:

    - Nature and Biodiversity: focuses on the implementation of the EU directives on the conservation of habitats and of wild birds, as well as further strengthening the knowledge needed for developing, assessing, monitoring and evaluating EU nature and biodiversity policy and legislation;

    - Environment Policy and Governance: covers the other 6th EAP priorities besides nature and biodiversity, as well as strategic approaches to policy development, implementation and enforcement;

    - Information and Communication: supports information dissemination and awareness raising activities, communication actions and campaigns, and organization of conferences and trainings.

[17] See Council Regulation (EC) No 74/2009 of 19 January 2009 amending Regulation (EC) No 1698/2005 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD).

- Under **INTERREG**, funding is made available by the European Union for cooperation between organisations in other European Member states. Its aims include promoting harmonious economic and social development through the sharing of knowledge and experience. INTERREG projects tackle a huge range of regional development issues: innovation, urban regeneration, employment, spatial planning, economic development and the environment. Examples of INTERREG projects addressing climate adaptation are: SAFECOAST (comprising the full risk chain, including risk communication), BEACHMED (comprising the built up of coastal information systems and integration of coastal erosion and sediment management into regional planning), MESSINA (setting up a network of local authorities, national administrations and coastal interest groups in order to find new and innovative techniques for managing coastal erosion and coastal planning processes).

- **European Commission Research Funding (FP6 and FP7):** The European Commission has funded several climate and health projects under the environment research calls of its Framework Program on Research (FP6) in order to improve the knowledge base on climate change and its impacts Now under the current Framework Programme Seven (FP7) this funding goes on opening the doors for research institutes and government institutions outside Europe. This allows being part of large multi-sectoral/multinational research projects, exchanging experiences across the world and developing the knowledge base further. Regional governments could benefit from this research specially when links were created between Universities and research centres and local governments in the study of climate impacts and possible adaptation measures.

Having all the above funding options in mind it comes clear that with the existing funding most of the adaptation activities can be covered.

Table 5: Use of funds for different issues related to adaptation

	ERDF	Cohesion Fund	ESF	RD-Fund	EFF	LIFE+	INTERREG	FP
Knowledge development and sharing	X							X
Testing and validation of knowledge development	X					X		X
Monitoring the adaptation process								X
Implementation of measures	X	X		X	X	X	X	
Generation of awareness		X		X	X	X	X	
Training and skill development	X	X	X	X	X	X	X	X

4.2. POSSIBLE FUTURE TOOLS TO SUPPORT RAS

It is also important to ensure that different stakeholders which might need to adapt to climate change have access to specific funds, in particular the private sector (e.g. agricultural and fishing sectors are daily and directly dependent on weather conditions for their economic activity). The Table 6 provides a first overview:

Table 6: Beneficiaries of funding

	ERDF	Cohesion Fund	ESF	RD-Fund	EFF	LIFE+	INTERREG	FP
Public sector	X	X	X	(X)	/X)	X	X	(X)
Industry	X	x	X		X	X	X	X
Companies	X	x	X		X	X	X	X
Farmers/Fishers	X	x		X	X	(X)	X	
Private	X		X	(X)	(X)			

X = full access
(x) = Limited access

The Table 6 suggests that adaptation in the European regions can be supported by financial mechanisms already in place in the EU. However currently no real systematic overview on the different funding lines within each of the funds mentioned above is available to the regions and they might not consider the possibilities provided. So there is a need of communicating that adaptation on the regional level can be supported by existing European funding. A specific information document might be beneficial in this context.

4.2 Possible future tools to support RAS development

4.2.1 Subsidiarity principle and justification for EU action

Actions to adapt to climate change will not only need to be taken at national and EU level, but also at a very local and regional level to match the specific conditions therein. However, it was recognised the lack of information, knowledge and expertise at local and regional level and the lack of guidance to the local and regional authorities is, in part, a consequence of the uncertainties as regards the scale, timing and consequences of climate change.

Under the principle of subsidiarity decisions are taken as closely to the citizen as possible, it requires a constant check whether action at EU level is justified in the light of the capacities at national, regional or local level. The EU does not take action (except in areas which fall within its exclusive competence) unless it is more effective than action taken at more local levels[18]. However, integration and coordination at EU level could provide benefits to the regions due to assistance in capacity building and good practice sharing as well as information exchange. In particular as regards to adaptation, EU level coordination could allow:

In this area where the lack of information, knowledge and expertise at local and regional level as well as the lack of guidance to the local and regional authorities may hinder access and use of available tools the EU could also play an important role, by developing methodologies for assessing the impact and designing cost-effective adaptation policies:

- **To support and redirect existing common policies**. Climate change impacts are affecting various sectors (agriculture, fisheries, water, biodiversity, energy) which are already organised at EU level through the single market and common EU policies.

- **To facilitate cross-border cooperation**. Climate change impacts require cross-boundary approach as some bordering regions may need to coordinate their activities with the neighbouring country.

- **To facilitate negotiations with neighbouring non-EU countries**. Europe has enhanced capacity to negotiate climate change policies at global level and it has the duty to support other regions and developing countries in the world developing strategies to cope with climate change. Under the European Neighbourhood Policy (ENP), EU agreed to offer its neighbours a privileged relationship, building on, among other values, mutual commitment to sustainable development and good governance.

In light of the climate change challenge, it is likely that local and regional authorities will have to bear huge cost of developing and implementing adaptation strategies. A new context for solidarity and burden sharing will therefore emerge, and there will be the need for revising the framework for EU financial support to the regions to facilitate adaptation. This can either be done by creating new funding opportunities for regions to adapt or by redirecting existing EU funding programmes. A key in this context could be the **development of vulnerability indicators which allow prioritising the funds and actions to the most vulnerable regions in Europe**. This could snowball by raising awareness from the EU level to the MS level and regional level. Thus, actions at the EU level to

[18] http://europa.eu/scadplus/glossary/subsidiarity_en.htm

mobilise adaptation responses among public authorities at local, regional and national level enabling regional adaptation strategies to develop throughout the EU.

4.2.2 Methodological support to the development and implementation of RAS

Guidance and testing – setting up pilot regions

The guidelines developed in chapter 3 might be used by several regions in the process of developing, implementing and evaluating RAS. Testing of this guidelines was not part of the technical specifications of this project. Pilot regions for practical testing of the guidelines could close this gap and could support the refinement of the guidelines. This testing exercise (application of guidelines in practice) could be undertaken through an EU network, comprised of several projects across Europe covering several different regions. The experiences made could provide the basis for a EU wide information network, allowing to share experiences among different regions. The principle used to create the Pilot River Basins established under the Common Implementation Strategy of the Water Framework Directive could serve as a blue print for such a pilot-testing exercise. Further objectives of pilot regions could be:

- to present examples and ideas for key elements of the RAS implementation ahead of other regions;
- to provide concrete input and case studies for the further development of an EU-wide adaptation policy;
- assessment and reporting on incoherence amongst the different sectoral guidance documents in the selected pilot regions leading to the long-term development of coherent RAS.
- creating a list of examples showing the benefits of RAS
- awareness raising

Development of tools and methods for development of RAS

Adaptation to climate change will remain a key issue over the next decades and the current knowledge remains insufficient in many cases. The guidelines developed in the previous chapter can only be seen as an intermediate step to a more informed decision making on the regional level. Further efforts to improve knowledge and decision making on the regional level could cover:

- **Creation of a guidance document to provide technical direction on how to consider climate change in the context of existing policies**. Such a guidance document was requested at the RAS workshop in May 2009 in Brussels.
- **Development of specific tools to support cost-benefit assessment of the options**. Developing evidence on the costs and benefits of adapting to climate change is an important step towards understanding how to select adaptation options.
- **Access to a database of adaptation measures**. Within the Digital Compendium of the ADAM project a first database of potential adaptation measures has been developed. The catalogue could be updated regularly in three ways. Firstly by adding measures not included in the database so far, secondly by technical information on the measures and thirdly with information on practical experiences from implementing the measures. This database could be

made available through the European Climate Change Impacts, Vulnerability and Adaptation Clearinghouse.

- **Development of indicators to measure vulnerability to climate change and the progress in adaptation**. RAS would benefit from a system allowing the elaboration of a set of indicators, both consistent with other regions, member states and the EU level and adapted to the regional conditions. This could also be made available through the European Climate Change Impacts, Vulnerability and Adaptation Clearinghouse.

4.2.3 Information exchange and networking – Towards a European Climate Change Impacts, Vulnerability and Adaptation Clearinghouse

The establishment of RAS will create a lot of information, experience and knowledge that could be compiled, analysed and shared within a network of RAS developers. At the RAS workshop (17.6.2009) held in the context of this study the participants clearly indicated the need for a new network focusing particular on regional adaptation. Main focus of such a network could be the exchange on developing and implementing RAS as well as the exchange on cost, effectiveness and benefits of certain adaptation measures (technical, non technical).

An EU-Wide platform for information exchange and networking beyond the existing networks could be beneficial to:

- Develop a common understanding of approaches, tools and methodologies
- Elaborate informal/formal specific technical guidance including best practice examples
- Share experiences and resources
- Avoid duplication of efforts and
- Limit the risk of mal-adaptation through the wrong use of tools and methodologies.

Such a network could provide input to the proposed Clearinghouse which objectives would be:

- Enhance information structuring and sharing and act as a facilitator for collecting and disseminating scientific information, data and case studies about climate change impacts, vulnerability, and adaptation plans and measures, to build a consistent and updated knowledge base.

- Assist an effective uptake of this knowledge by EU, national, regional, local or sectoral decision makers, by offering guidance, tools, best practices for assessments of vulnerability to climate change at different geographical levels and of adaptation plans and measures.

- Promote a greater level of coordination among the relevant sectoral policies, and among different institutional levels, which is necessary for a proper approach to adaptation.

5 Literature

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6 Glossary

Adaptation - 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, including anticipatory, autonomous and planned adaptation (IPCC, 2007).

- **Anticipatory or proactive adaptation –** adaptation that takes place before impacts of climate change are observed.
- **Autonomous or spontaneous adaptation –** adaptation that 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.
- **Planned adaptation –** adaptation that 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 policy framework/guidelines - a structured process for developing adaptation strategies, policies, and measures to enhance and ensure human development in the face of climate change, including climate variability. The adaptation policy framework is designed to link climate change adaptation to sustainable development and other global environmental issues (UNDP, 2004).

Adaptive capacity (in relation to climate change impacts)- 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 (IPCC, 2007).

Building adaptive capacity – involves creating the information and conditions (regulatory, institutional, managerial) that are needed before adaptation actions can be undertaken (West and Gawith 2005, P.46)

Clearinghouse - a central agency or entity for collecting and giving out information. A **Data Clearinghouse** is an organization or an organisational framework that acquires, maintains, and distributes data or provides information services about data for many different data users. Such an organization may also integrate the data, generate the data, or perform other types of data processing functions.

Climate change - Any change in climate over time, whether due to natural variability or as a result of human activity. This usage differs from that in the United Nations Framework Convention on Climate Change (UNFCCC), which defines 'climate change' as: 'a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods' (IPCC, 2001).

Climate scenario - A plausible and often simplified representation of the future climate, based on an internally consistent set of climatological relationships and assumptions of radiative forcing, typically constructed for explicit use as input to climate change impact models. A ‘climate change scenario’ is the difference between a climate scenario and the current climate (IPCC, 2007).

Climate variability - variations in the mean state and other statistics (e.g. standard deviations, statistics of extremes) of the climate on all temporal and spatial scales beyond that of individual

weather events. Variability may be due to natural internal processes within the climate system (internal variability), or to variations in natural or anthropogenic external forcing (external variability) (IPCC, 2007).

Existing strategies (this project)– procedures that are formally adopted by governmental bodies, in form of plans of action or formally adopted processes.

Exposure - is the nature and degree to which a system is exposed to significant climatic variations (IPCC, 2001).

Hazards - A physically defined climate event with the potential to cause harm, such as heavy rainfall, drought, flood, storm and long-term change in mean climatic variables such as temperature (UNDP, 2004).

