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**SUBSIDIARY BODY FOR SCIENTIFIC AND TECHNOLOGICAL ADVICE**
**Twenty-sixth session**
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**Item 3 of the provisional agenda**
**Nairobi work programme on impacts, vulnerability and adaptation to climate change**

# Relevant programmes, activities and views on the issues relating to climate related risks and extreme events

## Submissions from Parties

1. The Subsidiary Body for Scientific and Technological Advice (SBSTA), at its twenty-fifth session, invited Parties to submit to the secretariat, by 23 February 2007, information on their relevant programmes, activities and views on the following issues:[*]

(a) Experience with assessment and management of current and future climate related risks and impacts, including those related to extreme events and in specific sectors;

(b) Ability, gaps, needs, opportunities, barriers and constraints to predicting climate variability, impacts and extreme events across regions and hazards;

(c) Contribution of traditional knowledge to understanding and managing climate related risks;

(d) Implications for sustainable development in relation to sub-paragraphs 1 (a) to (c) above;

(e) Promoting understanding of impacts of, and vulnerability to, climate change.

2. The secretariat has received ten such submissions. In accordance with the procedure for miscellaneous documents, these submissions are attached and reproduced[**] in the language in which they were received and without formal editing.

[*] FCCC/SBSTA/2006/11, paragraph 46.

[**] These submissions have been electronically imported in order to make them available on electronic systems, including the World Wide Web. The secretariat has made every effort to ensure the correct reproduction of the texts as submitted.

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* This submission is supported by Bosnia and Herzegovina, Croatia, Serbia, The former Yugoslav Republic of Macedonia, and Turkey.

PAPER NO. 1: ARGENTINA

**Implementation of the Buenos Aires Programme of Work on Adaptation and Response Measures - Five-year programme of work on impacts, vulnerability and adaptation to climate change**

## Mandate

The COP, by its decision 1/CP.10, requested the SBSTA to develop a structured five-year programme of work for the SBSTA on the scientific, technical and socio-economic aspects of impacts, vulnerability and adaptation to climate change (hereinafter referred to as the programme of work). The COP at its eleventh session adopted a five-year programme of work contained in an annex, requesting SBSTA to start implementation of the programme of work by undertaking the initial activities specified in the SBSTA conclusions and elaborate further additional activities and modalities of the programme of work, *inter alia*. In their conclusions, the SBSTA 23 requested the Secretariat to compile an initial list of organizations and institutions active in areas relevant to the programme of work. The SBSTA 25 agreed to further implement the programme through the activities contained in its conclusions. Under the activities undertaken in line with the objective in the annex to decision 2/CP11 to advance subtheme a (iv) "Promoting understanding of impacts of, and vulnerability to, climate change, current and future climate variability and extreme events, and the implications for sustainable development", the SBSTA invited Parties and relevant organizations to submit to the secretariat information on the issues contained in para. 34 of the conclusions.

Argentina welcomes this opportunity to provide information on relevant programmes, activities and views about the matter. This submission contains relevant information about three Argentinian institutions working on these issues.

**1. Center for Sea and Atmosphere Research** (Centro de Investigaciones del Mar y de la Atmósfera - CIMA)

The Centro de Investigaciones del Mar y de la Atmósfera (CIMA) is an institute of the Argentinian Council of Science and of the University of Buenos Aires, devoted to the research of the climate and ocean system with increasing capability in the development of climate scenarios.

According to its profile and capabilities, CIMA is participating in the assessment of the climate change impacts and the associated vulnerabilities by cooperating in the development of regional climate scenarios to narrow down present uncertainties. In particular, CIMA has experience in the issues included in literals a), b) and e) of para. 34 of the conclusions.

*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;*

- Extensive research with peer reviewed publications on climate variability, including ENSO, and their impacts on hydrology,
- Assessment of current and past climate trends in South-America,
- Experience with MCGs: cooperation with LMD of France in assessing models performance and of some processes,

- MCG scenarios developed for the IPCC Fourth Assessment Report. Assessment of mean and interannual variability of surface climate and atmospheric circulation,
- High resolution modelling: MM5 runs based on HadCM3 model,
- Climate scenarios for the Argentinian First and Second National Communications[1],

*(b) Ability, gaps, needs, opportunities, barriers and constraints to predicting climate variability, impacts and extreme events across regions and hazards;*

*Abilities*
- High level scientific staff with a good understanding of climate variability, impacts and extreme events in southern South-America,
- Insertion in an outstanding College of Sciences, which facilitate the incorporation of talented young scientists,
- High resolution modelling presently running at CIMA with different purposes:
    - Mm5: experimental weather forecast
    - WRF: experimental weather forecast and climate scenarios
    - ETA: climate scenarios
    - PRECIS: Climate scenarios.
    - Mesoscale model experiments on severe convective processes
    - Distributed hydrological model experiments on Plata basin rivers

*Opportunities*
- Growing national awareness of climate change impacts at the country level,
- Growing governmental support to Science,
- Good regional and international cooperation.

*Barriers and constraints*:
- Lack of sufficient computer facilities,
- Modest funding.

*Needs*
- Funds to expand computer facilities,
- Scholarships for training abroad.

*(e) Promoting understanding of impacts of, and vulnerability to, climate change*

CIMA is working in the development of regional climate and hydrological scenarios to reduce their uncertainty. Its activities help to improve the understanding of impacts of, and vulnerability to, climate change.

2. **National University of Rio Cuarto** (Universidad de Río Cuarto) – Departments of Agricultural Ecology (Departamento de Ecología Agrícola), of Agricultural Meteorology (de Agrometeorología), of Economy (de Economía), and of Sociology (de Sociología).

The National University of Rio Cuarto participated in the "Integrated Assessment of Social Vulnerability and Adaptation to Climate Variability and Change Among Farmers in Mexico and

[1] The Second National Communication is under preparation.

Argentina" (AIACC LA-29). In particular, CIMA has experience in the issues included in literals a), b) and e) of para. 34 of the conclusions.

*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;*

In Argentina and Mexico, extreme climatic events and dramatic changes in agricultural and water resource policy have had significant impacts on farmers' livelihoods and thus their vulnerability. The objective of the project was to understand how these multiple sources of change were affecting the livelihoods of vulnerable populations.

Through case studies of agricultural production in both countries, this project has used expertise in climatology, agrometeorology, rural development, political science, economy and geography to address two principle questions: To what degree is adaptation to climate change at regional or farm level constrained and/or facilitated by current trends in institutional change and water and agricultural sector policy? And, how can new climate change and variability research be integrated better into practices and policies to assist processes of agricultural adaptation?

These questions were addressed through an interdisciplinary assessment involving an analysis of climate variability, trends and climate change scenarios; an analysis of the institutional context of production and resource allocation; surveys of farm operations / households concerning climate and non-climate impacts on livelihoods as well as capacity for adaptation; interviews and ethnographic research with a variety of actors in the agricultural sector; and a continued dialogue with key stakeholders, in order to guide the focus of the research as it evolves, and ultimately to develop concrete recommendations for improving adaptive capacity.

The project successfully identified particular subsectors within each case study that demonstrated either higher sensitivity and/or low adaptive capacity to both climate impacts and economic change. Through linking the evaluation of household capacities to trends in the policy environment, the project identified possible public sector interventions that could facilitate local-level risk management.

*(b) Ability, gaps, needs, opportunities, barriers and constraints to predicting climate variability, impacts and extreme events across regions and hazards;*

Uncertainties in the inter-annual weather variability create risky environments for agricultural production, increasing the vulnerability of the whole system. Through the climate analysis performed for the south region of Córdoba (Argentina) during the last four years through the AIACC La 29 project[2], it was found significant correlation of the Southern Oscillation Index (SOI) with rainfall which allows the monthly SOI values to be proposed in the region as a basis for seasonal rainfall predictions. Undoubtedly, future research must be done in the same region to identify other predicting variables besides SOI that may help to improve seasonal forecasts.

The Standardized Precipitation Index (SPI) for different time scale periods was applied for monitoring hydrological conditions and flood risk showing its potential for climate risk monitoring into a regional system as part of a comprehensive flood mitigation program. The characterization of drought by the water supply (precipitation) did not define alone the risk to the phenomenon in the area. By coupling the weather variability (mainly water supply by precipitation) to the spatial variation of the physical resources in the region (soil types, crops water demands, etc.) we identified changes in the risk and vulnerability to drought at which farmers are exposed.

[2] A detailed description of the methodology used to reached these results can be consulted at http://aiaccproject.org)

"Climatic threat spaces" were developed for the area of study as a tool to visualize possible threats to agricultural activities, proving to be an interesting mechanism to integrate social, agronomical and climate studies and to communicate the results to regional experts and stakeholders. A limitation of these threat spaces is that they are not for the analysis of extreme events in daily frequency (frosts, heavy rain, for example), since threat spaces are constructed using seasonal means, which can hide the effect of a daily extreme value. However, using other sources, as newspaper articles, interviews, and surveys, along with specific daily climatic studies, this limitation can be overcome.

*d) Implications for sustainable development in relation to a) to c) above*

Analysis on social vulnerability to climate variability and change carried out during the project, showed that social vulnerability to climate at farm-level is determined as much or even more by socioeconomic factors than by climatic variability and change. This means that particular sub-populations adjustment strategies are necessarily in relation to improving their livelihood stability in face of these types of changes and that these strategies may not address their climatic risk. Collectively, the responses of farm households to the new opportunities and obstacles in the economy may indirectly exacerbate the sensitivity of the case study regions to future environmental change through environmental degradation and land use change. We did not find that any particular system of production is necessarily more sensitive to climate impacts than any other system, but rather, in an economy favoring large-scale commercial production, family and smallholder farmers face economic difficulties that undermine their traditional risk management strategies and diminish their capacities to adjust to new shocks.

Methodologically, we found that comparison between very different farm systems is possible on the basis of the similar factors producing vulnerability (global trends in economic development, similarities in the ideology driving domestic policy and similarities in the impacts of such policy), and compatibility in the generic attributes of adaptive capacity and sensitivity in each case study. However, we also found that the experience of vulnerability is necessarily site specific and vulnerability assessments need to be relevant to the particular governance and/or decision-making unit of the population of study. This means that the variables used to measure vulnerability in each case and the recommendations for enhancing adaptive capacities were developed to reflect the important local social, economic and institutional characteristics of each case in order to not only enhance the capacities of farmers to adopt and implement adaptation measures but also to ensure a more equitable distribution of resources and the sustainability of the socio-economic and environmental system.

*(e) Promoting understanding of impacts of, and vulnerability to, climate change*

We also initiated, in the region of study, a process in which issues of climatic change, variability and extreme events were given new consideration in the development of sector policy. This was accomplished through raising awareness among appropriate sector agencies and stakeholders of the importance of these issues through outreach efforts, and motivating support for the contributions of scientific research in decision-making. In addition, the debate installed in the society through the Project outcomes resulted in an increment of the solicitudes to the government for the design of new infrastructure to deal with floods in the south of the area. Floods events may be exacerbated in the future as climate change scenarios indicated an increment in rainfall mainly during summer and fall but with the highest increases during April (the month with bigger floods in the area). On the other hand, expected rainfall diminutions during the winter may jeopardize the possibility of double cropping although this effect might be ameliorated for the increments expected for the fall. Climate scenarios indicated higher temperatures which on one hand diminish the risk of frosts but on the other hand will reduce the length of the growing season for the summer crops probably causing yields reductions. New policies and regulations should be developed to face increasing

environmental risks in the area; the outputs of this Project will be of technical support to develop and instrument these measures.

The involvement of different stakeholders (farmers, farmers' organizations, grain dealers, city major, city council, etc.) and the mass media support to the activities of the project resulted in a broad diffusion of climate variability and climate change issues in the region creating a fertile and collaborative environment for the development of the project. Following the activities initiated with this project a number of new initiatives were developed by the research team to reinforce stakeholders' involvement (through workshops, conferences, brochure, booklets, web site, etc) to improve current adaptive capacities and enhance future adaptation to climate variability and change in the region. These issues were proposed to be carried out in a new project that was just presented for scientific evaluation and funding. Discussions have also been initiated with researchers from two universities from nearby provinces to develop a network for permanent research, knowledge exchange and adaptation practices and experiences about climate change issues. New research pathways are being undertaken through the collaboration with different stakeholders associations.

**3) Center of Global Climate Change Studies (Centro de Estudios en Cambio Climático Global - Instituto Torcuato Di Tella)**

This research Center is one of the newest branches of a research institution created in 1958, the Institute Torcuato Di Tella (ITDT). The purpose of the creation of the center was to bring together several lines of research being carried by the ITDT, benefiting from a systematic approach in those areas related to global climate change including those related to energy, technology and economics, from the perspective of a developing country. The Center has experience in all the issues included in para. 34 of the conclusions.

*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;*

Argentina has gained experience with the assessment of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors, through the participation of the Center in the preparation of its First (FNC) and Second National Communications (SNC)[3]. The FNC included three impact assessments, while the SNC dealt extensively with identification of adverse effects in diverse regions and sectors of out country. These impacts were considered for different timeframes and scenarios which was made possible through the use of dynamic downscaling techniques.

It has also to be into account that the national research system and its different research centers, under the Ministry of Education, have also been carrying over studies to identify adverse effects on some of the main socioeconomic and natural systems.

In addition, several institutions devoted to climate change research have worked on this same field. Amongst them, Instituto Torcuato Di Tella (ITDT) has assessed vulnerability of the socioeconomic and natural systems in Argentina to changes in climatic and hydrological conditions. Problematic zones were identified and for each of them the potential vulnerabilities were identified and analyzed. In this area work has been done at three different levels: the first one is the assessment of changes occurred and future changes for their consideration at the planning level, with a thirty year

[3] The SNC is under preparation.

horizon and under different scenarios. The second level is the analysis of the vulnerability of infrastructure and of natural systems both under the current climate conditions and for future changes in each of the scenarios previously considered. Finally, general guidance is to be provided in order to prepare adaptation strategies in different critical areas.

Among the studies most recently developed by ITDT related to the adverse effects of climate variability and climate change in Argentina and Latin America, the following can be listed:

- Past and future climatic trends and scenarios.
- Hydrological trends.
- Extreme weather events in the southern cone of South America.
- Urban vulnerability to high precipitation events.
- Road and infrastructure vulnerability.
- Vulnerability to floods in the Plata basin.
- Coastal vulnerability to climate change and antropic direct actions.
- Dam vulnerability to new climatic conditions.
- Economic assessment of climate change impacts in Patagonia.
- Planning for adaptation.

In addition, ITDT has worked on the preparation of an "Environmental agenda for Argentina" that includes specific proposals for addressing climate change issues, and of a study on "Environmental NGOs in the MERCOSUR" as part of an overall study on governance and integration in the MERCOSUR.

*(b) Ability, gaps, needs, opportunities, barriers and constraints to predicting climate variability, impacts and extreme events across regions and hazards;*

Although the inception of the ITDT is relatively recent, The Institute has worked intensively in developing a conceptual framework to address adaptation.

However, while scientific and technical capacities are available in Argentina and, in particular, in ITDT to work in this field, the main constraints are related to the changing environment for political decision making, the scarcity of budgetary resources to work on the wide of scope of adverse effects in Argentina, and the limited awareness by public decision makers of the challenges that climate change represents.

*(c) Contribution of traditional knowledge to understanding and managing climate-related risks;*

*(d) Implications for sustainable development in relation to paragraph 34 (a) to (c) above;*

*(e) Promoting understanding of impacts of, and vulnerability to, climate change.*

The ITDT has organized workshops and seminars to promote the understanding of these issues, both at the national and regional level, with the participation of governmental and non-governmental organizations. At the same time, it has been giving support to the Secretariat of Environment and Sustainable Development Plan of Action to increase awareness during the last three years.

PAPER NO. 2: AUSTRALIA

**Nairobi Work Programme on Impacts, Vulnerability and Adaptation**

The *Nairobi Work Programme on Impacts, Vulnerability and Adaptation* assists parties to improve their understanding and assessment of impacts, vulnerability and adaptation, and to make informed decisions on practical actions to respond to climate change. The Australian Government strongly supports the Work Programme, and is committed to progress its effective implementation.

**a) Experience with assessment and management of current and future climate related risks and impacts, including those related to extreme events and in specific sectors**

The Australian Government undertook a national risk and vulnerability assessment during 2004-05. The findings of this assessment were published in the report *Climate Change Risk and Vulnerability: Promoting an Efficient Adaptation Response in Australia*. The full document can be found at www.greenhouse.gov.au/impacts/publications/pubs/risk-vulnerability.pdf.

The sectors identified as the highest priorities for adaptation in Australia were biodiversity, water resources, settlements and infrastructure, and agriculture. Human health, fisheries and forestry were also identified as important sectors in this respect. Additionally, some regions were pinpointed as high priorities for adaptation planning. These were the Murray-Darling Basin, the Cairns-Great Barrier Reef region, south-west Western Australia and the coastal zone.

A number of specific studies dealing with risks in these priority regions and sectors have been completed or are in progress. Examples include:

- *The South-East Australia Climate Initiative*: a three year project to:
    i. understand whether the decade-long dry period in south-east Australia represents a shift in the climate and if so what has caused this shift;
    ii. improve projections of climate change for south-east Australia, especially projections of climate variable critical to managing water resources in the Murray-Darling Basin; and
    iii. improve seasonal climate forecasting in south-east Australia.
- Developing a *Climate Change Action Plan for the Great Barrier Reef*: a four year $2 million project to increase the resilience of the Great Barrier Reef to climate change impacts by building on existing best-practice management.
- *The Integrated Assessment of Human Settlements sub-programme*: a suite of five linked projects using integrated assessment techniques to understand the vulnerability of specific urban centres to the impacts of climate change and explore adaptation options.

The Australian Government is developing a robust risk management framework to guide its response to the climate change impacts. This includes the preparation of practical guidance for business, governments and communities on how to apply the Australia and New Zealand Risk Management Standard to climate change impacts. Further details are at www.greenhouse.gov.au/publications/index.html#impacts.

The Australian Government also recognises that Pacific Island Countries are highly vulnerable to climate change. We are therefore providing practical assistance to monitor sea levels, improve climate prediction services, assess vulnerability and enhance adaptation capacity. Our support includes AU $32 million for a *Sea Level and Climate Monitoring Project*, AU $4 million for a *Pacific Vulnerability and Adaptation Initiative* and AU $2.3 million for an *Enhanced Climate Prediction Project*.

In delivering these projects, the Australian Government has learnt a number of useful lessons, including:

- not to be overly ambitious in setting timeframes for projects - some projects may not be able to deliver results in short-term, though may provide substantial benefits over long-term;
- take into account local circumstances, capacity and competing priorities, in order not to set unrealistic expectations; and
- genuine and early community consultation, while potentially extending the duration of a project, is vital to ensure local engagement and ownership.

**b) Ability, gaps, needs, opportunities, barriers and constraints to predicting climate variability, impacts and extreme events across regions and hazards**

Understanding how climate change is likely to affect climate variability and extreme events is a major focus of the *Australian Climate Change Science Programme*. The lack of quality, comprehensive, and comparable data over preceding decades limits the capacity to analyse changes in extreme events in Australia. The major exception is for extreme temperatures, where extensive work and international cooperation over the past decade or so has led to a clear depiction of increasing warm extremes and decreasing cold extremes. Developing high quality data sets for analysis is an important priority for research in this area.

A number of studies have projected changes in climate variability and extreme events in Australia, although such studies are often limited in their geographical scope. Many use statistical or dynamical downscaling techniques to explore possible changes in storm surge, extreme rainfall, bushfires or other extremes. Extreme climate events of interest include:

- extreme temperature;
- heavy precipitation events (including floods and hail);
- tropical cyclones;
- strong winds;
- droughts;
- high sea level events; and
- small-scale extremes (eg. severe thunderstorms, hail and tornadoes).

In the South Pacific, there are still significant gaps in observational coverage over critical areas for climate change and variability. There is a need for data collection on extreme weather events, as comprehensive, comparable and long-term data is limited for most variables (including droughts, heavy rainfalls, cyclones and tornadoes).

The Australian Government is working to bridge data deficiencies in the South Pacific. The *Sea Level and Climate Monitoring Project* is developing long term sea level and climate records, and the *Enhanced Climate Prediction Project* is building the capacity of Pacific Islands Countries to issue climate predictions and improve communications with stakeholders. We are also making committed efforts to rescue historical information, and enhancing data accessibility through digitisation and proper data management.

**c) Contribution of traditional knowledge to understanding and managing climate related risks**

Traditional knowledge does not currently inform the Australian Government's understanding or management of climate change related risks, however, Aboriginal and Torres Strait Islander weather knowledge is beginning to be documented through an initiative supported by the Australian Government and Monash University. The Government recognises that traditional knowledge can form an important input into the response to climate change risks, particularly where such knowledge may pre-date historical records or supplement conventional scientific data, in conjunction with other inputs.

**d) Implications for sustainable development in relation to (a) to (c) above**

The Australian Government's concerted efforts to better understand climate change impacts, and establish a comprehensive risk management framework, are practical measures which promote sustainable development. These measures will assist Australian government agencies, businesses and communities to adapt to climate change in an effective, efficient and targeted manner, and in so doing, minimise the adverse impacts of climate change on Australia's development over the coming decades.

Australia considers that this approach may assist other countries in safeguarding their development potential. We therefore encourage all Parties to aim to integrate climate change responses into their long-term policy-planning processes at the country (and where appropriate, regional) level, and to adopt effective risk management practices.

**e) Promoting understanding of impacts of, and vulnerability to, climate change**

The Australian Government recognises that an effective adaptation response requires the communication of information on impacts and vulnerability to a wide range of stakeholders, including governments, scientists, industry, and indigenous and local communities.

Domestically, the Australian Government's *National Climate Change Adaptation Programme* is raising awareness of the benefits of early attention to adaptation planning and building partnerships with key stakeholders in the most vulnerable sectors and regions. State and Territory governments have also established adaptation initiatives.

At the international level, Australia:

- made significant contributions to the Working Group II report for the IPCC's Fourth Assessment Report;
- provided funding for the UNFCCC 'Hands-on Training Workshop on Vulnerability and Adaptation Assessments for the Asia and the Pacific Region (Jakarta, March 2006), to enable developing country experts to be trained on assessing vulnerability and adaptation measures;
- informs communities and relevant sectors of industry of the benefits of climate predictions through the *Enhanced Climate Prediction Project*; and
- has co-funded (for several years) the annual Asia Pacific Seminar on Climate Change, which has provided a forum for Australia to share its institutional and technical expertise on the impacts of and vulnerability to climate change with developing country participants.

Australian expertise in understanding impacts, assessing vulnerability, and managing the risks associated with climate change is highly recognised – particularly within the Southern Hemisphere. We will continue to work closely with climate scientists and policy-makers in our region to ensure that results of our climate change adaptation programmes are widely disseminated. The *Nairobi Work Programme on Impacts, Vulnerability and Adaptation* provides a very useful framework for sharing, responding to, and building on

the broad range of international adaptation efforts. Australia looks forward to working closely with other Parties to successfully implement the agreed activities under the Programme.

PAPER NO. 3: GERMANY ON BEHALF OF THE EUROPEAN COMMUNITY AND ITS MEMBER STATES

This submission is supported by Bosnia and Herzegovina, Serbia, Former Yugoslav Republic of Macedonia, Croatia and Turkey

**Subject:** **Nairobi work programme on impacts, vulnerability, and adaptation to climate change Information on relevant programmes, activities and views on the following issues:**

**a) Experience with assessment and management of current and future climate related risks and impacts, including those related to extreme events and in specific sectors**
**b) Ability, gaps, needs, opportunities, barriers and constraints to predicting climate variability, impacts and extreme events across regions and hazards**
**c) Contribution of traditional knowledge to understanding and managing climate related risks**
**d) Implications for sustainable development in relation to (a) to (c) above**
**e) Promoting understanding of impacts of, and vulnerability to, climate change**

## 1. Introduction

Under para 34 of the Nairobi work programme (document FCCC/SBSTA/2006/L26), the Subsidiary Body for Scientific and Technological Advice (SBSTA) invited Parties and other relevant organizations to submit to the secretariat, by 23 February 2007, information on their relevant programmes, activities and views on the following issues:

a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;
b) Ability, gaps, needs, opportunities, barriers and constraints to predicting climate variability, impacts and extreme events across regions and hazards;
c) (c) Contribution of traditional knowledge to understanding and managing climate related risks;
d) (d) Implications for sustainable development in relation to paragraph 34 (a) to (c) above;
e) (e) Promoting understanding of impacts of, and vulnerability to, climate change.

The EU is taking this opportunity to respond to this request.

## 2. General Remarks and Views

3. **(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;**

Within the European Union and its Member States there is significant experience with regard to current and future climate related risks and impacts available. Relevant information has been put together, e.g.

- on political activities by working group 2 on climate change impacts and adaptation under the European Climate Change programme II [1],

[1] the European Climate Change Programme is the Commission's main instrument to discuss and prepare the further development of the EU's climate policy. The online library information provides detailed information: http://forum.europa.eu.int/Public/irc/env/eccp_2/library?l=/impacts_adaptation&vm=detailed&sb=Title

- on research activities in climate impact sciences under the CIRCLE project [2],
- as an overview of vulnerabilities to climate change and adaptation activities compiled in the technical report on "Vulnerability and adaptation to climate change in Europe" [3] by the European Environmental Agency.

The Fourth Assessment Report of the IPCC is expected to provide additional information on current and future climate-related risks and impacts and the European Union notes that there has been a significant improvement in understanding of climate related risks during the last 5 years. The European Union expects that the knowledge about climate risks and impacts will improve further in the coming years.

However, the European Union notes with concern that the management of current and future climate-related risks and impacts is still in a very preliminary stage. It is very likely that this lack of management will result in significant damage and stranded investments. From the perspective of cost efficiency the climate risk management approach seems to be a rather promising one although the EU is well aware of the significant demand in data and underlying observations. In this context programmes like the Nairobi work programme adopted in Nairobi at SBSTA 25 as well as even longer term ones like GEOSS and GMES seem to be quite relevant to facilitate implementation of a climate risk management approach.

The UK Climate Impacts Programme may offer an approach that helps to bridge the gap between the knowledge about climate-related risks and impacts among a specialized scientific community and decision-making in vulnerable sectors (for more information: Climate Policy 6 (2006) 201-215). One of the more basic barriers in closing this gap is the fact that (commercial) pressures on stakeholders including financial institutions effectively close off the scope for risk avoidance and/or risk transfers beyond the medium term (10 years).

**(b) Ability, gaps, needs, opportunities, barriers and constraints to predicting climate variability, impacts and extreme events across regions and hazards;**

In general tested tools/toolkits to assess climate-related risks are available and are used by a broad user-community. However, it is noted that lack of data or lack of training might be a barrier for their application. The European Union believes that further efforts are needed to close data gaps and to improve capacity building, especially for developing countries.

It is also noted with interest that the available tools are further improved and it is expected that such improvement will continue. Priorities for further improvement might be a better approach to address uncertainties (e.g. with the help of probability density functions, ensemble modelling, and improved resolution in time and space, e.g. to achieve a better presentation for climate-risks in mountainous regions.

The European Union also notes that in the long-term the uncertainty about future emissions introduces the most significant uncertainty and that this uncertainty reflects the potential to mitigate climate change. In this context some agreement on a long-term aspirational target might help to

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[2] "Report on the current state of National Research Programmes on Climate Change Impacts and Adaptation in Europe" available at http://www.circle-era.net/uploads/media/CIRCLE_Del_Ia1_Extended_Country_Report_1stISSUE_Final_DRAF_.pdf

[3] Available at http://reports.eea.europa.eu/technical_report_2005_1207_144937/en/

significantly reduce that uncertainty and may thus help to make projections of future climate change a much more useful planning tool.

**(c) Contribution of traditional knowledge to understanding and managing climate-related risks**

The European Union believes that traditional knowledge is a quite interesting source of information. Traditional knowledge brings with it experience and understanding of the social and cultural environment that are fundamental to understanding and evaluation impacts, vulnerabilities and adaptation options.

The European Union is keen to learn more about traditional knowledge to understanding and managing climate-related risks. One example of how such knowledge can be used is the ACIA (Arctic Climate Impact Assessment) report which attempted to combine knowledge and insights from indigenous people with data from scientific research, bringing together these complementary perspectives on arctic climate change. There are examples, e.g. with regard to water management, that show that such traditional management approaches worked quite well but were ignored by more modern governance. Furthermore it might be a challenge to link traditional knowledge with the most up-to-date information on climate change and its impacts because it may need co-operation across significant cultural barriers.

**(d) Implications for sustainable development in relation to paragraph 34 (a) to (c) above**

The European Union is concerned about the significant implications of climate-related risks and impacts, including those related to extreme events, for the most vulnerable countries, e.g. small island developing states. Therefore the European Union believes that adaptation is a necessary complement to mitigation that needs to be integrated into many policy areas including public investment programmes and private sector investments and land-use planning. The concept of a risk management approach might offer an instrument to address that challenge in a cost-efficient manner.

**(e) Promoting understanding of impacts of, and vulnerability to, climate change**

Promoting understanding of impacts of, and vulnerability to, climate change seems to be key to trigger management of current and future climate-related risks. The experience of the UK Climate Impacts Programme shows that an approach in which decision-makers take control to produce information on impacts of, and vulnerability to climate change is more efficient in promoting understanding compared to position stakeholders in a consultative role in research. A prerequisite for this approach is adequate institutional capacity to support adaptation to climate change. It is the expectation of the EU that the Nairobi work programme on impacts of, and vulnerability to climate change facilitates promoting such understanding. In this context the EU encourages governments to plan and implement a very broad participation in the Nairobi Work Programme that covers all vulnerable sectors as well as all relevant stakeholders in those sectors and policy areas.

**(f) Cooperation with Developing Countries**

The EU puts emphasis on existing and future cooperation with developing countries being most affected by and vulnerable to the negative impacts of climate change. All vulnerable countries have to cope with specific climate related risks and extreme events such as floods and droughts. To enhance resilience to these risks the EU implements and strives to further strengthen processes aimed at strengthening the mainstreaming of climate change impacts into development cooperation, e.g. the OECD declaration on integrating adaptation into cooperation with developing countries and the EU-Action Plan on Climate Change and Development. EU member states also support a wide range of bilateral and multilateral projects on the risks of climate change and adaptation with individual developing countries.
Specific activities and joint projects concerning risk management and development cooperation will be listed in an amendment to this submission.

## 3. Specific Activities and Programmes in the European Union

3.1 Questionnaire responses by Member States

In preparation for this submission, the German Presidency asked EU Member States (MS) to provide information about their programmes, activities and views with on climate change related risks and extreme events. In order to allow for a structured submission, a questionnaire was provided (see Annex A).

Eleven MS and the European Commission responded: Austria, Belgium, Czech Republic, Finland, Germany, Malta, The Netherlands, Romania, Spain, Sweden, United Kingdom. Their submissions are compiled in Annex B.

3.2 Other sources of information on specific activities and programmes

In 2005, the EEA and its Topic Centre on Air and Climate (ETC/ACC) change prepared a detailed report on vulnerability and adaptation to climate change in Europe [4]. Its Chapter 3 contains a detailed assessment of vulnerabilities of both natural ecosystems and socio-economic sectors. A review of adaptation responses implemented and/or planned (as of 12/2004) is provided in Chapter 4. Furthermore, a comprehensive survey of climate change impacts in Europe was conducted in 2004 by the ETC/ACC [5].

The CIRCLE project aims at aligning national research projects in the field of climate change impact and adaptation sciences and thus creating a coherent body of research. An account of research projects on a country by country basis is provided in the "Extended Country Report" [6]. A continuously updated project data base is also available at the CIRCLE web site [7].

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4 Available at http://reports.eea.europa.eu/technical_report_2005_1207_144937/en/

5 Available at http://reports.eea.europa.eu/climate_report_2_2004/en/impacts_of_europes_changing_climate.pdf

6 Available at http://www.circle-era.net/uploads/media/CIRCLE_Del_Ia1_Extended_Country_Report_1stISSUE_Final_DRAF_.pdf

7 http://www.circle-era.net/projects/.

There are a number of activities, programmes and assessments on the impact of climate change on water resources and coastal areas. Two reports prepared by EU's Joint Research Centre, "Climate Change and the European water dimension" [8] and "Marine and Coastal Dimension of Climate Change in Europe" [9] evaluate in detail the possible impact of climate change on water resources and quality in Europe as well as marine and coastal areas. In 2007, an EEA report on "Climate change and water adaptation issues" [10] was published, presenting the most recent state of knowledge on climate change impacts, policy frameworks and national practices.

In preparation for the conference "Climate Change and the European Water Dimension" held in Berlin 12-14 February 2007, a questionnaire based survey on climate change related impacts, vulnerabilities and adaptation measures in the water sector was conducted among EU and EEA Member States. An evaluation of the results is available at the conference website [11]. In its Annex A, this document also provides an overview of current adaptation initiatives.

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[8] Available at http://ccu.jrc.it/Pubblications/Climate_Change_and_the_European_Water_Dimension_2005.pdf

[9] JRC report No EUR 22554 EN

[10] Available at http://reports.eea.europa.eu/technical_report_2007_2/en

[11] http://www.climate-water-adaptation-berlin2007.org/documents/questionnaire_000.pdf

**ANNEX A**

**Questionnaire and Guidelines for Submissions**

**Introduction**

Under the Nairobi work programme on impacts, vulnerability and adaptation to climate change (NWP), the Subsidiary Body for Scientific and Technical Advice (SBSTA) invited Parties to submit information on programmes, activities and views on climate related risks and extreme events.
The German Presidency asks Member States to provide input for a joint EU submission.

**General guidelines**

- Please **be user-oriented** and focus on compact and specific information on **issues relevant for other Parties**, particularly developing countries. Include different levels (European, national, sub-national)
- **Include references** to further information (contact information, URLs of web sites), preferably in English language.
- **Please use the format provided below and the attached excel table for your submission**

**I. General questions**

1. **Which current and future climate change related risks and extreme events are relevant in your country? Among others, extreme events might include heat waves, inland and coastal flooding, droughts, storms and tornadoes, wild fires, avalanches, and mass movements due to melting permafrost or glaciers; possible issues for risks related to gradual climate change might include sea level rise, change in water supply, advance of vector-borne diseases and plants causing problems for allergic or sensitive people, loss of biodiversity, changes in ecosystems, changes in the cryosphere.**

2. **Does traditional knowledge contribute to understanding and managing climate related risks? If yes, please specify.**

3. **Are there any additional comments or views, e.g. on methodological gaps or urgent needs for activities? Please specify.**

**II. Specific questions (please use the attached excel table)**

For which of these climate change related risks and extreme events exist activities, programmes or views in your country that might help other Parties facing similar issues?
For each of these activities and programmes, please provide information according to the structure given by the table attached. If appropriate, please split by affected sector or geographical region:

1. **Experience with the assessment and management of climate change related risk or extreme events**
   a. To what extent is your country affected at present or has been affected in the past? Please provide prominent examples.
   b. To what extent is your country expected to be affected in the future?
   c. Please name major programmes [e.g. the ERA-Nets CIRCLE (climate impacts and adaptation) and CRUE (flood risk management), both have a compendium of running national programmes], policies or activities underway in your country to address this

climate change related risk or extreme event. At which are they implemented (European, national, sub-national)? Please provide further references (contact information, URL).

d. Are there any implications for sustainable development? Please specify.

**2. Prediction of climate variability, impacts and extreme events**
**What are your country's ability and opportunities for prediction?**

a. What are the opportunities and the ability of your country for prediction? Please list any relevant programmes and provide references.
b. Please list any gaps, needs, barriers and constraints for your country
c. Are there any implications for sustainable development? Please specify.

**3. Are there any activities implemented or planned to promoting understanding of impacts of, and vulnerability to, the climate change related issue?**

Please provide further references e.g. to programmes to raise risk awareness, educational programmes, projects aimed at capacity building (contact information, URL)

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**ANNEX B**

# Programmes, activities and views submitted by Member States

## 1. Austria

### General Remarks

*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;*

- Floodings (cp. 2002 in northern and eastern Austria, 2005 in western Austria)
- Droughts and connected heat waves (cp. summer 2003)
- Mass movements after heavy precipitation (mudflows and debris flows after rain, avalanches after snow)
- Advance of ticks and thus lyme boriolosis
- Advance of allergy-causing neophytes (e.g. Ambrosia)
- Losses of biodiversity especially in subnival and nival environments (thus in Alpine region)
- Glacier retreat causing problems for water management (water power and in future irrigation water supply)
- Glacier retreat causing destabilisation of mountain slopes (more frequent rock falls) due to pressure relief and melting permafrost

Important Austrian websites to refer to:
www.accc.gv.at, www.umweltbundesamt.at/klima, www.austroclim.at

*(b) Ability, gaps, needs, opportunities, barriers and constraints to predicting climate variability, impacts and extreme events across regions and hazards*

- Higher spatial resolution of regional climate models (10km is fine, but for alpine terrain, we need it down to 1km)
- Urgent need to connect modelling and impact community with adaptation stakeholders
- Cp. also outcomes of ERA-Net CIRCLE (www.circle-era.net)
- Outcomes of a dedicated workshop on that topic organised by the Austrian ministry of science will soon be available

### Heat waves and droughts

*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;*

- heat waves: mainly urban areas
- droughts: mainly lowlands and hilly areas in Eastern and Southern Austria
- sectors hit: agriculture, forestry and health sector
- heat wave of summer 2003 with casualties mainly in urban areas, connected drought with heavy impacts on agriculture
- probability and duration of heat waves is predicted to increase
- research is being undertaken in StartClim programme (cp. www.austroclim.at/startclim for results), heat wave warning system from ZAMG
- impacts of heat waves and droughts hit poor and older people in cities as well as farmers in the first place, with all economical implications and impacts on the social coherence

*(b) Ability, gaps, needs, opportunities, barriers and constraints to predicting climate variability, impacts and extreme events across regions and hazards*

- weather forecast by ZAMG

- special prediction models for urban areas and catastrophe plans are needed
- heat waves and droughts have impact on all three dimensions of sustainable development: 1. social coherence (heat waves and droughts hit poor and older people as well as farmers most significantly), 2. economic dimensions via losses and lower productivity, 3. ecological dimension via impacts on water quantity and quality as well as degradation of soil functions

*(e) Promoting understanding of impacts of, and vulnerability to, climate change.*
- many institutions in A inform the public about climate change via homepages, press conferences, interviews, publications,…but no concerted awareness campaign is underway yet

## Storms

*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;*
- severity (not so much the frequency) of storms likely to raise
- all regions
- sectors: mainly forestry and insurance
- impacts on the forestry sector, so far only few casualties, also occurrence of tornadoes (db available at http://www.tordach.org/at/index_e.html )
- storm frequency likely to increase, tornado frequency can not be correlated with global warming in Austria,
- research is being undertaken in StartClim programme (cp. www.austroclim.at/startclim for results)

*(b) Ability, gaps, needs, opportunities, barriers and constraints to predicting climate variability, impacts and extreme events across regions and hazards*
- weather forecast by ZAMG
- special prediction models for urban areas and catastrophe plans are needed

*(e) Promoting understanding of impacts of, and vulnerability to, climate change*
- many institutions in A inform the public about climate change via homepages, press conferences, interviews, publications,…but no concerted awareness campaign is underway yet

## Hail and thunderstorms

*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;*
- due to warmer summers, thunderstorm severity and frequency likely to raise, all regions affected, sectors: agriculture (especially under glas), insurance and private sector
- impacts on agriculture with main focus on "under glas" cultures, impacts on insurance sector
- likely to increase
- research is being undertaken in StartClim programme (cp. www.austroclim.at/startclim for results)

*(b) Ability, gaps, needs, opportunities, barriers and constraints to predicting climate variability, impacts and extreme events across regions and hazards*
- weather forecast by ZAMG
- special prediction models for urban areas and catastrophe plans are needed

*(e) Promoting understanding of impacts of, and vulnerability to, climate change.*
- many institutions in A inform the public about climate change via homepages, press conferences, interviews, publications,…but no concerted awareness campaign is underway yet

## Heavy precipitation

Causing floods and mass movements

*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;*
- strong and extreme precipitation events tend to increase, impacts on slope stabilities, mass movements like debris and mudflows will increase as well as floods will occure more frequently, floods more in Danube and tributaries ("downstream"), mass movements in alpine ("upstream") regions
- impacts on infrastructure (train and roads), high costs for maintenance
- likely to increase
- research is being undertaken in StartClim programme (cp. www.austroclim.at/startclim for results)

*(b) Ability, gaps, needs, opportunities, barriers and constraints to predicting climate variability, impacts and extreme events across regions and hazards*
- weather forecast by ZAMG
- special prediction models for urban areas and catastrophe plans are needed

*(e) Promoting understanding of impacts of, and vulnerability to, climate change.*
- many institutions in A inform the public about climate change via homepages, press conferences, interviews, publications,…but no concerted awareness campaign is underway yet

## Spread of pest and diseases (indirect)

*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors*
- agriculture
- Starting problems with certain insects and pests from Mediterranean Europe which were not present in the past
- likely to increase
- research is being undertaken in StartClim programme (cp. www.austroclim.at/startclim for results)

*(b) Ability, gaps, needs, opportunities, barriers and constraints to predicting climate variability, impacts and extreme events across regions and hazards*
- weather forecast by ZAMG
- special prediction models for urban areas and catastrophe plans are needed

*(e) Promoting understanding of impacts of, and vulnerability to, climate change.*
- many institutions in A inform the public about climate change via homepages, press conferences, interviews, publications,…but no concerted awareness campaign is underway yet

**2. Belgium**

## Climate risk - general

*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors*
– temperatures are expected to rise significantly by 2050 both in summer and in winter; at the end of the 21st century, the rise in average temperature in relation to the end of the 20th century would be between 1 and 5°C in winter and between 1.5 and 7°C in summer;

- the projections for the change in precipitation until the end of the 21st century show a rise by 3 to 30% for winter (with few results under 10%) and a change in summer between the status quo and a drop by up to about 50%;
- Currently available information suggests that ecosystems and forestry have some vulnerability even with less than a 3°C increase in the regional mean temperature (in summer, from end 20th to end 21st century). The coastal zone, water resources, risks of flooding and human health may also become causes for concern in this scenario, although this involves more uncertainty. With a temperature increase of about 3°C or more, ecosystems and forests would likely face severe threats, while droughts and heat waves would be a serious concern in the fields of health and water availability, and there could also be negative effects for agriculture and soils. Because sea level rises slowly, the vulnerability of the coastal zone should not be high during the 21st century, but is a matter of concern at longer terms (possible rise in sea level of several metres during the coming centuries).

*(b) Ability, gaps, needs, opportunities, barriers and constraints to predicting climate variability, impacts and extreme events across regions and hazards*

- Uncertainties in climate change scenarios and hydrological impacts are very high, especially on local scale; research is needed to further investigate climate related risk; flooding, drought and coastal erosion issues are specific concerns.

*(e) Promoting understanding of impacts of, and vulnerability to, climate change.*

- 'Impact of climate change in Belgium' (2004) : this outstanding report was commissioned by Greenpeace and coordinated by UCL university; the publication was given considerable press coverage and as such contributed to creating public awareness (http://www.climate.be/impacts)

## Heatwave

*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;*

- during the heat wave of the summer of 2003, the number of deaths in excess of the mean has been estimated at about 1300 in the 65 and older age group, equivalent to +19% deaths during the first weeks of August
- The probability of severe heat waves is expected to rise significantly. This is both a consequence of higher mean temperatures and increased variability. Projections for the end of the 21st century show that about every second summer could be as warm or warmer (and as dry or dryer) than the summer of 2003
- health risks : increased mortality, troubles such as heat stroke, consequences of more frequent ozone peaks

## Drought

*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;*

- More evaporation and possibly less precipitation in summer reduce groundwater level
- Water availability is already limited in parts of the country
- increased frequency of dry summers and heat waves may damage crops, grasslands and forests; irrigation may become necessary
- The probable decrease in summer water supply will affect negatively the biodiversity of wetlands ecosystems by increasing biomass productivity; summer drought will also affect other ecosystems.

*(b) Ability, gaps, needs, opportunities, barriers and constraints to predicting climate variability, impacts and extreme events across regions and hazards*

- future impact of droughts on water resources is poorly known and is a growing concern

## Inland and coastal flooding

*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;*

***Inland***

- The frequency of floods increased in Belgium in recent decades, with important flooding in 1995, 1998, 2002, 2003 and 2005; projected changes in winter precipitation and the likely increase of extreme events are expected to raise the risk level further both in winter (due to winter precipitation expected to increase +3 to +30%) and summer (due to heavy rain events);
- studies indicate increases in the flow of watercourses reaching 4 to 28% in 2100, and a rising risk of flooding for all studied catchments

***Coastland***

- observations for the period 1937-2003 show an increase in mean sea level estimated at 16 cm/century, with no sign of recent acceleration
- storm-related floods are expected to increase (an increase in extreme winds and North Sea storms, with increased risk of storm surge, was found in the framework of the PRUDENCE EU project)
- increased coastal erosion is expected, as well as deterioration of natural ecosystems (indirect or long-term)
- other expected impacts of an increase in sea level are a rising groundwater level and an increase in soil and groundwater salinity.

*(b) Ability, gaps, needs, opportunities, barriers and constraints to predicting climate variability, impacts and extreme events across regions and hazards*

- PLUIES plan : flood prevention plan, aiming to improve knowledge of the risk of flooding, reduce and decelerate the run-off of water on slopes, improve the management of rivers, decrease vulnerability in zones liable to flooding and improve crisis management. A specific service was put in place for real-time monitoring of watercourses, hydrology studies, coordination and flood alert. Its work is based on a network of stations measuring the level of watercourses and amounts of rain
- Ongoing research projects :
    - Project for the “Flanders Hydraulics Research” water authority (responsible for research on (a.o.) the water management along the navigable rivers in the Flanders region of Belgium): “Methodology development to account for climate changes in the composite hydrograph method”, nov. 2005 – sept. 2006, by Katholieke Universiteit Leuven (Prof. J.Berlamont, P.Willems).

  Two parallel projects for the Belgian Federal Science Policy Office :
    - CCI-HYDR project on "climate change impact on hydrological extremes along rivers and urban drainage systems", coordinated by P.Willems, Katholieke Universiteit Leuven
    - ADAPT project on "socio-economic impact analysis and decision support (cost-benefit analysis) regarding adaptation measures to flood impact changes by global warming" coordinated by W.Hecq, ULB.

## Pests and diseases

*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;*

- observed : probable contribution of climate changes to increased prevalence of Lyme disease; possible contribution to increase in pollen associated allergies
- expected : increased migration and distribution of pests may damage crops, grasslands and forests

## Changes in ecosystems

*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;*
In Belgium, changes in ecosystems and biodiversity losses have multiple causes (air, water and soil pollution, destruction of habitats, agricultural and forestry practices, etc.); climate is becoming an important factor, however, and may be the main source of perturbation in the future
terrestrial life
– species move north (observed);
locally :
• those adapted to warmer climate increase
• those adapted to colder climate may decrease
– new species -> competition with existing ones
– complex perturbation of ecosystems (e.g. broken food chain due to different changes among species)
**estuarine and sea life**
– species move north (observed), with possible impacts on fishing (for instance, the lower limit of the range of shrimps is moving to the north; in parallel, southern species such as sardine and anchovy are increasingly being observed in the North Sea)
– Scheldt freshwater discharges could increase up to 28% during the next century (in spite of summer decrease). This larger freshwater discharge may influence estuarine ecology by decreasing water residence time and altering nutrient fluxes downstream to coastal waters

### 3. Czech Republic

## Heat waves

*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;*

The first impact of climate change on health is identified as heat stress and in this regard increased mortality. There is a significant increase of above-average summer temperatures. The most endangered population categories include elderly people, children and people with chronic diseases.
- health sector / within the Czech Republic
- heat waves in June, July 2004 and July 2006
- the probability of heat waves will increase
- the duration of heat waves will increase
- heat wave warning system from The Czech Hydrometeorological Institute
- cooperation between local administration and hospitals
- Programme for support of reconstruction and revitalisation of pannel houses

*(b) Ability, gaps, needs, opportunities, barriers and constraints to predicting climate variability, impacts and extreme events across regions and hazards*
- weather forecast by The Czech Hydrometeorological Institute http://www.chmi.cz/
- need of analysis of climate change impacts in each region in the Czech Republic

*(d) Implications for sustainable development in relation to paragraph 34 (a) to (c) above;*
- providing warning information in media and caring about especially vulnerable population

*(e) Promoting understanding of impacts of, and vulnerability to, climate change.*
– information related to climate change provided by the Czech Ministry of the Environment: http://www.env.cz

## Inland flooding

*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;*
Occurrence of floods in the winter as a consequence of increased outflow in the colder season of the year, heavier rain occurring in connection with summer storms constitutes a greater risk of flash floods.

- infrastructure, industry, agriculture, health sectors / within the Czech Republic
- floodings in July 1996, 1997 - Moravia
- - floodings in August 2002, March 2006 – Bohemia
- the probability of floodings will increase
- urban planning and Programme for support of reconstruction and revitalisation of pannel houses
- National program to Abate the Climate Change Impacts in the Czech Republic (prepatation of adaptation measures e.g. to increase the landscape capacity of water retention) also Support for afforestation of non-utilised agricultural areas
- Operational Programme - Rural developement and multifunctional agriculture

*(b) Ability, gaps, needs, opportunities, barriers and constraints to predicting climate variability, impacts and extreme events across regions and hazards*
- weather forecast by The Czech Hydrometeorological Institute: http://www.chmi.cz/
- T. G. Masaryk Water Research Institute: http://www.vuv.cz
- need of elaboration of specific adaptation measures
- need of improved warning system

*(d) Implications for sustainable development in relation to paragraph 34 (a) to (c) above;*
- implementation of adaptation measures in relevant sectors

*(e) Promoting understanding of impacts of, and vulnerability to, climate change.*
- National Program to Abate the Climate Change Impacts in the Czech Republic

## Droughts

*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;*
Occurrence of droughts have become more frequent in the last few decades. This is caused by increased evapotranspiration and also a slight decrease in total precipitation, i.e. a reduction in the moisture balance values. Droughts have the greatest impact on light, sandy soils. Increased temperature, prolonging of periods without precipitation and increased numbers of dry periods create more favourable conditions for the development and multiplication of agricultural pests and diseases.

- health, agriculture, forestry sectors / within the Czech Republic
- droughts in summer months 2001, 2003, 2004, 2005, 2006 / within the Czech Republic
- the probability of droughts will increase
- the duration of droughts might increase
- National program to Abate the Climate Change Impacts in the Czech Republic (prepatation of adaptation measures e.g. to change the crops)
- Support for aforrestation of non-utilised agricultural areas
- Operational Programme - Rural development and multifunctional agriculture

*(b) Ability, gaps, needs, opportunities, barriers and constraints to predicting climate variability, impacts and extreme events across regions and hazards*

- weather forecast by The Czech Meteorological Institute http://www.chmi.cz/
- need of analysis of climate change impacts in each region in the Czech Republic
- need of improved warning system with regard to in time-application of irrigation system

*(d) Implications for sustainable development in relation to paragraph 34 (a) to (c) above;*
- implementation of adaptation measures in relevant sectors

*(e) Promoting understanding of impacts of, and vulnerability to, climate change.*
- National Program to Abate the Climate Change Impacts in the Czech Republic

## Storms and tornadoes

*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;*
Occurrence of storms and tornadoes is not frequent, nevertheless this extreme event has a major impact on a number of sectors including agriculture, infrastructure etc.

- agriculture, forestry, energy, infrastructure sectors and housing / within the Czech Republic
- orkan in January 2007
- the probability of tornadoes will increase
- major impact on ecosystems e.g. forest ecosystems
- warning system from The Czech Hydrometeorological Institute
- National Program to abate The climate change impacts In The Czech Republic (forest biodiversity increase)
- Support for aforrestation of non-utilised agricultural areas
- Operational Programme - Rural developement and multifunctional agriculture
- implementation of adaptation measures especially in forestry

*(b) Ability, gaps, needs, opportunities, barriers and constraints to predicting climate variability, impacts and extreme events across regions and hazards*
- weather forecast by The Czech Hydrometeorological Institute http://www.chmi.cz/
- cannot be specified due to not frequent occurrance of those events

## Vector-borne diseases

*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;*
Climate change influences the biology of the main vector tick (Ixodes ricinus), which appeared in prolonged season and in this respect there is an increase of its population. Also, there is an increase of diseases due to infections distributed by vectors and rodents in the Czech Republic.

- health / within the Czech republic
- recent increase of abundance and expansion of certain species: tick Ixodes ricinus
- National Program to Abate the Climate Change Impacts in the Czech Republic

*(b) Ability, gaps, needs, opportunities, barriers and constraints to predicting climate variability, impacts and extreme events across regions and hazards*
- need to increase the attention on vaccination
- need of model prediction of tick activity in order to ensure warning system

*(e) Promoting understanding of impacts of, and vulnerability to, climate change.*

- Ministry of health: http://www.mzcr.cz/
- local hygienic stations:e.g. http://www.hygpraha.cz/"

## Changes in ecosystems

*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;*

Warming of the water leads to a reduction in the number of species in the community, as the temperature increases, more pollutants are accumulated in the biomass of organisms, increasing their toxicity – for both metals and pesticides.

Forest ecosystems must resist short-term climatic temperature and precipitation extremes, whose frequency clearly increases. The climate change gradually affects forests especially through the increasing temperatures and increasing CO2 concentrations, prolonged burdening of ecosystems by industrial emissions of sulphur and nitrogen.

- not very high impact up to now
- the extent of climate change impacts on ecosystems might increase
- the possibility of introduction of certain invasive species e.g. Ambrosia
- Operational Programme Environment
- Agro-environmetal Programs
- Landscape Management Programme available: http://www.ochranaprirody.cz/index.php?lang=en
- Horizontal Rural Development Plan of the Czech Republic available: http://www.mze.cz , http://www.sfzp.cz , http://www.szif.cz

*(b) Ability, gaps, needs, opportunities, barriers and constraints to predicting climate variability, impacts and extreme events across regions and hazards*
- ability for prediction insufficient
- need of monitoring and long-term studies

*(e) Promoting understanding of impacts of, and vulnerability to, climate change.*
- information available at the Czech Ministry of the Environment: http://www.env.cz

## General Remarks

*(b) Ability, gaps, needs, opportunities, barriers and constraints to predicting climate variability, impacts and extreme events across regions and hazards*

There is a need of better and improved models and analysis regarding the impacts of climate change especially in regional and local level of the Czech Republic. Also there is a need of monitoring and long-term studies in connection with successions of the ecosystems.

*(c) Contribution of traditional knowledge to understanding and managing climate-related risks;*
The State Environmental Policy is the basic, strategic, cross-cutting document for preparation of detailed programs in the individual components of the environment, including climate change, and for dealing with individual environmental issues. The State Environmental Policy includes an analysis of current conditions and quite specifically elaborates the main directions for environmental protection. Its targets and measures include the creation and use of an interconnected system of environmental education, enlightenment and awareness (EEEA) implemented in all the sectors, including state, public, private and civic institutions and organizations.

The work of the Ministry of the Environment includes publishing, film and promotional activities that, amongst other things, are related to global environmental issues, including climate change. The Ministry publishes a number of publications and periodicals. The Ministry has its own web site http://www.env.cz. Also, CENIA, the Czech Environmental Information Agency operates the Uniform Environmental Information System and the www.cenia.cz web site provides access to information, databases and applications. The Ministry holds its own exhibitions or has presentations at national and international exhibitions.

Institutes of the state administration in the area of the environment (Ministry of the Environment, Regional Authorities, Administrations of Protected Landscape Areas and National Parks, CENIA, the Czech Environmental Information Agency, the Nature Protection Agency) and some other institutions, such as universities and institutes of technology, professional scientific institutes, medical or enlightenment and cultural educational facilities, some tourist centres, the STEP Network of Environmental Consulting Centres, etc. participate in environmental education of the general public.

NGO's also play an important role, especially civic associations or specialized professional federations and societies and their environment, agricultural or medical consulting facilities. Environmental education, enlightenment and awareness are also supported by important foundations, e.g. the Foundation for Development of a Civic Society, the Partnership Foundation, the Via Foundation and the Open Society Fund.

The Program of Development of Human Resources, supported from European social funds, has been a significant source of support since 2004. In the framework of the grant scheme of the Network of environmental information and consulting centres, support can be provided for their formation and activities in the individual regions.
Greenpeace (www.greenpeace.cz), the DUHA Movement (www.hnutiduha.cz), Brontosauří ekocentrum Zelený klub (Brontosaurus Green Club Ecocentre) on the Ekolist web site (www.ekolist.cz), the CZ Biom Association (http://czbiom.ecn.cz/), Ekowat (www.ekowatt.cz), SEVEn o.p.s. (http://www.svn.cz) and other organizations are systematically concerned with the issue of climate change.

The Czech Republic participates in a number of international projects concerned with environmental education, enlightenment and awareness. These activities are supported methodically and financially directly by the Ministry of the Environment and Ministry of Education, Youth and Sports.

## 4. Finland

### Floods affect urban and rural infrastructure

*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;*

- Summer floods 2004 in southern Finland, spring flood 2005 in Lapland, both caused comprehensive economical damages
- floods in summer, winter and spring will be more frequent; flash floods for small catchment in summer due to increased intensity precipitation events
- flood warning system from Finnish Environment Institute (FMI), co-operation with Finnish Meteorological Institute (FMI), Regional Environment Institutes, rescue services, cities, water power and regulation enterprises, also flood maps, flood risk management plans.

*(b) Ability, gaps, needs, opportunities, barriers and constraints to predicting climate variability, impacts and extreme events across regions and hazards*

- flood forecast by FEI (www.environment.fi/waterforecast), use of 10 days up to seasonal weather

forecast, radar precipitation by FMI in flash flood forecasting; hydrological scenario simulations to asses the effect of climate change on flooding
- flash flood forecasting needs shorter time step in flood forecasting models, increased observation data needs in time frequency

*(c) Contribution of traditional knowledge to understanding and managing climate-related risks;*
*a. general comment*
*b. implications for sustainable development*

*(d) Implications for sustainable development in relation to paragraph 34 (a) to (c) above;*
- Increase of operational robustness, speed and spatial coverage of warnings, direct warning of regional flood mitigation authorities and practitioners: goal reduced damage in infrastructure
- early warnings give time to rescue property and decrease damage and repair work

*(e) Promoting understanding of impacts of, and vulnerability to, climate change.*
- Scenarios to estimate the effect of climate change on design floods (1/5000 recurency) for dam safety and the distribution of the results to flood mitigation authorities and stakeholders within. E.g. flood forecast by FEI ww.environment.fi/waterforecast
- Research conducted. Also flood maps, flood risk management plans are used to increase public knowledge on flooods.

**Extreme water levels affects the management of an international river basin**
*Lake Saimaa in Finland and Vuoksi river in Russia*

*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;*
- high water levels at 2004-2005 and low water levels at 2003 and 2006
- winter floods (warm wet winters) and summer droughts (longer summers, high evaporation) will both be increased due to climate change
- development of medium and long term water level forecasting with respective ECMWF (European Center for Medium range Weather Forecast) weather forecasts, changes in practical regulation and change of regulation policy taken under discussion

*(b) Ability, gaps, needs, opportunities, barriers and constraints to predicting climate variability, impacts and extreme events across regions and hazards*
- one to two month ahead forecasts with monthly and seasonal weather forecasts; hydrological climate change scenarios to asses the future problems in regulation and severity of flooding and droughts
- regulation rules may be changed due to climate change

*(c) Contribution of traditional knowledge to understanding and managing climate-related risks;*
*a. general comment*
*b. implications for sustainable development*

*(d) Implications for sustainable development in relation to paragraph 34 (a) to (c) above;*
- better regulation in time leads to smaller damage to infrastructure
- better forecast and regulation decrease damage and losses to infrastructure during flooding, ship traffic and fish breeding during droughts

*(e) Promoting understanding of impacts of, and vulnerability to, climate change.*
- Scenarios for lake level change due to climate change and distribution of this information to authorities and stakeholders responsible for water level supervising and possible regulation actions.

- Information on Transboundary Water Commission http://www.rajavesikomissio.fi/index_eng.htm

## 5. Germany

### Climate risk – general

*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;*

In Germany risks related to extreme events are heat waves, inland flooding due to continuous heavy rain and/or the melting of snow, flash floods, coastal flooding due to storms, storms, tornadoes.

In Germany risks related to graduate climate change are: modified hydrological cycle (more precipitation in winter, less winter precipitation storage in snow cover and glaciers, less precipitation in summer) leading to floods (esp. winter) as well as droughts (esp. summer), longer vegetation periods (spread of neophytes with allergenic pollen, longer pollen season), higher mean temperature, warmer winters (advance of vector borne diseases, e.g. spread of tick borne diseases in higher altitudes, Leishmaniosis).

Increasing risks of forest and rangeland fires, drought periods during vegetation periods will influence the yields of crops of corn, sugar beets and potatoes.

*Cross-Sectoral Assessment of Climate related risks*
German Federal Environment Agency UBA published a report on vulnerability and adaptation strategies of climate-sensitive sectors. This study recognizes the future risks of climate change for the individual regions in Germany and comprises potential damage by means of active climate protection and adaptation efforts. See http://www.umweltbundesamt.de/uba-info-medien-e/mysql_medien.php?anfrage=Kennummer&Suchwort=2974

*National Strategy on Adaptation and Competence Centre on Climate change and Adaptation*
The German government resolved to develop a national strategy of adaptation to global warming based on the excellent foundations laid by German stakeholders and institutions. The objectives of a national adaptation strategy are to establish priority areas of action as well as to identify and coordinate measures at the national, regional and local level. In October 2006 the Federal Environment Ministry sets up the Competence Centre on Climate change and Adaptation (KomPass) at German Federal Environment Agency (UBA). KomPass should support the development of such strategy. Furthermore KomPass aims to link fields of expertise as well as to educate decision makers in businesses and public administrations and the public. http://www.umweltbundesamt.de/klimaschutz-e/ and http://www.anpassung.net (German)

*(b) Ability, gaps, needs, opportunities, barriers and constraints to predicting climate variability, impacts and extreme events across regions and hazards*
It has proved mandatory to co-ordinate the weather warning management of the DWD with the disaster management and flood forecasting authorities and other disaster protection organisations. In 2004 the DWD introduced successfully the so-called FeWIS online system which provides the customers (e.g. fire brigades, control centres from the Ministries of the Interior of the Laender, fire safety and disaster management organisations, the police, relief organisations) 24 hours a day with all relevant weather and severe weather information specifically geared to their needs. All warning information is immediately made available to the general public, entirely and free of charge on the internet site of the DWD. An online information system for the flood forecasting centers of the German Länder is currently being developed (they already have online access to DWD weather forecasts).
Cross-border exchange of warnings between National Meteorological Services is helpful.
It is necessary to improve numerical weather forecasting (esp. reg. quantitative precipitation and reg. forecast uncertainties) as well as area-wide weather observation in order to enhance warnings of severe

weather with regard to its occurrence in space and time as well as its intensity.

With respect to the German Heat Health Warning System a better co-operation between the German Meteorological Service and the relevant health authorities of the German Laender would increase the effectiveness of the warnings.
More research with respect to the impacts of the pollen of Neophytes such as ragweed would be needed in order to better understand the relationship between atmospheric environment and pollen transmission.
In order to react to weather and/or climate extremes more effort should be made to forecast weather / climate situations with adverse impacts on the different sectors / aspects with lead times as soon as possible. This requires the improvement and the use of long-term weather forecasts.

Regional climate models are not of sufficient quality for regional/local climate change impact assessment and need to be improved. Climatological analyses of DWD should be used for climate model validation.

Using existing agro-meteorological or agro-climatological models for climate scenario data gives information of the future agro-climatological situation (soil moisture, etc.).

*(c) Contribution of traditional knowledge to understanding and managing climate-related risks;*
There exist lots of weather proverbs from former times based on the long-time experience of farmers. These proverbs are not reliable enough, so they can't be used in official weather forecasting, and they are no help in understanding or managing extreme events.

Traditional knowledge from regions already affected by specific climate change problems (e.g. lower altitudes Southwest Germany or other European regions) can be transferred to regions in Germany that are not yet affected (spatial analogues).

## Severe storms

*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;*
- traffic, buildings, forestry / severe storms: part or all of Germany; Tornadoes: very small area affected, tornadoes may occur anywhere in Germany
- e.g.: Storms Wiebke (Feb/Mar 1990), Lothar (Dec 1999), Anne (Feb 2002), Jeanette (Oct 2002), Kyrill (Jan 2007). Storms of that intensity happen roughly once every two years; tornadoes: There are 15-30 tornadoes observed every year in the whole of Germany
- the probability and intensity of storms might increase
- mid latitude wind speeds might increase
- Weather warning system from National Meteorological Service (NMS)
- Co-ordination of the NMS's weather warning management with disaster management authorities and other disaster protection organisations
- Cross-border exchange of warnings

*(b) Ability, gaps, needs, opportunities, barriers and constraints to predicting climate variability, impacts and extreme events across regions and hazards*
- no information available

*(c) Contribution of traditional knowledge to understanding and managing climate-related risks;*
*a. general comment*
*b. implications for sustainable development*

*(d) Implications for sustainable development in relation to paragraph 34 (a) to (c) above;*

*(e) Promoting understanding of impacts of, and vulnerability to, climate change.*
- Extreme events: Publishing of flyers for the general public in cooperation with disaster protection organisations; educating disaster protection organisations about using the NMS's warnings and the NMS's warning management.
- heavy rain leading to inland flooding

**Heavy rain leading to inland flooding**
*large river floods and flash floods*

*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;*
- traffic, buildings, landscape / surroundings of rivers
- e.g.: severe inland flooding in southern Bavaria in August 2005, inland flooding of river Elbe and flash floods in its catchment area in August 2002
- the frequency of heavy rain events and the total winter precipitation might increase
- increase in winter precipitation and in extreme precipitation
- Weather warning system from NMS
- Co-ordination of the NMS's weather warning management with the flood forecasting centres of the Laender, disaster and flood risk management authorities and other disaster protection organisations
- Cross-border exchange of warnings
- RADOLAN: use of the NMS's radar and raingauge network for the area-wide quantitative analysis of precipitation
- SNOW: analysis and prediction system for the runoff from melting snow and precipitation "

- better co-operation between involved institutions needed (problem: federal structure of the flood forecast responsibilities in Germany)
- improvements of quantitative precipitation forecasts needed (incl. probabilistic uncertainty estimations); land use planning should give more retention areas to rivers

*(b) Ability, gaps, needs, opportunities, barriers and constraints to predicting climate variability, impacts and extreme events across regions and hazards*
- significant improvement of regional climate models needed (precipitation has a very high spatial and temporal variability)

*(e) Promoting understanding of impacts of, and vulnerability to, climate change.*
- extreme events: Publishing of flyers for the general public in cooperation with disaster protection and flood forecasting organisations; educating flood forecasting and disaster protection organisations about using the NMS's forecasts and warnings
-

*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;*
- traffic, buildings, landscape / surroundings of rivers
- e.g.: inland flooding in southern Bavaria in August 2005, inland flooding of river Elbe and its catchment area in August 2002
- General discussion: the probability of heavy rain will increase
- Weather warning system from NMS
- Co-ordination of the NMS's weather warning management with the flood response centres of the Laender, disaster management authorities and other disaster protection organisations
- Cross-border exchange of warnings
- RADOLAN: using the NMS's radar network for the area-wide quantitative recording of precipitation
- BONIE: prediction system for the runoff from melting snow

*(b) Ability, gaps, needs, opportunities, barriers and constraints to predicting climate variability, impacts and extreme events across regions and hazards*

- It has proved mandatory to co-ordinate the weather warning management of the DWD with the disaster management authorities and other disaster protection organisations.
- In 2004 the DWD introduced successfully the so-called FeWIS online system which provides the customers (e.g. fire brigades, control centres from the Ministries of the Interior of the Laender, fire safety and disaster management organisations, the police, relief organisations) 24 hours a day with all relevant weather and severe weather information specifically geared to their needs. All warning information is made available to the general public immediately, entirely and free of charge on the internet site of the DWD.