Impacts (climate change) - the effects of climate change on natural and human systems. Depending on the consideration of adaptation, one can distinguish between potential impacts and residual impacts (IPCC, 2007):

Potential impacts: all impacts that may occur given a projected change in climate, without considering adaptation. This allows to assess all effects of climate change if no adaptation occurs for a specific sector or area.

Residual impacts: the impacts of climate change that would occur after anticipatory, planned and autonomous adaptation. This would allow to assess the actual need for intervention for a specific sector or area.

Autonomous adaptation residual impacts: impacts that may occur given a projected change in climate, considering only autonomous adaptation. This would allow to assess the actual need for public intervention for a specific sector or area

Indicators - quantitative or qualitative parameters that provide a basis for assessing change, they are logically tied to stated policy goals and chart progress towards policy targets.

Vulnerability Indicators - An observable variable that provides some indication of the possible future harm a system of interest is facing

Adaptation indicators - A measure of progress towards the implementation of adaptation measures (process-based) or a measure of effectiveness of adaptation policies and activities in general (EEA, 2008)

Index / indices – An aggregate indicator. An index combines several observable variables into one.

Likelihood – See probability

Measure - Technologies, processes, and practices that reduce GHG emissions or effects below anticipated future levels. Examples of measures are renewable energy technologies, waste minimization processes and public transport commuting practices (EEA, 2008).

Policies - Objectives, together with the means of implementation. In an adaptation context, a policy objective might be drawn from the overall policy goals of the country – for instance, the maintenance or strengthening of food security. Ways to achieve this objective might include, e.g., farmer advice

and information services, seasonal climate forecasting and incentives for development of irrigation systems (UNDP, 2004).

Probability – the likelihood or possibility of an event or outcome occurring. Probability can range from being qualitative, using word descriptions such as likely or highly confident, to quantified ranges and single estimates, depending on the level of understanding of the causes of events, historical time series and future conditions (UNDP, 2004).

Radiative forcing - the change in the net vertical irradiance (expressed in Watts per square metre; Wm−2) at the tropopause due to an internal or external change in the forcing of the climate system, such as a change in the concentration of CO2 or the output of the Sun.

Regional - Area covered by an administrative geographic unit below national level that is responsible for the development of the adaptation strategy (e.g. province, Länder, large cities).

Risk - The combination of the probability of an event and its consequences (UNISDR, 2009). This definition is consistent with that used in ISO/IEC Guide 73. Some climate change glossaries consider vulnerability a part of risk, for example the UNDP guidance defines climate related risk as the result of the interaction of physically defined hazards with the properties of the exposed systems, i.e., their sensitivity or (social) vulnerability. Risk can also be considered as the combination of an event, its likelihood, and its consequences, i.e., risk equals the probability of climate hazard multiplied by a given system's vulnerability (UNDP, 2004).

Sensitivity - the degree to which a system is affected, either adversely or beneficially, by climate-related stimuli. The effect may be direct (e.g. a change in crop yield in response to a change in the mean, range, or variability of temperature) or indirect (e.g. damages caused by an increase in the frequency of coastal flooding due to sea level rise (IPCC, 2001).

Strategy - A broad plan of action that is implemented through policies and measures (UNDP, 2004).

Strategy to adapt to climate change - A general plan of action for addressing the impacts of climate change, including climate variability and extremes. It may include a mix of policies and measures, selected to meet 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, 2004).

Vulnerability - The degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, its sensitivity, and its adaptive capacity (IPPC, 2007).

Annex I: Methodology used to assess existing RAS

A representative amount of regional strategies was collected, based on an internet survey, interviews and the assessment of published reports. The starting point for the survey was secondary information (publications and previous works carried out by the partners) and their networks. The inventory was divided into two broad meta-levels. The first level (Meta-level A) has taken a detailed but holistic look at the regional adaptation strategies themselves, analyzing the background information that led to the formation of the strategy as well as the inputs that went into making up the strategy. The second level (Meta-level B) focused on the individual adaptation actions proposed for each strategy (when these actions are present in the strategic plans) and categorize actions along certain criteria.

Meta-level A: Inventory of regional strategies

Meta-level A analysis the institutional, methodological and social components that formed the basis for the creation of an individual regional strategy. It provides critical background on the adaptation strategy. The choice of the issues to be included was agreed in the kick off meeting of the project in consultation with the Commission. Data collected for meta-level A:

- General Information:
- Country of the strategy;
- Existence of country-wide adaptation strategy plan, status and year of creation;
- If a country plan exists, does it mandate or encourage the creation of regional adaptation strategies, or provide an umbrella for existing ones?;
- Name of region, of the regional strategy and of the lead administrative body;
- Year of creation;
- Existence of national guidelines for the creation of a strategy
- What is the timeline of action for the adaptation strategy?
- Knowledge generation:
- What office or agency prepared the strategy?
- Type of climate scenarios – if any - used for creation of strategy: International, national, region specific;
- Type of vulnerability, risk and impact assessments used in creation of strategy: international, national, regional risk assessments;
- Stakeholder involvement:
- Was there stakeholder participation in the creation of the strategy?
- Who were the key stakeholders?
- What methods were used to enable stakeholder participation?

- When (in the process) did stakeholders participated in the development of the strategy?
- Does the strategy call for on-going stakeholder involvement in implementation of strategy? What kind?
- Fiscal Information:
- What was the cost of the strategy?
- What body financed the implementation of the strategy?;
- What are the expected public implementation costs of the strategy?

Meta-level B: Inventory of adaptation actions in the region

The unit of analysis for meta-level B is the adaptation policy action. An adaptation policy action is the building block of a strategy and consists of individual policy concerns, policy recommendations and policy measures: the instruments for conducting adaptation activities. By taking an inventory of individual adaptation policy actions in the regions along specifically defined criteria critical questions can be addressed such as (1) the level of adaptation progress in the region; (2) the objective of adaptation in the region; (3) the targeted domains of adaptation activities. Meta-level B also seeks to capture general information about adaptation policy actions where possible. These actions must also be taken into account when cataloguing adaptation options that do not directly address adaptation but rather provide information on larger governance issues surrounding the action. Data collected for meta-level A and B are described below. Data collected for meta-level B:

- ***General information, social issues, costs and benefits***: While the above criteria form the core of Meta-level B, there are other important factors that must be taken into account when cataloguing adaptation actions: name, description of the option, year of creation, lifetime or target date, and implementing entities.
- ***Evidence base for adaptation***: The evidence base used to elaborate adaptation strategies will determine the impact of identified responses. The greater the knowledge base of future climate changes and the systems affected by those changes, the greater the success of the adaptation response. We have investigated whether the adaptation strategies are informed by the available information on future changes, their impacts and the risks posed to a given region, and whether they are flexible enough to take on board new knowledge as it is generated.
- ***Level of adaptation progress:*** This refers to how far along a region is in defining and implementing adaptation policy actions. Specifically it makes a assessment of the difference between implemented policy measures, policy recommendations, and policy concerns with the assumption that a region with only policy concerns has a less developed strategy plan than a region with a handful of implemented policy measures. The issues that have been analyzed for this category are as follows:
- ***Adaptation policy concern*:** A policy concern is the first level of adaptation action that a region can undertake and is characterized by general statements in the adaptation strategy on specific issue areas but offering no concrete plan of action. For example it may say in, “In the next 10 years we foresee an increase in the incidence of heat waves, action must be taken”. Here they focus on the issue of heat waves but don’t specify what they might do.

- ***Adaptation policy recommendation*:** The nature of this second level is that a region puts forth specific recommendations to address specific problems. For example the strategy might state, "It is recommended that in the next 5 years we allocate 5 million euros to the development of a regional heat wave early warning system."

- ***Adaptation policy measure*:** This is an actual implemented policy measure (note: measures motivated out of climate concerns, or at least measures that acknowledge this concern) such as the implementation of an early warning system to detect heat waves.

- ***Adaptation objective***: The second major order of classification for Meta-level B is concerned with the objective of the adaptation policy action. What is it trying to accomplish? For what reason is adaptation being undertaken? Drawing from the work of Gallopin (2006) Klein and Tol (1997) and the IPCC (2001) four distinct objectives can be identified for any adaptation policy action. They are as follows:

- ***Building adaptation capacity*:** In the literature this term has received much attention and comes in various guises and definitions. In this case, the adaptive capacity inherent in a system represents the set of resources available for adaptation, as well as the ability or capacity of that system to use these resources effectively in the pursuit of adaptation. Thus building adaptive capacity is very specific and relates directly toward an action that builds or enhances regional government or societal awareness about adaptation. One frequent type of actions are reports, information campaigns or research studies that assess inter alia risks and sensitivities and inform about particular vulnerabilities to climate change (e.g. publication of flood risk maps). The overall theme is that these measures impart information so as to promote action at a later stage.

- ***Reduction of risk and sensitivity*:** Actions can be undertaken to reduce the risk (which is the result of the interaction of physically defined hazards with the sensitivity or vulnerability of the system) and/or target the sensitivity of a system (i.e. the degree to which a system is affected by climate). Reducing the sensitivity of people, property or nature to changed climatic conditions implying pre-emptive action will lessen potentially damaging impacts of climate change.

- ***Increased coping capacity to extreme or damaging events*:** While closely related to reduction of risk this objective focuses on actions planned to cope with extreme events and their effects on people, property and nature, not simply overall climactic change. Examples might be a municipality that erects "cooling stations" around a city in the summer or installs more hospital beds in anticipation of a heat wave. It could also include insurance companies or governments increasing capital outlays to help pay for the after effects of an extreme event.

- ***Capitalization on changed climatic conditions*:** One often-overlooked reason to undertake adaptation measures is that some benefit might arise from any changed climatic condition. In this case an action might be put in place to capitalize on such change. For example, if a study shows that there is an increase in the population of a specific fish species (presumably due to changed climate) a measure could be put in place to extend the harvesting season of said fish species. By capturing and aggregating out this information we can get a better picture of the regional concerns about climate change and adaptation. Is the region focused only on reducing their risk and exposure or do they have a more comprehensive and holistic outlook to

adaptation? A region that has actions capitalizing on climate change might have valuable information to share with its neighboring regions.

- ***Vulnerable sectors :*** This category assesses the sectors which are affected by the proposed actions. While the adaptation objective deals with the why an action is being undertaken, i.e. to reduce risk or build awareness, the vulnerable sectors/ adaptation aim is concerned with what problem or issue domain the action aims to address. While it is perfectly valid to create a measure to reduce risk, the question remains as to where this risk reduction should be or is taking place. For the purpose of this project we distinguish the following categories: Coastal zone management; Landscape management (including soil erosion, floods, and fires); Water management (including quantity and quality); Infrastructure; Energy, security of supply of energy; Biodiversity management; Financial management (insurance and financial markets); Health and disease management; Agriculture, and food security. By understanding the region's vulnerable sectors cross-site comparisons and learning can be drawn as regions vulnerable in the same sector may choose to learn from each other regarding the type and process of implementation of strategic actions.

- ***Miscellaneous implementation issues***: Dependent on the available information, we have looked at a number of questions related to the implementation of regional strategies:

- ***Type of policy instrument:*** This category aims at delineating what type of policy instrument the action is. Note however that this category applies only to an adaptation policy measure, not a recommendation (unless a specific instrument is recommended) or a policy concern. There are various types of standard policy instruments: fiscal instruments (tax, subsidy or grant); regulatory instruments; hortatory instruments (information campaign); and voluntary agreements.

- ***Governmental large scale infrastructure projects:*** This category captures government actions and especially those that are technical that fall outside the standard range of policy instruments for example large-scale government infrastructure projects such as improving road and rail infrastructures, dam building, nuclear power plant construction or sea wall construction. This category is also particularly relevant as adaptation can be construed as simply a technical issue to be solved by technical solutions.

- ***Civil society involvement*****:** Are any non-state actors involved in the implementation or enforcement of the particular action (NGOs, corporations, universities, research institutes etc.) If so who?

- ***Consideration of disadvantaged groups*****:** Does the action in any way target or address helping a particular disadvantaged/minority group. For example, grants to low-income families to help insulate their homes.