Cross-border exchange of warnings between National Meteorological Services is helpful.

It is necessary to improve numerical weather forecasting as well as area-wide weather observation in order to enhance warnings of severe weather with regard to its occurrence in space and time as well as its intensity. (c) Contribution of traditional knowledge to understanding and managing climate-related risks;

- There exist lots of weather proverbs from former times based on the long-time experience of farmers. These proverbs are not reliable enough, so they can't be used in official weather forecasting, and they are no help in understanding or managing extreme events.
- Traditional knowledge from regions already affected by specific climate change problems (e.g. lower altitudes Southwest Germany or other European regions) can be transferred to regions in Germany that are not yet affected (spatial analogues).

*(d) Implications for sustainable development in relation to paragraph 34 (a) to (c) above;*

*(e) Promoting understanding of impacts of, and vulnerability to, climate change.*

- extreme events: Publishing of flyers for the general public in cooperation with disaster protection organisations

## Droughts

*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;*

- water transport, agriculture, energy production
- mainly eastern and south-western parts of Germany
- e.g. drought connected with heat wave in year 2003; decrease in summer precipitation
- area affected by droughts might increase
- mean summer precipitation might decrease
- need of irrigation
- Weather warning system from NMS
- Co-ordination of the NMS's weather warning management with the authorities in charge of predicting water levels, as well as with disaster management authorities and other disaster protection organisations
- better drought forecasts needed

*(b) Ability, gaps, needs, opportunities, barriers and constraints to predicting climate variability, impacts and extreme events across regions and hazards*

- better drought forecasts needed

*(d) Implications for sustainable development in relation to paragraph 34 (a) to (c) above;*

- plant crop species that need less water

*Severe storms leading to coastal flooding (storm surge)*

*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;*
- traffic, buildings, landscape / coastal regions, offshore islands
- e.g.: flooding in Hamburg in 1962;
- General discussion: the probability of severe storms leading to coastal flooding will increase
- Weather warning system from NMS
- Co-ordination of the NMS's weather warning management with the authorities in charge of predicting water levels, as well as with disaster management authorities and other disaster protection organisations

*(b) Ability, gaps, needs, opportunities, barriers and constraints to predicting climate variability, impacts and extreme events across regions and hazards*
- no information available

*(c) Contribution of traditional knowledge to understanding and managing climate-related risks;*
*a. general comment*
*b. implications for sustainable development*

*(d) Implications for sustainable development in relation to paragraph 34 (a) to (c) above;*

*(e) Promoting understanding of impacts of, and vulnerability to, climate change.*

## Heat waves and warm spells

*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;*
- heat waves affect the health sector but also all other sectors due to a loss in productivity during periods with extreme heat eg. water transport, agriculture, energy production
- Several severe heat waves in the past decades (e.g., 1976, 1984, 2003,2006) that have been associated with an increase in mortality. E.g. about 1200 extra deaths in Baden-Württemberg due to the heat wave in August 2003
- the number and intensity of severe heat waves might increase (e.g. doubling of heat days in some areas in south west Germany)
- Heat Health Warning System operated by the National Meteorological Service in the framework of the overall weather warning system
- Development of special action plans in cooperation between local administration, hospitals and sanatoriums

*(b) Ability, gaps, needs, opportunities, barriers and constraints to predicting climate variability, impacts and extreme events across regions and hazards*
- Weather forecasts by National Metrological Service
- number of heat days can be predicted based on output of regional climate models
- significant improvement of regional climate models needed (heat waves can be much stronger in regional and local areas)

*(c) Contribution of traditional knowledge to understanding and managing climate-related risks;*
*a. general comment*
*b. implications for sustainable development*

*(d) Implications for sustainable development in relation to paragraph 34 (a) to (c) above;*
- It has proved mandatory to co-ordinate the weather warning management of the DWD with the disaster management authorities and other disaster protection organisations.
- In 2004 the DWD introduced successfully the so-called FeWIS online system which provides the customers (e.g. fire brigades, control centres from the Ministries of the Interior of the Laender, fire safety and disaster management organisations, the police, relief organisations) 24 hours a day with all relevant weather and severe weather information specifically geared to their needs. All warning information is made available to the general public immediately, entirely and free of charge on the internet site of the DWD.
- better co-operation between involved institutions needed (problem: federal structure of the health system in Germany)

*(e) Promoting understanding of impacts of, and vulnerability to, climate change.*
- European cCASHh project (climate change and adaptation strategies for human health in Europe) - finished in 2004 European EuroHEAT project (Improving public health responses to heat waves) the German Meteorological Service participated in these projects
- http://www.dwd.de/de/WundK/Warnungen/Hitzewarnung/index.htm; http://euroheat-project.org/ ; http://www.euro.who.int/ccashh; http://www.lubw.baden-wuerttemberg.de/servlet/is/1454/ (KLARA project)

## Longer vegetation

*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;*
- longer vegetation period can lead to the spread of neophytes with allergenic Pollen (e.g. ragweed)
- longer vegetation period can extend pollen season
- health sector, Germany
- ragweed starts spreading in Germany, emissions of the pollen especially in September when air temperatures are around 20°C
- there might be more years with long enough vegetation periods and warm enough days in September, so that more ragweed pollen are emitted
- Pollen forecasts / newsletter (however ragweed is not yet included in the forecast)
- Pollen forecasts /newsletter by National Meteorological Service

*(b) Ability, gaps, needs, opportunities, barriers and constraints to predicting climate variability, impacts and extreme events across regions and hazards*
- number of years with vegetation periods long enough for the spread of ragweed can be predicted based on the output regional climate models; seasonal weather forecasts might help to identify years with a high allergenic burden for the population
- significant improvement of regional climate models needed and more research about the influence of weather and climate on the emission of ragweed pollen needed

*(d) Implications for sustainable development in relation to paragraph 34 (a) to (c) above;*
- more research needed

*(e) Promoting understanding of impacts of, and vulnerability to, climate change.*
- http://www.dwd.de/de/Zusatzmenues/News/Newsletter/Pollenflug.htm

## Transmission of vector borne diseases

due to an increase in mean temperature and due to milder winters

*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;*
- transmission of vector borne diseases due to an increase in mean temperature and due to milder winters
- health sector, Germany
- increase in tick borne diseases
- further increase + other vector borne diseases that are not yet endemic in Germany

*(b) Ability, gaps, needs, opportunities, barriers and constraints to predicting climate variability, impacts and extreme events across regions and hazards*

*(c) Contribution of traditional knowledge to understanding and managing climate-related risks;*
*a. general comment*
*b. implications for sustainable development*

*(d) Implications for sustainable development in relation to paragraph 34 (a) to (c) above;*

*(e) Promoting understanding of impacts of, and vulnerability to, climate change.*

## Forest fire

*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;*
- eastern and northern parts of Germany
- forest fire 2003
- increasing risk
- publication of fire risk: www.agrowetter.de

*(b) Ability, gaps, needs, opportunities, barriers and constraints to predicting climate variability, impacts and extreme events across regions and hazards*
- using agromet./agroclim. models for climate scenario data

*(d) Implications for sustainable development in relation to paragraph 34 (a) to (c) above;*
replacing conifers by deciduous trees

## 6. Malta

*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;*
Malta's First National Communication to UNFCCC documented main climate-related risks of relevance to Malta as being the consequence of the projected regional changes in temperature, precipitation, evapotranspiration and sea level. Due to its regional geographic characteristics, temperature values in the Central Mediterranean region are 9% more sensitive to the enhanced greenhouse effect than the corresponding global values. To date, these vulnerabilities have largely manifested themselves through greater incidence of extreme weather events and greater dependence on energy-intensive adaptation measures (such as air conditioning, reverse osmosis) to cater for climatic changes.
The FNC indicates a 50% probability that the average temperature will increase by 3 degrees Celsius by the end of the century. Seasonal patterns will be retained with an approximately uniform temperature rise. There is a 50% probability of a 17% decrease in annual total precipitation by 2100. Precipitation will decrease in autumn and increase in spring. Increased evapotranspiration is expected owing to higher temperatures, leading to increased pressure on the water supply. Malta already has the lowest per capita fresh water

resources in the Mediterranean, itself one of the driest regions on Earth. Current trends in sea level rise indicate a 1cm per year local sea level rise. A sea level rise of 50cm by 2050 and 100cm by 2100 is being assumed for the assessments and adaptation measures in the Maltese islands. Other estimates indicate a rise of 50cm by 2100, however, there is still a great deal of uncertainty on sea level rise as there are other factors that could trigger an exponential rise not factored into the present climate models.

Malta's First National Communication (FNC) on climate change under UNFCCC (2000) reports the following key concerns:

- Drought (due to reduction in precipitation and increase in evapotranspiration).
- Deterioration of freshwater quality and availability (due to increased evaporation, decreased precipitation and increased saline water intrusion into mean sea level aquifer due to sea level rise).
- Increased risk of floods (due to increased rain intensity).
- Increase in soil erosion and desertification and associated impacts on agriculture.
- Increased risk of storms and severe weather incidence.
- Accelerated coastal erosion (due to sea level rise and increased incidence of storms).
- Changes in sea water mass characteristics (changes in physico-chemical parameters).
- Sea level rise.
- Biodiversity loss and degradation (fragmentation of habitats, Westward migration of Red Sea species, loss of marine biodiversity due to changes in salinity and turbidity).

The FNC notes that these risks may cause impacts on:

### Human health

- Projected increase in incidence of vector-borne and food-borne diseases endemic to Malta due to mean temperature increase (malaria, leishmaniasis, cholera, dysentery)
- Projected incidence of thermal stress-related illnesses, affecting most vulnerable population (aged, infirm, individuals with impaired cardio-vascular function, etc)

### Agriculture and Fisheries

- Projected negative impacts on agriculture due to deterioration of water resources, longer periods requiring irrigation, increase in flood intensity and loss of soil nutrients through run-off.
- Fisheries may experience disturbances from increased salinisation, reduced dissolved oxygen, changes in seawater circulation and increased incidence of algal blooms.

Although there has been no detailed national study of socio-economic impacts, the following impacts may be identified:

- Impacts on tourism: changes in seasonal tourism patterns.
- Impacts on energy demand: higher demand for electricity due to increased domestic and industrial requirements related to temperature changes.
- Impacts on irregular migration patterns (Central Mediterranean is increasingly becoming a hotspot for irregular migration from Northern and Sub-Saharan Africa).
- Impacts on heritage, particularly architectural heritage located in low lying coastal areas subjected to increased coastal erosion.

Adaptation to climate change will also bring about its own challenges due to:

- Potentially high costs involved;
- Limited spatial possibilities for changes that may be required;
- Effect of adaptation measures on “traditional” economic and social character;
- Potential conflict of adaptation measures with other policies and measures;
- Tradeoffs inherent in adaptation, such as possible loss of certain biodiversity or natural habitats due to

adaptation infrastructure required.

The following list of initiatives (not exhaustive) may be of relevance:

**Coastal flooding / Drought**: In the framework of the Mediterranean Action Plan (MAP) and within its Coastal Area Management Programme (CAMP), a project for Malta was launched in November 1999. The Project was oriented towards sustainable management of the coast of Malta (in the Northwest area). A Soil erosion / desertification control management activity was implemented within the CAMP Malta Project. (http://www.pap-thecoastcentre.org/about.php?blob_id=36&lang=en)

**Heat waves / severe weather:** Activities currently underway mainly involving ongoing monitoring, data storage and forecasting on expected changes in temperature and precipitation, as well as weather forecasting http://www.maltairport.com/weather

**Sea level monitoring:** The Physical Oceanography Unit at the International Ocean Institute's Malta Operational Centre at the University of Malta, monitors sea level changes and elaborates trends on sea level rise http://www.capemalta.net

**Inland flooding:** The Civil Protection Department of Malta developed a flood warning system giving a warning for a certain amount of precipitation and intensity which will lead to a volume of water that is hazardous for safety of humans in urban and specific areas which are prone to flooding. A Storm-Water Master Plan is being prepared by Malta's Water Services Corporation shortly to be concluded.

**Deteriorating water quality / availability:** In the context of the implementation of the European Union (EU) Water Framework Directive (WFD), the Malta Resources Authority (MRA) has launched a project for the development of the programme of measures in the Maltese Water Catchment District. The project focuses on groundwater resources and water supply and aims at identifying the most cost-effective option for restoring the status of groundwater resources in line with the requirements of the WFD. Another project also being implemented by MRA is titled INWATERMAN and involves cooperation between Malta and Sicily. The overall objective of the INWATERMAN project is the sustainable management of conventional and non-conventional water resources in arid and semi-arid insular settings. Additional details are available from www.inwaterman.eu and http://www.mra.org.mt MRA are also partners in an INTERREG project entitled Proactive Management of Water Systems to face Drought and Water Scarcity in Mediterranean Islands and Coastal Areas.

*(b) Ability, gaps, needs, opportunities, barriers and constraints to predicting climate variability, impacts and extreme events across regions and hazards*

The FNC provided an overview of some of the studies undertaken to date and is perhaps the most comprehensive national study on long-term climatic changes and their effects. Currently there is limited capacity for long-term prediction and analysis of climate change impacts although the Malta Environment and Planning Authority is seeking to secure funds to compile the National Adaptation Plan covering impacts on various sectors.

The main issue is lack of capacity, in terms of human resources, scientific research capacity and funding. Another constraint is the lack of awareness amongst socio-economic players of the potential long term impacts on the sustainable development of the country.

Although the research and modeling procedures used for assessments have been rapidly evolving and the main climate change effects on the Mediterranean environment can be forecast, data obtained on a Mediterranean spatial scale is still somewhat unreliable for an adequate evaluation and application (EEA, 1999). For instance, the detailed forecast of sea level rise in the Mediterranean region is precluded by the lack of climatic historical data series. Emerging socio-economic impacts are generally more complex to analyse and are less well understood and studied than natural impacts of the climate change.

Other concerns include:
- an urgent need for a detailed assessment of Malta's vulnerability and the setting out of a comprehensive adaptation strategy;
- need for greater resources to project and assess future climate related risks and their economic and social impacts;
- need for baseline and monitoring data that can help identify zones at risk from coastal erosion and flooding

*(c) Contribution of traditional knowledge to understanding and managing climate-related risks;*
Traditional knowledge can be of great use and is normally assessed and adapted as appropriate for inclusion in environmental management issues. This may also be the case with respect to knowledge that can help mitigate the causes of climate change.

In Malta, traditional knowledge is widely applied to managing adaptation to certain climate-related impacts, such as depleting water supply. For instance, principles inherent in traditional architecture and urban design may be applied to modern-day spatial planning to ensure greater thermal and water efficiency in buildings (such as, thick walls, window size and orientation, roofing materials, wells for water storage typical in most old structures). Similarly, certain traditional agricultural practices (such as, construction of traditional rubble walls, terracing of fields on hill-sides and planting of appropriate trees) are known to be highly effective in combating effects of climate change, such as soil erosion.

There are two challenges that are worth noting in this regard, the first is the challenge to link traditional knowledge with the most up-to-date information on climate change and its impacts and the second is rate at which such knowledge is lost with time unless documented.

*(d) Implications for sustainable development in relation to paragraph 34 (a) to (c) above;*
Good prediction of climate variability, impacts and extreme events would provide a strong information basis for (urgent or long-term) measures that may need to be taken to manage risks arising from such factors. This is essential for advancing sustainable growth agenda in Malta.

The implications of adapting to climate change would span the social, economic and environmental fields and hence by their very nature effect sustainable development. It is also expected that the need to adapt will have implications on the ability to mitigate (e.g. water shortage creates demand for desalination which in turn increases demand for energy, and hence impacts on climate change).

It is worth noting that most of the economic activities and urban development is concentrated along the low lying areas of the Maltese islands leading to potentially high costs to either combat impacts of climate change or relocation of certain activities – potentially leading to more pressure on undeveloped sites. The draft National Sustainable Development Strategy for Malta mentions the development of necessary infrastructure and investment in adaptation measures one of its main long term strategic priorities.

Of particular significance is Malta's present reliance on fossil fuels for energy production, when viewed in the context of its commitment to reduce GHG emissions, the projected greater reliance on energy-hungry desalination processes for the production of potable water and increased electricity demand for ambient cooling, besides the fluctuation of oil prices and availability.

*(e) Promoting understanding of impacts of, and vulnerability to, climate change.*
A national scale project focusing on providing an in-depth assessment of sectoral vulnerabilities to climate change and on the drawing up of the national Adaptation Plan is currently being developed by the Malta Environment and Planning Authority. A project to draft Malta's Second National Communication to UNFCCC is also currently being developed for financial support by the GEF.

## 7. Netherlands

### Climate risk – general

*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;*

- Inland flooding due to local heavy rain, rain and melting snow upstream of the rivers in our delta, or a combination. Sewerage can also be affected. Sea level rise will enhance this risk, especially in case of severe storms.
- Coastal flooding is a risk directly related to sea level rise and storms. Sea level rise will also lead to increased intrusion of salt water behind the coast.
- Droughts can cause weakening of river (peat) dikes and will affect agriculture. Other related risks are salt intrusion, insufficient water for cooling of power plants, and stagnation of transport on rivers.
- Heat waves are a threat for elderly people especially.
- Especially inland and coastal flooding. Two serious heat wave. Inner-city sewerage problems.
- We expect to be affected by sea level rise, winters with more precipitation, dryer summers and more severe precipitation events.
- Spatial planning programmes in view of climate change (BSIK and ARK, listed in the CIRCLE extended country report, see above). Contributions to (global) climate monitoring. Contributions to GMES. Regularly updated regional climate scenarios and reports on the state of the climate. National procedure for severe weather warnings. National Platform on Climate Change. Netherlands Environmental Assessment Agency.

*(b) Ability, gaps, needs, opportunities, barriers and constraints to predicting climate variability, impacts and extreme events across regions and hazards*

- Climate modelling at the NMS, contributions to ECMWF. Development of national climate change scenarios. Contributions to research on prediction of extremes in EU project Ensembles.
- Methods to store river water in specific regions in case of high water situations are being developed.
- Downscaling issues to local applications.

*(c) Contribution of traditional knowledge to understanding and managing climate-related risks;*

- We have a long-standing tradition in building and maintaining river dikes and coastal defence.

*(d) Implications for sustainable development in relation to paragraph 34 (a) to (c) above;*

- Sustainable water management

*(e) Promoting understanding of impacts of, and vulnerability to, climate change.*

- Governmental information campaigns, National Platform on Climate Change.

## 8. Romania

### Climate risk – general

*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;*

- During the last years, extreme events affected our country: river flooding, flashfloods, drought, heavy snow, forests and land fire, could waves, coastal flooding tornado, avalanches.
- In 2006, Romania faced with last century maximum flows of Danube (more than 15.000 cm/s) and was hit by catastrophic floods

- The special weather phenomena occurred in 2005 and 2006 (precipitation that inflicted wide-scale flooding and landslides, hail, storm-like wind gusts, tornadoes) caused huge damage and life loss. For instance, in 2005, due to floods, 1734 localities were affected in the 41 counties of the Romanian territory and in Bucharest and 76 fatalities were recorded. There were 93.976 households and house annexes, 656.392 ha of agricultural land, 1063 socio-economic units and a lot of infrastructure means destroyed or affected, the destruction being estimated to amount at 2 billion Euro. In 2006, In 2006, Romania faced with last century maximum flows of Danube (more than 15.000 cm/s) and was hit by catastrophic floods.
- It is expected that Romania will face with an amplification of the extreme meteorological phenomena; the meteorologists are warning that the number of extreme precipitation days and implicitly the floods will increase, as well as the number of extremely high days and droughts, or the number of days bellow 0. During summers there will be devastating storms and strong winds during winter. For instance, we expect 2007 to be one of the draughtiest years.

- During the last years Romania's efforts focused on implementing projects aimed to:
    - improve the forecast and detection of meteorological phenomena by implementing the Meteorological Integrated national System (SIMIN)
    - National Disaster Management System ( WATMAN) -
    - Water Disaster Monitoring System (DESWAT)
- Life Funding: The following LIFE projects dealing with the adaptation issues have been developed in Romania:
    - MOSYM – LIFE 99/ENV/RO/006697 – Modernization of the hydrological informational system (three pilot basins Arges, Mures and Siret)
    - ASSURE - LIFE 99/ENV/RO/006746 – Implementing of a integrated computational system for the urban area pollution (Baia Mare pilot)
    - RIVERLIFE - LIFE 00/ENV/RO/000986 – River life protection by flood mitigation
    - AIRFORALL - LIFE 00/ENV/RO/000987 – Air pollution forecast in unfavorable climatic and topographical conditions, monitoring and alarming system
    - DIMINISH - LIFE 03/ENV/RO/000539 – Developing an integrated basin management system in a GIS environment for water quantitative and qualitative monitoring with socio-economic conditions

*(b) Ability, gaps, needs, opportunities, barriers and constraints to predicting climate variability, impacts and extreme events across regions and hazards*

- Programmes:
    - Numerical Weather Prediction (ALADIN, etc)
    - SIMIN (DOPLER radars)
- Romania is in process to reshape and update the existing water management schemes and, in this respect started to develop a Strategy for flood control. The hydrological system is in process of modernization.
- It is needed to develop a research programme on adaptation, to update the climate change scenarios and also, to develop an national adaptation action plan; all those activities depends on limited financial resources.

*(d) Implications for sustainable development in relation to paragraph 34 (a) to (c) above;*

- Sustainable development requires a better understanding of the climate system with the possibility to better adapt to climate changes and their potential impacts on socio-economic activities and the environment. The development of action plans need more detailed scenarios and better communication among all involved stakeholders.
- Due to the threats posed by the increased frequency and intensity of extreme weather and climate events to sustainable development, the improvement of forecasting capabilities with emphasis on high-impact weather is a priority.
- The improvement of the prediction, forecasting and early warning systems can provide communities

with the information needed to activate plans in time to protect life and minimize economic losses.

*(e) Promoting understanding of impacts of, and vulnerability to, climate change.*
- 2006: Awareness campaign on flood risk management www.mmediu.ro;
- Guidelines for prefects and majors on flood emergencies management;
- Starting with 2007 MEWM intends to organise awareness campaigns on climate change issues; one of them will address children (10-14 years old) and teachers.

## Floods and flashfloods

*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;*
- in 2005 and 2006 Romania has been affected by the most severe floods in the last 30 years. During this floods, historical discharges have been recorded on the inland rivers.
- life losses: 76 in 2005 and 17 in 2006
- flood protection infrastructure: hidrotechnical works: 630 in 2005 and 214 in 2006
- transport infrastructure: roads: 15529 km in 2005 and 3748 km in 2006
- agriculture : 656 392 ha of agricultural land in 2005 and 88 146 ha in 2006
- the meteorologists raised a warning signal on the increasing of extreme precipitation days and implicitly the floods,
- The National Strategy and National action plan on climate change National Strategy for Flood Risk Management SIMIN WATMAN DESWAT LIFE projects dealing with the adaptation issues have been developed in Romania:
  - MOSYM – LIFE 99/ENV/RO/006697 – Modernization of the hydrological informational system (three pilot basins Arges, Mures and Siret)
  - ASSURE - LIFE 99/ENV/RO/006746 – Implementing of a integrated computational system for the urban area pollution (Baia Mare pilot)
  - RIVERLIFE - LIFE 00/ENV/RO/000986 – River life protection by flood mitigation
  - AIRFORALL - LIFE 00/ENV/RO/000987 – Air pollution forecast in unfavorable climatic and topographical conditions, monitoring and alarming system
  - DIMINISH - LIFE 03/ENV/RO/000539 – Developing an integrated basin management system in a GIS environment for water quantitative and qualitative monitoring with socio-economic conditions
  Operational Headquarter is situated at the Ministerial Committee for Emergencies

*(b) Ability, gaps, needs, opportunities, barriers and constraints to predicting climate variability, impacts and extreme events across regions and hazards*
- Weather forecast (National Meteorological Agency) Hydrological forecast (National Hydrological Institute)
- Romania is in process to reshape and update the existing water management schemes and, in this respect started to develop a Strategy for flood control. The hydrological system is in process of modernization. It is needed to develop a research program on adaptation, to update the climate change scenarios and also, to develop a national adaptation action plan; all those activities depends on limited financial resources.
- It is needed to develop a research programme on adaptation, to update the climate change scenarios and also, to develop an national adaptation action plan; all those activities depends on limited financial resources.

*(c) Contribution of traditional knowledge to understanding and managing climate-related risks;*
- The traditional knowledge and practices should be integrated with new scientific insights and technology in order to enhance risk management and adaptation;

*(d) Implications for sustainable development in relation to paragraph 34 (a) to (c) above;*
- Flood risk will be better assess
- agriculture, water supply

*(e) Promoting understanding of impacts of, and vulnerability to, climate change.*
- 2006: Awareness campaign on flood risk management www.mmediu.ro; Guidelines for prefects and majors on flood emergencies management;
- In 2007 there will be organized an awareness campaigns on climate change issues, one of them will address education field

## Severe droughts

*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;*
- Southwestern part of Romania (aridity index P/EPT< 0.65)
- 48% of the agricultural area (14,717.4 thousand ha) is affected by drought
- We expect 2007 to be the doughtiest year
- National Committee for Drought Mitigation, Land Degradation and Desertification: Plans on water use and restrictions during droughty periods, established at basinal level

*(b) Ability, gaps, needs, opportunities, barriers and constraints to predicting climate variability, impacts and extreme events across regions and hazards*
- Assessment of the climate change and climatic variability impacts on agricultural crops and the main water balance elements, including the effects of agriculturally significant climatic extremes by using modelling approaches;
- It is needed to develop a research programme on adaptation, to update the climate change scenarios and also, to develop an national adaptation action plan; all those activities depends on limited financial resources.

*(c) Contribution of traditional knowledge to understanding and managing climate-related risks;*
- The traditional knowledge and practices should be integrated with new scientific insights and technology in order to enhance risk management and adaptation;

*(d) Implications for sustainable development in relation to paragraph 34 (a) to (c) above;*

*(e) Promoting understanding of impacts of, and vulnerability to, climate change.*

**9. <u>Spain</u>**

## Climate risk – general

*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;*
- *<u>Terrestrial ecosystems</u>*
  Climate change will affect the structure and functioning of terrestrial ecosystems, will alter the phenology and interactions among species, will favour the spread of invasive species and pests and will increase the impact of both natural and anthropic disturbances. The areas and ecosystems most vulnerable to climate change are islands and isolated ecosystems, such as edaphic islands and high-mountain systems, and ecotones, or areas of transition between systems.

- *Inland aquatic ecosystems*
  With a high degree of certainty, climate change can be expected to make many of Spanish continental aquatic ecosystems (SCAE) change from permanent to seasonal; some will disappear. The biodiversity of many of them will be reduced and their biogeochemcial cycles will be altered. The magnitude of these changes cannot yet be established. The ecosystems most affected will be: endorheic environments, lakes, lagoons, rivers and high-mountain streams (1600-2500 metres), coastal wetlands and environments depending upon subterranean waters.

- *Marine ecosystems and the fisheries sector*
  The effects of climate change will differ for upwelling ecosystems or those comprising stratified areas and for coastal or oceanic areas. Reduced productivity is expected in Spanish waters, given their characteristics as subtropical or warm temperate seas. The changes will affect many groups of organisms, from phytoplankton and zooplankton to fish and algae. There will be changes in the marine trophic networks, affecting resource species, especially in their larval phase and in recruitment. Species distribution will change, with an increase in temperate waters and subtropical species and a decrease in boreal species. There will be a possible increase in invasive species. Marine cultures provided with no food supplement could be affected by the reduced marine productivity. Increases are to be expected in the appearance of species of toxic phytoplankton or parasites of cultivated species, favoured by the temperature increase in coastal waters. The areas and systems most vulnerable to climate change are benthic communities; fields of phanerogams will be the most affected.

- *Plant biodiversity*
  The direct impacts of climate change on plant biodiversity will occur through two antagonistic effects: warming and reduced hydric availability. The "Mediterraneisation" of the North of the Peninsula and the "aridification" in the South are the most significant tendencies. The biggest indirect impacts are those deriving from edaphic changes, changes in the fire regime and a rise in sea level. Interactions with other components of global change and the modification of interspecies interaction constitute another potential source of impacts for which evidence is now beginning to accumulate. High-mountain vegetation, forests and deciduous thickets sensitive to summer drought, sclerophyllous and lauroid forests in the South and Southwest of the Peninsula and coastal vegetation are among the most vulnerable types. Structural simplification and the predominance of local extinction over re-colonisation constitute recurring tendencies of the different impacts. The loss of floristic diversity is of particular relevance in Spain, given that our country contains a high proportion of Europe's plant diversity.

- *Animal biodiversity*
  Spain is possibly the EU's richest country with regard to animal species, and the one with the highest number of endemisms. Climate change will cause:
  - 1) Phenological changes in populations, with advances (or delays) in the initiation of activity, arrival of migratory species or reproduction;
  - 2) maladjustment between predators and prey due to differential responses to climate;
  - 3) displacement in the distribution of terrestrial species northwards or towards greater altitudes, in some cases with a clear reduction of their distribution areas; in rivers, displacement of thermophilic species upstream and a decrease in the proportion of cold water species; in lakes and lagoons, altitude, latitude and depth have similar effects upon communities in relation with temperature;
  - 4) greater virulence of parasites,
  - 5) an increase in populations of invasive species.

- *Hydric resources*
  In Spain, climate change will cause big decreases in water resources. For the 2030 horizon, we can expect average decreases in hydric rosurces in natural regime of between 5 and 14%, whereas for 2060 an average global reduction of hydric resources is expected of 17% on the Peninsula. These figures could exceed between 20 and 22% for the scenarios predicted for the end of the century. Along with this decrease in resources, an increase is expected in the interannual variability thereof. The impact will be

noted more severely in the Guadiana, Canarias, Segura, Júcar, Guadalquivir, Sur and Balearic Isles river basins.

- *Soil resources*
  Much of Spain's territory is currently threatened by desertification processes, especially by the impact of forest fires and fertility loss in irrigated soils due to salinisation and erosion. The projected climate changes will exacerbate these problems in a generalised manner, especially in the areas of Spain with dry and semiarid Mediterranean climates. The projected climate changes will probably cause a carbon decrease in Spanish soils, which will negatively affect the physical, chemical and biological properties of the soils.

- *Forestry sector*
  Forests pests and diseases can play a fundamental role in the fragmentation of forest areas.
  Some perforating or defoliating species can complete up to two biological cycles per year or increase their colonisation area as a consequence of more benign winters.
  The physiology of most forest species could be profoundly affected. There is a high risk that many of our forest ecosystems will become net carbon emitters during the second half of this century. Tip of mountain areas, the more xeric environments and riparian forests could become more vulnerable to climate change.

- *Agrarian sector*
  Changes in CO2 concentrations, in air (and ground) temperature values, and variations in seasonal rainfall will have opposing and non-uniform effects upon Spain's agricultural systems. Climate change could affect the ingestion and wellbeing of the livestock and, consequently, the profitability of livestock farming systems. From the point of view of animal health, we can expect to observe the effects of climate change in all parasitic and infectious processes the etiological agents or vectors of which have a close relationship with climate.

- *Coastal areas*
  The main problems related to climate change in Spain's coastal areas are associated with a possible rise in mean sea level (MSL). Projections by the models vary from 10 to 68 cm for the end of the century. For the end of the century, a 50 cm rise in MSL can reasonably be expected, with 1 m in the most pessimistic scenario. With a generalised rise in MSL, the most vulnerable areas are deltas and confined and rigidized beaches. This could lead to the loss of many beaches, especially on the Cantabrian coast. Many coastal lowlands would be flooded (Ebro and Llobregat deltas, Manga del Mar Menor, Doñana coast), some of which might be built up.

- *Natural hazards of climatic origin*
- Flood risk
  Hydrological variability in Atlantic basins will increase in the future as a result of the intensification of the positive phase of the NAO index. This might reduce the frequency of floods, although not the magnitude of these. In the Mediterranean and inland basins, the greater irregularity of the rainfall regimes will cause an increase in the irregularity of the regimes of floods and flash floods.

- Slope instability risk
  Landslides and avalanches are concentrated in the main mountain ranges, especially in the Pyrenees, and the Cantabrian and Betic ranges. Slope instability currently causes losses of hundreds of millions of Euros annually, especially in communication channels and, to a lesser extent, in population settlements. The number of deaths caused by landslides has dropped in the last few decades, but there has been an increase in those caused by avalanches as a result of the mountains being more frequented. While confirmation by more accurate climate models is being awaited, increased torrentiality will cause a greater number of surface landslides and debris flow, the effects of which could be exacerbated by changes in land uses and less plant cover. Consequently, increased erosion is expected on slopes, along

with a loss of quality of surface waters, due to increased turbidity, and a higher rate of clogging in reservoirs.

- Forest fires risk
  Temperatures and soil moisture scarcity will increase, which will cause greater and more longlasting desiccation of fuels. Fuel flammability will therefore increase. Mean danger indices and, in particular, the frequency of extreme situations will increase. The average duration of the firedanger season will be prolonged. There will be more ignitions caused by lightening. There will be an increase in the frequency, intensity and magnitude of fires.

- *Energy sector*
  In a scenario of temperature increases and reduced rainfall, an increase is expected in the demand for electric energy, which should be covered without having to resort to hydraulic energy production, as this would be reduced; an increase in the demand for oil and natural gas is also predicted, along with reduced deposits of biomass (currently scarce). Only solar energy (in its different forms) would be favoured by the plausible increase in hours of insolation. If there were to be an increase in episodes of strong winds, there might also be an increase in the production of aeolic-generated electricity.

- *Tourism sector*
  The impacts of climate change on the geographic-tourism space could cause changes in the associated ecosystems. Water scarcity would cause problems related to the functionality or economic viability of certain destinations. Temperature increases could cause changes in some activity schedules, leading to more travel between seasons. A rise in sea level would threaten the current location of certain touristic resorts and the infrastructures thereof. These impacts would have a greater effect upon the more deteriorated areas with a greater combination of the different climatic effects. There might be a reduction in the average stay at each destination, a delay in the moment of deciding to travel and a change of destination, foreign tourists thus staying at home and nationals travelling to northern coasts or inland.

- *Insurance sector*
  The detection of the effects of climate change upon the Spanish insurance sector involves analysis of the claims rates for coverage of flooding, storms, frosts, hail and drought, damages being the branch most affected. Storms and flooding are the most numerous and costly events. Compensation for flooding in the 1971-2002 period increased, most likely due to the increase in the insurance index, in exposure and in insured capital. Statistics for agricultural insurance show that the eastern half of the Peninsula is the most sensitive to climate change.

- *Human health*
  From the point of view of the possible impacts upon human health, we would need to consider the effects on morbidity and mortality of extreme temperatures, fundamentally through heat waves, which have been indicated as the most frequent with regard to intensity and duration for the coming years. Furthermore, the foreseeable increase in fine particles and ozone will constitute the main impacts in relation to atmospheric pollution. To these impacts we must add the geographic spread to our country of pre-established vectors or the establishment of subtropical ones adapted for survival in cooler, drier climates.

*(b) Ability, gaps, needs, opportunities, barriers and constraints to predicting climate variability, impacts and extreme events across regions and hazards*

*Some needs for activities:*

- *Terrestrial ecosystems*
  The management of terrestrial ecosystems should involve society as a whole and seek creative ways of

financing activities aimed at mitigating effects and for restoration and research. The conservation of terrestrial ecosystems in a scenario of climate change clashes with many human activities, especially in relation to the use of natural resources like water. There is a need for integrated management of the multiple goods and services provided to us by terrestrial ecosystems.

- *Inland aquatic ecosystems*
  The possibilities of adaptation of continental aquatic ecosystems (CAE) to climate change are limited. In order to mitigate the effects thereof, there is a need for water saving policies, improved water quality and an intensification of the measures for the conservation of the surrounding terrestrial environments. Given that new conflicts over water are to be expected as a result of climate change, it is reasonable to expect the conservation of CAE to be the easiest priority to ignore. The changes the CAE are really subjected will affect environmental conservation and the tourism sector, population protection, water supply and continental fisheries.

- *Marine ecosystems and the fisheries sector*
  The management of coastal marine ecosystems and of marine species should be considered from a multispecific and ecosystemic perspective. The search for solutions that mitigate the effects of direct human activity should be promoted, along with medium- or long-term follow up of actions.

- *Plant biodiversity*
  Avoiding losses of biodiversity caused by the impacts of climate change requires global responses. The sectorial strategies designed require a broader geographic framework than that of regional or local administrations, upon which they currently depend. The network of protected spaces, conservation policy, ecological restoration, forest management, the regulation of livestock farming and hunting uses, land planning, environmental evaluation and education constitute the policies most involved in the challenge of providing responses to the impacts of climate change.

- *Animal biodiversity*
  The areas most vulnerable to climate change are coastal areas, wetlands and permanent water course which will become seasonal and seasonal ones that will have a more irregular flow or will even disappear, high mountain areas and moist pasturelands. Neither the displacement of distribution ranges (hypothesis I) nor rapid adaptation to new ecological conditions (hypothesis II) appear to constitute feasible solutions for most of the species studied. The main management solutions should include the design of nature reserves and parks interconnected by biological corridors. The network of protected areas should include latitudinal and altitudinal gradients in order to protect populations undergoing processes of geographic displacement as a result of climate change. The zones or areas especially sensitive to climate change should be identified, especially for species with no option for habitat displacement.

- *Hydric resources*
  The change will necessarily involve re-modelling and redefining new policies such as those related to science and technology, hydraulics, energy, agriculture, environment and land planning. We recommend continuing with the tradition of measurements established in Spain by means of control systems, which are generally well-established or being improved. However, the convenience should be highlighted of designing and establishing, or clearly improving, the water use control networks, in relation both to surface and groundwater, along with the flow gauge network in fountains and springs.

- *Soil resources*
  The reforestation of marginal, barren land and the practice of a type of agriculture aimed at soil conservation, along with an increase in organic carbon content and improved edaphic fertility, offer great possibilities with regard to counteracting the negative effects of climate change. The amendment of the PAC (Agenda 2000) offers possibilities for applying this principle. Soil quality should be taken into account in town planning and in any re-classification of use. The drafting of the *European Strategy*

*for Soil Conservation* s should established the basis for the development of European regulations dealing with the conservation and sustainable use of soils.

- *Forestry sector*
  In view of the foreseeable changes, an adaptational strategy is recommendable. Clipping of the underbrush to reduce stump density has proved to be an efficient treatment that improves the response of these forests to climate change. Control and adjustment of exploitation turns and intensities should be considered as an option for optimising the response of the forest. Equally important is the careful selection of the origins of the seeds in reforestation, for appropriate management of genetic diversity.

- *Agrarian sector*
  In agricultural systems, extensification or forestation should be favoured in areas with increased instability, or intensification of stabilisation by means of irrigation in other areas, along with the establishment of alternative crops or areas of compulsory fallow and new design of integral control of pests and diseases. In livestock farming, reduced carrying capacity should be favoured, along with the necessary changes in grazing management; there should be support for supplementing and adapting facilities. The farming of autochthonous species and vector control should be considered, due to their possible repercussions in relation to foreseeable pathologies.

- *Coastal areas*
  Immediate action is required in relation to the human factors affecting the stability of the coast, such as the maintenance of discharge and solid deposits by rivers as a solution to the "origin" of the problem (the lack of sedimentary material). As a solution to the "symptoms" of the problem (excessive retreat or mobility of the coast), we can indicate the stabilisation of beaches and dunes, the construction of structures for limiting the transport capacity of incoming waves and artificial deposits of sediments. Protection of natural values (strict land planning to ensure the maintenance and recovery of valuable areas) is vital. There is also a need to demarcate and inventory the areas and elements that could be affected by a rise in sea level, in order to define where to apply abandonment and retreat strategies, or ones related to protection.

- *Natural hazards of climatic origin*
- *Flood risk*
  We must improve the quantification of risk and prevention in relation to climatology and land planning, especially in urban areas and tourist resorts, particularly in Mediterranean ones; we also need to improve catchment prediction systems.

- *Slope instability risk*
  Land and town planning, aimed at avoiding the areas most susceptible to slope instability constitute the best and most economical adaptational tool.

- *Forest fires risk*
  Policies on fire fighting, land and forest planning and training and information for the public should be adjusted to the new conditions. Management schemes based on the total exclusion of fire should be modified, providing the possibility to use fire as a tool for reducing the hazadousness of certain areas. Plans for conserving biodiversity or for combating desertification ought to incorporate the new scenarios of increasing fire-danger. Management of public spaces for recreational use should take into account the growing danger that approaches.

- *Energy sector*
  We seem to be following the right path with regard to energy policy, both in the EU and in our country, but our energy production, however, is far from being sustainable. We therefore need to study these policies in depth in order to adopt specific and additional measures for implementing strategies, in order to make our energy production sustainable, especially with regard to reducing emissions.

- *Tourism sector*
  Implications for public policies, from the incorporation of financial and fiscal aid and investment in specific infrastructures, to the modification of existing legislation on land planning, delimitation and uses, transport and even school schedules. All of this can be established through policies that reinforce investment in tourist infrastructures that capitalise on new opportunities in new areas, apart from the necessary restructuring of certain destinations and traditional products.
  This will require the vital public leadership and the active incorporation of all the companies in the tourism sector.

- *Insurance sector*
  We recommend the follow-up, in each regional autonomy, of the following measures, to be analysed and applied at national level:
  - 1) Review of the Basic Construction and Design Regulations, and Review of Land Planning and Land Uses, in accordance with the climatic risk of each area and the foreseeable evolution of this.
  - 2) Promotion of prevention education from primary school level.
  - 3) Promotion of insurance as a prevention instrument.
  - 4) Adaptation by the insurance market to the possible demands in a new scenario of climatic risk.
  - 5) Analysis of the variability of agricultural policy in future climate scenarios.

- *Human health*
  There is a need for public health action plans based on early warning systems aimed at identifying risk situations before these occur, which involves an agile and reliable morbidity and mortality database. We need to apply and follow up European Directives relating to all the aspects that might affect human health, both in the short- and long-term. It is also of vital importance to promote and develop specific surveillance and control programmes related to vector-borne diseases, and to initiate activities aimed at increasing citizen awareness and participation in all the activities related to climate change and the implications thereof for human health.

*(c) Contribution of traditional knowledge to understanding and managing climate-related risks;*
- Traditional knowledge can contribute to understand and manage climate change related risks.
- For example from our perspective, it is known that Spain has during summer time, in the warmest places of our territory, customs that could be named as "heat culture" (reducing activities during the hottest of the day, buildings adapted to high temperatures, etc).
- It is possible to find many other examples in many other places of the world. Solutions found in the past for some regions could not be valid now for that region but could be valid for other regions that were "colder" (from the climate point of view) years ago.

*(d) Implications for sustainable development in relation to paragraph 34 (a) to (c) above;*
- Sustainable water management

*(e) Promoting understanding of impacts of, and vulnerability to, climate change.*
- Governmental information campaigns, National Platform on Climate Change.

## 10. Sweden

### Climate risk – general

*Overall climate change, in conjunction to other human and environmental pressures*

*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;*
- Forestry: Forestry operations may become more difficult in absence of frozen grounds.

- Fishery: Both cold-water and warm-water species existing in Sweden will be affected by climate change. In conjunction with warming, a reduced salt concentration in the Baltic Sea would cause cod and other saltwater species to be displaced.
- Tourism (winter): Ski resorts will suffer from a less snow. The tree line is moving, so that the popular hiking trails might in the future pass through deciduous forest instead of going over bare mountain.
- Reindeer herding: Formation of ice layers in snow during winters punctuated with mild spells
- Human health: Tickborne desease, heat waves, more frequent outbreaks of "exotic diseases" carried to Sweden by travellers
- Ecosystems (endemic ones, sub-arctic mountains, Baltic Sea (cf. water temperature, sea ice, salinity), cold lakes) : A rise in temperature and carbon dioxide concentration, affects a number of different plant-physiology processes, which in turn govern the structure and function of entire ecosystems.
- Sporadic events, occurrences of tick-borne diseases have been noted further north than earlier
- http://www.regeringen.se/content/1/c6/05/47/46/98ae6857.pdf and http://www.circle-era.net/uploads/media/CIRCLE_Del_Ia1_Extended_Country_Report_1stISSUE_Final_DRAF_.pdf
- Human health is a theme in the newly started research program CLIMATOOLS http://www.foi.se/FOI/Templates/ProjectPage____5351.aspx

*(b) Ability, gaps, needs, opportunities, barriers and constraints to predicting climate variability, impacts and extreme events across regions and hazards*

- Forecasting. Regional climate scenarios and hydrological impact studies. Time series analyses.

(i) Operational: Weather forecasting.
(ii) Climate: regional climate scenarios + impact studies.

- Local (point) skill of weather forecasts, esp with respect to intensive precipitation and snowfall.

- Their sporadic nature, event-to-event variability of the storms and, at times, very rapid development of systems makes prediction difficult. Potential of probablistic information not fully exploited.

(i) Operational: Hydrol. forecasting based on weather forecasts.
(ii) Climate: regional climate scenarios + hydrological impact analyses.

- Skill in medium-to-long range weather forecasts. Further advances needed in probabilistic forecasting (weather & hydrology) and probabilistic climate scenarios + impact assessments.

- (i) Weather forecasting combined with soil/ground water monitoring. Geographical mapping of vulnerable areas. (ii) Climate change: regional climate scenarios + impact studies.

- Short-range weather forecasting of the events. (Possibly seasonal/climate forecasting and scenarios of the statistics of storm frequency etc.)

- Assessment of the climate change and climatic variability impacts on agricultural crops and the main water balance elements, including the effects of agriculturally significant climatic extremes by using modeling approaches;

*(c) Contribution of traditional knowledge to understanding and managing climate-related risks;*
*a. general comment*
*b. implications for sustainable development*

*(d) Implications for sustainable development in relation to paragraph 34 (a) to (c) above;*
- Risk reduction planning tools, insurance or other financial frameworks for ameliorating economical damages

*(e) Promoting understanding of impacts of, and vulnerability to, climate change.*
- Commission on Climate and Vulnerability to assess the need for enhanced capacity in different sectors and to outline possible further work and research needs.

**Flooding (inland/coastal)**
*over large areas due to persistent rain over longer periods*

*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;*
- Areas around and downstream of the large lake of Vänern (Western Sweden, including cities like Karlstad and Gothenburg, as well as the Göta river valley)
- Areas around and downstream of the large lake system of Hjälmaren/Mälaren (Eastern Sweden, including Stockholm).
- Flooding of 2000-2001
- The probablity of high water levels (both the frequency and maximum levels) is projected to increase for Vänern. Landslides are projected to become more frequent with more rainfall in high risk areas in the Göta river valley
- In the Mälaren region, the current risk levels in conjunction of high water levels largely persist.
- Governmental Commission on Climate and vulnerability appointed in 2005 to identify activities and sectors vulnerable to CC and propose actions to reduce damage. Final report 1 October 2007. Report on the risks of flooding in lakes Mälaren, Hjälmaren and Vänern presented on 1 nov 2006 (http://www.sou.gov.se/klimatsarbarhet/ , Swedish only)

**Low water levels in (large) lakes**

*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;*
- Areas around and downstream of the large lake system of Hjälmaren/Mälaren (Eastern Sweden, including Stockholm).
- E.g., in 2006 (aug-sep)
- Som increased risk seem to apply for extremely summer low water levels in the Lake Mälaren system (affects water supply in the region and boat transports).
- The governmental Commission on climate and vulnerability has the remit to identify activities and sectors vulnerable to climate change and to propose actions that could reduce damage. It is to present its findings by 1 October 2007. A report on the risks of flooding in Mälaren, Hjälmaren and Vänern was presented on 1 nov 2006, http://www.sou.gov.se/klimatsarbarhet/ (Swedish only), SEAREG INTERREG IIIb programme

**Drought**
*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;*
- Especially Southern Sweden: forestry, agriculture, water supply (large-scale and individual wells)
- Some events have occurred, (i.a. drought followed by wet weather has reduced harvest in Southern Sweden substantially).
- According to climate projections, precipitation might be reduced in summer in Southern Sweden (cf. the projected conditions over continental Europe)

**Urban flooding (inland, inland/coastal)**
*due to persistent rain over longer periods, possibly in conjunction of mid-winter or spring snow melt*

*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;*
- Kristianstad, Hässleholm in Southern Sweden, as well as many locations along the Swedish river systems throughout the country.
- E.g., 2002 (winter), 2007 (Jan)
- Spring floods are in general projected to decrease, whereas risk of flooding would increase in autumn and winter.
- Research initiatives, such as http://www.smhi.se/sgn0106/if/biblioteket/rapporter_pdf/RH19.pdf (in Swedish only, "framtidens översvämningsrisker")

**Urban flooding due to higher sea level, possibly in conjunction with storms**

*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;*
- Falsterbonäset in Southern Sweden, as well as many other coastal communities in especially Southern Sweden
- 2007 (Jan)
- The regional sea level is likely to rise, possibly more/less than in the global mean. The increase of storm surges might also be somewhat non-linear. Southern Sweden has marginal land sinking, in contrast to further north.
- E.g., task by the government (uppdrag i regleringsbrevet) to SGI (Swedish Geotechnical Institute). See www.swedgeo.se/publikationer/övrigt/pdf/SGI_JORIKS-Handlingsplan.pdf

**Local heavy precipitation**

*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;*
- All of Sweden, especially urbanized areas (transports, waste water systems, flooding of buildings, erosion)
- Orust, West Coast (2002), Stockholm (2006?), Fulufjället (1997) etc.
- A general increase in intensive precipitation is projected.

**Local heavy snowfall**

*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;*
- All of Sweden, especially along the eastern seaboard: transports, functioning of local communities
- Gävle (1998), Oskarshamn (1985)
- Possibility of new occurrences will remain even in a warmer climate (cf. wind, precipitation and Baltic Sea ice conditions).

**Heavy and/or persistent precipitation (saturated soil moisture, water table shifts)**
*causing mud slides, erosion and landslides*

*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;*
- Many parts of Sweden along roads, railways and suchlike.
- Ånn (2006), Munkedal (2006), …

- A general increase in intensive precipitation, as well as amounts in winter is projected.
- A report on the risks of flooding in Mälaren, Hjälmaren and Vänern was presented on 1 nov 2006 (http://www.sou.gov.se/klimatsarbarhet/ ) some information on landslides (Swedish only)

### Wind storms

*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;*
- Especially southern Sweden (exposed to the typical storm tracks): transport (infrastructure & operations) and Forestry.
- Storm Gudrun (January 2006), 75Mm3 stem wood = approx 1 normal annual felling in Sweden; storm Per 12 Mm3 stem wood (January 2007)
- Storm Gudrun (January 2006); storm Per (January 2007); the storm in December 1999 (Anatol)
- Projections are not yet clear on how wind storms might change. Some geographical shifts and potential increased strength of the worst storms is possible. Reduced ground freezing and increased precipitation in winter add on the risk of windthrow (forests).
- Subsidies to forest owners for re-planting and harvesting of storma damaged forests (www.svo.se). Gudrun-hearing..
- Power Companies are investing several billions of Euros to secure electricty grids against storm damage, Gudrun-hearing…,

### Pathogen outbreaks (insects etc.)

*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;*
- Forestry, agriculture
- Gremmeniella outbreak causing damage in pine wood (2000), Spruce beetle outbreak 2006-2007
- The generally milder & wetter winters, longer summers / after major storms and during spells of warm weather
- Information to forest owners on the need to remove spruce-beetle infetsed trees.(www.svo.se )

### Hydropower and mining dam breaks

*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;*
- Hydropower production, human security (mainly central and northern Sweden)
- Noppikoski, Dalarna (mid-Sweden), in 1985
- Changes in precipitation and snow season length will affect the timing and amount of runoff, with consequences to dam safety.
- Ongoing studies on dam safety guidelines wrt climate change scenarios

## 11. United Kingdom

### Climate risk - general

*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;*
- All sectors, all regions
- The UKCIP Risk, Uncertainty and Decision-Making Framework suggests that an assessment of climate risk begin with understanding risks associated with current climate extremes. Reducing or eliminating vulnerabilities associated with current extremes is seen as a good first step towards adaptation. In addition to the benefits associated with addressing current risks, this also builds adaptive capacity,

including understanding risks and adaptive options, that is essential to considering adaptation measures to address changes in climate, including its variabilities and extremes. Regional scoping studies have been undertaken for most regions and the devolved administration assessing their current and projected climate risks. Some sectors (e.g., biodiversity, agriculture, marine environments, gardens, visitors economies) have also assessed their risks, including those associated with extreme events. As part of the Notingham Declaration, local authorities (of which in access of 100 have signed the Declaration) are also looking at their risks.

- The UKCIP02 climate change scenarios indicate that:
  - Annual temperatures averaged across the UK may rise by between 2 and 3.5oC by the 2080s, depending on the level of global greenhouse gas emissions. Warming will generally be greatest in parts of the southeast, where temperatures may rise by up to 5oC in summer by the 2080s.
  - Winters will become wetter and summers may become drier across all of the UK. The largest relative changes will be in the south and east where summer precipitation may decline by up to 50% by the 2080s. Heavy winter precipitation will become more frequent.
  - Sea-levels are expected to rise around the UK. In line with previous predictions, sea-levels could be between 26 and 86 cm above the current level in southeast England by the 2080s. This means that, at some east coast locations, extreme sea-levels that currently have a 2% chance of occurring in any given year, could occur between 10 and 20 times more frequently by the 2080s.
- UKCIP's 'Climate adaptation: risk, uncertainty and decision-making' framework provides step-by-step guidance to help planners, businesses and government assess the risks posed by climate change, and work out how best to respond. The guidance helps organisations to judge the significance of the climate change risks, compared to other risks they face, enabling them to devise appropriate adaptation strategies. The UKCIP web-based Adaptation Wizard (prototype version 1.0) is designed to help organisations move through the process from simple understanding of climate change to integration of climate change considerations into decision-making. The UKCIP Climate Digest is an on-line searchable database that provides a perspective for stakeholders of the latest climate, impacts, vulnerability and adaptation science. Climate change partnerships in each of England's regions and the devolved administrations of Scotland, Northern Ireland, and Wales have activities underway that include understanding and disseminating information on their climate risks. In addition, the Nottingham Declaration on Climate Change and Scotland's Climate Change Declaration to which England and Scotland coucils can sign up to, includes recognition of the impacts of climate change and incorporation of adaptation measures.

*(b) Ability, gaps, needs, opportunities, barriers and constraints to predicting climate variability, impacts and extreme events across regions and hazards*

- UKCIP02 and 08 scenarios, as referred to above.
  Hadley Centre have ongoing research investigating future extremes, and on uncertainty, risk and dangerous climate change.
  For those carrying out their own impacts modelling, a range of results from various Hadley Centre climate experiments are provided on the website of the Climate Impacts LINK project at the Climatic Research Unit, University of East Anglia. Along with the British Atmospheric Data Centre's Data Distribution Centre, the LINK project is the main source for supply of Hadley Centre model data for use in research projects, in the UK and internationally. The Building Knowledge for Climate Change (BKCC) project Built Environment Weather Scenarios for Investigation of Impacts and Extremes (BETWIXT) has developed and made available high resolution climate change scenarios based on the UKCIP02 scenarios. The resulting scenarios have been developed for daily and sub-daily time periods and point locations to meet the particular needs of the built environment, including information about changes in extreme weather.
- There is a need to provide high resolution projections of extremes that better include the associated uncertainties. The move to probabilistic like outputs within UKCIP08 provides an opportunity to move to probabilistic estimates of variability and extreme events. There is also a need to provide more robust projections of climate variability and extremes for the period T+4-10 years which are more often the

decision-making timeframes of interest to decision makers. With respect to impacts, the necessity to include risk assessment related to climate variability and extremes in planning (including strategic) presents a major impediment. To some extent this is linked to limits associated with developing adaptation objective/targets and effective measures of success. The need to begin developing impacts scenarios and to use these to develop and assess adaptation scenarios needs further development.

*(c) Contribution of traditional knowledge to understanding and managing climate-related risks;*
*a. general comment*
*b. implications for sustainable development*

*(d) Implications for sustainable development in relation to paragraph 34 (a) to (c) above;*
- Understanding, and subsequently reducing, the additional risks associated with climate change is pivotal to ensuring that the UK society can develop sustainably. This is reflected in the Planning Policy Statements that have been and are being developed by the Government that require accommodating the impacts of climate change (e.g., PPS 1: Delivering Sustainable Development). Another example is the guidance on designing developments in a changing climate - a checklist developed through the Three Regions Climate Change Group (London, South East and East of England). Many of these reflect the risk-based adaptation approach behind the UKCIP risk, uncertainty and decision-making framework.

- See implications for sustainable development to the right. Predictability of climate risks is essential to ensuring that development of existing and new areas are sustainable. Adherence to planning guidance necessitates that robust predictions are available and applied.

*(e) Promoting understanding of impacts of, and vulnerability to, climate change.*
- UKCIP adaptation wizard: www.ukcip.org.uk/resources/tools/adapt.asp UKCIP risk, uncertainty and decision-making framework: www.ukcip.org.uk/resources/tools/risk.asp
  LINK: www.cru.uea.ac.uk/link/
  The Hadley Centre publications: www.metoffice.gov.uk/research/hadleycentre/pubs/brochures/
  BADC Data Distribution Centre: http://badc.nerc.ac.uk/home/index.html
  UKCIP Climate Digest: www.ukcip.org.uk/resources/climate_digest.asp
  UKCIP08 scenarios - further information:
  www.ukcip.org.uk/scenarios/ukcip08/what_is_ukcip08.asp#Moreinfo
  Tyndall Centre 'Building Resilience to Climate Change' research programme:
  www.tyndall.ac.uk/research/programme3/programme3.shtml
  The establishing and workings of the regional climate change partnerships with a full-time coordinator in all nine regions of England and the devolved administrations of Scotland, Wales and Northern Ireland have been instrumental in raising awareness of climate risk and involving regions in assessing and addressing these risks. EPSRC is planning to support a further stakeholder-researcher collaborative research programme exploring coping with extreme weather events.

## Heatwave

*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;*
- Heatwaves affect
  (i) Health: Heatwaves in August 2003 and 2006. 2003 heatwave: In England 2045 more people died compared to the 1998-2002 average; the Association of British Insurers (ABI) calculated that related damage left insurers with almost £400 million in subsidence claims in the UK. Casualty figures for the 2006 event are yet to be calculated.
  (ii) Transport, built environment and related infrastructure: 2006 heatwave: increased incidences of grass fires, and distortion of transport infrastructure (e.g. rail lines) were reported. Both currently and into the future, the major impacts in this area associated with heatwaves have been on the underground

(in terms of human comfort/health), rail (track integrity) and roadways (integrity of the surface, with impacts on traffic and maintenance costs). All of these have resulted in significant disruptions in service/usability and costs associated with maintenance.

- The Hadley Centre indicate (with 90% confidence) that the likelihood of a 2003-like European heatwave has at least doubled, with the best estimate being a quadrupling of the likelihood, due to greenhouse gas emissions, and that such summers could be as frequent as every other year by 2050 (Ref: Stott, P. A., D. A. Stone, and M. R. Allen (2004), Human contribution to the European heatwave of 2003, Nature, 432, 610-613).
- According to the Hadley Centre a doubling of CO2 could increase the severity of heatwaves by more than 10 °C for Europe
- The UK Climate Impacts Programme (UKCIP) climate change scenarios (2002) indicate that hotter, drier summers will become more frequent over the U.K with summer precipitation decreasing by up to 50% or more by the 2080s.
- In addition, responses to increased heatwaves could lead to significant costs related to upgrading and replacing large portions of the existing transport infrastructure and retrofitting of existing building stock and its supportive infrastructure.

- Early warning system: the Met Office Heat-Health Watch operates during summer months - UK Met Office works with the National Health Service (NHS), using weather and climate data to forewarn and prevent pressure on NHS resources and manage these resources effectively, thereby supporting more effective targeting and delivery of healthcare, and reducing hospital admissions.
- Department of Health issue guidance on reducing Health risks during a heatwave.
- Defra funded a study in 2006, investigating the costs of the impacts of climate change on UK sectors, including the costs of the 2003 heatwave.
- The £3m Engineering and Physical Sciences Research Council (EPSRC) funded UKCIP 'Building Knowledge for a Changing Climate' research programme has looked at how climate change will affect aspects of the built environment. This work is being continued through the EPSRC-funded project Sustaining Knowledge for a Changing Climate (SKCC). The London Climate Change Partnership and Transport for London have looked into the impacts of heatwaves on the London underground and work is continuing as to how best to address the current and evolving impacts.

*(b) Ability, gaps, needs, opportunities, barriers and constraints to predicting climate variability, impacts and extreme events across regions and hazards*

- Existing UKCIP02 UK climate change scenarios are to be updated and improved in 2008 ('UKCIP08'), using ensembles to allow output to be described in probabilistic terms, which is better-suited to risk-based decision-making for adaptation
- Outputs of the Building Knowledge for a Changing Climate research programme (referred to in (a))
- Observations within the urban environment need to be improved (specific urban environment observational programme), including through more effective use of remote and non-traditional observing strategies. Understanding vulnerabilities with the urban environment, including how the urban heat island enhancement will evolve (includes integrating development and socio-economic scenarios). As with all of these impacts, required is an enhanced understanding of how to assess multiple risks, including those associated with climate extremes and social, cultural and environmental futures.
- Prediction of future climate extremes and risk is pivotal to enabling society to successfully adapt and continue to develop, whilst minimising the negative impacts of a changing climate.

*(c) Contribution of traditional knowledge to understanding and managing climate-related risks;*

*a. general comment*

*b. implications for sustainable development*

*(d) Implications for sustainable development in relation to paragraph 34 (a) to (c) above;*

- Maintaining health is an essential prerequisite for a society that wishes to develop sustainable.
- Effective transport infrastructure provides an essential footing for continued economic development. Recognition of the links between impacts of climate change and the sustainability of transport infrastructure have been recognised within the London study, as well as within several Local Authorities (e.g., Oxfordshire).

*(e) Activities promoting the understanding of impacts of, and vulnerability to, climate change.*

- UKCIP: www.ukcip.org.uk
- Met Office/NHS health forecasting: www.metoffice.gov.uk/health/index.html, www.metoffice.gov.uk/weather/uk/heathealth/index.html
- Dept. Health heatwave guidance: www.dh.gov.uk/PublicationsAndStatistics/Publications/PublicationsPolicyAndGuidance/PublicationsPolicyAndGuidanceArticle/fs/en?CONTENT_ID=4135296&chk=kQeY65
- Hadley Centre technical note on UKCIP08 scenarios: http://www.ukcip.org.uk/scenarios/ukcip08/documents/UKCIPnext_technote.pdf
- Defra-funded 2003 heatwave study: http://www2.defra.gov.uk/research/project_data/More.asp?I=GA01075&M=KWS&V=climate+change&SCOPE=1
- Building Knowledge for a Changing Climate research programme: www.ukcip.org.uk/resources/sector/projectsdets.asp?sector=1&project_ref=5
- Sustaining Knowledge for a Changing Climate: www.k4cc.org
- LCCP Transport for London study: http://www.london.gov.uk/climatechangepartnership/docs/climatetransportsept05.rtf
- Planned activity: EPSRC call for research on Coping with Extreme Weather Events, with focus on built environment: http://www.epsrc.ac.uk/callsforproposals/ideasweather.htm
- EPSRC is also funding specific research stakeholder-researcher collaborations) related to the urban heat island through two targeted projects - The Development of a Local Climate Model and its Application to the Intelligent Development of cities (LUCID) and Sustainable Cities: Options for Responding to Climate Change Impacts and Outcomes (SCORCHIO).

## Drought

*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;*

- Drought affect Water resources (particularly in South-East England), agriculture and forestry
- It is clear that throughout the historical record, drought has been a recurring feature of the UK climate, with recent drought events by no means exceptional in terms of their intensity or duration. A notable feature is the repeated tendency for dry years to cluster together, which results in multi-year droughts that contain shorter more intense periods. The extended drought periods from 1780-1790, 1798-1808, 1854-1860, 1890-1909, 1990-1992, 1995-1997 are all evidence of this. The recent 18 month drought (2005-2006) has seen a number of water companies issue drought orders.
- The UKCIP02 climate change scenarios indicate that hotter, drier summers will become more frequent over the U.K. In summer, the whole of the UK will experience a decrease in average soil moisture, with the largest reductions - 40 per cent or more by the 2080s - occuring in southeast England. Summer precipitation will decrease by between 10 and 60% by the 2080s (depending on emissions scenario and location). 'Short' droughts will increase significantly by the 2050s and be common-place by the 2080s. Combined with projected increased demand in the south-east, water resources in this area are likely to come under increased and considerable pressure in the future, necessitating water conservation measuers and, possibly, greater reservoir capacity to enable the (increased) winter rainfall to be used in summer.
- In 2003, Defra commissioned research, carried out by the Stockholm Environment Institute (Oxford office) into the impact of climate change (UKCIP02 scenarios) on water demand.
  Defra have funded a project on drought through the Defra Cross-Regional Research Programme (Project

C (water)). This project is now complete and the project outputs are available from http://www.future drought.org.uk.

UK Water Industry Research (UKWIR) fund research that is relevant to the water industry and have a group of projects focused on climate change and water supply. Further information on this reserach can be found at www.ukwir.org.uk

*(b) Ability, gaps, needs, opportunities, barriers and constraints to predicting climate variability, impacts and extreme events across regions and hazards*

- Efforts directed at better understanding of the spatial and temporal variability of precipitation, including enhancing the hydrological modelling capabilities within climate models, use of weather generators, hydrological modelling improvements (including site specific characterisations), and increased understanding of the nature of drought within the UK (EA Severe Drought Report) will provide opportunities to improve predictability of water resources (and drought).