- ***Gender issues*****:** Does the action have any gender specific consideration?

- ***Stated budget as well as costs/benefits:*** How much has been or will be spent for the action? What are the expected financial benefits?

Annex II: Results from the assessment of existing RAS

Even before national strategies were developed, local and regional governments, as well as other stakeholders, have began developing strategies to reduce vulnerability to climate change impacts. These strategies are not always published or accessible as "climate change strategies". While the national strategies are often triggered in a top-down fashion by the consideration of physical vulnerability to global climate change, the regional initiatives often emerge from social vulnerability to various stresses, including weather extremes at the local level (see Figure 4). This suggests that most of the regional strategies identified were developed in parallel or even before the national strategies in ways that were not harmonised at the national or international level, but shaped instead by local concerns. National adaptation strategies can then play a role in harmonising existing activities, and stimulate the development of additional plans in other regions building on regional priorities and capabilities (Swart et al., 2009).

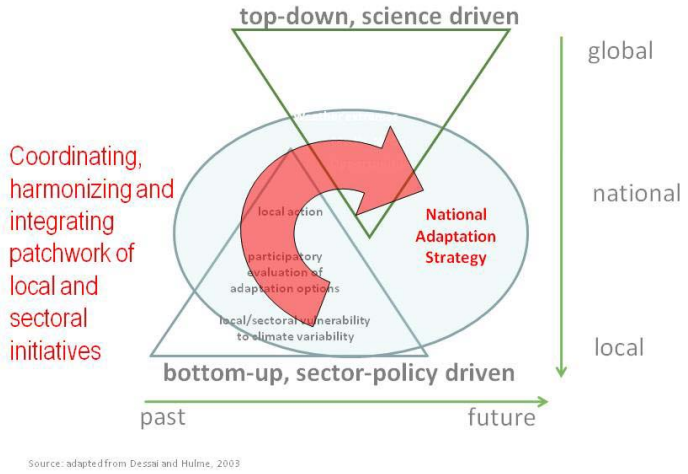

Figure 4: Top-down" and "bottom-up" approaches used to inform climate adaptation policy (Dessai and Hulme, 2003)

Figure 2 summarizes the "existing" (i.e., adopted) regional adaptation strategies that were identified. With the exception of Spain, most regional strategies identified are concentrated in Northern and Western Europe, in countries which already have a national strategy with the exception of Sweden. This presents some surprises since Southern European countries are considered to be most vulnerable to climate change. However it is likely that the list of existing regional adaptation strategies is not comprehensive, for several reasons:

- Information about adaptation strategies at the local and regional level is almost always only available in national languages only, and often not easily accessible through the internet;
- Adaptation is sometimes included but only as one component in an overall climate change response plan, where the emphasis is often on mitigation;
- Several regions are at the stage of assessing their vulnerability or developing their adaptation strategies;

- Transnational regions, such as shared river basins or ecosystems, were not included in the study;
- Many of the regional strategies found are strategies in major administrative units in federal-type countries (Länder in Germany, Communidades Autonomas in Spain, parts of the United Kingdom), of which the size of the population and economy is often comparable to smaller individual countries, such as The Netherlands or Finland.

For example, in The Netherlands various regional "hotspots" are currently in the process of developing adaptation strategies in collaboration with the scientific community (KfC, 2009), transnational adaptation plans are currently being developed for various international river basins, including the Rhine, Danube and Meuse rivers (ICPR, 2007; ICPDR, 2007), and countries in the Baltic region are developing guidelines for regional adaptation policies (ASTRA, 2009[19]). Since 2006 the Commission Internationale pour la Protection des Alpes (CIPRA) has called for enhanced activities to address climate change in the multi-country Alpine region, various conferences have been held and studies done, but this has not yet led to a formal adaptation strategy. Climate-related activities in the framework of the Alpine Convention appear to be primarily addressed in the context of water management and natural hazards. In France, the regions Aquitaine, Nord-Pas de Calais, Réunion, Rhône-Alpes, and the cities of Paris, Nantes and Lyon are in the process of developing regional adaptation strategies. With the exception of Paris (Mairie de Paris, 2008) and Rhônes-Alpes (RAEE, 2009) these were not yet accessible through the internet, while for some regions adaptation would be added to earlier mitigation-oriented "Plans Climats" or linked to broader sustainable development initiatives - most local and regional attention in France is still addressing greenhouse gas emissions and broader development dimensions. Since 2008, the "CLUB VITECC" (Villes, Territoires en Changement Climatique) works with a growing network of more than 20 municipalities and regions in France on both mitigation and adaptation, including the development of analytical tools and economic instruments for supporting local innovative initiatives to adapt to climate change. There are some other local initiatives, e.g. the mayors of Le Ferré and Romagne have initiated the development of local urbanisation plans for their community, which integrate climate change adaptation aspects into local sustainable development plans (rain water disposal, landscape management). Such initiatives can provide practical feedback to the activities of the national climate change observatory (ONERC). We have not classified such local initiatives as existing regional adaptation strategies however.

Northern and Western European countries have been particularly active in the international climate change negotiations with an emphasis on mitigation for a long time. The fact that especially in these countries climate change has been on the political agenda for a long time may also explain why they are the first to tackle the impacts, even if the countries are generally assumed to be less vulnerable. Most regional strategies that were identified were published after 2005, suggesting that they were developed in parallel with the national strategies. An exception is the strategy for Yorkshire and Humber in the UK, which was published in 2002.

It should be noted that interviews or other ways to directly discuss the strategies with local officials or stakeholders was beyond the scope of the project, however in a small number of occasions we contacted the responsible authority to consolidate some of the information presented in the strategies.

[19] Hilpert, K., Mannke, F., Schmidt-Thomé, P., 2007. Towards Climate Change Adaptation Strategies in the Baltic Sea Region - Developing Policies and Adaptation Strategies to Climate Change in the Baltic Sea Region, Espoo

On the whole, we had to rely on information published on the internet. Often these strategies published information that is relevant for agenda setting, informing decision-makers and/or for informing the public, therefore they do not always include information about how they were developed, nor do they specify in detail how the strategy will be implemented. Nevertheless, we can draw some relevant conclusions from the inventory.

Regional adaptation strategy type and focus

There are two types of climate change strategies: local (LAS) which are focused on the city-level and regional (RAS) which focus on a larger geographical coverage. The focus of these strategies differs across Europe.

- Adaptation is often part of a broader climate change response plan that also (or primarily) targets mitigation (e.g., "climate neutrality"). Many cities in Europe appear to have climate response plans that do not yet include adaptation (e.g. in Spain).

- On the other hand, all UK RAS focus on adaptation, while some plans in Spain and all plans identified in Germany address both mitigation and adaptation issues.

Climate adaptation plans tend to address similar vulnerability sectors: landscape, water and health (Figure 5). However, there are regional and local distinctions resulting from differences in vulnerability, e.g. in Paris the emphasis is on heat stress, while in Rotterdam the emphasis is on water safety. Also, some strategies include unique factors, such as accessibility and transport (e.g. Rotterdam) and pollution of water and soils (e.g. Stockholm).

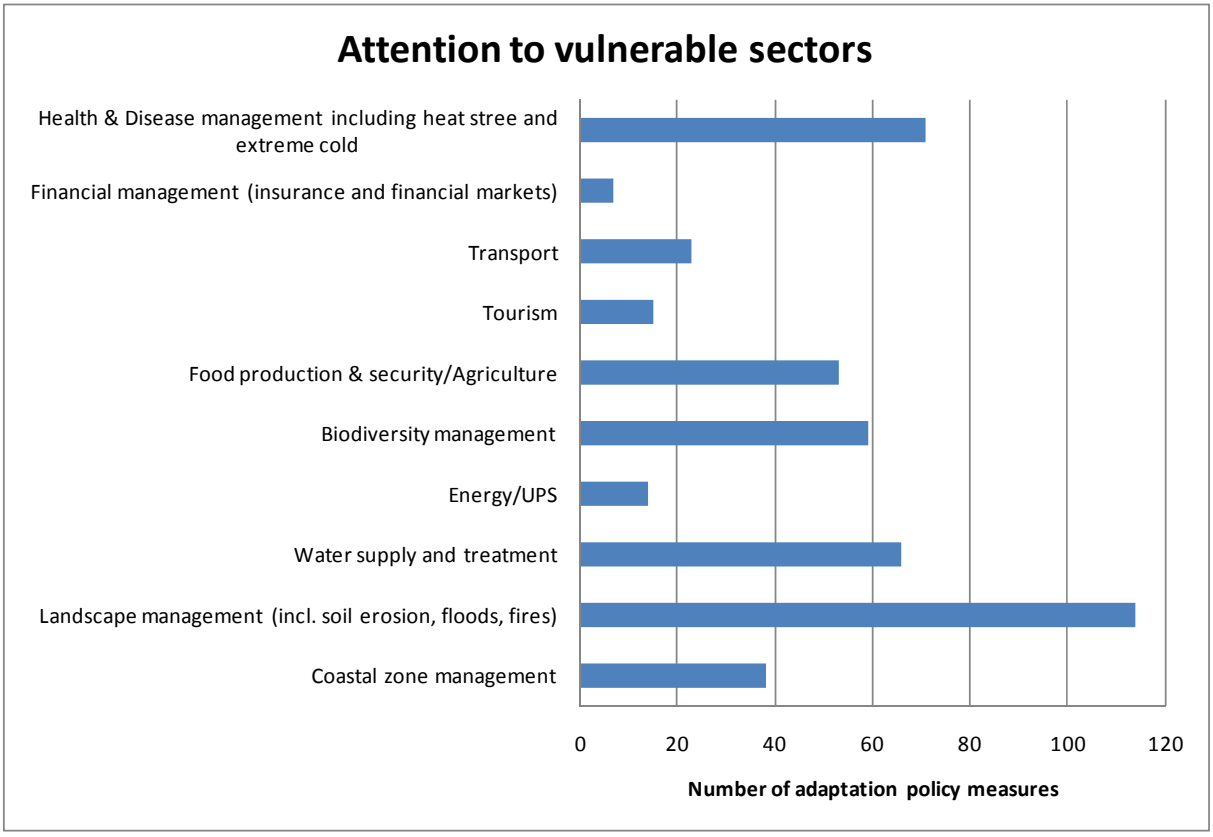

Figure 5: Vulnerable sectors covered in RAS analyzed in this project

RAS development process

Across Europe regional governments in general take the initiative to **develop regional or local adaptation plans**. In some cases, the actual drafting of the strategy and the organization of the process is subcontracted to consultants (e.g., in most of the UK strategies). There appears to be limited national level guidance on how regional plans should be developed. Although many national governments suggest that adaptation will and should take place at regional or lower administrative levels, there appears to be no overall mandate requiring the creation of RAS. However, under the UK's Climate Change Bill, the national government can ask any and all public authorities (if they so choose) to demonstrate what adaptive measures are being undertaken.

In many regions there is **stakeholder involvement** during the development process (DE 2 region; UK 7 regions; NL 1 region; FR 1 region; ES 3 regions) Different methods are used: in some cases telephone or electronic consultations (e.g. in UK: South East England, Yorkshire and Humber), in other countries a series of consultation workshops (e.g. Cataluna in Spain), active sectoral or cross-sectoral working groups with broad societal participation (including citizens and research organizations) (Rotterdam, Paris, Islas Baleares, Pais Vasco). In terms of continuous stakeholder involvement in the implementation plan, monitoring and review, the regions in the UK and Netherlands most notably stress that this is an important factor and element of the adaptation process.

Box 1: Adaptation in action – example of good practice

The adaptation strategy emphasises the need for cooperation between public authorities, scientific knowledge institutes, NGOs and the business community. As such, stakeholder engagement was used to inform the content of the ARK strategy through intensive collaboration and consultation. Stakeholders included various municipal departments, province, water board, harbour company, neighbouring municipalities, Erasmus University, Milieudienst Rijmond, Economic Development Board, Ministries of Environment, Transport and Water Management, Building Research Foundation, Cooperative Programme on Water and Climate and the Netherlands Water Partnership.

Source: Rotterdam Climate Proof: The Rotterdam challenge on water and climate adaptation. Adaptation Program 2009

The strategies are not very clear about **roles and responsibilities**. In the UK, the Climate Change Bill provides the framework for assigning responsibilities, introducing powers for Government to require public bodies and statutory undertakers to carry out their own risk assessment and make plans to address those risks.

The **level of adaptation progress** varies between regions. Many strategies identify vulnerabilities and put forward general directions how to organise a response. Often, the existence of the strategy demonstrates that the stage of "concern" has been passed, because resources have been committed to develop the strategies. This means that many of the strategies are at the stage of formulating recommendations (see for example all strategies in the UK). A few strategies put forward a more concrete plan with timelines and responsibilities to implement a particular action (e.g. the Federal States of North-Rhine Westfalia and Bavaria, Hamburg, Rotterdam). Many strategies include recommendations on organizing and informing the regional response, e.g. by setting up monitoring systems in Paris and Stockholm, or setting up implementation bodies. Approximately 50% of the actions stated in the strategic plans are policy recommendations, 30% are policy measures and 18% policy concerns (Figure 6). For definitions see Box 2.

Box 2: Definitions of adaptation policy actions

Policy concern: A policy concern is characterized by a general statement on specific sectors but offers no concrete plan of action. For example a concern may state, "in the next 10 years we foresee an increase in the incidence of heat waves, action must be taken". Here the issue of heat waves is addressed but no further action is specified.

Policy recommendation: A policy recommendation puts forth a specific recommendation to address a specific problem. For example, "it is recommended that in the next 5 years we allocate 20 million Euros to the development of a heat wave early warning system."

Policy measure: This is an actual implemented policy measure (note: measures motivated out of climate concerns, or at least measures that acknowledge concerns of climate change) such as the construction of a sea wall or the implementation of an early warning system to detect heat waves.

Source: Massey and Bergsma (2007)

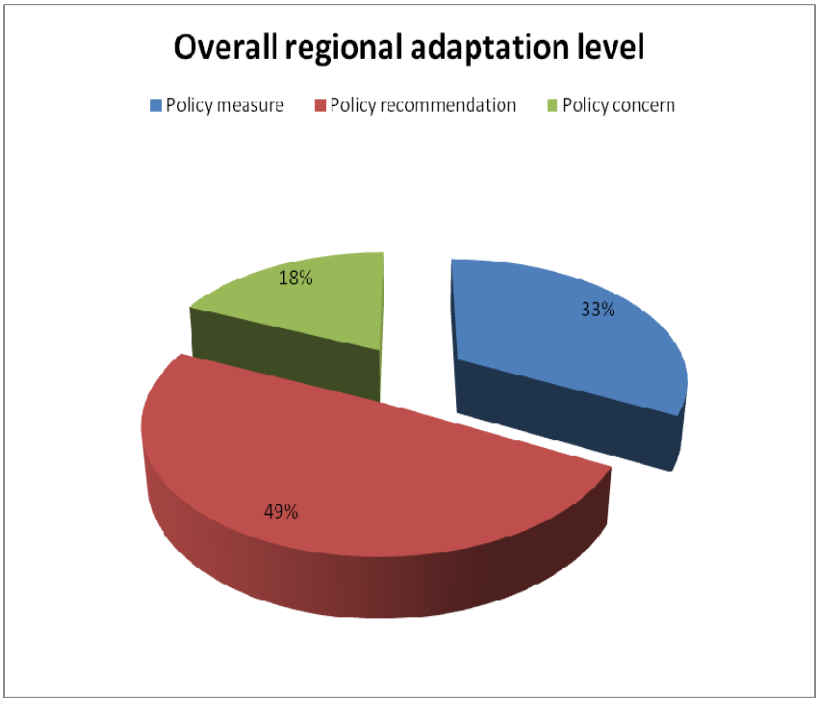

Figure 6: Regional adaptation level analyzed in this project

Of the four **types of responses** (see Box 3 and 4) reduction of risk and sensitivity; increased coping capacity to extreme damaging events; capitalization on changed climatic conditions; and building adaptive capacity, the emphasis in most strategies (40%) is on the first: reduction of risk and sensitivity (Figure 7). This is in line with the role of governments as the initiators and actors with major responsibility to protect population their economic assets from climate threats. Most strategies recognise the limits of governmental interventions and lay out plans to enhance adaptive capacity. Those strategies that see benefits include recommendations to capitalise on changed climatic conditions, e.g. pay attention to new opportunities for tourism and use climate change as a vehicle to improve the management of water and land in general. In Spain, somewhat different from the other countries, regional strategies focus on building adaptive capacity. This occurs because most of the

actions in Spanish plans relate to finance and coordinate research and communication of findings to the population.

Box 3: Adaptation practice response definitions

Building adaptive capacity: Building adaptive capacity related to a country's adaptation policy is very specific and relates directly towards a measure that builds or enhances government or societal awareness about adaptation, builds capacity to enable action and also prompts some form of action to be undertaken. These measures are government reports, information campaigns or research studies that assess inter alia risks and sensitivities, and inform about particular vulnerabilities to climate change. For example, the publication of flood risk maps would be considered to increase adaptive capacity. The overall theme is that these actions impart information so as to promote action at a later stage.

Reduction of risk and sensitivity: Actions can be undertaken to reduce the risk of damage and disruption, and reduce sensitivity of people, property, natural resources, and ecology to changed climatic conditions implying pre-emptive action should be taken to lessen potentially damaging impacts. Actions include activities such as building a sea wall or improved ecological networks to increase resilience.

Increased coping capacity during extreme or damaging events (response to extreme events): While closely related to reduction of risk, this objective focuses on extreme events and their impacts on people, property and nature inter and post factum. Examples might be a municipality that erects "cooling stations" around a city in the summer or installs more hospital beds in anticipation of a heat wave. It could also include insurance companies or governments increasing capital outlays to help pay for losses incurred after an extreme event.

Capitalization on changed climatic conditions: One often-overlooked reason to undertake adaptation is that some benefit might arise from any changed climatic condition. In this case an action might be undertaken to capitalize on such change. For example, if a study shows that there is an increase in the population of a specific fish species (presumably due to changed climate) a measure could be put in place to extend the harvesting season of said fish species.

Source: Massey and Bergsma (2007)

Box 4: Adaptation in action – examples of good practices (Action strategy to cope with climate change of Cantabria, Government of Cantabria)

The region of Cantabria in Spain has implemented a number of adaptation measures to date. These include cross cutting measures such as the development of regional climate scenarios for Cantabria as well as a coordinated program among the General Administration of State and Cantabria, especially in the sectors of health, tourism, agriculture and forests.

Sector-specific measures have also been put in place, for example in relation to biodiversity. Measures include broadening knowledge on habitats that are more vulnerable to climate change, noting potential measures for their conservation to minimise impacts. In relation to coastal regions, a study has been conducted into the maritime constructions most vulnerable to changes in wave size and frequency, in order to avoid disruption to construction activities.

Source: Massey and Bergsma (2007)

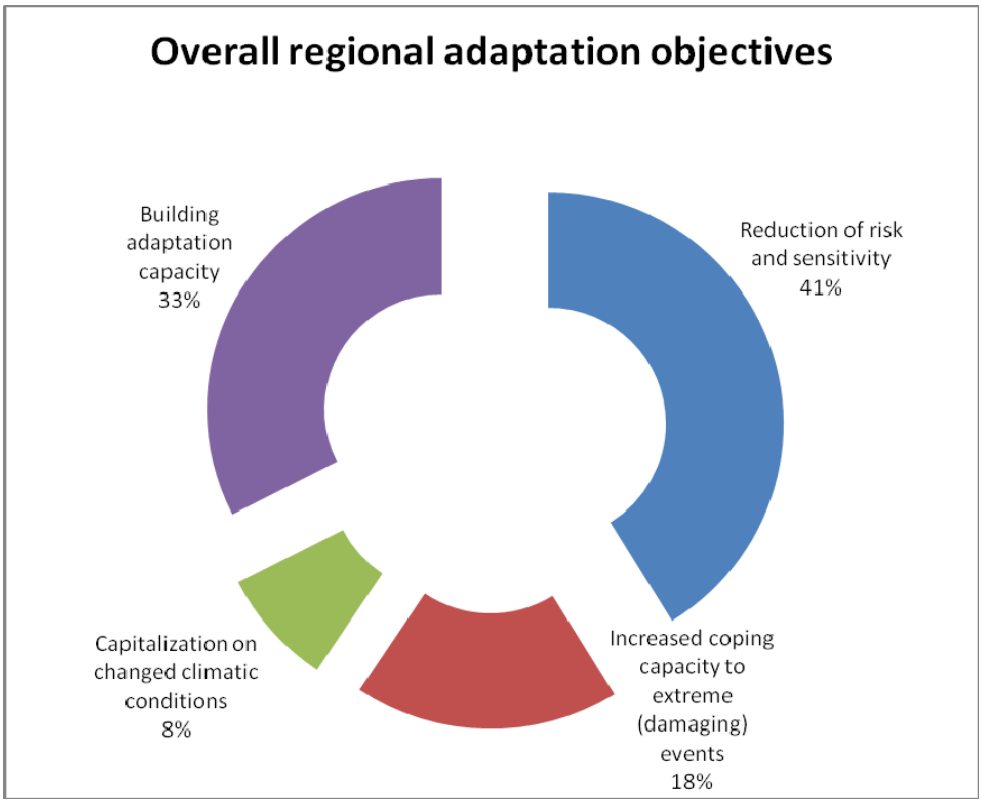

Figure 7: Regional adaptation objectives analyzed in this project

Evidence base for adaptation

Most regional strategies are informed by national or regional expert knowledge, often in the form of climate change scenarios provided by the national meteorological services, or other organizations such as the United Kingdom Climate Impacts Programme (UKCIP) in the UK. In some cases these climate change scenarios are complemented by an assessment of the regional vulnerability. Most often, strategies appear to be based on more general notions of climate change, e.g. assumptions that the temperature, intensive rainfall events and/or droughts will increase without using detailed quantitative information. In countries in which a solid scientific resource base exists, like in the UK and Germany, more advanced scientific information could be used to support strategy development with model-based impact assessment and a relatively large literature database of past and present research results. Countries with a less advanced scientific support capacity appear to rely more on expert opinions and the results of EU studies (e.g. Spain).

Fiscal information

Having assessed and catalogued regional vulnerabilities, strategies were developed as a means for placing adaptation on the political agenda and serve primarily as a blueprint for more concrete action in the future. Comparable to national strategies (Swart et al., 2009), the current regional strategies generally lack estimates of costs or associated financial commitments. This could be a major threat for the effective implementation of the strategies at a later stage. In Germany, the state of Bavaria and the Hamburg region have committed 84.7M€ and 59.7M€ respectively for the implementation of the strategies. In Spain, Pais Vasco and Valencia estimate that the implementation of their strategies would cost 630.6M€ and 10M€, respectively. In some cases (Scotland, Utrecht), the strategies include a commitment to allocate staff to the next phases of plan development.

Annex III: Overview of the guidelines reviewed

A review of guidelines on adaptation in the EU has been conducted. This review aimed to identify key features for developing adaptation strategies and to inform the elaboration of Regional Adaptation Strategies at the European level. This review focused on guidelines only – that is documents that present a methodology or approach for developing an adaptation strategy. It considered guidance documents identified in the screening of the RAS inventory, as well as a number of other guidance documents developed within and outside the EU (Table 7).