  The UK Water Research Industry (UKWIR) are also undertaking research to better understand how the frequency and intensity of drought events might change in the future under different climate scenarios and GCMs.
- Ability to model changes in extreme rainfall is limited by the resolution of climate models and representation of small-scale processes (e.g. cloud physics)

  Require ability to model accurately the interaction of rainfall with land surface processes and implications for groundwater. Research has also shown that it is difficult to generalise on the potential impacts of climate change on water resources, as site specific factors (such as existing regulatory requirements, infrastructure, and catchment characteristics) are as important as changes in 'drivers' (such as precipitation). Even within the same region, results can vary from negative to positive depending on local factors. Predictions of impacts requires more effort including the involvement of social scientists.
- There is not an infinite supply of drinking water in the UK and therefore water availability needs to be considered in all development issues. Water saving measures need to be incorporated at the design stage if development is to be sustainable.

*(c) Contribution of traditional knowledge to understanding and managing climate-related risks;*

*a. general comment*

*b. implications for sustainable development*

*(d) Implications for sustainable development in relation to paragraph 34 (a) to (c) above;*

- Societal growth and development is clearly dependent upon satisfactory availability of water resources, both directly and indirectly, through multiple uses (e.g. agriculture and food production).

*(e) Promoting understanding of impacts of, and vulnerability to, climate change.*

- Defra climate change and water demand study (CC:DeW):
  www.ukcip.org.uk/resources/publications/pub_dets.asp?ID=52
  CEH climate change research programme: www.ceh-nerc.ac.uk/sci_programmes/climate_change.html
  Research on future drought frequency: www.futuredrought.org.uk
  Research specifically for water companies: www.ukwir.org.uk
  Severe droughts project being undertaken by the Environment Agency www.environment-agency.gov.uk

## Inland and coastal flooding

*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;*

- Inland and coastal flooding affects Housing and other infrastructure, agriculture, cultural heritage

- Over 2.3 million out of 25 million homes and business are situated in flood risk areas with property, land and assets to the value of £237 billion at risk.
  The ABI estimate the extremely high rainfall event of autumn 2000 resulted in over 11,000 homes and businesses being flooded at 700 locations from Kent and Devon, to North Wales and the Scottish borders.
  The cost to the insurance industry from floods in autumn 2000 has been estimated at £1bn.
- In 2004, the Foresight Future Flooding report estimated that annual average flood damages could rise from the present level of £1 billion to about £25 billion by the end of this century in the worst case scenario.
- Making Space for Water, a cross-Government Strategy for Flood and Coastal Erosion Risk Management, provides guidance for those implementing flood and coastal erosion measures in 2007 to ensure that adaptability to climate change through robust and resilient solutions becomes an integral part of all flood and coastal erosion management decisions.
  The Environment Agency for England and Wales Floodline service provides free continually-updated information on the status of the flooding situation and flow status of rivers. The Scottish Environmental Protection Agency (SEPA) provide a similar service for Scotland.
  In 2006 Defra issued new Flood and Coastal Defence Project Appraisal Guidance, incorporating the latest climate change impacts predictions.
  The National Flood Risk Assessment (NaFRA) has been undertaken by the Environment Agency for England and Wales in 2004, 2005 and 2006, and provides a national assessment of the likelihood of flooding from rivers and the sea, made freely-available on the Environment Agency's website. A similar exercise - Flood Map - has been undertaken for Scotland by the Scottish Environment Protection Agency.
  ESPACE programme (European Spatial Planning: Adapting to Climate Events) has the aim of ensuring that adaptation to climate change is recognised and to recommend ways that it is incorporated within spatial planning mechanisms at the local, regional, national and European levels. This project focuses specifically on managing water resources, including flooding, in order to plan for a future climate.

*(b) Ability, gaps, needs, opportunities, barriers and constraints to predicting climate variability, impacts and extreme events across regions and hazards*

- UKCIP02 and 08 scenarios, as referred to above.
- The Natural Environment Research Council (NERC) funded research programme Flood Risk from Extreme Events (FREE) aims to predict floods minutes to weeks/seasons to decades ahead, helping to forecast and quantify flood risk.
  The EA/SEPA flood maps provide an estimate of the current areas of flood risk (not including climate change) at a national scale.
- Ability to model changes in extreme rainfall is limited by the resolution of climate models and representation of small-scale processes (e.g. cloud physics).
  Require very high resolution to represent coastal geography and surface hydrology (including interaction with land cover).
  Dependent on assumptions about adaptation and requires accurate modelling of coastal/inland defences.
  Need for coupling of hydrometric and climate models, and for better hydrometric modelling.
  Need for better understanding (and modelling) of behaviour of groundwater in response to climate change.
  Little understanding about the flood risk in relation to urban drainage and waste water infrastructure.

*(c) Contribution of traditional knowledge to understanding and managing climate-related risks;*

*a. general comment*

*b. implications for sustainable development*

*(d) Implications for sustainable development in relation to paragraph 34 (a) to (c) above;*

- Unless provisions are made for sea-level rise, or the changing intensity and pattern of precipitation, current and future building and transport infrastructure (not to mention the people dependent on them)

could be increasingly exposed to the threat of extreme events associated with a changing climate, thus significantly undermining the sustainability of future development in the UK. In addition, the costs of repairing damage (or for the insurance industry) could eventually undermine economic development at the national scale.

*(e) Promoting understanding of impacts of, and vulnerability to, climate change.*

- Foresight: www.foresight.gov.uk/previous_projects/flood_and_coastal_defence/index.html
  NERC FREE programme: www.nerc.ac.uk/research/programmes/free/background.asp
  http://www.defra.gov.uk/environ/fcd/pubs/pagn/climatechangeupdate.pdf
  http://www.defra.gov.uk/environ/fcd/default.htm
  Flood warning - England and Wales: www.environment-agency.gov.uk/subjects/flood/floodwarning/
  Flood warning - Scotland: www.sepa.org.uk/flooding/
  Revised Flood and Coastal Defence Project Appraisal Guidance:
  www.defra.gov.uk/news/2006/061107a.htm
  LCCP Transport for London study:
  http://www.london.gov.uk/climatechangepartnership/docs/climatetransportsept05.rtf
  Planned activity: EPSRC call for research on Coping with Extreme Weather Events, with focus on built environment: http://www.epsrc.ac.uk/callsforproposals/ideasweather.htm
  Association of British Insurers: www.abi.org.uk/flooding

## Storms, high winds, tornadoes

*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;*

- Storms, high winds, tornadoes affect housing & other infrastructure including transport.
- An increase in winter storminess in December and January 2006/7 affected the transport sector. Trains were cancelled as speed restrictions were introduced. Five people died in overturning vehicles on motorways. People were hurt in falling scaffolding. 42 people were killed across the UK as a result of the storms. Air traffic was disrupted as aeroplanes were diverted because of the high wind.
  In recent years, events such as flash-flooding in Boscastle (South-west) in August 2004 and North Yorkshire in June 2005, and tornadoes in Birmingham (2005) and north-west London (2006).
  Storms in October 2002 could have resulted in approx £50m of damage, according to the Association of British Insurers (source: BBC news).
- The Hadley Centre project increased wintertime storminess over the UK; this result was presented in the UKCIP02 scenarios.
  Additional work, analysing sea-level pressure data, has indicated an increase in the frequency of damaging storms over the UK since 1950 (Alexander et al. 2005).
- Hadley also contributed to the creation of a daily sea-level pressure data set for the North Atlantic and Europe since 1850 (with full error estimates) as part of an EU funded project, EMULATE.
  The Benfield Centre for Hazard Research (based at University College London) plays a pivotal role in the Eurotempest programme, which provides real-time forecasts of the localised wind damage that powerful North Atlantic winter storms could inflict on Europe.

*(b) Ability, gaps, needs, opportunities, barriers and constraints to predicting climate variability, impacts and extreme events across regions and hazards*

- UKCIP02 and 08 scenarios, as referred to above.
  The Benfield Hazard Research Centre is investigating the implications of climate change for future Atlantic hurricanes and European windstorms.
- Requires high resolution modelling and accurate representation of small-scale processes.
  Increased understanding of the formation of Tornadoes is needed.
  Better modelling of natural variability (e.g. El Nino) and their interactions with local weather events as the climate changes.

*(c) Contribution of traditional knowledge to understanding and managing climate-related risks;*
*a. general comment*
*b. implications for sustainable development*

*(d) Implications for sustainable development in relation to paragraph 34 (a) to (c) above;*
- Increasing frequency of high winds and intense storms could disrupt the current transport system affecting multiple sectors of industry. Certain housing infrastructure may not be able to withstand severe storms. There will be implications for the insurance sector.
- This may have implications for town planning with a preference to sheltered areas.

*(e) Promoting understanding of impacts of, and vulnerability to, climate change.*
- LCCP Transport for London study:
  http://www.london.gov.uk/climatechangepartnership/docs/climatetransportsept05.rtf
  Planned activity: EPSRC call for research on Coping with Extreme Weather Events, with focus on built environment: www.epsrc.ac.uk/callsforproposals/ideasweather.htm
  Eurotempest: www.eurotempest.com/
  Alexander et al paper: Alexander, L. et al, (2005) Global observed changes in daily climate extremes of temperature and precipitation, J. Geophys. Res.

## Extreme precipitation

*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;*
- All sectors, all regions
- A large portion of winter precipitation in all regions now falls on heavy rainfall days than was the case 50 years ago
- Very dry summers such as 1995 might occur in 30 per cent of years by the 2050s, while very wet winters such as 1994/95 might occur on average once every three decades. In winter, nearly the whole country experiences an increase in the number of intense precipitation events. The wetter winters are partly the result of an increase in the frequency of wet days but also because of an increase in the intensity of wet events.
- UKCIP02 and UKCIP08 will continue to look at developing robust and useful information related to extremes. Extreme precipitation continues to be of interest in the built environment and efforts through Sustaining Knowledge for Changing Climate (www.k4cc.org) continue efforts under Building Knowledge for a Changing Climate (BKCC) directed at under understanding risks associated with extreme precipitation. A major gap is related to the inadequacy of the observational network which limits are ability to understand spatial and temporal variability and thus extremes. This includes improving the integration of remote sensing and traditional monitoring systems.

*(b) Ability, gaps, needs, opportunities, barriers and constraints to predicting climate variability, impacts and extreme events across regions and hazards*
- UKCIP02 and 08 scenarios, as referred to above, plus related and supportive efforts using downscaling techniques, including weather generators (e.g., BKCC (www.k4cc.org), EARWIG (UK Environmental Agency) and within the UKCIP08 project)
- Gaps related to more robust projections of extreme precipitation at appropriate temporal and spatial scales to support decision making, and including realistic measures of uncertainty.

*(c) Contribution of traditional knowledge to understanding and managing climate-related risks;*
*a. general comment*
*b. implications for sustainable development*

*(d) Implications for sustainable development in relation to paragraph 34 (a) to (c) above;*

- Planning Policy Statement 1: Delivering Sustainable Development sets out the government's objectives for the planning system, and how planning should facilitate and promote sustainable patterns of development, avoiding flood risk and accommodating the impacts of climate change. Planning Policy Statement 25: Development and Flood Risk is directed at taking full account in decisions on plans and applications of present and future flood risk, and the wider implications of flood risk of develop located outside flood risk areas.
- Ability to deliver on sustainable development objectives will necessitate that existing developments and supportive infrastructure (drainage) are able to handle extreme rainfall events that are often associated with flooding events and their impacts

*(e) Promoting understanding of impacts of, and vulnerability to, climate change.*

- The EPSRC-funded Sustaining Knowledge for a Changing Climate (SKCC www.k4c.org) includes dissemination of the results of research conducted under Building Knowledge for a Changing Climate (BKCC). This includes results related to a better understanding of climate extremes and impacts on the built environment.

## Rapid climate change

*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;*

- All sectors, all regions
- Although too short a time-series to infer any long-term trend, the first full year (2004-05) time series recovered from the RAPID Atlantic moorings across 26 degrees north suggest that there is evidence of a small decrease in the overturning circulation and that the interannual variability between the years 1980 and 2005 is not significantly different from the variability in the first year of observations. However, more observations and analysis of the resulting data is needed to clarify whether the observations gathered to date reflect natural variability or a longer term trend.
- The results of modelling future changes in the North Atlantic MOC within the RAPID project suggest a projected slowing of the current in the 21st century with a recovery in the 22nd century. Reported results indicate that any weakening could be substantially increased by melting of the Greenland ice-sheet and that that weakening is also dependent on the rate of melting. Modelling of freshwater input from melting of the Greenland ice-sheet suggests that the impact on the strength of the MOC may not be as dramatic as previously thought and further research suggests that abrupt climate change on the North Atlantic MOC as a result of melting of the Greenland ice-sheet may not be a realistic possibility.
- The NERC-funded RAPID research programme is investigating the potential impacts of climate change on thermohaline circulation, particularly in the North Atlantic, and the way in which disturbances to this current could affect the climate of north-west Europe. The programme has invested about £5m in a prototype system to continuously monitor the strength and structure of the North Atlantic meridional overturning circulation (MOC).
  Researchers are incorporating information about past rapid climate change (e.g. from ice-cores and sediments) into the models used to predict potential change over the next century.
  Although international in scope, the 2005 conference 'Avoiding Dangerous Climate Change' (held at Met Office, Exeter) presented research findings related to rapid climate change, of relevance to the UK.

*(b) Ability, gaps, needs, opportunities, barriers and constraints to predicting climate variability, impacts and extreme events across regions and hazards*

- UKCIP02 and 08 scenarios, as referred to above.
  Also models specifically developed as part of RAPID to look at the dynamics of the North Alantic MOC http://www.soc.soton.ac.uk/rapid/rapid.php
- Research needs depend on type of rapid climate change: (all require improved regional modelling).
  Thermohaline circulation - high resolution modelling of ocean processes and better representation of ocean-atmosphere interactions required, and more data/analysis is needed to clarify whether this

indicated a temporary halt in the circulation, or geographical re-arrangement of the system.
Natural methane emissions - requires better understanding of location and scale of deposits and modelling of the processes involved in releasing them.
Collapse of ice sheets - requires greater understanding of ice sheet processes and ocean-atmosphere interactions (observations, testing and modelling).
Need to couple ice sheets models to climate models.
Carbon-cycle feedbacks - high resolution hydrology models and better knowledge and modelling of biosphere interactions needed.

*(c) Contribution of traditional knowledge to understanding and managing climate-related risks;*
*a. general comment*
*b. implications for sustainable development*

*(d) Implications for sustainable development in relation to paragraph 34 (a) to (c) above;*
- The crossing of critical thresholds in the climate system could lead to a rate of climate change that far outstrips societies ability to implement the adaptation measures necessary to prevent significant societal, infrastructural and economic damage.
- Understanding of the nature of the impacts of rapid climate change, along with the associated risks (with uncertainties) and credible monitoring programmes of critical indicators of change (e.g., triggers of rapid change) are essential elements for developing appropriate preparedness strategies. This approach includes an enhanced understanding fo the nature of the associated natural variability of these potential triggers of rapid climate change (means of better understanding the associated risks).

*(e) Promoting understanding of impacts of, and vulnerability to, climate change.*
- NERC RAPID programme: www.nerc.ac.uk/research/programmes/rapid/background.asp
  RAPID research results: www.noc.soton.ac.uk/rapid/kt/2006_RAPID_conf_sum.pdf
  'Avoiding Dangerous Climate Change' conference website: www.stabilisation2005.com

## 12. European Commission

The European Commission currently carries out two main activities on adaptation:

### The PESETA Study

Incomplete scientific methodologies and gaps in data still do not allow for a systematic and complete economic analysis of the costs of inaction for the EU, particularly when integrating adaptation measures. The on-going PESETA study, coordinated by the Joint Research Centre of the European Commission (DG JRC), will fill some of the knowledge gaps.
The objective of the PESETA project (Projection of Economic impacts of climate change in Sectors of the European Union based on bottom-up Analysis) is to make an assessment of the impacts, including monetary estimates, of climate change in Europe (EU25, Rumania, Bulgaria and Turkey) in the 2011-2040 and 2071-2100 time horizon, based on bottom-up physical methodologies.

The project largely benefits from DG Research projects that have developed impact modeling capabilities and high resolution climate scenarios for Europe. It is coordinated by the European Commission's Joint Research Centre and involves several research institutes. The PESETA project focuses on the following sectoral impacts: Coastal systems, Energy demand, Human health, Agriculture, Tourism, and Floods. Each of these sectoral categories comprehends a sectoral study in the corresponding field carried out by the partners of the project, considering cross-sectoral issues. It does so for two global scenarios from the IPCC's Special Report on Emissions Scenarios (SRES), belonging to the A2 and B2 scenario storyline.

The PESETA project provides a valuable indication of the economic costs of climate change in Europe based on physical impact assessment and state-of-art high-resolution climate scenarios.

- http://peseta.jrc.es/

## The ECCP - The Impacts and Adaptation Workgroup

In response to the increasing threat of climate impacts and damages from extreme events, the European Commission is exploring its role and the scope for a policy strategy to adapt to the impacts of unavoidable climate change and how best to assist local, regional and national efforts. As part of exploring options to improve Europe's resilience to climate change effects and defining the European Union role in climate change adaptation the European Commission is undertaking an extensive activity on impacts and adaptation, under the second European Climate Change Programme.

A series of expert meetings have been carried out to consider climate impacts and policy options for the following sectors:

- Impacts on water cycle and water resources management and prediction of extreme events
- Marine resources and coastal zones and tourism
- Human health
- Agriculture and forestry
- Biodiversity
- Regional planning, built environment, public and energy infrastructure, Structural funds
- Urban planning and construction
- Development cooperation
- Role of insurance industry
- Building national strategies for adaptation (country reports)

These expert meetings have acted as a forum for fostering learning and sharing of best practices among European stakeholders.

The commission is currently carrying out on-going reflection on the scope for a community-wide strategy on adaptation; the conclusions from this reflection will be published in a communication. A conference on adaptation and regional workshops will be carried out as a means to consult with stakeholders on the proposals set out in the communication on adaptation.

- http://ec.europa.eu/environment/climat/eccp.htm
- http://ec.europa.eu/environment/climat/eccpii.htm

**Amendment on ANNEX B**
**to the submission on**
**CLIMATE RELATED RISKS AND EXTREME EVENTS**
**under the Nairobi Work Programme (NWP)**

# Programmes and activities on Adaptation concerning development cooperation and risk management in developing countries, submitted by Member States

## 1. Germany

### Droughts/Water Scarcity

***Benin, northwest (ongoing)***
*(1) Experience with the assessment and management of climate change related risk or extreme events*
*a. affect at present and/or affect in the past*
Increased climate variability has worsened the water supply situation and threatened the agricultural sector with its predominantly traditional techniques.
*b. affect in the future*
As climate variability will increase the water supply situation will further deteriorate.
*c. major programmes, policies or activities*
Improved watershed management
*d. Implications for sustainable development*
An improved watershed management will enable the rural population to manage the resource water sustainable.

*(3) Are there any activities implemented or planned to promoting understanding of impacts of, and vulnerability to, the climate change related issue?*
Development of "awareness creating" workshop modules directed towards the rural population

**China, Jinshan (completed)**

*(1) Experience with the assessment and management of climate change related risk or extreme events*
*a. affect at present and/or affect in the past*
Erosion due to very dry climate
*b. affect in the future*
Due to increased global warming, precipitation will further decrease.
*c. major programmes, policies or activities*
Risk analysis and land use plans, disaster risk-reduction activities (i.e. reforestation)

***India (in planning)***

*(1) Experience with the assessment and management of climate change related risk or extreme events*
*b. affect in the future*
The severity of droughts and intensity of floods in various parts of India is projected to increase. The number of rainy days and the quantity of available runoff will decrease over a major part of the country. The hydrological cycle is likely to be altered resulting into water scarcity and shortage.
Over 60% of the crop area in India is under rainfed agriculture. Food production is still considerably dependent on rainfall quantity and distribution. Food security of India may be at risk in future due to the threat of climate change leading to increase in frequency and intensity of droughts and floods, thereby affecting production on small and marginal farms. The loss in farm revenue is estimated to be 9-25% for a temperature rise of 2-3.5°C.

Forest: The impacts of climate change is likely to result in shift in forest boundaries, changes in forest type, reduction in net primary productivity of forest and loss or change in biodiversity. As a result, the livelihood of about 200 million people dependents directly or indirectly on forests will be adversely affected.
In addition to these, achievement of vital national development goals related to other systems such as habitats, health, energy demand and infrastructure investments would be adversely affected.
*c. major programmes, policies or activities*
Integrated watershed management and forestry management

***Peru, Arequipa (completed)***
*(1) Experience with the assessment and management of climate change related risk or extreme events*
*a. affect at present and/or affect in the past*
Region is prone to droughts
*b. affect in the future*
Due to the increased climate variability the number and intensity of droughts is projected to increase.
*c. major programmes, policies or activities*
Disaster Risk Management to secure local food production and supply: reduction of the vulnerability of the local population towards droughts and other extreme weather events
*d. Implications for sustainable development*
Sustainable rural development

*(3) Are there any activities implemented or planned to promoting understanding of impacts of, and vulnerability to, the climate change related issue?*
Irrigation committee workers and members of municipal and communal administrations are being trained

***Guatemala, Catchment Area of Río San Pedro (completed)***

*(1) Experience with the assessment and management of climate change related risk or extreme events*
*a. affect at present and/or affect in the past*
Prone to droughts
*b. affect in the future*
Due to the increased climate variability the number and intensity of droughts is projected to increase.
*c. major programmes, policies or activities*
Vulnerability reduction through capacity building and improved knowledge management

## (Rain) Storms/Flooding

***Mekong Delta (Vietnam, Cambodia, Thailand and Laos)***

*(1) Experience with the assessment and management of climate change related risk or extreme events*
*a. affect at present and/or affect in the past*
Flooding recurrently effects the live of eight million people living in the Mekong Delta.
*b. affect in the future*
Due to climate change the number and intensity of floods is projected to increase.
*c. major programmes, policies or activities*
Improvement of flood and catastrophe management
*(3) Are there any activities implemented or planned to promoting understanding of impacts of, and vulnerability to, the climate change related issue?*
The program has an educational component, which is especially directed at women and children as they tend to stay in the high risk areas while the men go off to find work elsewhere.

***Tajikistan, Zeravshan Valley (ongoing)***

*(1) Experience with the assessment and management of climate change related risk or extreme events*
*a. affect at present and/or affect in the past*
Prone to flooding and mudslides
*b. affect in the future*
Due to increased climate variability the number of extreme weather events (e.g. rain storms) will increase and thus worsen the fragile situation
*c. major programmes, policies or activities*
Establishment of an early warning system and capacity building for disaster management
*d. Implications for sustainable development*
Discourage people from living in high risk areas, thus permanently conserving their livelihoods

*(3) Are there any activities implemented or planned to promoting understanding of impacts of, and vulnerability to, the climate change related issue?*
Training for catastrophe management on local and national level.

***India (in planning)***

*(1) Experience with the assessment and management of climate change related risk or extreme events*
*b. affect in the future*
The intensity of floods is project to increase. The projected sea level rise will have tremendous effects on coastal areas.
*c. major programmes, policies or activities*
Risk assessment and integration into investment planning: This component will make use of risk management tools to help cope with/adapt to climate change impacts through effective integration into major investment planning/programmes for the rural population in India Implementation-oriented technical measures for adaptation: Vulnerable rural population in 3 State(s) use technical measures/economically diversified income sources for adapting to climate change impacts. Technical products will be integrated into the large-scale rural investment programmes (private sector, public programmes, NABARD) Insurance Market Infrastructure: A substantial number of vulnerable rural population in 3 State(s) has access to financial risk management products. The insurance products will be integrated into the rural mainstream insurance sector (private sector, public programmes) Potentials for policy assessment and development: Identify and assess the use of future adaptation measures into large scale public investment programmes. The Climate change adaptation has become a priority area on the policy agenda on state and central level.

***Central America: Panama, Costa Rica, Nicaragua, El Salvador, Honduras, Guatemala***

*(1) Experience with the assessment and management of climate change related risk or extreme events*
*a. affect at present and/or affect in the past*
Region is regularly hit by hurricanes
*b. affect in the future*
Due to increased ocean temperatures the number of hurricanes will increase.
*c. major programmes, policies or activities*
Establishment of CEPREDENAC as a regional capacity to facilitate Disaster Risk Management in Central America

***Nicaragua, municipalities of Waspam, Bonanza, Rosita and Santa Teresa (completed)***

*(1) Experience with the assessment and management of climate change related risk or extreme events*
*a. affect at present and/or affect in the past*
Along the Atlantic East Coast, hurricanes, tropical rainstorms, floods and mudslides are taking an increasing toll on remote communities in the country's poorest and least developed region.

*b. affect in the future*
Due to increased ocean temperatures the number of storms will increase.
*c. major programmes, policies or activities*
Adaptation to climate change through disaster risk management
*(3) Are there any activities implemented or planned to promoting understanding of impacts of, and vulnerability to, the climate change related issue?*
The most important tool to date has been the carrying out of a series of participatory risk analyses involving 550 citizens from five Miskito communities. These were facilitated by employees from the environmental unit of the municipalities of Bonanza and Santa Teresa, assisted by the local authorities. They had received special training on this new tool, which creates anticipation in order to ensure preparedness. In addition to several workshops in the communities, a contest of drawing local risk-maps was conducted and well received.

***Honduras, Department of Atlántida (completed)***

*(1) Experience with the assessment and management of climate change related risk or extreme events*
*a. affect at present and/or affect in the past*
Region is regularly hit by hurricanes
*b. affect in the future*
Due to increased ocean temperatures the number of hurricanes will increase.
*c. major programmes, policies or activities*
Risk analysis: land use and community structure planning

***Honduras, Northern Caribbean Coast (completed)***

*(1) Experience with the assessment and management of climate change related risk or extreme events*
*a. affect at present and/or affect in the past*
Region is regularly hit by hurricanes
*b. affect in the future*
Due to increased ocean temperatures the number of hurricanes will increase.
*c. major programmes, policies or activities*
Risk analysis: land use and community structure planning

***El Salvador, Catchment Area of Río Lempa in the Trifinio Region***

*(1) Experience with the assessment and management of climate change related risk or extreme events*
*a. affect at present and/or affect in the past*
Prone to flooding and mudslides
*b. affect in the future*
Due to increased climate variability the number of extreme weather events (e.g. rain storms) will increase and thus worsen the fragile situation
*c. major programmes, policies or activities*
Risk analysis; capacity building; sensibilisation

*(3) Are there any activities implemented or planned to promoting understanding of impacts of, and vulnerability to, the climate change related issue?*
Awareness and sensibilisation measures directed towards the rural population.

***El Salvador, Ahuapachapán (completed)***

*(1) Experience with the assessment and management of climate change related risk or extreme events*
*a. affect at present and/or affect in the past*
Prone to mudslides

*b. affect in the future*
Due to increased climate variability the number of extreme weather events (e.g. rain storms) will increase and thus worsen the fragile situation
*c. major programmes, policies or activities*
Establishing an early warning system, raising the awareness of the endangered population, improving communication structures

*(3) Are there any activities implemented or planned to promoting understanding of impacts of, and vulnerability to, the climate change related issue?*
Raising awareness of the endangered population for the risk they are exposed to.

***Mozambique, Búzi (completed)***

*(1) Experience with the assessment and management of climate change related risk or extreme events*
*a. affect at present and/or affect in the past*
Droughts over consecutive years during El Niño phases alternate with severe flooding during their "El Niña" counterparts. Most of the 150,000 people living in the Búzi district of the central province of Sofala depend on subsistence farming. The success or failure of their crops is strongly influenced by the behaviour of the Búzi river and its main effluents.
*b. affect in the future*
For the future extremely variable climatic conditions including increased frequency of cyclones from the Indian Ocean are predicted.
*c. major programmes, policies or activities*
People oriented, inter-district early warning system for the catchment area of the Rio Búzi: participatory risk analysis; establishment of local Disaster Management Committees
*d. Implications for sustainable development*
Discourage people from living in high risk areas, thus conserving their livelihoods

*(3) Are there any activities implemented or planned to promoting understanding of impacts of, and vulnerability to, the climate change related issue?*
A series of field workshops and community meetings were conducted, many of them by local experts from Costa Rica and Honduras who had developed disaster risk management programmes in their own communities.

***Uganda, District of Sironko (completed)***

*(1) Experience with the assessment and management of climate change related risk or extreme events*
*a. affect at present and/or affect in the past*
Prone to mudslides
*b. affect in the future*
Due to increased climate variability the number of extreme weather events (e.g. rain storms) will increase and thus worsen the fragile situation
*c. major programmes, policies or activities*
Systematic elaboration of the complex causes of landslides; an action plan for disaster risk management

**Extreme Weather Events**

***Tunisia (completed)***

*(1) Experience with the assessment and management of climate change related risk or extreme events*
*b. affect in the future*
Heat waves, droughts, water scarcity, storms

*c. major programmes, policies or activities*
Assistance to the national government developing a national adaptation strategy for the sectors agriculture, water and ecosystems

## 2. Spain

**Ibero-American Climate Change Bureau Network (RIOCC)**

The special attention which Spain dedicates to Latin American countries has given rise to the creation, in 2004 and in cooperation with Portugal, of the Ibero-American Climate Change Bureau Network (RIOCC in its Spanish initials), supported by the Ibero-American Conference of Nations, with the aim to deal, in a widespread approach, with climate change matters.

Climate Change Offices of 21 countries belong to the RIOCC: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Ecuador, El Salvador, Spain, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Portugal, Dominican Republic, Uruguay and Venezuela.

The Network objective is to guaranty a permanent dialogue which will allow knowing better the priorities, difficulties and experiences in the region. The working program establishes, among other, activities, in the following sections: research and systematic observation, **impacts and adaptation**, Clean Development Mechanism, capacity building, institutional reinforce, education and awareness, climate change and developing aid, and cooperation between public and private sectors.

**Programme of Impacts assessment, vulnerability and Adaptation to Climate Change (PIACC)**

As a result of this initiative, it has been set up the Ibero-American **Programme of Impacts assessment, vulnerability and Adaptation to Climate Change** (PIACC), supported by the Ibero-American Ministers of Environment Forum. The general aim of the PIACC is to strengthen the development and application of adaptation strategies in the region, and to facilitate assistance to all the members of the RIOCC in the assessments of impacts, vulnerability and the adaptation options to climate change within the sector/system/geographic area of their interest.

The Programme is conceived as a continuous and accumulative process of knowledge generation and as a process of strengthening capacities to better apply them. At the same time, the Programme is a valuable instrument for exchanging knowledge and experiences within the RIOCC framework, which will facilitate North–South and South–South cooperation and will enhance adaptation capacity to climate change in the Ibero-American region.

The initial specific objectives of the PIACC, to be achieved in a continuous way, are the following:

i. Strengthening of the institutional frameworks
ii. Search for synergies with regional institutions and initiatives working on adaptation to climate change in Ibero-America
iii. Support climate and climate change research, and systematic observation.
iv. Empower exchange and availability of knowledge, experiences, methods and tools to evaluate Impacts, Vulnerability and Adaptation to Climate Change.
v. Promote the development of participative projects on adaptation to climate change in priority sectors and systems, giving special importance to trans-frontier projects, trans-sectorial projects and/or pan-sectorial projects.
vi. Promote information and communication activities of the PIACC
vii. Produce evaluation reports of work on Impacts, Vulnerability and Adaptation to climate change in Ibero-America.

One of the first activities of the PIACC has been the development of an analysis on the priorities in the region in climate change adaptation, that can be downloaded from: (http://www.mma.es/portal/secciones/cambio_climatico/areas_tematicas/cooperacion_cc/coop_iber/pdf/analisis_piacc.pdf).

**Climate Change and Natural Disaster**

Regarding climate change related risks and extreme events, an important meeting was organized in the framework of the RIOCC last June 2006 in the CIIFEN (International Center on Research "El Niño"), Guayaquil, Ecuador. This event, "Climate Change and Natural Disaster", brought together three main communities with the aim to enhance coordination among them and identify common priorities and work: the Climate Change community, the Hydrological and Meteorological community and the Civil Defense community. The conclusions of the meeting can be downloaded from: http://www.mma.es/portal/secciones/cambio_climatico/areas_tematicas/cooperacion_cc/coop_iber/pdf/concl_encuentro_guayaquil.pdf

**Ibero-American Center for the Analysis of Emerging Environmental and Climate Change Problems**

Another initiative regarding development cooperation and risk management is the set up of the so-called "Ibero-American Center for the Analysis of Emerging Environmental and Climate Change Problems in Meso-American region and the Caribbean", which is located in the "Water Center for the Humid Tropics of Latin America and the Caribbean" (CATHALAC), Panama. This Meso-American Center, also supported by the Ibero-American Ministers of Environment Forum, has as a principal core the Ibero-American Programme of Impacts assessment, vulnerability and Adaptation to Climate Change (PIACC).

Also Spain has launched a joint initiative with UNDP-UNEP with an initial contribution of 2 millions euros, which will be assigned to climate change adaptation projects in Latin American and African countries.