Table 7: Adaptation guidelines reviewed in this study

Guidance document	Member State or Regions	Reference used in this report	Level of governance
Guidance developed within European Union			
Scottish Local Climate Impacts Profile (LCLIP) Guidance[20]	Scotland, United Kingdom	LCLIP guidance	Local
The Nottingham Declaration Action Plan[21]	England, United Kingdom	Nottingham Declaration	Local
UK Climate Impacts Programme (UKCIP) 'Identifying Adaptation Options'[22]	United Kingdom	UKCIP Identifying Adaptation Options	All levels
UKCIP 'Adaptation Wizard'[23]	United Kingdom	UKCIP Adaptation Wizard	All levels
European Spatial Planning: Adapting to Climate Events (ESPACE) programme, 'Planning in a Changing Climate'[24]	North West Europe - England, Belgium, The Netherlands and Germany	ESPACE Planning in a changing climate	All levels
ESPACE 'A toolkit for delivering water management climate change adaptation through the planning system'[25]	North West Europe - England, Belgium, The Netherlands and Germany	ESPACE water management guidance	Transboundary
'Towards Climate Change Adaptation Strategies in the Baltic Sea Region'[26]	Baltic Sea Region	ASTRA guidelines	Transboundary

[20] http://www.sccip.org.uk/Projects/Default.aspx?pid=17

[21] http://www.energysavingtrust.org.uk/nottingham/Nottingham-Declaration/Developing-an-Action-Plan

[22] http://www.ukcip.org.uk/index.php?id=23&option=com_content&task=view

[23] http://www.ukcip.org.uk/index.php?Itemid=273&id=147&option=com_content&task=view

[24] http://www.espace-project.org/part1/publications/ESPACE%20Stategy%20Final.pdf

[25] http://www.espace-project.org/publications/library/SEERA%20toolkit_appendix_7.pdf

[26] Hilpert, K., Mannke, F., Schmidt-Thomé, P., 2007. Towards Climate Change Adaptation Strategies in the Baltic Sea Region - Developing Policies and Adaptation Strategies to Climate Change in the Baltic Sea Region, Espoo Available at: http://www.astra-project.org/

NordRegio, 'Climate Change Emergencies and European Municipalities: Guidelines for Adaptation and Response'[27]	Norway, Sweden, Finland	NordRegio guidelines	Transboundary
'Climate Change, Impacts and Adaptation Strategies in the Alpine Space'[28]	Alpine regions	Alpine guidance	Transboundary
United Nations Economic Commission for Europe (UNECE) 'Draft Guidance on Water and Climate Adaptation'[29]	Europe-wide	UNECE guidance	Transboundary
Other Guidance			
International Council for Local Environmental Initiatives (ICLEI) guidance 'Preparing for Climate Change: A Guidebook for Local, Regional and State Governments'[30]	International	ICLEI guidance	All levels
The Australian Government's Climate Change Impacts & Risk Management Guide for Business and Government[31]	Australia	Australian guidance	National
The USAID Guidance Manual for Development Planning[32]	United States	USAID guidance	National
United Nations Development Programme (UNDP) guidance on 'Formulating an Adaptation Strategy'[33]	International	UNDP guidance	All levels

The map shown in Figure 8 highlights the coverage of the guidelines reviewed in this report. Where guidelines are transboundary or have been developed by multiple partners, the lead country is highlighted.

[27] Nordregio (2009) Climate Change Emergencies and European Municipalities. Guidelines for adaptation and response. Page 3.

[28] http://www.climchalp.org/images/stories/documents-final_texts/climchalp_common_strategic_paper_en.pdf

[29] UNECE. Adaptation for Transboundary Water. Available at: http://www.preventionweb.net/files/8986_GuidanceWaterClimateAdaptationfinaldraftamsterdam.pdf

[30] http://www.icleiusa.org/action-center/planning/guidebooks

[31] http://www.climatechange.gov.au/impacts/publications/risk-management.html

[32] USAID. Guidance manual for development planning: Adapting to Climate Variability and Change. Available at: http://www.usaid.gov/our_work/environment/climate/docs/reports/cc_vamanual.pdf

[33] http://www.undp.org/climatechange/adapt/apf.html

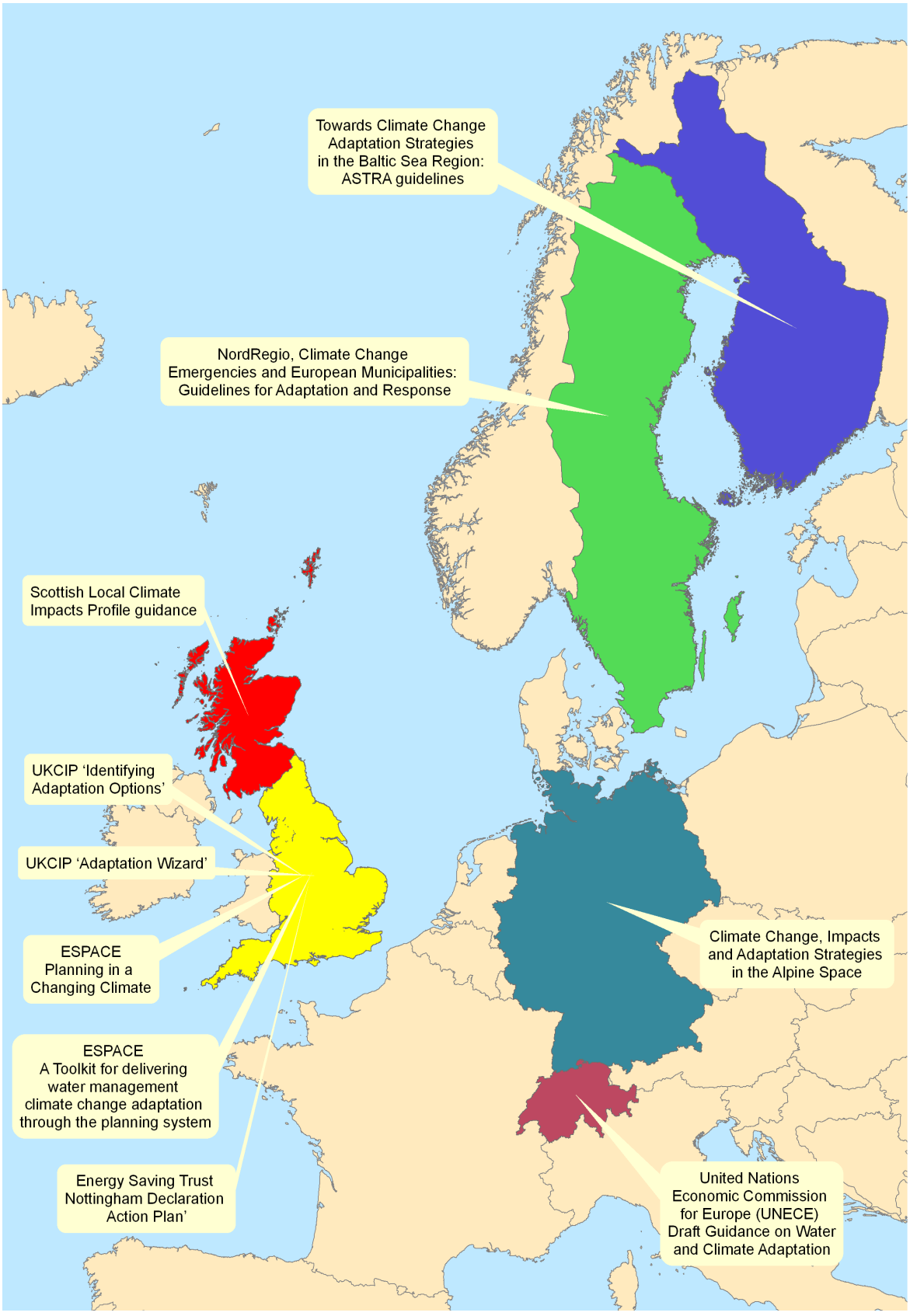

Figure 8: Map illustrating selected countries across the EU which have produced adaptation guidelines

This report does not present a comprehensive review of all existing adaptation guidelines in the EU. The Guidance documents reviewed in this report are only a sample of what is available and documents have been selected to represent a broad spectrum of guidance developed within and outside the EU.

Annex IV: Results from the analysis of existing guidelines

1. Gaining political backing and managerial commitment

As a first step in developing an adaptation strategy, a preparedness group comprising a leader and core team should be established (Nottingham Declaration). At this stage, key actions include identifying a 'climate champion' who can communicate with the public (different to the leader of the group), understanding the audience, developing a preparedness message and then spreading this message (ICLEI guidance).

To help gain backing, it is recommended to secure a meeting with corporate management and present a brief on why a climate change adaptation strategy is needed. If backing cannot be secured, involve staff across all departments within the local government as they may then influence their own managers. Making a statement about the motivation for considering climate change adaptation as well as the attitude towards climate risk can provide another substantial case upon which to seek managerial and political backing (e.g. UKCIP Adaptation Wizard).

Once established, the team's role will be to conduct a climate resilience study, identify priority action areas, set goals, implement the plan and finally measure, monitor and review the plan. The success of an adaptation strategy is dependent on cumulative action across departments and by forming a group, actions can be monitored and coordinated at a more strategic level (ICLEI guidance).

2. Embedding climate change adaptation within existing plans, policies and programmes

The integration of adaptation actions into existing policy can be instigated through existing regulatory mechanisms such as the Strategic Environmental Assessment (SEA) Regulations, enacted in Europe by the Directive 2001/42/EC (). SEA is a tool for assessing the potential implications of plans and programmes on the environment and it aims to integrate environmental issues into the planning process at an early stage. Climate Impact Assessment is suggested as a way to ensure climate considerations in planning in the future.

Other tools for integrating adaptation into existing policy have been developed but not reviewed in detail in this report. These include Spanish guidelines for the development of emergency plans to cope with drought in urban centres as well as guidance which helps reconcile adaptation and mitigation: 'Adaptation and Mitigation - an Integrated Climate Policy Approach' (AMICA guidance).

3. Developing an evidence base

A robust adaptation strategy will be based on sound science and the best available technology. Examples of climate change scenarios: the United Kingdom Climate Projections 2009 (UKCP09) provides climate change projections in the UK and is widely used by regional and local authorities, as well as other practitioners, to develop adaptation strategies in the UK. At the EU level, **PRUDENCE** regional climate models are tools used in many of the RAS reviewed to illustrate projected changes in future climate. The **IPCC climate change scenarios** are used in many of the other EU Member States' strategies. Other sources of scientific evidence include flood risk maps which indicate how a region is likely to be impacted under changing patterns of precipitation (UNECE guidance).

Meteorological offices, national datasets, government departments' archives, journalistic sources and research institutes are other useful sources of scientific evidence for climate change (Nordregio guidance, LCLIP guidance).

Once evidence has been gathered on the projected impacts of climate change, a **risk assessment** can be undertaken. Climate risk is the result of the interaction of physical hazards with the sensitivity or vulnerability of the exposed systems (UNDP guidance). There are different ways of conducting a risk assessment: in general, the process will involve evidence gathering, identification and analysis of risks, evaluation of risks using a 'low, medium or high' ranking system with justifications given to the ranking of each impact. Alternatively, rankings can be converted into number form to provide a quantitative assessment of risks (ICLEI guidance). **Flood risk assessments** are prepared by or for developers and aim to assess the impact that developments may have on flood risk (ESPACE water management guidance).

4. Identification of key vulnerabilities

During a vulnerability analysis, climate and socioeconomic factors that may enhance vulnerability, including geography, demographics and economics, should be assessed in order to identify those sectors, regions or groups most vulnerable to climate change impacts (ASTRA guidelines). A sensitivity analysis can be carried out at a strategic level or for priority areas, for example, transport, health or tourism. This information is typically compiled in a vulnerability matrix. Key vulnerabilities can be identified through researching journalistic sources such as local and national newspaper media (LCLIP guidance, Nordregio guidance).

5. Selection and assessment of adaptation options

There are different ways to select adaptation options. Establishing a set of guiding principles can help to focus on the reasons for adapting in the first place (see Box 5).

Box 5: Possible guiding principles for a climate resilient community

- Increase public awareness of climate change and its impacts
- Increase technical capacity for adapting to climate change
- Mainstream information about climate change vulnerabilities, risks and impacts into planning, policy and investment
- Increase the adaptive capacity of built, natural and human systems
- Strengthen community partnerships to reduce vulnerability and risk to climate change

Source: ICLEI guidelines

Once adaptation options have been identified they should be assessed in terms of cost benefit and relevance. Cost benefit analysis is often used to quantify the cost of adapting to climate change through an analysis of monetary cost versus social, environmental and economic benefits (ASTRA guidance, UNECE guidance). Avoiding mal-adaptation is also important to avoid actions which limit or restrict future adaptations. One must consider the impact of adaptation options on mitigation options and vice versa (ASTRA, ESPACE guidance).

Some of the questions to consider when assessing adaptation options include 'are the actions robust under different climate change scenarios?' 'Can these actions can be adjusted to take into account changing technology or climate science?' 'How easy are the actions to be implemented and within what timeframe?'

6. Stakeholder engagement and communication

Once adaptation options have been selected, the adaptation strategy can be compiled. This stage should effectively engage stakeholders in order to maximise understanding and acceptance of the strategy (Nottingham Declaration, UKCIP Adaptation Wizard, Alpine guidance, UNECE, USAID). This is considered key to a successful strategy. Stakeholders have a variety of roles to play: this information is conveyed by use of a flow diagram outlining the roles and responsibilities of stakeholders to provide knowledge, skills and experiences in Figure 9.

Different degrees of participation, from non-participation which involves a one-way exchange of information from policy makers to participants, to engagement where stakeholders are able to inform the decisions made, will be necessary at different times of the process and it is important that these are established early on in the process to provide maximum benefits.

There is added value in stakeholder engagement. By having planners and developers work in collaboration, knowledge transfer will be made easier as bodies will be able to advise, support and implement the adaptation strategy. Stakeholders must be consulted at the appropriate stage in the design of the strategy. For instance, before developing the strategy, there should be consultation on the needs of the community (ESPACE guidelines, Nordregio guidelines).

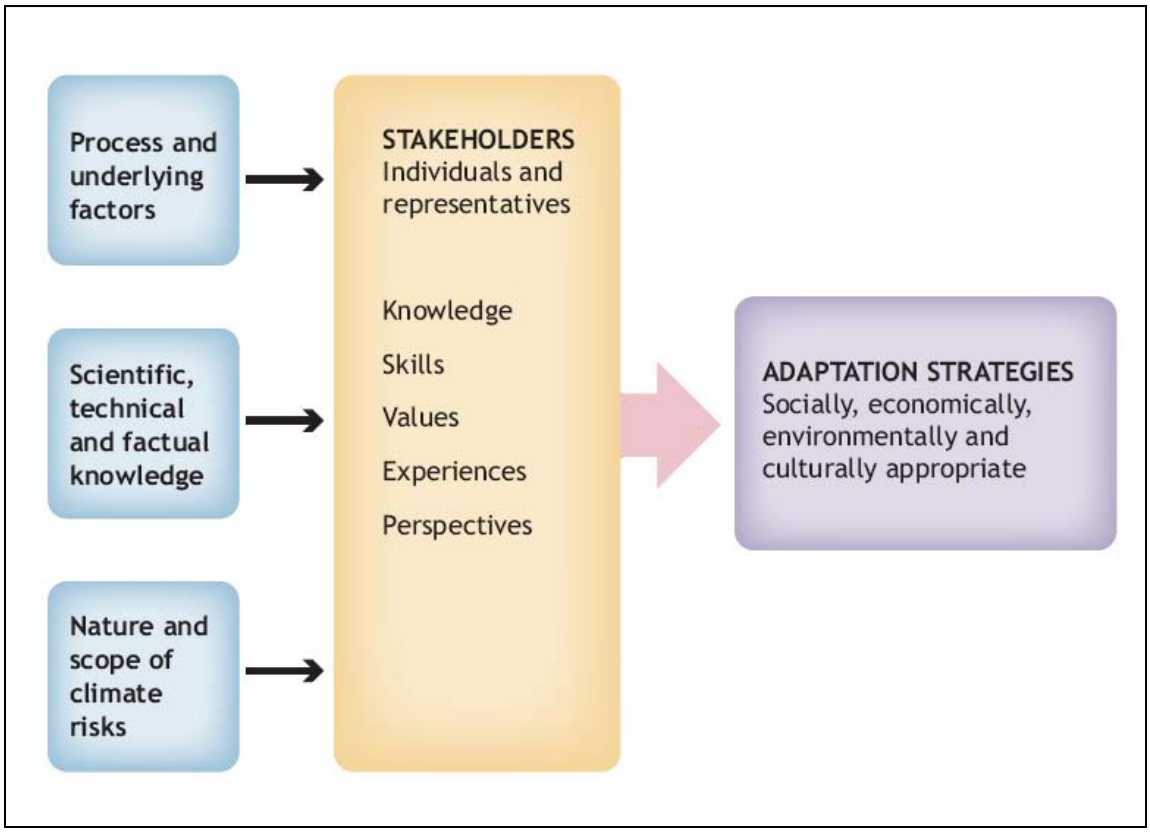

Figure 9: Process of developing an adaptation strategy and some key features (Source: UKCIP, Identifying Adaptation Options).

7. Monitoring, evaluation and review

Strategies should be reviewed on an annual basis or more frequently to ensure the effectiveness of adaptation decisions and to keep it relevant (UKCIP guidelines).

There are a range of methods for monitoring the progress of an adaptation strategy, including setting targets and indicators. Targets should be specific, measurable, achievable, realistic and time-framed (ICLEI, UNECE). Indicators can then be used to measure the success of the strategy. Other ways to measure progress include conducting public surveys, monitoring the number of visits to a climate change community website and monitoring the number of requests for climate change literature (ICLEI).

Annex V: Criteria for assessing the impacts of adaptation actions

Criterion	Indicators	Questions to be asked
Effectiveness of adaptation	Adaptation function	Does the option provide adaptation in terms of reducing impacts, reducing exposure, enhancing resilience or enhancing opportunities?
	Robustness to uncertainty	Is the option effective under different climate scenarios and different socio-economic scenarios?
	Flexibility	Can adjustments be made later if conditions change again or if changes are different from those expected today?
Side-effects	No regret	Does the option contribute to sustainability and bring benefits in terms of alleviating pre-existing problems?
	Win-win (or win-lose)?	Does the option entail side-benefits for other social, environmental or economic objectives? E.g. does it: • Help to reduce social inequality • Decrease energy demand • Require the benefactor to pay for additional services • Etc.
	Spill-over effects	Does the option affect other sectors or agents in terms of their adaptive capacity? Does the option cause or exacerbate other environmental pressures?
Efficiency/ costs and benefits Efficiency/ costs and benefits	Low-regret	Are the benefits the option will bring high relative to the costs? (If possible, consider also distributional effects (e.g. balance between public and private costs), as well as non-market values and adverse impacts on other policy goals)
	Low-regret	Will the options deliver non-linear benefits, e.g. will there be a period of relatively little (or negative) benefit before full-benefits are realized? How does this non-linearity affect different groups in society?
Framework conditions for decision-making	Equity and legitimacy	Who wins and who loses from adaptation? Who decides about adaptation? Are decision-making procedures accepted by those affected and do they involve stakeholders? Are there any distributional impacts of the climate change impacts or of the adaptation options?

Criterion	Indicators	Questions to be asked
	Feasibility of implementation	What barriers are there to implementation? • Technical • Social (number of stakeholders, diversity of values and interests, level of resistance) • Institutional (conflicts between regulations, degree of cooperation, necessary changes to current administrative arrangements)
	Alternatives	Are there alternatives to the envisaged adaptation option that would e.g. be less costly or would have fewer negative side-effects?
	Priority and urgency	How severe are the climate impacts the adaptation option would address relative to other impacts expected in the area/river basin/country? When are the climate change impacts expected to occur? At what timescales does action need to be taken?

Source: Adapted from Report on good practice measures for climate change adaptation in river basin management plans, EEA 2009, forthcoming

Annex VI: Other sources of information

Step1: Examples, tools and sources of relevant information

1. General sources of peer-to-peer information

- **wikiADAPT**[34] is a flexible, accessible, inclusive medium for enhancing the **knowledge base** of the climate adaptation community.

- **Learn how other regions are adapting to climate change.** Contacting and reading previous adaptation documents from peers at regional level may speed up the learning process and provide excellent opportunities for knowledge sharing and the exchange of good practice. ENCORE working group on climate change collects 19 EU regions policies and actions on climate change adaptation and mitigation.

2. Climate Change Partnerships and other stakeholder processes

- Where available, **climate change partnerships** provide useful networks for sharing information and processes between regions. Such partnerships can also provide useful channels for identifying appropriate stakeholders to involve in the RAS process. Sectoral partnership groups, such as water management partnerships or local economic partnerships may also provide this stakeholder network function.

    - In the UK, each region of England, as well as Scotland and Northern Ireland, have a Climate Change Partnership. These partnerships operate as networks of stakeholders and facilitators of adaptation by providing information, tools and examples and by involving local stakeholders in climate change initiatives. The UKCIP Identifying Adaptation Options document provides guidance on how to work in partnership, identify and engage the community and ensure they are well informed. Stakeholders contribute through the knowledge and skills that they bring to the process. The UKCIP document includes a flow diagram of roles and responsibilities for stakeholders.

- Another option for identifying RAS stakeholders and sharing information is via roundtable discussions and multi-stakeholder processes. In the Islas Baleares region of Spain "Action plan against climate change", stakeholders were consulted via **roundtable discussions** on a draft of suggested actions for Local Authority service providers. They were also invited to send in comments on the suggested actions for other service providers.

- The **HarmoniCOP project's (2002 -2005)**[35] objective was to generate practical information about participation processes in river basin management and to support the implementation of the public participation provisions of the European Water Framework Directive (WFD). Especially in drought and flood-prone regions, the process of implementing the WFD at river

[34] Further information can be found at http://wikiadapt.org/index.php?title=Main_Page

[35] HarmoniCOP handbook "Learning together to manage together – Improving participation in water management". Available at http://www.harmonicop.uos.de/handbook.php

basin level will involve steps that are also key to developing RAS. The common steps between RAS and River Basin Management Plans are:

1. Risk assessment - the summary of significant pressures and impact of human activity on the status of surface water and groundwater (Article 5, WFD)
2. Monitoring and assessment of the status of surface water (ecological and chemical) and groundwater (chemical and quantitative) (Article 8 and Annex V, WFD)
3. Objective setting for surface waters, groundwater and protected areas; these objectives should align with RAS objectives related to water (Article 4(4), (5), (6) and (7), WFD)
4. Economic analysis - a summary of the economic analysis of water use (Article 5 and Annex III, WFD); this analysis will support the RAS by providing relevant data that can be used to select adaptation measures
5. A Programme of Measures to be implemented at river basin level that should contribute to achieving environmental objectives; ideally, the PoM will consider future climate scenarios

It is therefore recommendable to engage with the RBM Committees and involve them in the RAS Steering Group.

- **Defra and the Environment Agency**[36] have published a report to raise awareness of the role of local planning authorities in limiting construction in flood areas, and the impact of climate change upon flood risks.

3. Public Commitment

- The **Nottingham Declaration Action Pack (NDAP)**[37] is a mechanism used in England, United Kingdom, to demonstrate Local Authority commitment to assessing climate risks and planning adaptation. To date the Declaration has been signed by over 300 English Local Authorities and all Scottish[38] and Welsh[39] Local Authorities have signed their own versions. In England, National Indicator 188 is used to assess local performance on adapting climate change.

- In the **Islas Baleares region of Spain**, the "Action plan against climate change" interviews were held with directors in residential, industrial, tourism, transport, agriculture and environment sectors. These directors were responsible for implementing measures within these sectors. Meetings with the administrative units of Islas Baleares were also held in order to raise awareness of the impact of climate change and gather their support in the implementation of the action plan. Workshops were held and stakeholders were encouraged to email their opinions.