## 3. United Kingdom

**Climate-screening of UK Department for International Development (DFID) country programme office activities**

***Six pilot countries: Bangladesh, India, China, Kenya, Ghana, Ethiopia. All sectors. Bangladesh (near-complete); India and China (just started); Nairobi, Ghana, Ethiopia (planned)***

*(1) Experience with the assessment and management of climate change related risk or extreme events*
*a. affect at present and/or affect in the past*
Current climate-related hazards (e.g. floods, drought) already reduce the impact of poverty reduction interventions in many developing countries.
*b. affect in the future*
Climate change impacts are likely to exacerbate many existing hazards and bring newer hazards such as temperature rise and sea-level rise to bear. Importantly, these impacts will be felt most acutely by poor people and communities, who tend to be more exposed to these hazards and have fewer resources to cope and adapt. Development investments are also at risk. For example, OECD estimates that as much as 53% of total donor expenditure in Bangladesh is at risk from climate impacts, including increased flooding.
*c. major programmes, policies or activities*
Such risks have prompted action to take steps to reduce risks associated with these hazards in the context of development interventions, in order to improve progress towards poverty reduction. UK DFID is working to develop guidance to screen all development investments for the effects of climate change. The individual pilot risk screening studies will provide inputs for an innovative methodology, ORCHID (Opportunities and

Risks for Climate Change and Disasters), designed to help integrate climate change and climatic disaster risk management into DFID's regular programme activities.

*d. Implications for sustainable development*

In addition to the risk posed to human lives and livelihoods, climate change is a threat to national and international development investments. Screening projects for climate-risk is a first step towards minimising this threat.

*(2) Prediction of climate variability, impacts and extreme events*

*a. opportunities and ability for prediction*

The screening approach is evolving over time, and a standardised approach hasn't yet been agreed. Furthermore, the extent to which climate prediction can be incorporated into the screening process is largely dependent upon the (geographically highly variable) quality of data available. However, where sufficiently robust data exist, climate model outputs will be applied to the local setting.

*b. gaps, needs, barriers and constraints*

Clearly, quantity and quality of sufficient data is an issues in some settings.

*(3) Are there any activities implemented or planned to promoting understanding of impacts of, and vulnerability to, the climate change related issue?*

DFID has produced a set of key sheets that examine the impact of climate change on poverty and the Millennium Development Goals. They also explore action that can be taken at country and international levels to manage the impacts of climate change on the achievement and sustainability of the Millennium Development Goals. The sheets are aimed at informing in-country and central-office-based decision-makers and cover the following relevant issues:

- Climate change deepens poverty and challenges poverty reduction strategies
- The impact of climate change on pro-poor growth
- The impact of climate change on the vulnerability of the poor
- The impact of climate change on the health of the poor
- Responding to the risks of climate change: are different approaches to poverty eradication necessary?
- Adaptation to climate change: making development disaster-proof
- Adaptation to climate change: the right information can help the poor to cope
- Adaptation to climate change: can insurance reduce the vulnerability of the poor?
- Taking initial steps towards adaptation
- Climate change in Africa
- Climate change in Asia
- Climate change in Latin America

All can be found at: http://www.dfid.gov.uk/pubs/files/climatechange/keysheetsindex.asp

***Africa; Research***

*(1) Experience with the assessment and management of climate change related risk or extreme events*

*a. affect at present and/or affect in the past*

Many parts of Africa already experience high variability in rainfall and other climatic extremes. African people have developed coping strategies to deal with this variability, but the ability of African institutions and people to adapt to anticipated climate change impacts over the next 20 to 30 years is limited by widespread poverty, fragile ecosystems, weak institutions, ineffective governance, and other factors.

*b. affect in the future*

Expected impacts range from decreases in crop yields in regions where people are already undernourished, to more severe water stresses and increased incidence of serious climate-related disasters. Poverty reduction efforts will also be impaired. The poor will have to cope with more droughts, more extreme temperatures and sudden and intense rainfall causing greater food insecurity, loss of income, greater mortalities and increased prevalence of diseases.

*c. major programmes, policies or activities*
DFID has undertaken a joint venture with the Canadian International Development Research Centre to develop this research in Africa. The Climate Change Adaptation in Africa Research and Capacity Development Programme (CCAA) commenced in April 2006.
*d. Implications for sustainable development*
See above.

*(2) Prediction of climate variability, impacts and extreme events*
*a. opportunities and ability for prediction*
CCAA will operate through calls for and funding of research and capacity building proposals that clearly contribute to the objectives of the programme, which may include climate prediction activities.
CCAA funds and supports:

- Research that reduces uncertainty and clearly enhances adaptive capacity
- Established capacity-building programmes in Africa that clearly contribute to the goals of CCAA
- Action research that supports adaptation by rural or urban people, particularly the most vulnerable
- Research that adds value to existing initiatives

The full programme activities will be determined once the full programme team is in place.
*b. gaps, needs, barriers and constraints*
See above.
*(3) Are there any activities implemented or planned to promoting understanding of impacts of, and vulnerability to, the climate change related issue?*
Project website: http://www.idrc.ca/en/ev-94424-201-1-DO_TOPIC.html

***Southern Africa; Research***
*(1) Experience with the assessment and management of climate change related risk or extreme events*
*a. affect at present and/or affect in the past*
Many parts of Africa already experience high variability in rainfall and other climatic extremes. African people have developed coping strategies to deal with this variability, but the ability of African institutions and people to adapt to anticipated climate change impacts over the next 20 to 30 years is limited by widespread poverty, fragile ecosystems, weak institutions, ineffective governance, and other factors.
*b. affect in the future*
Expected impacts range from decreases in crop yields in regions where people are already undernourished, to more severe water stresses and increased incidence of serious climate-related disasters. Poverty reduction efforts will also be impaired. The poor will have to cope with more droughts, more extreme temperatures and sudden and intense rainfall causing greater food insecurity, loss of income, greater mortalities and increased prevalence of diseases.
*c. major programmes, policies or activities*
The DFID regional office in Southern Africa is funding a programme of £5 million over 5 years, currently being scoped as part of a large resilience livelihoods programme. Implementation is due in last quarter of 2007.
*d. Implications for sustainable development*
In addition to the risk posed to human lives and livelihoods, climate change is a threat to national and international development investments. Screening projects for climate-risk is a first step towards minimising this threat.

*(2) Prediction of climate variability, impacts and extreme events*
*a. opportunities and ability for prediction*
Unclear at this stage, whether project will involve climate prediction.
*b. gaps, needs, barriers and constraints*
Clearly, quantity and quality of sufficient data is an issues in some settings.

*(3) Are there any activities implemented or planned to promoting understanding of impacts of, and vulnerability to, the climate change related issue?*
http://www.dfid.gov.uk/procurement/ojec7514.asp

***India: Orissa, Andhra Pradesh and Maharashtra***

*(1) Experience with the assessment and management of climate change related risk or extreme events*

*a. affect at present and/or affect in the past*
Parts of India are increasingly prone to flooding, drought, heat-waves; land-slips following heavy rains have resulted in loss of lives.
*b. affect in the future*
First phase of Defra-funded projected revealed: a temperature increase of 2°C was predicted to result in a 10-16% reduction in rice yields, while a 4°C rise led to a 21-30% reduction. The study found that climate change could increase the incidence of malaria in areas that are already malaria-prone, and also introduce malaria into new areas. Climate change is likely to affect the availability of water resources. While India has about 16% of the global population, it only has 4% of total water resources, and many parts of India already face water scarcity. Across India the hydrological cycle is predicted to become more intense, both with higher annual average rainfall as well as longer periods of drought. The intensity of daily rainfall is also predicted to increase.
*c. major programmes, policies or activities*
DFID country office in India supported a study by the World Bank addressing adaptation needs in three river basins (in Orissa, Andhra Pradesh and Maharashtra) in India. Outcomes sought include a common understanding of issues and options for an informed dialogue between and within the Bank and the Government of India and better integration and mainstreaming of climate issues into the Bank's activities and into India's development efforts. The work started in 2005 and is due for completion in early 2007.
*d. Implications for sustainable development*
In addition to the risk posed to human lives and livelihoods, climate change is a threat to national and international development investments. Screening projects for climate-risk is a first step towards minimising this threat.

***LDCs; Health***

*(1) Experience with the assessment and management of climate change related risk or extreme events*

*c. major programmes, policies or activities*
DFID is funding a health and vulnerability assessment in 12 Least Developed Countries that aims to engage the health sector in climate change discourses, highlight adaptation responses, and provide recommendations on effective mainstreaming responses. This should be completed by Spring 2007.
*d. Implications for sustainable development*
In addition to the risk posed to human lives and livelihoods, climate change is a threat to national and international development investments. Screening projects for climate-risk is a first step towards minimising this threat.

***All developing countries; All sectors***

*(1) Experience with the assessment and management of climate change related risk or extreme events*

*c. major programmes, policies or activities*
DFID's disaster risk reduction policy and implementation plan aims to mainstream disaster risk reduction into national development planning. Activities will include training on disaster risk reduction, estimating the economic impacts of disasters, strengthening government capacity and strengthening the UNDP and civil society organisation. Spend on disaster risk reduction from HQ was £11.5 million over 2005-6. In addition DFID has a commitment to make available 10% of its spending on natural disaster responses (that cost over £500k) for disaster risk reduction. Over the years 2005-8 this will amount to £13.8m.

*d. Implications for sustainable development*
In addition to the risk posed to human lives and livelihoods, climate change is a threat to national and international development investments. Screening projects for climate-risk is a first step towards minimising this threat.

*(3) Are there any activities implemented or planned to promoting understanding of impacts of, and vulnerability to, the climate change related issue?*
http://www.dfid.gov.uk/pubs/files/disaster-risk-reduction-implementation.pdf

***Bangladesh; All sectors***

*(1) Experience with the assessment and management of climate change related risk or extreme events*
*a. affect at present and/or affect in the past*
A densely-populated, low-lying country at the confluence of three major rivers, Bangladesh is highly succeptible to coastal and inland flooding, with floods in previous years (e.g. 1998, 2004) covering approximately 2/3 of land area. Furthermore, over half of the people of Bangladesh (total popultion approx 140 million) live on under US$1 per day, and are therefore highly vulnerable to any shocks - climate or otherwise.
*b. affect in the future*
Assessment of the climate risks to the livelihoods of coastal communities in Bangladesh. Making projections for areas inundated in 2020, 2050 & 2080 under different scenarios. Similar assessments for salinity intrusion, drainage congestion and socio-economic impacts on livelihoods.
*c. major programmes, policies or activities*
The purpose of the CDMP is to achieve a shift in disaster management from conventional response and relief to a more comprehensive risk reduction culture. The CDMP has 5 strategic focus areas: i) Capacity Building; ii) Partnership Development and Mainstreaming; iii) Community Empowerment; iv) Research Information Management and v) Response Management. A significant component of CDMP is the Government of Bangladesh Climate Change Cell to build government capacity to coordinate and integrate climate change issues in mainstream development activities and across government. The cell's work focuses on awareness raising, advocacy and coordination to promote climate change adaptation and risk reduction in development activities, as well as strengthening existing knowledge and information accessibility on impact prediction and adaptation to climate change. It has established a focal point system with key ministries and its departments to enable mainstreaming of climate risks into policies and programmes.The CDMP is jointly funded by UNDP, DFID and EC. The total programme is about USD$15 million.
*d. Implications for sustainable development*
In addition to the risk posed to human lives and livelihoods, climate change is a threat to national and international development investments. Screening projects for climate-risk is a first step towards minimising this threat.

*(2) Prediction of climate variability, impacts and extreme events*
*a. opportunities and ability for prediction*
The Climate Change Cell has initiated a process for climate impact prediction modelling that shall ultimately lead to identification of saline water intrusion inside the country over seasons (timeframe: 2 years). The Cell is also coordinating adaptation research over the period 2006-7.CDMP is also conducting an all-hazard all-risk approach through Community Risk Assessments (CRA), Risk Reduction Action Plans (RRAP) and Local Disaster Risk Reduction Fund (LDRRF). These address risk assessment as well as management at all levels of operation. Also as part of CDMP, and in collaboration with FAO and the GoB Department for Agricultural Extension, DFID is supporting a pilot livelihood adaptation strategy approach for drought-related climate risks. This will develop a methodology to translate climate change impact data into agricultural response options and livelihood adaptation practices, with a view facilitating replication elsewhere.
*b. gaps, needs, barriers and constraints*

Clearly, quantity and quality of sufficient data is an issues in some settings.

## Defra-funded research projects

***Bangladesh; coastal communities***

*(1) Experience with the assessment and management of climate change related risk or extreme events*

*a. affect at present and/or affect in the past*

A densely-populated, low-lying country at the confluence of three major rivers, Bangladesh is highly succeptible to coastal and inland flooding, with floods in previous years (e.g. 1998, 2004) covering approximately 2/3 of land area. Furthermore, over half of the people of Bangladesh (total popultion approx 140 million) live on under US$1 per day, and are therefore highly vulnerable to any shocks - climate or otherwise.

*b. affect in the future*

Sea-level rise and increased inland flooding could be disastrous for Bangladesh. Furthermore many people (particularly in coastal areas) may need eventually to make the ultimate adaptation decision, of abandoning land reclaimed by the sea.

*c. major programmes, policies or activities*

Defra-funded project is investigating the potential impact of sea-level rise on lives and livelihoods of coastal populations of Bangladesh.

*d. Implications for sustainable development*

In addition to the risk posed to human lives and livelihoods, climate change is a threat to national and international development investments. Screening projects for climate-risk is a first step towards minimising this threat.

*(2) Prediction of climate variability, impacts and extreme events*

*a. opportunities and ability for prediction*

Hydrological and coastal geomorphological models are being run, informed by GCM outputs and global sea-level rise projections provided within the IPCC Third Assessment report. Projections are being made for total land area (and associated population) inundated in 2020, 2050 & 2080 under different scenarios. Similar assessments for salinity intrusion, drainage congestion and socio-economic impacts on livelihoods. Population projections for coastal areas are being made.

*b. gaps, needs, barriers and constraints*

Lack of coherant reliable data set of climate observations makes reliable regional climate modelling (e.g. via the Hadley Centre's PRECIS model) very difficult. Work is being undertaken locally, to remove outlier observations and refine the ground data, enabling callibration of the PRECIS model to local conditions, and sectoral impacts studies to subsequently be undertaken.

*(3) Are there any activities implemented or planned to promoting understanding of impacts of, and vulnerability to, the climate change related issue?*

None yet identified.

***India; water-resources, agriculture, forestry, human health (particularly effect of heat)***

*(1) Experience with the assessment and management of climate change related risk or extreme events*

*a. affect at present and/or affect in the past*

Parts of India are increasingly prone to flooding, drought, heat-waves; land-slips following heavy rains have resulted in loss of lives.

*b. affect in the future*

First phase of Defra-funded projected revealed: a temperature increase of 2°C was predicted to result in a 10-16% reduction in rice yields, while a 4°C rise led to a 21-30% reduction. The study found that climate change could increase the incidence of malaria in areas that are already malaria-prone, and also introduce

malaria into new areas. Climate change is likely to affect the availability of water resources. While India has about 16% of the global population, it only has 4% of total water resources, and many parts of India already face water scarcity. Across India the hydrological cycle is predicted to become more intense, both with higher annual average rainfall as well as longer periods of drought. The intensity of daily rainfall is also predicted to increase.

*c. major programmes, policies or activities*

First phase of Defra-funded impacts project developed climate and socio-economic scenarios for India, and conducted broad-scale impact assessments in the following sectors: water resources; agriculture; forestry; coastal zones; industry, transport & infrastructure; and human health. Second phase will also conduct adaptation case study, looking at an area particularly vulnerable to the effects of climate change, and working closely with stakeholders to develop practical options for effective adaptation. The work will focus on one of the DfID target states to enable any recommendations to be followed through by an executive body. Second phase will revise the climate scenarios to use the latest modelling techniques to provide a probablistic approach to the assessment of climate changes. More detailed integrated assessments will then be made on the following sectors: water resources; agriculture; forestry; and human health (heatwaves).

*d. Implications for sustainable development*

See above. Also: as a formal government bilateral project it is likely that the recommendations will find more fertile ground than otherwise. This should provide a valuable source of information which can inform Government-of-India planning for the sectors concerned over the coming years. Working in a DFID key-state (within phase 2) enables the recommendations to be carried through.

*(2) Prediction of climate variability, impacts and extreme events*

*a. opportunities and ability for prediction*

The first phase involved the training of researchers at the Indian Institute of Tropical Meteorology in the use of PRECIS. IITM then carried out the modelling themselves. This is likely to be repeated in the second phase using the latest techniques. Linkages are also being sought with a parallel research programme looking in detal at the effects of climate change on the Indian monsoon. It is likely that much of the modelling will be relevant to both projects and significant capacity will be built.

*b. gaps, needs, barriers and constraints*

Clearly, quantity and quality of sufficient data is an issues in some settings.

*(3) Are there any activities implemented or planned to promoting understanding of impacts of, and vulnerability to, the climate change related issue?*

Communication of results is a key part of the project. For the first phase a set of successful 'key sheets' were produced that summarised the findings of the project [http://www.defra.gov.uk/environment/climatechange/internat/devcountry/india2.htm]. These proved popular among stakeholders in India and contributed significantly the raising of awareness of the issue in India.

The second phase will have a communications strategy integrated into the project from the start. The adaptation project will engage with stakeholders at a local level (which will involve capacity building) and if successful the adaptation options will provide a model for activities that could be replicated. Modelling capacity will also be improved through the project - one of the aims of the project is to increase cooperation between Indian and UK researchers.
[http://www.defra.gov.uk/environment/climatechange/internat/devcountry/india.htm#impacts ]

***China; agriculture, rural livelihoods, water-resources.***

*(1) Experience with the assessment and management of climate change related risk or extreme events*

*a. affect at present and/or affect in the past*

Flooding, water resource issues, drought are all of concern.

*b. affect in the future*

Results from the first phase of the Defra-funded research suggest:

- Average temperature increase in China by the end of the 21st century may be between 3 and 4 °C
- More extremely high temperature events during the summer
- Fewer extremely cold events during the winter
- Increase in the number of days with heavy rainfall
- Food crop yield reduced in scenarios for 2080s
- Rice – between 12-28% reduction
- Wheat – between 4-36% reduction
- Maize – between 8-22% reduction
- Decline on area of arable land by 13%

*c. major programmes, policies or activities*

Phase one used the PRECIS model to create climate predictions for the whole of China. Second phase of project is conducting a more in-depth study of the impacts of climate change (again using PRECIS, along with impacts and socio-economic modelling) on agriculture in Ningxia, Northern China. This is taking an integrated approach to water resources and agriculture to get a more realistic projection (phase 1 considered direct impacts of CO2 and temp/ppt change on crops, assuming infinite availability of water). Stakeholder consultation is informing the development of options for adaptation.

*d. Implications for sustainable development*

See above. Also: agriculture in China accounts for 35% of China's GDP and provides food for 25% of the world's population. Any reduction in agricultural output will seriously affect China's growth. Adaptation of agriculture will be essential - providing options and building capacity in this area is therefore of huge importance to international sustainable development.

*(2) Prediction of climate variability, impacts and extreme events*

*a. opportunities and ability for prediction*

Researchers at the Chinese Academy of Agricultural Sciences now trained on the use of PRECIS, and have fostered good linkaged with researchers in the UK, particularly the Hadley Centre.

*b. gaps, needs, barriers and constraints*

Clearly, quantity and quality of sufficient data is an issues in some settings.

*(3) Are there any activities implemented or planned to promoting understanding of impacts of, and vulnerability to, the climate change related issue?*

Results of the first phase were disseminated through a series of UK funded workshops in China. The second phase has more stakeholder engagement and hence more inbuilt capacity for awareness raising.

## 4. European Commission

### Linking Climate Change Adaptation and Disaster Risk Management for Sustainable Poverty Reduction

An EC funded project on behalf of the Vulnerability and Adaptation Resource Group (VARG), involving studies in Mexico, kenya and Vietnam and culminating in an international project workshop hosted by UN-ISDR in Geneva in October 2006.

The project used grounded examples in the 3 countries and exchange of experiences across those contexts to provide insights into how a more integrated approach to disaster risk management and climate change adaptation can be built. Although risk assessments formed part of the studies, main emphasis was placed on analysing the institutional capacity and constraints/opportunities within the policy process.

The country studies and the synthesis across the studies/workshop yielded a series of recommendations relating to integrating information packaging and communication; incorporating livelihood resilience;

improving coordination; leveraging finance for adaptation; and creation of an enabling environment. the reports are available on the VARG website: http://www.climatevarg.org/

### EU Action Plan on climate change and development

The five strategic objectives of the Action Plan, adopted by the EU Council of Ministers in November 2004, are:

- Raising the policy profile of climate change. Measures include: putting climate change on the agenda of high-level consultations under EU development cooperation agreements; preparing country- or region-specific briefs on climate change; promoting exchange programmes between the EU and partner countries to foster mutual understanding.
- Support for adaptation. Measures include: supporting partner countries in preparing vulnerability and adaptation assessments and national adaptation programmes of action (NAPAs) for least developed countries; developing guidelines for integrating climate change into development programmes – including measures to avoid maladaptation – based on consultation with all stakeholders; supporting capacity-building in developing country institutions to prepare for and reduce the impact of climate change-related disasters.
- Support for mitigation and low GHG development paths. Measures include: supporting pilot projects to strengthen the links between government ministries and the research community; supporting partner countries to carry out research on low-carbon technologies and further develop local mitigation technologies; supporting capacity-building for developing countries' participation in the Kyoto Protocol's clean development mechanism (CDM).
- Capacity development. Measures include: building individual and institutional capacity in impact prediction and vulnerability assessment; identifying ways to support improved coordination between developing countries to prepare for climate change negotiations; establishing knowledge banks to disseminate information and provide training for action on climate change.
- Monitoring and evaluation of the Action Plan: Measures include: regular discussions on implementation of the Plan and encouragement of feedback from stakeholders; preparation of a biannual evaluation report and, based on this, modification and updating of the Plan.

### The DIPECHO programme - Reducing the Impacts of Disasters

The European Commission's humanitarian aid department (ECHO) was set up in 1992 to provide rapid and effective support to the victims of crises outside the European Union. Having recognised the importance of pre-emptive measures, ECHO launched its disaster preparedness programme, DIPECHO, in 1996, which targets vulnerable communities living in the main disaster-prone regions of the world and concentrates on reducing the vulnerability of the population. This programme funds support training, capacity-building, awareness-raising and early-warning projects as well the organisation of relief services. The programme has shown that even simple precautions can help save lives and property when disaster strikes. The funds are directed through ECHO and implemented by aid agencies working in the regions concerned.

### ACP-EU Natural Disaster Facility - under the Commission's Disaster Risk Reduction programme

The objective of the programme is to provide the populations in ACP states with the capacity to improve their involvement in activities relating to disaster risk reduction and disaster management including preparedness and mitigation and post-disaster reconstruction and rehabilitation. The Facility is to operate:
(a) a strengthening of early warning systems in ACP states; and
(b) an adequate response to the financial and technical needs of those ACP states which are vulnerable to or affected by natural disasters. The preparation and implementation of disaster risk management plans will also significantly strengthen ACP states capacity to deal with the long term effects of natural disasters.

The Natural Disaster Facility will, inter alia, work to:

- Facilitate inter-ACP regional sharing of experiences and best practices;

- Strengthen information and public awareness through media and civil society involvement for dissemination and implementation;
- Promote Community empowerment through capacity building and enhancing community resilience by building knowledge bases;
- Reinforce partnerships and cooperation on disaster risk reduction policy and strategy;
- Incorporate disaster research in science policy for applied research and practice;
- Incorporate disaster risk reduction into curricula at all levels of education;
- Undertake initiatives at the grass root levels which utilize indigenous and traditional knowledge bases; and
- Develop communication strategies for disaster reduction, including on line and on-site education curricula for practitioners and field workers.

### The AMMA Project - (African Monsoon Multidisciplinary Analysis)

The EC funded research project under the 6th Framework programme aims to provide the African decision makers with improved assessments of similar rainfall changes which are likely to occur during the 21st century due to natural fluctuations and as a result of anticipated global climate change. An essential step in that direction is to improve our ability to forecast the weather and climate in the West African region. Its main objectives are: to improve our ability to predict the West African Monsoon and its impacts on intra-seasonal to decadal timescales, and our ability to predict the consequences of climate change on WAM variability and its impacts. These objectives will be achieved by re-enforcing the regional environmental monitoring systems and conducting intensive field campaigns. This will lead to a better understanding of the mechanisms involved and in-fine improve our models and their predictive skills. The observational system will cover the regional water cycle, the atmospheric dynamics and chemistry, the land-surface and oceanic conditions. It will cover 3 time scales : i) a long term monitoring, ii) an enhanced observing period of two years and iii) a special observing periods over one rainy season. In order to monitor the human dimension of the West African monsoon variability crop yields, water resources and health will be monitored with the same strategy.

### Advancing Capacity to Support Climate Change Adaptation

The European Commission-funded ACCCA (Advancing Capacity to Support Climate Change Adaptation) project builds capacity for understanding and communicating climate change risks and applies these capacities to the management of climate risks. These goals are being achieved through the execution of pilot actions in Africa and Asia to:

- Identify and prioritize climate risks of concern to stakeholders and the climate influenced decisions that they face
- Assess available knowledge about risks and adaptation opportunities and synthesize the knowledge in terms that are directly relevant to stakeholder concerns and decision-making needs
- Develop, test and disseminate risk communication materials that are designed to assist adaptation decisions
- Use the risk communication materials in stakeholder forums to develop recommendations for climate change adaptation and promote their adoption
- Identify critical knowledge gaps that impede effective adaptation decisions and design assessment activities that would generate new knowledge to fill them

### The European Commission AID-CCD project

This project, in the framework of the ENRICH implementation, aims at developing and co-ordinating exchange of experiences across the world between scientific institutions involved in the UNCCD implementation by setting up two thematic seminars each one dealing with a specific issue relevant in all UNCCD Annexes. The project addresses the issue of the UNCCD implementation in a global perspective, by involving all regional Annexes.

Among the main issues, indicators, information circulation systems and prevention and mitigation activities have been recognised has the priorities, and much work has been carried out to address these aspects in all Annexes. All these activities have been developed in parallel and have produced a relevant quantity of data and information that has never been organised systematically. In fact, there is a lack of exchange of information among Annexes mainly because there are little opportunities to meet and thoroughly discuss the experiences and the activities carried out.

### DeSurvey - Assessing and Monitoring of Desertification

This project offers a contribution to fill the gap of standardized procedures to perform diagnosis at operational scales by complementing assessment of desertification status with early warning and vulnerability evaluation of the involved land use systems. To this purpose the interactive effects of climatic and human drivers of desertification will be taken into account in a dynamic way. The project goal is to deliver a compact set of integrated procedures, with application and tutorial examples at the E.U. and national scales. The performance of DeSurvey in other desertification threatened areas of UNCCD regional Annexes will be further tested against other expertise and available procedures. To this aim partners and sites from Maghrebian and Sahelian countries as well as from Chile and NW China have been included in the Consortium. Fulfilling this objective requires the integration of a hard core basic and application-oriented research, with the development of user- support technologies, capacity building, and stakeholders, as well as data and technology providers including SMES. A Consortium of 39 Organisations with a wide range of skills, from 10EU Member States and 6 Third Country States, builds the project partnership. Desurvey aims to develop a prototype of low cost surveillance systems that allows for:

- Understanding and assessing desertification and land degradation status
- Forecasting and monitoring desertification
- Formulating policy to detect, prevent and resolve desertification risks

The system is intended to be used at several temporal and spatial resolutions such as the European Union, the United Nations Convention to Combat, desertification and local consortia of stakeholders in risk-affected districts. The geographical scope of the project is primarily the E.U. member countries affected by desertification. Validation experiments will be made in a selection of desertification case studies in the southern Mediterranean and other affected areas around the world.

### INDEX Project – Indicators and thresholds for desertification, soil quality and remediation

In 2003 the UN Convention to Combat Desertification (UNCCD) and other organisations have emphasised the continuing need for indicators. The prime goal of INDEX is to develop modern, rapid, sensitive, universal, multivariate indicators with which the dynamic state of land degradation as well as its remediation can be assessed. In view of Global Change such indicators are especially needed. An early warning system is needed to indicate the need for countermeasures, while they are still economical. INDEX will rely on previously supported Commission projects and will disseminate its results to subsequent projects. It will attempt to utilise small and medium enterprises (SMEs) as links to non-scientific institutions. The whole will be imbedded within the UNCCD and disseminated to stakeholders.

PAPER NO. 4: INDIA

## India's Views on the Five-year Nairobi programme of work on impacts, vulnerability, and adaptation to climate change

India is pleased to submit information and views on the programme of work on Impacts, vulnerability, and adaptation to climate change. The work programme's particular thrust on assistance to developing and least developed countries to assess their impacts and vulnerabilities will play a crucial role in actions for reducing climate risks.

1. Climate change science has a distinctive attribute in the tropics. Tropical climate is characterized by its variability involving phenomena such as the El Nino & Asian summer monsoons. Intense tropical storms and extreme weather events also temper the meteorology of the region. Observed trends are difficult to assess because of insufficient information and uncertainties introduced by data gaps, instrumental errors and large expanse of data sparse ocean area. Current projections made by models show little change or small increase in strength of the El Nino events. According to model estimates the Asian summer monsoon is likely to be more variable with increasing green house gases in the atmosphere. However, the level of confidence in the predictions made by climate models for the tropics and the monsoon region remains limited due to inadequacies in representation of tropical processes and in simulations of El Nino as well as the monsoon. Trends in tropical storm intensity and frequency as well as their future projections in a warmer world remain unclear.

2. Although capabilities for observations/monitoring and early warning of extreme weather phenomena like tropical cyclones exist, the capacities to forewarn localized high-impact weather events is limited. A major effort to modernize meteorological observational networks and improving predication capabilities are underway. Facilitation of free exchange of high resolution forecasts from leading international centers will be of great help in improving early warning capacities. These efforts have to be augmented with detailed vulnerability assessments coupled with local information on GIS platforms to convert them into effective decision support systems that could reduce future risks triggered by climate change. More specifically there is an urgent requirement to improve capabilities in -
    a. Short-term forecasting of extreme events like heavy rainfall, tropical cyclones
    b. Coupling these products to local information for decision support systems to mitigate risks like floods, and storm surge.
    c. Integration and mainstreaming of this forecasting capability and climate information into operational management systems, such as water resource management, agriculture and other sectors.

3. Consequences of climate change are likely to permeate almost all sectors of human activity as well as our natural environment. The present information-base available at micro-level, especially in the developing countries, is highly fragmented. Information availability, in regions like Asia and Africa with almost 65% of the population living in rural area, is generally scarce. It is therefore necessary to create systems, which can assemble information, and information sources related to sectors influenced by climate change. India with its rich heritage clearly recognizes the importance of traditional knowledge as an integral component of this information-base.

4. Impact assessment, formulation of adaptations strategies to future scenarios of climate change requires expertise on a number of research components. Creation of human resources with interdisciplinary skills to address and respond to climate change remains a challenge. To sustain such capacities, we need to establishment institutional capacity that embodies such skills.

5. The key to concerted and efficient action on climate change lies in building an effective science-policy interface that can provide viable strategies for bringing together innovations and research in S&T to better utilize our available natural, financial and human resources to steer us towards sustainable development, both regionally and globally. Efforts made for preparation of India's first National Communication on Climate Change brought together a large number of National research institutions working on varied issues related to Climate change. Actions to sustain such efforts, through appropriate guidance to the financial mechanism of the Convention, need to be built-in.

PAPER NO. 5: MEXICO

**Subject:** **Information on the relevant programmes, activities and views to advance subtheme a(iv) in the annex to decision 2/CP.11, "Promoting understanding of impacts of, and vulnerability to, climate change, current and future climate variability and extreme events, and the implications for sustainable development".**

Mexico welcomes the opportunity to submit, as requested by SBSTA 25 (FCCC/SBSTA/2006/11), information on relevant programmes, activities and views on the following issues:

a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;
b) Ability, gaps, needs, opportunities, barriers and constraints to predicting climate variability, impacts and extreme events across regions and hazards;
c) Contribution of traditional knowledge to understanding and managing climate-related risks;
d) Implications for sustainable development in relation to paragraph 34 (a) to (c) above;
e) Promoting understanding of impacts of, and vulnerability to, climate change.

For the Mexican government, adaptation to climate change and climate variability is a major concern and a priority. In consequence, Mexico has established, at the highest level, a Climate Change Inter-secretarial Commission (CICC) which reports to the President, and whose objective is to coordinate the actions taken by the institutions, offices and organizations of the Federal Government, with regards, *inter alia,* to the formulation and implementation of national policies to adapt to the impacts of climate change and climate variability, and to promote the development of climate change programmes and strategies to comply with Mexico's commitments as subscribed under the UNFCCC.

**a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;**

Mexico has developed national capacity for the assessment of current and future climate –related risks at governmental, academic, and private levels. Particularly, tasks have focused on specific sectors such as water, forestry, health and agriculture. Mexico's Third National Communication to the UNFCCC includes results from these assessments.

Vulnerability assessments for several regions, sectors, and particular ecosystems have been produced, but they are still far from enough to understand the complexity of future risks associated to climate variability and extreme events.
In regard to civil protection, Mexico is moving from a reactive to a preventive approach particularly when facing climate related risks and extreme events. It is widely understood that the participation of the three orders of government, all government sectors, the general population, and the social and private sectors is crucial to succeed in such approach.

Mexico has set up institutional coordination arrangements and some financial mechanisms for the management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors.