[36] http://randd.defra.gov.uk/Document.aspx?Document=FD2007_2046_TSM.pdf

[37] http://www.energysavingtrust.org.uk/nottingham

[38] http://www.sustainable-scotland.net/climatechange/

[39] http://www.wlga.gov.uk/english/archive-of-reports9/welsh-declaration-on-climate-change-1/

4. Steering Group

Establishing a RAS **Steering Group** is a useful way to keep the RAS on track. The project leader or climate champion (e.g. an individual within a key agency) will take the initiative and convene influential members of key partner organisations to the Steering Group. The composition of this Steering Group should strongly reflect the expert climate change community and relevant administrative and regulatory bodies who play a role in adaptation. Depending on preliminary objectives settled by the project leader and the context of the RAS, the Steering Group may include Thematic Sub-Groups, for example on water safety, heat and land management, or alternatively organised to monitor particular sectors, such as energy, tourism, biodiversity, communities and water. The 'RAS Steering Group' might meet every few months to monitor progress in the design of the strategy, and, crucially, to monitor and evaluate its implementation. A Steering Group can not only help to improve the quality of the RAS, but may also serve to increase buy-in to the process from important regional stakeholders.

Key actions for the Steering Group include understanding the audience, developing a preparedness message and then spreading this message (ICLEI guidance). This can help gain senior management and political backing, making the RAS more robust and more likely to attract funding (Nottingham Declaration). The North East England Climate Change Adaptation Study was managed by a Steering Group whose members provided valuable direction to the work, contributed essential data and information, provided established links with organisations working across the region, and provided contributions to the format and content of the website.

Step 2: Examples, tools and sources of relevant information

1. Regional Climate impacts

- **Local Climate Impacts Profile (LCLIP)** is a method utilised by Yorkshire and Humber Climate Change Adaptation Study. This method uses findings from recent research and literature on climate trends, press cuttings and Meteorological Office data on recent disruptive weather events can help to raise awareness and act as a starting point for developing an adaptation strategy. This approach uses UK Climate Projections (UKCIP02) under medium-high emissions scenarios in 2050s. It also uses EARWIG, the Environment Agency's Rainfall and Weather Impact Generator.

2. Costing climate impacts

- **UKCIP guidance** provides a methodology for calculating the costs of climate impacts. It explains how to compare these to the costs of adaptation measures and is aimed at decision-makers who will commission and make use of the information resulting from a costing analysis.

- **OECD publication**[40]**: Economic Aspects of Adaptation to Climate Change:** Costs, Benefits and Policy Instruments

- **OECD working paper**[41]**: Economic Aspects of Adaptation to Climate Change:** Integrated Assessment Modelling of Adaptation Costs and Benefits

- **IIED publication**[42]**: Assessing the cost of adaptation to climate change**.

- **McKinsey report**[43]**: Shaping climate resilient development – a framework for decision making**.

3. Climate and socio-economic scenarios

Climate change scenarios should be used to identify potential threats and opportunities of a changing climate. UKCP09, PRUDENCE and IPCC are some of the most commonly used in European RAS. **United Kingdom Climate Projections 2009**[44] (UKCP09) provides climate change projections in the UK and is widely used by regional and local authorities, as well as other practitioners, to develop adaptation strategies.

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[40] http://www.oecd.org/document/2/0,3343,en_2649_34361_40691458_1_1_1_37465,00.html

[41] http://oberon.sourceoecd.org/vl=3016140/cl=33/nw=1/rpsv/workingpapers/19970900/wp_5ksm3715ql23.htm

[42] http://www.iied.org/climate-change/key-issues/economics-and-equity-adaptation/costs-adapting-climate-change-significantly-under-estimated

[43] http://www.mckinsey.com/clientservice/Social_Sector/our_practices/Economic_Development/Knowledge_Highlights/Economics_of_climate_adaptation.aspx

[44] http://ukcp09.defra.gov.uk/

PRUDENCE project will provide high-resolution climate change scenarios for Europe using regional climate models, with results covering 2071 to 2100. Existing climate models do not provide the necessary level of detail for regional vulnerability assessment or adaptation planning, for example because they fail to take into consideration regional topography, such as the Alps. PRUDENCE will use several model results along with expert judgement to quantify the confidence in its results. Several Spanish RAS use PRUDENCE European climate change scenarios, including the Regional strategy of Murcia for Climate Change 2008 – 2012.

IPCC[45]**.** Although the Intergovernmental Panel on Climate Change (IPCC) does not carry out research, they have executed five widely cited climate assessments based their research on peer reviewed and published scientific literature. The IPCC Fourth Assessment Report contains a helpful chapter on Europe.

Scenarios linking predictions of climate change and socio-economic

- **ENSEMBLES** webportal is intended to provide easy access to regional climate information and results for ENSEMBLES applications users as well as the wider user community. The project develops an ensemble prediction system for climate change to produce an objective probabilistic estimate of uncertainty in future climate at seasonal to decadal and longer timescales. The project links the climate predictions to an extensive range of applications including agriculture, forestry, human health, water resources and energy use and demand

- **UKCIP Socio-economic scenarios** give an explanation of why socio-economic scenarios are important for climate change impact and adaptation assessments; present four national level socio-economic scenarios; and provide guidance on their application at a regional level.

- **GLOWA** develops simulation-tools and instruments, which will allow the development and realisation of strategies for sustainable and future-oriented water management at regional level (river basins of approx. 100.000 km²), while taking into account global environmental changes and socioeconomic framework conditions. GLOWA has five projects; two of them are located in Germany (Danube, Elbe), the others are investigating river catchment areas in North and West Africa (Drâa, Ouémé, Volta) as well as in the Middle East (Jordan). Each of these projects is tackling the following scientific core themes in an interdisciplinary and integrative research approach: i.) Climate change, variability of precipitation, variations caused by human activities and their effect on the hydrological cycle, ii.) Interactions between biosphere/ land use and the hydrological cycle, iii.) Water availability and conflicting water uses.

4. Tools to assess vulnerability and vulnerability indicators

- **Vulnerability assessment** can be based on expert opinion and the results are used to prioritise areas of action. This approach is found in the RAS of Pais Vasco. This relates to the soft approach covered in **Australian guidance,** which states that a brainstorming approach could be adopted at an early stage in the process, allowing stakeholder engagement to be factored in. Following the ranking of vulnerabilities, a workshop could be held in order to confirm the priorities identified.

[45] http://www.ipcc.ch/

- **Vulnerability assessment** follows a technical approach in the RAS of Westphalia in Germany. This region developed regional high resolution climate projections which are later linked to a database of ecological and social indicators.

- **Nordregio guidance** suggests the following procedure to gather evidence on climate change vulnerability:

    1. Assemble archival information about past and more recent extreme weather events in the local area. *Consult local sources within the community and in the administration.*
    2. Gather information about the climate changes predicted in the future. *Consult meteorological institutes, research institutes and other statistical sources that might be able to provide such data.*
    3. By considering the past, present and future climatic conditions in the local area we can compare and then assess the future impacts on the community.
    4. Map out the impacts and identify the vulnerable areas in the community. Create a model for constant monitoring of climate change impacts and define a local climate change scenario that in turn can form a basis for future actions.

- Vulnerability can also be assessed on a **parameter-by-parameter basis**, for example, vulnerability to flooding, followed by drought, then health (e.g. the London Climate Change Adaptation Strategy). A map of flood risk is presented followed by analysis of areas affected, the number of times the Thames Barrier has been closed and the likelihood of flooding at various times of the year according to area in London.

- The concept of climate change vulnerability indicators is new to the academic and policy community. There is therefore a lot of additional research and data collection or management work to be done before indicators can be produced easily at the regional level. However, some attempts have been made to develop indicators of vulnerability to climate change, including: the **Regions 2020 Project.** Within this project a climate change vulnerability index was created, which gave a simplified overview of vulnerability across the EU (with a focus on exposure to specific climate hazards). The purpose of this index was to raise awareness of the spatial distribution of vulnerability across regions of the EU.

- Adaptive capacity was deconstructed into components: Equality, Knowledge, Technology, Infrastructure, Flexibility and Economic Power by the **ATEAM project** (Advanced Terrestrial Ecosystem Analysis and Modelling). The results are available in a layered map format along with other outputs from the ATEAM research.

Societal vulnerability to climate change is very difficult to define and therefore to measure. Vulnerability Indicators are more likely to be useful if they are developed to assess the vulnerability of a specific system to a particular kind of harm resulting from climate change.

DG Environment has commissioned a study looking at the feasibility of developing a set of Climate Change Vulnerability Indicators, which could be used to support adaptation policy at EU level. The outcome of this project (available end 2009) will be threefold:

- a 10-Step process for developing Vulnerability Indicators, which could be applied at any institutional level and could therefore be added to a further version of the present guidelines;

- the identification of key issues for which a vulnerability indicator should be developed at EU level, according to 3 criteria (high risk, EC role, aggregation potential);

- a short list of key issues for which data is already available, together with the presentation of maps and indicators at NUTS-2 level.

The outcomes of this project may be used informally by regional decision-makers to undertake an assessment of vulnerability within the region. However, it is unlikely that many authorities will choose to develop their own vulnerability indicators, as this will be costly and highly complex. If attempts are made to develop basic indicators, the following key principles should be noted.

- Be clear on what the policy objective of the indicator is (e.g. to raise awareness of how vulnerability is distributed within the region)
- Be transparent in how the variables that are used to make up the indicator are chosen
- Involve stakeholders, particularly end-users of the indicator, in any decisions and development of a methodology (ultimately it is users who will assess the value of the indicator when it is applied)
- Ensure that sufficient data is available to mobilise the indicator
- Do not over-interpret the results of indicators –early models will provide simplified assessments that should not be treated as the only evidence upon which to base policy or investment decisions

The European Commission will further develop key vulnerability indicators during Phase I of EU's Adaptation Strategy (2009-2012), as set out in the White Paper on Adaptation.

5. Tools for risk assessment

Australian guidance for Risk Assessment[46] provides a framework for climate change risk management that it is based on the results of a stakeholder consultation.

Community-based Risk Screening Tool – Adaptation & Livelihoods (CRiSTAL)[47] is a tool designed to assist project planners and managers integrate risk reduction and climate change adaptation into community-level projects.

6. Various information sources

- **The European Environment Agency report 'Impacts of Europe's changing climate – 2008 indicator-based assessment'**. This report summarises the past trends and future projections for about 40 indicators (from 22 in the 2004 report). The indicators cover atmosphere and climate, the cryosphere, marine systems, terrestrial systems and biodiversity, agriculture and forestry, soil, water quantity (including floods and droughts), water quality and fresh water ecology, and human health. The report also addresses adaptation and the economics of climate change impacts and adaptation strategies and policies, and data availability and uncertainty.
- **The Impact Assessment accompanying the White Paper on Adaptation**. This assessment discusses the key concepts of climate change, identifies the most vulnerable EU sectors and regions and proposes better coordination of action at different levels. It advocates a screening

[46] http://www.climatechange.gov.au/impacts/publications/pubs/risk-management.pdf

[47] http://www.iisd.org/PUBLICATIONS/pub.aspx?pno=854

of the potential adaptation options with an early assessment and prioritisation of adaptation options. The White Paper IA supports incremental and responsive action towards an EU adaptation strategy, which should lay the ground for future EU action.