For instance, the Secretariat of the Interior (SEGOB), through the National Civil Protection System, supported by research and training from the National Center for Disasters Prevention (CENAPRED), and in coordination with the Secretariats of Communications and Transport (SCT), Energy (SENER), Defense (SEDENA), Tourism (SECTUR), the Navy, and others, has developed, updated, implemented and operated evacuation and civil protection plans for climate related risks and extreme events in Mexico, and operates the early warning system for hurricanes. The work of these institutions has been done in close collaboration

with state and municipal governments. The SCT works in coordination with state governments and SEDENA for maintaining and securing evacuation routes, while SEDENA runs the DN-III-E Plan, to assist and help civil population in cases of disasters.

A diversity of documents and guidelines, prepared, published and disseminated by the aforementioned institutions are a helpful resource for promoting the understanding of impacts of, and vulnerability to climate change, current and future climate variability and extreme events. These publications include the *National Atlas of Risks*, and *The guidelines for the development of state and local level atlases of hazards and risks*, both publicly available at the Integrated Information System on Risks of Disasters; the SCT's *Guide for the attention of emergencies in highways and bridges*; SECTUR's *Manual on how to proceed when facing climate related emergencies*; and the Pan American Health Organization's *Safe Hospital* booklet.

Altogether, these products allow Mexico to evaluate the risks, assess the potential impacts and losses associated with climate related events, and plan and implement disasters prevention measures.

As mentioned before, Mexico has financial mechanisms like the Fund for Natural Disasters (FONDEN), the National Fund for Natural Disaster Prevention (FOPREDEN), the Trust Fund for the Prevention of Natural Disasters (FIPREDEN), and the Fund for Supporting the Rural Population Affected by Climate Contingencies (FAPRACC). These mechanisms provide resources for actions and measures to reduce risks and for avoiding or diminishing the effects of destructive phenomena on the life and goods of the population, public infrastructure, and the environment, and for the attention of natural disasters.

**b) Ability, gaps, needs, opportunities, barriers and constraints to predicting climate variability, impacts and extreme events across regions and hazards;**

In Mexico, the institution in charge of generating and distributing information about weather at national, regional and local scales is the National Meteorological Service (SMN). The SMN performs permanent surveillance of the dynamics of the atmosphere, in order to identify the meteorological phenomena that may produce adverse impacts on population and infrastructure, and gathers information on climate at the national scale.

With the information they generate and gather, the SMN keeps the Civil Protection System informed about the meteorological conditions that may affect the population and their patrimony; informs the public directly about weather conditions; produces and divulgates alarm bulletins, especially during the cyclone season, from May to November; produces climatic and meteorological studies; and systematizes information on a National Climatic Data Bank.

The observation infrastructure existing in Mexico includes: a surface synoptic network, with 72 meteorological observatories that transmit information on atmospheric conditions in real time; a high altitude synoptic network, with 15 stations that perform observation of the higher strata of the atmosphere; a Network of Automatic Meteorological Stations, with 94 observation and transmission stations; a network of meteorological radars, with 12 radars across Mexico, that cover almost the whole national territory; and a terrestrial station that receives satellite imagery every 30 minutes.

Although the observation network is ample, investments are much needed to improve the state of the meteorological monitoring stations, some of which are not performing properly, due to some equipment becoming obsolete. The same applies for hydro-monitoring. In both cases, a diagnosis is needed to assess what needs to be done, and at what cost.

In general, there is also the urgency to extend the systematization and availability of data, particularly at the regional and local levels, and to improve analysis capacity at all levels, particularly for long-term trends and for hazards identification.

At the national level, the capacity to use models for predicting climate variability, impacts and extreme events is very limited, both in terms of the level of resolution of models, often not useful for regional and local decision making, but also in terms of their availability.

The development of a Climate Modeling Program has been identified as a national priority, especially as it would reduce the costs and impacts of extreme climate events. Its implementation, nevertheless, has faced several barriers, particularly when it comes to the availability of resources to acquire, adapt and run models, and the development of capacities in academia (to develop, use and analyze models), government (to translate model results into information useful to decision makers) and the general public (to improve their response capacity).

For the prediction of impacts, risk atlases have proved to be useful, but their coverage at state and local levels is still very limited. About half of all the cities in Mexico with more than 15,000 inhabitants, have a risk atlas, while only 1% of the 2,249 municipalities existing in this country have one.

**c) Contribution of traditional knowledge to understanding and managing climate-related risks;**

Mexico has improved the understanding of climate-related risks by integrating stakeholders, at different stages of regional or sectorial studies. This is particularly useful while in the process of assessing the vulnerability, improving the adaptive capacity, and designing adaptation measures to climate change. In these cases, the experiences and traditional knowledge of stakeholders have proved useful. For instance, the project called "Capacity Building for Stage II Adaptation to Climate Change in Central America, Mexico and Cuba", made it possible to assess trends and impacts of climate change and extreme events, like droughts and floods, at regional and local levels, taking into consideration the inputs of local communities, which was especially useful in the cases where there was scarce hydrometeorological information. This input helped to understand the magnitude of the impacts of climate in agricultural productive systems; to know, from the stakeholders perspective, which factors are important to their sector; to identify, from their experience, the intensity and duration of recurrent climate events as well as the historical vulnerability of producers; and to identify the different strategies and measures adopted by stakeholders when facing climate-related events.

The results of this study were included in the Adaptation Policy Framework for climate change (APF, 2003), as a reference for future investigations on the usefulness of integrating a multi-stakeholder approach, with broad representation, in the design and implementation of adaptation policies.

**d) Implications for sustainable development in relation to paragraph 34 (a) to (c) above;**

Mexico's experiences on the assessment and management of current and future climate-related risks and impacts, as well as the contributions of traditional knowledge to understanding and managing climate-related risks have both become an input to the work of the Climate Change Inter-secretarial Commission (CICC), a body of the federal government comprising representatives from the Secretariats of Agriculture, Livestock, Rural Development, Fisheries and Food (SAGARPA), Communications and Transport (SCT), Economy (SE), Social Development (SEDESOL), Energy (SENER), Environment and Natural Resources (SEMARNAT), and Foreign Affairs (SRE).

The impacts of recent extreme events, together with the information generated on the topics and issues of current and future climate-related risks and impacts, have fostered the interest and improved the sensibility, openness and comprehension of climate change at the Secretariats represented at the CICC, and to a lesser extent, of the sectors they represent.

As a result, the CICC decided to prepare an introductory document towards the development of a National Strategy on Climate Change, and has also decided to integrate a working group on adaptation.

In a following stage, and as part of the integration of the National Strategy on Climate Change Action (ENAC), the CICC aims to influence the federal government as a whole by mainstreaming climate change on Mexico's public policies, including sustainable development criteria, particularly looking for policies and strategies that achieve local, regional and global benefits.

Climate change is identified as a threat to the economic and social development of the country, and its mainstreaming represents an opportunity to develop public policies that conduce towards sustainable development.

**e) Promoting understanding of impacts of, and vulnerability to, climate change.**

Mexico's efforts towards promoting the understanding of impacts of, and vulnerability to, climate change have steadily increased since Mexico's ratification of the UNFCCC and the Kyoto Protocol.

A key element of the Mexican policy in relation to climate change has been outreach, in order to allow the population to improve their knowledge and understanding of the impacts of, and vulnerability to climate change.

The outreach activities undertaken have included presentations and participation of the members of the CICC, academia, and government representatives in a number of public forums and seminars devoted to the discussion of climate change all over the country. In the last five years alone, more than 60 events have taken place in Mexico. Such activities have permeated the media, who are publishing and broadcasting more and more climate change-related articles and news on newspapers, magazines, the internet, radio and TV.

Mexico has also promoted the understanding of these topics through publications and printed materials, such as leaflets, posters, books and articles, or contributions to magazines, journals, and newspapers. Over the last two years alone, five thousand copies of a children's book on climate change were produced and distributed to schools by way of the Secretariat of Public Education; four books as well as the Third National Communication to the UNFCCC and the National GHG Emissions Inventory were also prepared and became available to the general public in electronic format and in hardcopy; and a number of articles have been published.

In addition, two climate change related websites were developed and became public in 2005 and 2006 respectively: (1) a climate change website, fully in Spanish with partial content in English, with information relevant to 6 different types of audience, including the general public, the private sector, academia and the media; and, (2) a climate change website with information on climate change impacts, vulnerability and scenarios, arranged by state and sector, including each one of the 31 states and the Federal District, and 8 different sectors, among them water, agriculture, energy, tourism and health.

In spite of these achievements, Mexico recognizes the prevailing differences within its population in terms of access to, and understanding and comprehension of the impacts of, and the vulnerability to, climate change. Local authorities and the society, although they may be generally aware of the topic, do still misunderstand the causes and effects of different environmental problems, and sometimes attribute a variety of unrelated environmental phenomena to climate change. Even the media are still unable to effectively transmit relevant climate change information to the society. Aware of the need to further promote the understanding of climate change, Mexico will prepare a National Climate Change Outreach Strategy in the forthcoming months.

PAPER NO. 6: MOROCCO

# UNFCCC Five-year programme of work on impacts, vulnerability and adaptation to climate change.

Relevant programmes, activities and views related to the issues of points a, b, c, d, e, of the paragraph 34 of the UNFCCC Five-year programme of work on impacts, vulnerability and adaptation to climate change.

## I. Project Second National Communication on Climate Change (Study on the vulnerability and adaptation of Morocco to climate change).

### 1. Context and stakes:

Morocco signed United Nations Framework Convention on Climate Change (UNFCCC) at the time of the CNUED of Rio de Janeiro, in June 1992. It ratified it on December 28, 1995. Party non annex I of the Convention, Morocco must transmit a national communication in accordance with articles 4 and 12 of Convention. Morocco subjected to the UNFCCC its Initial National Communication (CNI) on November 1, 2001. This report/ratio provides an inventory of the greenhouse gases emissions (GES) of the country, analyzes the possible impact and the vulnerability of its natural resources and its environment and economy, and clarified draft amendments in the sectors of water and agriculture.

Whereas Morocco is not a very important gas transmitter of greenhouse gases, it is supposed to suffer from the considerable negative impacts of the climate change. The CNI of Morocco showed the great vulnerability of the country to the impacts of the climate changes, for two key sectors of the national economy which are the water resources and agriculture, and the need for a strategy of adaptation.
The realization of this study Vulnerability and Adaptation (V&A) enters within the framework of the preparation of the Second National Communication (SNA) of Morocco which must be subjected in 2008. It will be based on the results of the first study Vulnerability & Adaptation carried out within the framework of the preparation of the CNI

### 2. Acquired knowledge and recommendations:

The first national communication was evaluated, the strong points were underlined and the lessons drew were very well deferred by the document of the project national second communication. Thus, it is important to take into account during the development of the second national communication.

### 3. General Objective:

The major objectives of this study are as follows:

• A prospective and thorough evaluation of the environmental and socio-economic impacts of climate changes for the country.

• An identification of the most appropriate options and the measurements of adaptation of the ecosystems and sectors socio-economic to the negative effects of the climate changes.

The team of experts of the study will refer to the relevant results of the first study carried out within the framework of the preparation of the First National Communication, being studied entitled “Evaluation of the Initial Communication of Morocco to the UNFCCC and development of the terms of reference of the project of activities entitling for the preparation of the Second National Communication” and other original researches led to Morocco in the close Mediterranean countries

### 4. Activities and tasks requested:

The present study will proceed in three phases while following the orientations hereafter:

**4.1 Mission I:** Evaluation of the environmental vulnerability and the economic sectors of the country to the climate changes. This first phase is made up of the three following stages:

4.1.1. Workshop of starting: Organization of a workshop of starting to introduce the methodological approach, planning of the work and for the making of contact with the Committee of follow-up.

4.1.2. Selection and consolidation of the climatic scenarios and sea level rise for Morocco:
The first study Vulnerability and Adaptation, carried out a the framework of the preparation of the CNI of Morocco, were carried out on the basis of climate scenario retained for Morocco, according to the methodology of the IPCC), with use of software MAGICC and SCENGEN.

On the basis of average scenario of the IPCC (IS92a), with an average sensitivity of the climate and the grid of SCENGEN, seven models of general circulation (MCG) were considered for projections of the climate of Morocco in 2020.

4.1.3. Evaluation of the environmental and sectoral impacts of the projected climatic changes and seeks interrelationships, from a point of view of taking into account integrated:
This stage comprises the following activities:
• Choice of the methods, steps and/or hot lines to use to evaluate the vulnerability of the ecosystems and the socio-economic sectors. The consultants in load of the study will use the methods, methodologies and the most recent tools and approvals on an international scale such as (1) the technical directives of the IPCC for the evaluation of the incidences of the evolution of the climate and the strategies of adaptation "IPCC Technical Guidelines for Assessing Climate Change Impacts and Adaptations (Casing, T.R., M.L. Parry, H. Harasawa, S. Nishioka, 1994)", (2) the handbook of the Program of the United Nations for Environment (PNUE) entitled "Handbook one Methods for Climate Changes Impact Assessment and Adaptation Strategies (Feenstra, J.F., I. Burton, J.B. Smith, R.S.J. Tol, 1998)", (3) the handbook entitled "International Handbook one Vulnerability and Adaptation Assessments (Benioff, R., S. Guill, J. Lee, 1996)" as all the methodological approaches contained in the repertory of tools of decision for the evaluation of strategies of adaptation to the climatic changes heading "Compendium of Decision Tools to Evaluate Strategies for Adaptation to Climate Changes" recently updated and available on the site of convention (www.unfccc.int/issues/meth_tools.html).
• General and qualitative Evaluation, at a defined temporal horizon, vulnerability of the water resources, agriculture, coastal zones and forests compared to the climatic changes.
• Deepened Evaluation of vulnerability of a zone targets particularly significant to apprehend the unfavourable effects of the climate changes on all the ecosystems and the natural resources of zone (water resources, forests, wetlands, etc) like on the company and economy (agriculture, human settlements, etc).

**4.2.Mission II:** Evaluation of the vulnerability of socioeconomic sectors to climate change: This phase includes primarily the following activities:
• Establishment of socio-economic scenarios specific to the Moroccan national context: projections and socio-economic orientations of the key sectors, having a connection with the climatic change
• In the light of the results of the first phase, evaluate the impact of the climatic change on the socio-economic and human development in Morocco while focusing on the impacts on the rural world (human settlements, poverty).
• To release the factors of risks of losses in term of ecosystems, resources, biodiversity and overall losses economic and stressing of the social vulnerability in relation to several scenarios of change. On the methodological level, the consultants in load of the study can refer to the handbook of the UNDP entitled "Developing Socio-economic scenarios for uses in vulnerability and adaptation assessments" for the preparation of the socio-economic scenarios.

**4.3. Mission III:** Development of a strategy of adaptation to the impacts of the climate change:
This phase includes the following activities:

• To identify, in the light of the analysis of the phases I and II, the options and possible measurements of adaptation of socio-economic sectors for the negative effects of the climate change, while utilizing types of actions necessary (sensitizing, options legal, institutional, technological…).
• For the targeted zones selected in phase I and for each economic sector making object of the analysis of vulnerability, identify the specific options of adaptation being able to attenuate the negative impacts of the climate change.
• Evaluate the cost of implementation of each identified option and establish a procedure of recovery of these costs.
• Establish a calendar of implementation of the options of adaptation to short, average and long terms, by identifying priority actions to engage during the next economic and social plans of development.
• Analyze and identify the requirements in reinforcement for the capacities and support for the institutions in load for the implementation for the strategy for adaptation to the impacts for the climate change.
• Analyze and identify the requirements in sensitizing, education and supply of information to the public.
• Identify the technological needs by type of sector (town planning, irrigation, drinking water, balneal tourism,…).
• Identify the requirements in scientific and technological research required to be able to offer options of adaptation.
• Identify measurements of accompaniment of an institutional and lawful nature capable to consolidate the implementation of the options of adaptation.
• Explore the financing opportunities at international scale whose Morocco can profit to implement the identified draft amendments.
• Establish and finalize proposals for a financing of priority projects of adaptation to subject to international funds.

For the identification of measurements of adaptation to the negative impacts of climate change, the consultants in load of the study will use the most recently developed and recognized methodological tools on an international scale, such as the use of the "Framework of policies of Adaptation" ("Adaptation Policy Frameworks For Climate Change - Developing Strategies, Policies and Measures") of the PNUD/FEM and taking account the national circumstances, the priorities of development at the local and national level, of the economic evaluation of these measurements, etc. This approach will facilitate the integration of the adaptation to the climate change in national policies of development, and in particular those relating to the reduction of poverty and the durable development. This phase will be packed by the development of a national strategy of adaptation to the climate change. The strategy of elaborate adaptation will be supplied with an action plan of implementation taking account the relevant elements of the above-mentioned activities.

During the development of the third mission, it should be stressed the importance of a systematic implication of all the recipients to the design and the implementation of measurements of adaptation in the sectors of development.

To this end, the study will adopt an approach supporting the dialogue between all the actors concerned, as well individually, as within the framework of workshops of consultation, restitution of the results, and examination of the reports before their validation.

At the end of mission III, the team of experts in load of the study will submit a total review article gathering the relevant elements of the various phases of the study. Also, an organization of a final workshop to submit the principal results of the study to the Committee of follow-up should be envisaged.

## II. The scientific and technical national Committee on the climate change (Comité National Scientifique et Technique sur les Changements Climatiques / CNST-CC):

The CNST-CC is a committee which has a role of council near the governmental authority in charge of the environment, on the scientific and technical aspects related to the climatic changes. It constituted in the form of grouping of people deprived of the legal personality near the Minister in charge of the environment: Its members are selected among the scientific personalities recognized for their professional qualifications and competences in the fields of the climate changes.

The CNST lead to the following goals:
- Support the focal point of the IPCC in Morocco,
- gives a preliminary opinion on the scientific and technical work presented by Morocco at the international level about the climatic changes,
- Constitutes a scientific space of exchange and information on the questions relating to the climatic changes and,
- proposes, of its own initiative, or at the request of a governmental authority the studies and the measures to be taken in connection with the climatic changes.

The missions of the CNST are:
1. Follow-up and diffusion of work of the IPCC.
2. Development of the sales leaflets related to the Moroccan positions relating to the scientific and technical questions carrying about climate change, for the negotiators and for any other interested part.
3. Participation in the proposal for studies and work relating to climate change, the drafting of their terms of reference and to their scientific validation.
4. Coordination and followed work of the working groups and networks sets of themes.
5. Develop proposals of the axes and priority topics of R & D on the questions relating climate change.
6. Repertory Moroccan researchers and experts working in the fields of climate change.
7. Contribution to the design and the realization of specific trainings to the benefit of scientists and officials of the departments and institutions concerned by the questions of climate change.
8. Production of a periodic report/ratio and files sets of themes on the scientific and technical activities related to climate change in Morocco.
9. Periodic conference holding on the evolution of knowledge as regards of climate change.

## III. Mission of the World Bank for the proposal study on climate change adaptation of the agricultural sector.

The mission was joined by a group of expert of the SEI to carry out a review of the various measurements of adaptation taken by the countries of the Middle-East and of North Africa for a regional workshop which will be scheduled during the course of 2007 and whose objective will be to promote an exchange of knowledge and experiment on the possible adaptations to the climatic changes.

In Morocco there' is a consensus which the climatic changes are in hand and which this will have a negative impact unless measurements of adaptation are not taken particularly in the agricultural sector.

The study should lead to the formulation of concrete options allowing policymakers to give opinions on measurements of adaptation to be set up to reduce at maximum the negative effects of the expected climatic changes taking into account the greatest possible advantage from potential positive effects.

The mission proposes that the responsibility first for the realization of the study is entrusted to the Ministry for Agriculture, the Rural Development and Maritime Fisheries since it is the first concerned.

The study could be carried out in one year period in four phases:

1. The establishment of a climatic data base relating to at least the three last decades, into climatic agro areas.

2. The modeling and the projection of the climatic changes on the temporal horizon which it still to define,

3. The modeling and the calculation of the physical impacts of the changes on the principal vegetable and animal productions including the standard agricultural operating systems, taking account the vocation and vulnerability of the productions,

4. The modeling and the calculation of the agro economic impacts on rural incomes, employment, flows commercial (including export/importation) and proportion/composition of the agricultural GDP.

The study will also make possible to appreciate the possible political implications including as well as technical on the water stock management (their reduction constituting a crucial element for agriculture).

## IV. Climate Change Adaptation in Africa Research and Capacity Development Program (CCAA) http://www.idrc.ca/ccaa

The purpose of the **Climate Change Adaptation in Africa Research and Capacity Development Program (CCAA)** is to *significantly improve the capacity of African countries to adapt to climate change in ways that benefit the most vulnerable*. Four objectives support this purpose:

1. To strengthen the capacity of African scientists, organizations, decision makers and others to contribute to adaptation to climate change.
2. To support adaptation by rural and urban people, particularly the most vulnerable, through action research.
3. To generate a better shared understanding of the findings of scientists and research institutes on climate variability and change.
4. To inform policy processes with good quality science-based knowledge.

The **Climate Change Adaptation in Africa Research and Capacity Development Programme (CCAA)** commenced in April 2006. It operates through calls for and funding of research and capacity building proposals that clearly contribute to the objectives of the programme, and funds and supports:

- Research that reduces uncertainty and clearly enhances adaptive capacity
- Established capacity-building programmes in Africa that clearly contribute to the goals of CCAA

- Action research that supports adaptation by rural or urban people, particularly the most vulnerable
- Research that adds value to existing initiatives

CCAA involve and engage users from beginning to end. This approach will promote the incorporation of indigenous knowledge on coping with climate variability into research projects, lead to better-defined research questions, and facilitate the process of transferring or devolving results and skills to those who will use them.

CCAA's first call for concept notes received 280 submissions, of which 214 met the basic eligibility criteria. 25 technical experts reviewed these both individually and in panel discussions. The call elicited a broad and exciting range of ideas and approaches from a wide spectrum of proponents across Africa and from overseas.

In the inception phase of CCAA, 16 concept note proponents have been invite to submit full project proposals.

The review by the technical experts highlighted a large number of concept notes that have considerable merit. These have been invited to participate in capacity development activities in the coming months with the hope that such activities will equip them to align their approaches with CCAA's intended outcomes and programming priorities.

Two concept notes have been selected from Morocco:

**1. Climate change adaptation mechanisms of rural communities in two contrasting ecosystems (plains and mountains) of Morocco. Institut National de la Recherche Agronomique. Rabat. Morocco.**

**2. Building capacity and awareness on climate change vulnerability and adaptation measures in the Eastern Mediterranean coasts of Morocco adjusting its Integrated Coastal Zone Management Plan of Action. École Nationale Forestière d'Ingénieurs. Salé. Morocco**

PAPER NO. 7: NEW ZEALAND

## Nairobi work programme on impacts, vulnerability and adaptation to climate change.

This submission responds to the invitation in FCCC/SBSTA/2006/L.26, paragraph 24, to provide information on relevant programmes, activities and views on the following issues:

*(a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors;*

*(b) Ability, gaps, needs, opportunities, barriers and constraints to predicting climate variability, impacts and extreme events across regions and hazards;*

*(c) Contribution of traditional knowledge to understanding and managing climate-related risks;*

*(d) Implications for sustainable development in relation to paragraph 34 (a) to (c) above;*

*(e) Promoting understanding of impacts of, and vulnerability to, climate change.*

In responding to impacts, vulnerability and adaptation to climate change, New Zealand takes a cross-government approach. Much of the work is coordinated by the Ministry for the Environment, but because preparing for and responding to the impacts of climate change cuts across all sectors, all parts of government are expected to play a part. Many programmes are interlinked, coming together around an enhanced focus on sustainability for New Zealand.

### (a) Experience with assessment and management of current and future climate-related risks and impacts, including those related to extreme events and in specific sectors

This section is divided into three parts: research programmes, government programmes, and reports and publications.

### I. Research Programmes:

***Research on Adaptation to Climate Variability and Change***

The National Institute of Water and Atmospheric Research (NIWA) is funded by the New Zealand government through the Foundation for Research Science and Technology (FRST) to undertake a multi-year research programme on adaptation to climate variability and change.

This research programme provides information, predictions and tools to help New Zealanders make best use of climate-dependent natural resources, adapt to natural variations in climate, and identify and manage expected regional impacts of global climate change. The underpinning science helps improve understanding of the interactions within the climate system – between the atmosphere, ocean, and land and sea ice. This informs regional climate information, advances national climate modelling and prediction capabilities, and contributes systematic climate observations to national and international archives.

This research enables New Zealand to make better use of its climate-dependent natural resources, increases resilience to natural variations in climate through appropriate adaptation actions, and enables identification and management of regional impacts of global climate change.

The programme has been developed to include:

- greater integration of research on the atmospheric, ocean and sea ice components of the climate system;
- increased research on the development of climate tools for end users; and,

- new social research focusing on community response to extreme events, economic impacts of climate variability, and climate impacts on Māori[1] land use and health.

Further developments are likely to include:
- new information on past climate variability, improved models of future variability and new tools and products tailored to climate sensitive industry needs to facilitate their adaptation to climate variability;
- improved risk assessments to better understand how climate extremes (droughts and storm/flood events) respond to changing climate to reduce New Zealand's vulnerability to climate extremes;
- quantifying the economic impacts of climate change incorporating the AR4 scenarios and climate change impacts on land use, agriculture, energy and other climate sensitive sectors;
- improved observation and understanding of the marine environment, the regional atmosphere, physical processes and enhanced global and regional climate models;
- development of climate related decision-tools for local government to take adaptation to climate change into policy and strategic planning to minimise impacts of climate change on future developments and the environment.

***The Regional Riskscape Model***
*Regional Riskscape* is a research project funded by FRST as a joint venture between GNS Science[2] (geological hazards) and NIWA (weather-related hazards) to develop a generic decision-tool/model which can be applied across a region for use by emergency, asset and environmental managers, the insurance and engineering sectors.

The objective of the project is to use existing hazard knowledge to assess likely consequences, such as damage and replacement costs, casualties, disruption and number of people that could be affected. Consequences for each region presented in a common framework across all natural hazards, can then form the basis for planning and risk mitigation measures that link directly to the severity of the risks.

**CLIMPACTS:** ***developing capacity for climate change Adaptation***
CLIMPACTS is a FRST funded research programme examining the sensitivity of the New Zealand environment to climate sensitivity and change. The programme is designed to improve capacity in New Zealand to respond effectively to the risks posed by global change, particularly climate change, including climate variability and extremes.

It aims to enhance the ability to anticipate the future impacts of climate change and to develop behavioural responses and tools to adapt to the changes. Case studies are being carried out in the Bay of Plenty region as a basis for New Zealand wide application. It is led by the International Global Change Institute at Waikato University in collaboration with a number of Crown Research Institutes.

***CLINZI- Climate Long-term Impacts on New Zealand Infrastructure***
CLINZI is a Landcare Research led regression modelling initiative with NIWA to assess the long-term impact of climate on infrastructure investments with a view to assisting local councils with their functions and to develop a decision-tool. To date there have been two case studies completed at Waitakere City and Hamilton City. The objective is to model rainfall, sea level rise, transport, energy, health and some economic impacts. Work is underway using the CLIMPACTS model to look at the impact of climate extremes for specific regions.

***Quantification of the Interaction between New Zealand Climate and Construction Materials and Systems***

[1] Māori are the indigenous people of New Zealand
[2] Geological and Nuclear Sciences (GNS Science)

This research by Building Research Association New Zealand (BRANZ) aims to provide guidance for cost-effective selection of building materials and systems appropriate to specific New Zealand regional climatic conditions, including allowing more informed selection of materials in anticipation of possible changes in climatic conditions based on NIWA climate scenarios.

***Environmental impacts of buildings***
This BRANZ programme is developing environmental data and tools to better understand and evaluate the interaction between buildings and the environment, including consideration of climate change based on NIWA climate scenarios.

***Land Use, Climate Change and Kyoto: Human Dimensions Research to Guide New Zealand Policy***
This research programme by Motu Economic and Public Policy Research aims to understand human-induced land-use change processes, understand their implications for the environment, and model possible management systems at a national policy level. This programme has application for adaptive management by the land use sector.

***The Costs of the Impacts of Climate Change on Agriculture***
The Ministry of Agriculture and Forestry (MAF) is funding Infometrics (an economic consultancy), with NIWA, Motu (an economic and public policy research organisation), and Landcare Research to undertake a study of the costs of the impacts of climate change on agriculture. This will be completed by June 2007.

## II. Government programmes

***Climate Change Adaptation Programme***
The purpose of the government's adaptation programme is to improve New Zealand's preparedness for climate change and its capacity to act. The focus is on water and coastal management; infrastructure investment and maintenance; primary industry; and biodiversity and biosecurity. The programme is based on partnerships with priority sectors - local government; the Institute of Professional Engineers; the insurance industry and the agriculture sector.

To enhance existing work to prepare New Zealand for the impacts of climate change the programme is encouraging better coordination of central government agencies; new partnerships with the key stakeholders; engaging more widely with non-government sectors to raise awareness of climate change impacts and adaptation to influence decision making; and, making information on climate scenarios more widely available.

In addition climate change risk management is being factored into all existing work programmes (refer below) where climate change and variability will have an effect.

***Resource Management (Energy and Climate Change) Amendment Act 2004***
The Resource Management Act (RMA) requires local councils to plan for the effects of climate change. This enables them to make provision for adaptation to climate change effects and to avoid the risk associated with climate change like natural hazards through their Long-term Council Community Plans, regional plans and polices and district plans and rules.

***Sustainable Water Programme of Action***
This programme addresses water quality, water allocation and availability, including consideration of the impacts of climate variability and change. The work on more efficient water allocation will assist land and water users across a range of sectors (including agriculture, forestry, electricity generators and communities) to adapt to the impacts of climate change and increase resilience to climate variability. Linkages between other government programmes are being made to ensure climate change actions are consistent.

Key elements of the programme include;

- increased national direction for freshwater management through National Policy Statements, National Environmental Standards, and industry targets e.g. methods for establishing environmental flows; for managing increasing demands for water;
- national priorities by identifying nationally outstanding natural water bodies; and sensitive and at risk catchments; and,
- legislative and best practice tools for regional councils.

These will provide clearer national guidance on water management that will enable better adaptation to climate change and variability and speed up local responsiveness to adaptation.

There is a wide consultation and public awareness raising programme underway on the programme activities. Elements include; a Regional Water Forum; four technical working groups; stakeholder meetings with sectors; Sector Partnership Groups, including with Māori iwi[3] on cultural and environmental values of water and with Local Government New Zealand; a three year National Water Awareness Campaign including advertising and a website.

***Water enhancement policy***
MAF is assessing government's role in the development of community water enhancement schemes. Community schemes that include water storage are an effective way of adapting to expected climate change e.g. the likelihood of reduced rainfall on the eastern parts of New Zealand.

***Review of Flood Risk management***
MfE is undertaking a review of flood risk management to develop ways of reducing the impacts of flood events on communities and rural areas. The risks from flooding and its impacts are changing. The Review includes how land management practices and climate change affect flood risk levels. The review is assessing how projected climate change effects can be integrated into catchment management, land use decisions (including deforestation and afforestation), and the design and location of infrastructure to reduce the impacts of adverse climate events.

The issues being explored in the Review are:

- the adequacy of the current approach to flood risk management;
- understanding current and future flood risk and what mitigation is required;
- future best practice in flood risk management;
- funding and affordability;
- the legislation on managing flood risk and river control;
- how to get good information on flood risk and how this information is communicated;
- the role of local government, central government and communities.

Case studies have been carried out in the North and South Islands on current flood risk management practice and an assessment of whether the funding, roles and responsibilities for flood risk management are adequate to manage projected land use and climate changes is underway.

Government is also producing more guidance material on management of flood risk including the effects of climate change; investigating a way of monitoring flood risk management across New Zealand and is investigating a central and local government forum to provide leadership in flood risk management.

***Adverse events policy***
MAF is assessing the risk profile of adverse events in terms of the impact of projected climate change and variability. MAF is consulting around New Zealand on a discussion document entitled *Building Resilience: Review of the on-farm adverse events recovery framework.* Policy work will assess what role government might play after adverse events have occurred including assistance and bolstering rural support networks. It also proposes a new approach to grading adverse events that attempts to be clear, consistent, but also flexible to take account of the unique circumstances of each adverse event.

[3] An iwi is a tribe

***Review of the National Civil Defence Emergency Management Strategy, Plan and Guide***
This Department of Internal Affairs (DIA) led programme will improve the response capability of communities to adverse rainfall events, which are projected to increase in intensity and frequency over much of New Zealand with climate change.

***National Hazardscape Report***
The National Hazardscape Report (NHR) is a non-statutory document that provides a contemporary summary of the physical nature, impacts, distribution and frequency of occurrence of 16 key hazards affecting New Zealand. The Report also provides general information on the current management of hazards with the focus on reduction and readiness initiatives. Four key factors that influence New Zealand's current hazardscape are discussed in the NHR – climate change, demographic and future development trends, reliance on technology, and human modification of the natural environment. The report also describes the development of indicators from which future trends can be measured. The report will be revised and updated every three years and is led by the Ministry of Civil Defence and Emergency Management.

***Review of the New Zealand Coastal Policy Statement***
This Department of Conservation (DOC) led review is integrating climate change issues into a new statement to guide adaptation action such as impacts of sea-level rise, increased intensity of storms and changes to sediment supply to coastal areas which are expected to change coastal risk profiles.

***Sustainable Land Management***
This MAF programme is examining the role of government in supporting local government initiatives to address erosion risk, flood risk reduction and the resilience of farming systems in vulnerable catchments. This arises from the changes in the risk profile of hill country that has occurred with a changing and more variable climate.

***Sustainable Farming Fund***
The Sustainable Farming Fund (SFF) is administered by MAF and supports environmentally sustainable community projects. A large proportion of the funded projects have benefits for adaptation of current farming systems to increase economic and environmental resilience e.g. drought tolerant species, dry land management, irrigation efficiency, water feasibility studies and new forestry species.