- **European Environmental Agency**. This website hosts items and reports with useful information on climate change and adaptation in Europe.
- **European Commission Joint Research Centre website** hosts information on a number of relevant research projects. For example:
    - A **Pan-European River and Catchment Database** provides digital data on river networks, lakes and drainage basins (catchments) are an important data for modelling hydrological processes, including the analysis of pressures and their impact on water resources.
- **EUROSTAT website** provides socio-economic statistical data for regions across the EU
- National websites

  Denmark: national web portal for climate change adaptation

  France: Observatoire national sur les effets du réchauffement climatique (ONERC)

  Germany: KomPass

  Netherlands: Platform Communication on Climate Change

  Norway: Information platform, "Norwegian Climate Adaptation Programme"

  Sweden: Klimatanpassningsportalen

  United Kindom: United Kingdom Climate Impacts Programme (UKCIP)

7. EU funded projects

Project name	**Description**	**Status on 28.09.09**
CLIMATEWATER: Bridging the gap between adaptation strategies of climate change impacts and European water policies	The Project analyses and syntheses of data and information on the likely water related impacts of the changes of the climate with special regard to their risk and to the urgency of getting prepared to combat these changes and their impacts. The Project identifies all adaptation strategies that developed in Europe and also globally for handling (preventing, eliminating, combating, mitigating) the impacts of global climate changes on water resources and aquatic ecosystems, including all other water related issues of the society and nature. The most important output of the project will be the identification of gaps that would hinder the implementation of the EU water policy in combating climate impacts on water. **Project start date:** [2008-11-01] **End Date:** [2011-10-31]	Beginning
WATERWORLDS: natural	The project studies local, social responses to environmental disasters related to water. For example, responses to the melting	Beginning

environmental disasters and social resilience in anthropological perspective	of ice in the Arctic and in other glacier areas, the rising of seas that flood islands and coastal communities, and the drying of lands accelerating desertification in large parts of Africa and elsewhere. The proposed research is groundbreaking empirically as well as theoretically. Empirically it contributes a substantial ethnographic supplement to the sweeping diagnoses of the global malaises captured in notions like global warming . Theoretically, the project allows for a new, general understanding of the effects of environmental disaster on social life, and of the responsibility that people take locally to ensure the survival of their community. The project rethinks the human implications of global climate change by way of an explication of what is and what can be done on the ground. **Start date:** [2009-01-01] **End Date:** [2013-12-31]	
FUTURESOC: Forecasting societies adaptive capacities to climate change	This interdisciplinary project (combining social and earth sciences) addresses a gap in the knowledge of global assessments concerning the likely consequences of future climate change on future human wellbeing. This rather complex project structure is necessary for reaching generalizable and useful results. All components have been designed to complement each other to maximize the chances of achieving path-breaking and at the same time tangible results in this highly complex, multidisciplinary field. S**tart date:** [2009-03-01] **End Date:** [2014-02-28]	Beginning
BACCARA: Biodiversity and climate change, a risk analysis	Forecasting forest diversity under the influence of climatic changes and the consequences for stability and productivity of forest ecosystems. Forecasting the effect of climate change on forest productivity through changes in tree species composition. The forecast will be expressed as a risk of dysfunction, in particular the risk of forest productivity loss. The project will consider hazards as changes in average and extreme climatic conditions. Vulnerability for the project is the vulnerability to climate change of forest species that both shape forest composition and are the main drivers of forest biomass productivity. The objective is the generalization of project results to diverse types of European forest. **Start date:** [2009-01-01] **End Date:** [2012-12-31]	Beginning
MOVE: Methods for the improvement of vulnerability assessment in Europe	The objective of this project is to provide policymakers, public administrators, researchers, educators and other stakeholders with an improved generic framework and methodology for the measurement and assessment of vulnerability to natural hazards in Europe's regions. **Start date:** [2008-10-01] **End Date:** [2011-09-30]	Beginning
IMVUL: Towards improved groundwater vulnerability assessment	The project aims to train researchers in the major issues and processes relevant to groundwater vulnerability. The network consists of 8 partners in the United Kingdom, France, Spain, Italy, Israel and Norway and 13 associated partners from the water industry. The research objectives are to increase our understanding of the fundamental processes relevant to groundwater vulnerability and develop improved prediction tools. **Start date:** [2008-10-01] **End Date:** [2012-09-30]	Beginning

MEECE: Marine ecosystem evolution in a changing environment	MEECE is a scientific research project which aims to use a combination of data synthesis, numerical simulation and targeted experimentation to further the knowledge of how marine ecosystems respond to combinations of multiple climate change and anthropogenic drivers. MEECE will improve the decision support tools to provide a structured link between management questions and the knowledge base that can help to address those questions. **Start date:** [2008-09-01] **End Date:** [2012-08-31]	Beginning
CLIMATECOST: Full costs of climate change	The objectives of this study are to advance knowledge of the full economic costs of climate change, through the following tasks: i. To identify and develop consistent climate change and socio-economic scenarios, including mitigation scenarios, ii. To quantify in physical terms, and economic costs, the costs of inaction for these scenarios, iii. To extend analysis to quantify and value the costs and benefits of adaptation, and the residual costs of climate change after adaptation, iv. To asses the physical effects and economic damages of a number of the most important major catastrophic events and major socially contingent effects, v. To bring all the information above together to provide policy relevant output, including information on physical effects and economic values, and undertake analysis of policy scenarios. **Start date:** [2009-01-01] **End Date:** [2011-08-31]	Beginning
ACQWA: Assessment of climatic change and impacts on the quantity and quality of water	The project aims to assess the impacts of a changing climate, focusing on the quantity and quality of water originating in mountain regions, particularly where snow- and ice melt represent a large, sometimes the largest, streamflow component. The goal of the project is to use advanced modelling techniques to quantify the influence of climatic change on the major determinants of river discharge at various time and space scales, and analyse their impact on society and economy, also accounting for feedback mechanisms. Regional climate models will provide the essential information on shifting precipitation and temperature patterns, and snow, ice, and biosphere models will feed into a hydrological model in order to assess the changes in basin hydrology and seasonality, amount, and incidence of extreme events in various catchment areas. Environmental and socio-economic responses to changes in hydrological regimes will be analyzed in terms of hazards, aquatic ecosystems, hydropower, tourism, agriculture, and the health implications of changing water quality. **Start date:** [2008-10-01] **End Date:** [2013-09-30]	Beginning
CCTAME: Climate change - terrestrial adaption and mitigation in Europe	The project will assess the impacts of agricultural, climate, energy, forestry and other associated land-use policies, considering the resulting feed-backs on the climate system. Geographically explicit biophysical models together with an integrated cluster of economic land-use models will be coupled with regional climate models to assess and identify mitigation and adaptation strategies in European agriculture and forestry. The role of distribution and pressures from socio-economic drivers will be assessed in a geographically nested fashion. **Project start date:** [2008-06-01] **End Date:** [2011-05-31]	Beginning
ENSURE:	The objective of ENSURE is to structure vulnerability	Beginning

Enhancing resilience of communities and territories facing natural and na-tech hazards	assessment model(s) in a way that different aspects of physical, systemic, social and economic vulnerability will be integrated as much as possible in a coherent framework. The ENSURE approach starts from the recognition that for all considered hazards most of damages and most of vulnerabilities arise from the territory, including artefacts, infrastructures and facilities. **Project start date:** [2008-06-01] **End Date:** [2011-01-31]	
ADAM: Adaptation and Mitigation Strategies: Supporting European climate change	The objective of this project was the assessment and appraisal of existing and development of new and innovative EU climate policies. The specific objectives were: i. to assess the extent to which existing climate policies can achieve a socially and economically tolerable transition to a world with a global climate no warmer than 2°C above pre-industrial levels, ii. to develop a portfolio of longer-term policy options that could contribute to the EU's 2°C target and targets for adaptation, iii. to develop the requirements for climate change appraisal in different contexts to enhance the emergence of innovative mitigation and adaptation strategies. **Start date:** [2006-03-01] **End Date:** [2009-07-31]	Completed
CECILIA: Central and Eastern Europe Climate Change Impact and Vulnerability Assessment	To deliver a climate change impacts and vulnerability assessment in targeted areas of Central and Eastern Europe. Emphasis is given to applications of regional climate modelling studies at a resolution of 10 km for local impact studies in key sectors of the region **Start date:** [2006-06-01] **Ongoing**	Ongoing with Deliverables
CIRCE: Climate change and impact research: the Mediterranean environment	CIRCE aims at developing for the first time an assessment of the climate change impacts in the Mediterranean area. The objectives of the project are: i. to predict and to quantify physical impacts of climate change in the Mediterranean area; ii. to evaluate the consequences of climate change for the society and the economy of the populations located in the Mediterranean area; iii. to develop an integrated approach to understand combined effects of climate change; iv. to identify adaptation and mitigation strategies in collaboration with regional stakeholders.	Ongoing with Deliverables

The forthcoming DG Environment research report into vulnerability indicators also lists a number of European models and projects that provide relevant information for assessing vulnerability in a number of key systems, including Agriculture, Forestry, Biodiversity, Water, Coasts, Tourism, Urban, Disaster Risk Management, Climate, Energy, Land Use, Transport, Waste, Demography, Economy, Integrated Models.

Step 3: Examples, tools and sources of relevant information

1. Tools to support the integration of RAS into current political strategies

ESPACE guidance discusses provisions for including adaptation strategies into the planning policy:

- **Development Plan Document (DPD) policies** form the basis for development control decision making and are essential to ensure that the correct climate change adaptation measures are implemented where practicable.
- **Supplementary Planning Documents (SPD)** can perform a useful role in enabling Local Planning Authorities to provide additional guidance and advice to developers.
- **Local planning authority (LPA) involvement in the design process** helps to ensure that decisions made at the earliest design stages consider the need for adaptation measures.
- **Planning conditions and obligations** are legal delivery mechanisms to deliver the requirements that are articulated in policy and guidance and through discussions with developers.
- Where it is inappropriate for LPAs to impose conditions or negotiate planning obligations, but where the LPA considers that the developer should be made aware of certain matters, it is possible for the LPA to attach a short statement known as an **informative** to any consent.

2. Tools to define success and set targets

- **ICLEI guidance** explains how to establish a vision for a climate resilient community, and how to use it as a guiding principle for resilience. This vision and principles are then used to inform the process of setting goals in priority planning areas.
- **UNECE Guidance** recommends setting targets through reflection on political principles.

Step 4: Examples, tools and sources of relevant information

1. Tools to select and assess adaptation options

It is necessary to screen adaptation options in order to determine which are most suitable for the regional adaptation strategy. There is different ways of selection adaptation options.

- **AMICA matrix** of adaptation options[48]. This matrix is a tool to explore the various possibilities of adapting to climate change on the regional level. The matrix has more than 40 adaptation options, which are assigned to four impact types (columns) and nine categories of measure (rows). By clicking on a single measure one is directed to its webpage which contains a detailed description of the measure, internet links, and material for download.

- **ADAM digital compendium**[49] This Digital Compendium acts as a portal for the dissemination of the transdisciplinary results from the following five types of analysis carried out in the ADAM Project:

    - Workshops and interviews were conducted and synthesised into key messages about what supports and what hinders adaptation and a set of learning examples that describe the experiences that decision makers and organisations have gained in the adaptation learning processes.
    - A meta-analysis of climate change impact, vulnerability and adaptation case studies was performed in order to give a systematic account of what is known in the literature.
    - A macro-economic analysis was conducted to estimate the monetary effects of climate change and adaptation for different European countries.
    - An adaptation catalogue was developed to collate information on possible adaptation measures including the extent, feasibility, efficiency, and cost effectiveness of these options.
    - Finally, an analysis of risk of climate-related extremes such as floods and droughts was performed in order to produce risk / damage maps for Europe.

- The **UKCIP's 'The Brain'** [50]provides real examples of adaptation options.

- The **USAID guidance** recommends an initial list of actions to be compiled through discussion with the stakeholders. Following this, stakeholders agree on a process to review, refine and finalise the list of options before they are assessed and ranked. Options should be evaluated for their effectiveness at building resilience to climate impacts identified during the vulnerability analysis. Suggested methods include an assessment matrix using a number of criteria such as cost, feasibility and time.

[48] http://www.amica-climate.net/online_tool.html

[49] http://adam-digital-compendium.pik-potsdam.de/dc-search/

[50] http://www.ukcip.org.uk/index.php?option=com_content&task=view&id=286&Itemid=423

- **ASTRA** and **UNECE** guidance recommend the use of tools such as **Benefit-Cost Analysis** to screen adaptation options. It quantifies the cost of adapting to climate change through an analysis of monetary cost versus social, environmental and economic benefits.

See **Criteria for assessing the impacts of adaptation option** for an example of questions that options should be assessed and ranked before final decision.

2. Tools supporting implementation of adaptation measures

The **USAID guidance** suggest include the following stages in the implementation plan:

- definition of the specific tasks
- timeframe for implementation and description of the roles of implementing partners
- decision-makers and stakeholders
- resource requirements should be defined