The following are some of the climate change projects funded through the SFF;

- *Adaptation, change management and the psychology of change* - Gavin Kenny, Earthwise Consulting Ltd
- *Sustainable production in Marlborough's variable climate* - Marlborough Sustainable Primary Production Group: The implementation and demonstration of systems of sustainable pastoral and arable farming within Marlborough's dryland climate by using predictive pasture modelling based on soil moisture analysis as a management tool to identify sustainable farming systems
- *Adapting to climate change in eastern New Zealand* – The Hawkes Bay Climate Change Adaptation Group: To identify and implement practical measures aimed at the long-term sustainability (ecological, social and economic) of land and water resources in eastern New Zealand, in the face of uncertain climate change projections through;
    - The development of a "best practice" adaptation resource kit for the management of climate change impacts in eastern New Zealand;
    - Education and awareness raising of farmers and rural communities on climate change and adaptation measures that can be adopted over time
- *Changing attitudes and practice for farming dry land in Marlborough* – Starborough - Flaxbourne Soil Conservation Group: This project aims to change farmer attitudes and land management

practices for farming fragile dry land in Southern Marlborough. It is lead by a farmer management group based in the Starborough - Flaxbourne area of Marlborough

## III. Reports and publications

Table 1 provides an overview of some of the available reference material (most of which are available on the government's climate change website[4]) specific to New Zealand on the assessment and management of current and future climate related risks and impacts, including those related to specific sectors.

**Table 1: Overview of some of the available reference material specific to New Zealand**

| ***Assessment of hazards and risk*** | |
|---|---|
| **Natural disasters in our changing climate – a look at the major risks affecting New Zealand Civil Defence And Emergency Management** David Wratt, Principal Scientist & Centre Leader, National Climate Centre, NIWA, Wellington presented at the Fifth Annual Integrated Emergency Management Conference, Wellington, New Zealand, 14-15 **February 2006**. | This Report assessed the impacts of meteorological hazards and the potential impacts of climate change on the Manawatu-Wanganui region which was subject to severe flooding in 2004. The hazards investigated were intense rainfall and floods, droughts, landslides and erosion, coastal flooding, severe winds, snowfall and frost, excessively high temperature, lightning and hail, ex-tropical cyclones and wildfire. The likely impacts of climate change on these hazards over the next 50 to 100 years were also identified using NIWA climate scenarios. |
| **Manawatu - Wanganui Region Meteorological Hazards and Climate Change NIWA Report: February 2005** | NIWA has provided similar reports for 6 other regional or local councils, and has also produced reports for various other clients on climate and flood related hazards e.g. the electricity distribution sector. These reports assist such clients with their planning for the impacts of climate change and variability. |
| **A methodology to assess the impacts of climate change on flood risk in New Zealand - NIWA Report: July 2005** | This report outlines how councils can take steps to prepare for climate change by assessing their own flood risk |
| **Changes in Drought Risk with Climate Change – NIWA report: May 2005** | This report aims to give central and local government and the agriculture sector an indication of how big future drought changes could be in the various regions. This information will be relevant for managing long-term water resources and land use, including planning for irrigation in a future with climate change and greater climate variability. |
| **Community-based Dune Management for the Mitigation of Coastal Hazards and Climate Change Effects- a guide for local authorities: April 2005** | The purpose of this report is to bring together lessons from existing and successful dune care/restoration programmes in New Zealand to provide guidelines for councils wanting to initiate dune restoration programmes to mitigate coastal hazards, and adapt to climate change effects such as projected sea level rise, and to restore the beneficial natural and human use values associated with coastal dunes.<br>An educative process is set out, that can be used to raise community awareness of likely coastal hazards including sea-level rise and potential impacts. |
| **Coastal Hazards and Climate Change manual: May 2004** | This is a Guidance Manual intended to help local authorities manage coastal hazards by: providing information on the effects of climate change on coastal hazards; presenting a decision-making framework to assess the associated risks; and providing guidance on appropriate response options. |

[4] http://www.climatechange.govt.nz/resources/adaptation/index.html

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| | Three main types of coastal hazard are addressed:<br>• coastal erosion caused by storms and/or long-term processes;<br>• coastal inundation caused by storms or gradual inundation from sea-level rise;<br>• coastal inundation caused by tsunami<br><br>This Manual is to be updated using the IPCC AR4 information |
| ***Impacts of climate change*** | |
| **Impact of climate change on long-term fire danger: May 2005** | This report investigates how potential climate change effects are likely to change future fire danger through application of climate change scenarios to the long-term fire weather records, to enable New Zealand rural fire authorities to make more informed fire management decisions on fire prevention and preparedness activities now and in the future. |
| **The Waikato weather bomb - understanding the impact: March 2004** | This report explores the economic effects of an extreme rainfall and flood event, which in the context of climate change is likely to increase in frequency and severity. The study was designed to assist in response measures that minimise damage and are cost-effective and to understand the way in which communities understand, perceive and prepare for such events. |
| **Economic impact on New Zealand of climate change related extreme events-focus on freshwater floods: July 2004** | This report presents a framework in which the economic costs of extreme events can be assessed. By comparing the cost of past events with the costs of possible future events occurring under climate change scenarios, this work provides a basis for estimating future costs of climate change. |
| **Impacts of climate change in New Zealand and the required response: December 2003** | This report investigates the role of engineers in planning for and adapting to the impacts of climate change in New Zealand. A particular focus is on coastal margins, human settlements, infrastructure, and water resources. The report identifies and actions that can be taken by engineers to mitigate adverse effects and maximise benefits associated with climate change in New Zealand. |
| ***The building sector*** | |
| **Climate Change Adaptation: Guidance on adapting New Zealand's built environment for the impacts of climate change: October 2004** | This report is to help government agencies and the building and construction sector to understand the impacts that climate change will have on the built environment and to begin planning and implementing integrated adaptation strategies to future proof built assets and protect communities. |
| ***The local government sector*** | |
| **Climate Change - An analysis of the policy considerations for climate change for the Review of the Canterbury Regional Policy Statement: February 2007** | This report assesses natural, physical, societal and economic effects of climate change in the Canterbury region, and considers the consequent regional planning impacts. |
| **Preparing for climate change - A guide for local government in New Zealand: July 2004** | This guide is to help councils across New Zealand assess the likely effects of projected climate change during the 21st century and plan appropriate responses where necessary. It summarises the main elements of a comprehensive technical report *Climate Change Effects and Impacts Assessment* which is available in full at: http://www.climatechange.govt.nz/resources/local- |

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| | govt/guidance.html |
| **Biotic effects of climate change in the Bay of Plenty, Earthwise Consulting, 2006** | This report was prepared for Environment Bay of Plenty Regional Council in order to investigate the potential impacts of climate change on biosecurity, indigenous biodiversity and economic land use within the region administered by the council. It identifies key issues and relevant sources of information/data; conducts an initial assessment of effects and subsequent risk assessment; and considers adaptation options and next steps. |
| **Local Government Climate Change Adaptation – Environment Bay of Plenty Coastal Hazards Case Study 'Issues, Barriers and Solutions': July 2003** | This case study was prepared for MfE as part of a programme to assist regional councils and territorial authorities to better understand and take into account climate change effects when carrying out their day to day operations. In particular, the programme aims to develop guidance materials for local authorities to assist them in assessing and managing the risks of climate change in their planning processes. |
| **Assessment of the impacts of sea level rise on floodplain management planning for the Avon River: December 2003** | This is a case study on the impact of climate change on risk management planning for the Avon catchment and associated coastal areas. The study focuses primarily on an economic analysis of likely damages, and the response options available to local government to mitigate these. |
| **Flood risk arising from future precipitation changes in Gleniti, Timaru: December 2003** | This report describes the projected climate change effects, discusses the outcomes of a re-worked flood model which takes into account these effects, and assesses the implications for two of the catchments. |
| **Planning for Climate Change Effects on Coastal Margins: September 2001** | This report addresses the impacts of climate change and global warming on coastal margins. It aims to assist resource managers and planners to understand the underlying impacts and issues in climate change and sea-level rise, and to provide guidance in planning and the development of mitigation or adaptation strategies for coastal communities. |
| **Quality Planning Website-Guidance on the Resource Management Act 2004 amendment relating to climate change effects** | This website provides information on expected climate change impacts in New Zealand and advice on methods for considering and addressing climate change effects under the Resource Management Act. http://www.qualityplanning.org.nz/plan-topics/climate-change.php |
| **Other** | There are several other council based reports on infrastructure design, stormwater design, city-wide climate change work programmes and coastal environment plans which deal with the responses in the built environment e.g. North Shore City, Kapiti Coast District Council, Hawkes Bay Regional Council |
| ***The agriculture sector*** | |
| **The view from the ground: a farmer perspective on climate change and adaptation: July 2003** | This report provides a summary of farmers perspectives on climate change impacts and adaptation options collected through a series of workshops and compiled into a resource kit that helps building climate change resilience on New Zealand farms. |
| **Climate Change: Likely impacts on New Zealand Agriculture: September 2001** | This report sets out the most likely impacts on agriculture and suggests that the worst effects of climate change can be avoided and the potential benefits realised through a staged approach involving:<br>• *the short term*, through further development and implementation of strategies for dealing with present climate variability and extremes |

| | |
|---|---|
| | • *the medium term*, through implementing plant-breeding programmes, developing water conservation programmes, and planning conservatively to ensure there are buffers against adverse years<br>• *the long-term,* through developing a more integrated approach to land management that considers climate change alongside other important issues such as biodiversity, biosecurity, land degradation, and water resource use. |
| ***The health sector*** | |
| **Climate Change: Potential effects on Human Health in New Zealand: September 2001** | This report identifies the direct effects of temperature extremes and heavy rainfall and the indirect effects of vector borne diseases, flood, droughts and water supplies and the effects on regional economic and social stability |
| ***The natural environment*** | |
| **Linkages between climate change and biodiversity in New Zealand.** Matt McGlone, Landcare Research Contract Report (LC0102/014) prepared for the Ministry for the Environment**, September 2001** | This report provides advice to government on linkages between climate change and biodiversity. It covers recent and projected climate change in New Zealand; current, short- and long-term impacts on biodiversity; climate change interactions with other factors affecting biodiversity; and provides recommendations for policy and for research priorities. |
| **Report on some implications of climate change to Department of Conservation activities.** B G McFadgen, Science and Research Unit, Department of Conservation **2001** | This report briefly outlines the current climate situation in New Zealand, the regional patterns which characterise it, and the impact of El Niño and La Niña events. The possible and actual impacts of recent weather on the New Zealand Department of Conservation activities are described, and recommendations are made on how the Department might respond to changes in climate patterns |
| **Climate-Change Effects on Alpine Plant Biodiversity: A New Zealand Perspective on Quantifying the Threat.** Halloy, S. and Mark, A.; Arctic, Antarctic, and Alpine Research 35(2): 248-254. **2003** | This paper investigates the potential impact of climate warming on vascular plant floras, and tests model sensitivity scaling from the whole world to small alpine regions. These models showed that if the present mean temperature of ~0.6°C higher than in 1900 were maintained, together with a large pool of exotic species, 40-70 species of native plants could become at risk. With a rise of 3°C the risk of species loss increases to 200-300 indigenous alpine species |
| **Climate and net carbon availability determine temporal patterns of seed production by Nothofagus.** Richardson, S.J., Allen, R.B., Whitehead, D., Carswell, F., Ruscoe, W. and Platt, K.; Ecology 86(4): 972-98. **2005** . | The influence of temperature, soil moisture, and net carbon availability on seed production in Nothofagus is modelled. More frequent seed production at high elevations in response to increasing temperatures is suggested. This work has implications for threatened species in New Zealand as during years of high seed production, predator (stoats, rats) levels inflate greatly |

## (b) Ability, gaps, needs, opportunities, barriers and constraints to predicting climate variability, impacts and extreme events across regions and hazards

Whilst New Zealand has already developed expertise and produced a range of information relating to predicting climate variability, impacts and extreme events, there are still gaps in our knowledge and capability issues around filling these gaps. Some of the existing work programmes will help fill these gaps. Key gaps and barriers for New Zealand are summarised below:

- Capability and capacity issues exist at local government level and in the private sector that needs to be addressed through the partnerships under the government's Climate Change Adaptation Programme.
- Economic impact studies are needed across a range of sectors and these studies need to be integrated with the physical impact studies.
- Climate modelling work needs to be extended to model high intensity rainfall events out to 2080, to get a better assessment of the economic impacts of projected extreme events in sectors e.g. agriculture.
- New ways need to be designed to gain an overview of impacts across New Zealand - The Flood Risk Review currently underway will contribute to a better understanding of extreme events and the effect of climate change on current risk levels.
- Assessment is needed of the impacts from biosecurity risks arising from climate change and integration of this knowledge into border biosecurity management and pest management across New Zealand.
- Assessment is needed of the impacts of climate change on New Zealand's biodiversity and development of management regimes that factor in climate change impacts like insect and disease risk, fire risk and plant distribution for example.
- Studies are needed of the social impacts and costs of climate change to communities, including sensitivity studies of most vulnerable groups and communities e.g. health risks and the financial impacts of extreme events.

**(c) Contribution of traditional knowledge to understanding and managing climate-related risks**

***Research on Māori Environmental Knowledge of Weather and Climate***

Part of the research programme on adaptation to climate variability and change (being carried out by NIWA – see first page of this submission) is new social research focusing on community response to extreme events, economic impacts of climate variability, and climate impacts on Māori land use and health. The methodology for the research has been to work with Māori iwi organisations and across generations.

The first Māori Climate Forum was held at NIWA- Greta Point, Wellington in February, 2003. This gave Māori stakeholders an opportunity to:

- discuss the implications for Māori of changes in climate
- identify research needs to help Māori adapt to the effects of projected climate change

The second Māori Climate Forum was held at Hongoeka Marae[5], Plimmerton in May, 2006. This forum discussed climate change issues facing Māori, identified priorities for climate change research relevant to Māori, and reviewed input into the Intergovernmental Panel on Climate Change 4th Assessment Report (AR4)

Issues raised included;

- Likely impacts of climate change on coastal environments and communities.
- Water allocation issues for Māori due to climate change and relationships with water allocation regulators (councils).
- Effects of climate variability over the next 5 to15 years.
- The relationship between climate change and health.
- Using traditional knowledge in climate research.
- Local climate and soil information and maps for identifying sustainable land use opportunities (such as niche crops).
- Potential local and regional impacts of climate change on land use, and the challenges and opportunities these present.
- Energy issues affecting Māori, and the potential for renewable energy solutions.
- Likely impacts of climate change and climate variability on titi (muttonbird).

[5] *Marae* refers to the main buildings in a traditional māori village, but is commonly applied to the village itself.

- A process for researchers and Māori to work together to generate knowledge about impacts of climate change.

There was a demand for climate-related information to help develop resource bases for Māori communities. Case studies of the impacts of climate change on resource bases (economic, energy and cultural) of iwi / hapu[6] are now being developed.

***Contribution of traditional knowledge***
NIWA's Māori Research and Development Unit recently completed a pilot programme to examine Māori environmental knowledge (MEK) of weather and climate.

Through participatory based interviews and workshops, representatives from the tribal groups Ngāti Pare (Coromandel) and Te Whānau a Apanui (Eastern Bay of Plenty), demonstrated an intimate understanding of weather and climate in their respective localities.

Three principal strands of Māori knowledge emerged from these workshops that contribute to understanding and managing climate-related risks:

- The naming and classification of local weather and climate phenomena
- The observation and oral recording of local weather and climate based events and trends
- The use of environmental indicators to forecast and predict weather and climate

The research programme is informing science understanding, and Māori are gaining insights about the atmosphere from the latest scientific information. Observations by Māori are consistent with instrumental records.

The next stage of the research is to identify vulnerability of particular Māori communities around New Zealand to weather and climate related hazards using traditional and contemporary Māori environmental knowledge.

The research results are disseminated via articles, NIWA National Climate Centre Climate Update; educational posters and a CD Rom on Māori Environmental Knowledge programme. A Māori weather/climate forecasting network is proposed.

For further information see www.niwa.cri.co.nz

**(d) Implications for sustainable development in relation to sections (a) to (c) above**

The programmes and activities that are currently underway in New Zealand on impacts vulnerability and adaptation to climate change are now becoming more connected with other resource management, economic and community development programmes.

Research on climate change science is becoming embedded in work on climate change impacts at a national and regional level and into guidance materials for central and local decision-makers. Climate information is now informing national decision-making, for example about energy systems risks, flood risk management, local planning and the planning of infrastructure assets.

The next step is to have that work continue with a greater focus on economic and social impacts and to apply it more broadly to adaptation methodologies and tool development and their demonstration in practice.

[6] A *hapu* is a sub-tribe

Climate change impacts, vulnerability and adaptation work is now being seen in a sustainability context. The Water Programme of Action and the Flood Risk Review are good examples of where there is an increasing cross-over with climate change and its projected impacts on economic and social development in New Zealand.

The Government has signalled that New Zealand's future is dependent on long-term sustainable strategies for the economy, society, environment, culture and way of life. Sustainability is seen in an urgent light due to the environmental challenges that the world faces, in particular climate change and managing those risks has been elevated in government programmes. Agriculture is seen as a sector where farming practices will need to change. Adaptation to climate change will be a part of this. Sectors such as local government are a focus for adaptation activities in partnership with central government.

**(e) Promoting understanding of impacts of, and vulnerability to, climate change**

In New Zealand there has been an increasing volume of information available to promote the understanding of the impacts of, and vulnerability to climate change. This includes the outputs from research programmes, government advertising campaigns, guidance material produced by the Ministry for the Environment, training programmes for professional groups, workshops for local government, conferences and seminars. Examples of these are described below.

***Outputs from the research programmes***

The outputs from the FRST funded research programmes are disseminated through a range of seminars, conferences, talks to community groups and other presentations. In addition, collaborative interaction and dialogue with stakeholders under the Adaptation, Riskscape and other research programmes described above are built into the research methodology of the programmes.

NIWA in particular provides a range of information and services on the impacts and vulnerability to climate change which can be found on their website www.niwa.co.nz. *Climate Update*, the monthly newsletter from the National Climate Centre, is a good example.

***Advertising campaigns***

The Ministry for the Environment undertook two climate change campaigns under the banner of *4 Million Careful Owners* in 2004 and 2005. These successfully raised awareness of climate change as an issue and provided information on what people could do to adapt to the impacts of climate change.

The Ministry for the Environment, in partnership with regional councils also started a three-year National Water Awareness Campaign in August 2006. The Campaign includes advertising around the country on billboards, in major daily newspapers and magazines, and on a website under the *4 Million Careful Owners* brand. Further campaign targeting of urban and rural communities will follow.

***Ministry for the Environment Information and Guidance materials***

- *Quality Planning Website-Guidance on the Resource Management Act 2004 amendment relating to climate change* provides updated information on expected climate change impacts in New Zealand and advice on methods for considering and addressing climate change effects under the Resource Management Act.
- *The Guidance Manual for Local Government on Climate Change Effects and Impacts Assessment MfE 2004* and the shorter guidelines on *Preparing for Climate Change.* It is planned that these, the *Changes in Drought Risk with Climate Change* report and the *Coastal Hazards and Climate* guidance material, will be updated using the information in the IPCC 4th Assessment Report (AR4).
- The government's *adaptation programme* continues to produce and disseminate a range of information materials on the impacts of climate change; guidance on how local councils can prepare for the effects of climate change; checklists and other decision-tools to help councils integrate climate change into decisions on assets and infrastructure, planning and consents.

- *Information booklets 2006* include:
  - *Preparing for and adapting to climate change* – includes information about climate change; the costs of weather-related disasters 1968-2006; impacts and opportunities (energy; agriculture and forestry; water and rainfall; biosecurity and native species; and infrastructure); what to do to prepare; farmers and climate change; councils in action and government responses
  - *Understanding climate change* – includes information on the impacts of climate change
- Also available online at www.mfe.govt.nz is a map of climate change impacts on New Zealand which is also available as a poster; a *School Stuff* section of the 4 million owners website (www.4million.org.nz) has an interactive web-based activity - *Play it Cool,* and *Answers to common Questions* about climate change.

In section (a) part III of this submission (reports and publications) further relevant reports and information are listed.

***Professional groups training***

Over the last year or so climate change adaptation training activities have been targeted to particular professional groups in New Zealand. Examples of these types of activities follow.

- Local Government New Zealand with funding from the Sustainable Management Fund (administered by the Ministry for the Environment) held four workshops for councils in centres around New Zealand in 2006 to provide background and context to adaptation in New Zealand as well as case studies, tools, and resources to assist councils to make decisions about adaptation within their communities.
- In 2006 IPENZ, NIWA, Opus International Consultants and the Ministry for the Environment offered short courses nationally on addressing climate change in infrastructure design. These courses included best practice and practical tools for engineers to use when considering the impact of climate change on infrastructure projects. It is anticipated that these courses will be run again in 2007.
- *The Water Conference 2006* had a pre-conference workshop run by NIWA on: Climate variability and the energy sector, based on the FRST funded research programme.
- The Natural Hazards Centre (a joint initiative between the Institute of Geological and Nuclear Sciences and NIWA) provide a course for those wanting the most up to date information and on how to plan, manage and avoid the consequences of extreme weather and flooding and also a one day workshop on community participation in coastal hazard mitigation aimed at local councils who interact with community groups on coastal issues

***Workshops, seminars and conferences***

There have been a number of workshops, seminars and conferences in New Zealand aimed at promoting the understanding of climate change impacts and vulnerability to climate change. We will not attempt to list all these events, but wish to highlight the following examples.

Local Government New Zealand (LGNZ), often in partnership with central government, has held several workshops tailored to the needs of the local government sector. These workshops are an opportunity to share information on how climate change might impact on the operations of local government, and to explore how information on these issues might be better tailored for their needs.

Of particular note amongst recent conferences on climate change is the Victoria University of Wellington (Institute of Policy Studies and School of Earth Sciences) *Climate Change and Governance Conference* - critical issues for New Zealand and the Pacific, held in March 2006. Among the climate change topics on the agenda, the conference explored the nature and likely impacts of climate change and the options for accelerated action by governments, business and the wider community. Following the conference, a book and a video were produced to make the papers and interviews from the conference available to wider audiences. The book *Confronting Climate Change Critical Issues for New Zealand* (Victoria University Press, 2006) contains sections on the impacts of climate change, and on adaptation in New Zealand and the Pacific. A video of interviews from the conference was also produced (*Sleeping Giants-climate change,*

*science policy and action- www.elasticthinking.org* - Airplane Studios Ltd 2006) helping to make the information from the conference more widely accessible.

***Road shows***
In 2006 the MfE undertook its annual "Talk Environment" road show around New Zealand to discuss issues of concern to communities and local government. Information sheets were provided on *Helping New Zealand Prepare for and Adapt to the Impacts of Climate Change*

***Pacific outreach***
NIWA provides *The Island Climate Update* undertaken with support from SOPAC SPREP and NZAID. This newsletter provides an overview of the present climate in the tropical South Pacific Islands, with an outlook for coming months, to assist with the dissemination of climate information in the Pacific region. For example, the January 2007 issue contained an article on the Disaster Risk Reduction and Disaster Management Framework for Action 2005-2015.

Proposals are in train (NIWA and MfE in collaboration with others) to undertake an IPCC outreach programme through the provision of workshops and tools in the South Pacific.

**List of acronyms used in this submission:**

| | |
|---|---|
| BRANZ | Building Research Association New Zealand |
| CLINZI | Climate Long-term Impacts on New Zealand Infrastructure |
| DIA | Department of Internal Affairs |
| DOC | Department of Conservation |
| FRST | Foundation for Research Science and Technology |
| GNS Science | Institute of Geological and Nuclear Sciences |
| IPCC | Intergovernmental Panel on Climate Change |
| IPCC AR4 | Intergovernmental Panel on Climate Change 4$^{th}$ Assessment report |
| IPENZ | Institute of Professional Engineers New Zealand |
| LGNZ | Local Government New Zealand |
| MAF | Ministry of Agriculture and Forestry |
| MEK | Māori environmental knowledge |
| MfE | Ministry for the Environment |
| NHR | National Hazardscape Report |
| NIWA | National Institute of Water and Atmospheric Research |
| NZAID | New Zealand Agency for International Development |
| RMA | Resource Management Act |
| SFF | Sustainable Farming Fund |
| SOPAC | Pacific Islands Applied Geoscience Commission |
| SPREP | South Pacific Regional Environment Programme |

PAPER NO. 8: SAUDI ARABIA

The SBSTA at its 25th session held in Nairobi, invited parties to submit to the secretariat, by 23 February 2007, views on the adoption of the Nairobi programme of work (five-year programme of work) as contained in document (FCCC/SBSTA/2006/L.26, paragraph 34).

Saudi Arabia believes the **economic diversification** sub-theme addressed within the Nairobi programme of work (five-year programme of work) should direct SBSTA to coordinate with the scientific and research communities such as the IPCC, and collaborate with other organizations such as the International Energy Agency (IEA), the United Nations Conference on Trade and Development (UNCTAD), The Organization of Petroleum Exporting Countries (OPEC), the Organization of Arab Petroleum Exporting Countries (OAPEC), the United Nations Economic and Social Commission for Western Asia (ESCWA), the League of Arab States (LAS) and the Gulf Cooperation Council (GCC) to:

- Promote understanding, development and dissemination of measures, methodologies and tools for economic diversification aimed at increasing economic resilience and reducing reliance on vulnerable economic sectors, especially for relevant categories of countries listed in Article 4, paragraph 8, of the Convention.

- improve the quality of models, in particular those that assess the adverse impacts on social and economic development as consequence of the responses to climate change, taken into full account the legitimate priority needs of developing countries with specific emphasis on countries whose economies are highly dependent on income generated from the production, processing and export, and/or consumption of fossil fuels and associated energy-intensive products.

Further modeling work is needed to determine, with less uncertainty, the magnitude of those impacts, and to assess such impacts on individual developing countries.

Saudi Arabia also would like to emphasize that the meetings of experts and practitioners on economic diversification must have experts from the subject area. The meetings should consider elements arising from the report of the workshop on economic diversification, amongst other issues related to economic diversification, for countries whose economies are highly vulnerable to the adverse impacts on social and economic development as consequence of the response to climate change, such as:

a) Providing support for the integration of economic diversification into sustainable development strategies;

b) Exchanging of experience in economic diversification and lessons learned, with a view to identifying what technical assistance may be needed to develop structural and institutional capacity and/or to establishing a mechanism to facilitate efforts to achieve economic diversification;

c) Coordination by the secretariat with relevant international organizations and the private sector in developed countries on matters relating to economic diversification;

d) Building capacity, at the national level, in the areas of economic diversification

e) Promoting Private-public partnerships in various areas to support economic diversification;

f) Providing recommendations for encouraging direct investment and technology transfer from developed countries to assist in the economic diversification of developing countries listed in article 4.8 (h) of the Convention;

g) Addressing the extent to which trade and export barriers affect economic diversification in Parties addressed under article 4.8 of the Convention.

Saudi Arabia believes that economic adaptation to the adverse impacts on social and economic development as consequences of the responses to climate change, taken into full account the legitimate priority needs of developing countries with specific emphasis on countries whose economies are highly dependent on income generated from the production, processing and export, and/or on consumption of fossil fuels and associated energy-intensive products is crucial in attaining sustainable development.

Subsidies to coal and nuclear energy production, as well as the relatively high taxation on petroleum products, are environmentally unfriendly and have adverse impacts on the economic growth of developing countries, in particular oil exporting countries. Such practices contradict the aim of assisting economic development and world sustainable growth and contravene the requirements of Article 4, Paragraph 8 of the convention. Hence, the economic impacts of policies and measures taken by Annex I Parties on Non-Annex I Parties need to be evaluated.

In implementing their commitments, Annex I Parties shall give full consideration to what actions are necessary under the Convention. This includes, and not limited to, actions related to economic diversification, funding, insurance and the transfer of technology, to meet the specific needs and concerns of developing countries arising from the adverse impacts on social and economic development as a consequence of responses to climate change. In particular, countries whose economies are highly dependent on income generated from the production, processing and export, and/or on consumption of fossil fuels - such as Saudi Arabia - and associated energy-intensive products.

PAPER NO. 9: SOUTH AFRICA

**Nairobi work program on impacts, vulnerability, and adaptation to climate change**

**Views on assessment methodologies and tools**

## Background

South Africa's focus in the climate change arena has been on developing a strong core of climate modeling capacity with good international links, building capacity in the assessment of vulnerability and impacts, and on the potential for mitigation responses in relation to energy requirements given the overriding priority for economic development and poverty alleviation. Capacity to deal with the challenges of adaptation has not yet developed to any substantial degree, although there is a growing set of skills in this arena.

## Information on relevant programmes, activities and views on the following:

*a) experience with assessment and management of current and future climate related risks and impacts, including those related to extreme events and in specific sectors*

South Africa's capacity in climate and ocean research, observation and modeling, based at Universities and national institutions such as SA Weather Services, has facilitated a range of assessments of vulnerability to climate change at national, regional and local levels. Ongoing research in assessing both current and future climate risks has been translated through secondary level of impacts modeling on hydrology, agriculture, ecosystems and biodiversity through both University and State research Institutions. In addition to this, vulnerability assessments have come to the attention of development planners, and these considerations are increasingly taken into account in spatial planning at urban, regional and national levels. The use of GIS techniques, remote sensing in the ongoing development of spatial databases of climate, natural resources, soils, hydrological catchments and vegetation and land-use underpins this growing capacity.

While South Africa has some expertise in the assessment of the likelihood and impacts of extreme events, this area has lagged through poor international linkages.

Expertise in the field of risks to livelihoods is actively expanding, with special relevance to a mixed economy that is in transition, and where the livelihoods approach is better able to quantify social well-being than traditional economic measures.

*b) ability, gaps, needs, opportunities, barriers and constraints to predicting climate variability, impacts and extreme events across regions and hazards*

The primary challenge in this arena relates to a widely diversified but thinly populated scientific skills base, specifically in the areas of downscaled predictive modeling in southern Africa, with attendant risks of abrupt loss of capacity. In addition, observation systems in the continent are inadequate, and where they do exist, equipment is often obsolete. Barriers include the relatively low level of delivery of appropriately trained students at the secondary school level. There is substantial opportunity and a strong need to develop programmes to attract students into these areas. Computing capacity and internet connectivity also represent significant constraints, while difficulties in digital communication at the southern African regional level are a barrier to enhancing regional interaction.

*c) contribution of traditional knowledge to understanding and managing climate related risks*

Traditional agricultural, land-use, infrastructure and natural resource-use methods, and the use of indigenous crops and cropping systems holds promise for managing climate risks. Traditional social structures also hold key information necessary to understand adaptability of a wide range of livelihoods to climate related risks. However the resources and expertise available to capture, adapt and develop this knowledge into accessible technologies are inadequate.

*d) implications for sustainable development in relation to a-c above*

South Africa's sustainable development path, at least in the medium term, inevitably involves a blend of economic and social systems in a transitional economy. Both the formal and informal economies have vulnerabilities to climate change, but these may be distinct and need a careful assessment. Lack of predictive capacity as well as a lack of capacity to diffuse socially appropriate technologies, affect ability at local, national and regional levels for medium to long term development planning, required to promote and implement sustainable development. For example, rural depopulation and land restitution processes are both key aspects of a medium term land use change scenario, but the links with climate change impacts are not well studied.

*e) promoting understanding of impacts of, and vulnerability to climate change.*

South Africa emphasizes the importance of promoting exchange of information and best practice in understanding the impacts of, and vulnerability to climate change. A particular example in which we have benefited substantially from the ability to understand vulnerabilities, is access to information on seasonal projections of malaria in other parts of southern Africa.

Further investment in this capacity is a stated aim of several government departments, including the Dept Science and Technology, and Environmental Affairs and Tourism. A specific portal focused on adaptation, could facilitate exchange of information by making case studies and relevant information available.

PAPER NO. 10: UZBEKISTAN

**The information of the Republic of Uzbekistan on the relevant programs, activities and views on the issues of Nairobi work program on impacts, vulnerability and adaptation to climate change**

The Republic of Uzbekistan supports the activities of Secretariat on implementation of Nairobi work program of activities in the area of impact, vulnerability and adaptation to climate change.

**a)** The activities on the revelation of the obstacles and barriers in the field of adaptation to climate change in Uzbekistan are conducted in the framework of preparation of National Communications. In the process of preparation of Communications we **accumulate the experience on the assessment of the current and future risks** related climate change including the risks caused by the extreme phenomena. At present in the framework of preparation of the Second National Communication the assessment of the current and future risks related to climate and extreme phenomena is conducted.
The main **gap** for such assessment is the **absence** of the national practice of the collection and archiving of information about the **damages.** In this concern the assessment of risk is made on the base of investigation of probability of the hazardous phenomena for the **current climatic** conditions by the data of observations of the national hydrometeorological network.

**b) Forecasting of the future risks' assessment** related to the hazardous phenomena (droughts, mudflows, avalanches, frosts, heavy precipitation) is made on the base of climate scenarios including the designed quantities of the relevant percentiles (5, 20, 90, 95%). The resulted values characterize the probability of the extreme climatic phenomena in future and hydrometeorological conditions which correspond to them.

The used MAGICE/SCENGEN methods allow to assess the changes of variability (climate variability – standard deviation change) and also the **statistic calculations** by the functions of distribution of probabilities (temperature and precipitation regime). **Non-comprehensiveness of methods of the assessment of probability** of such hazardous and rare phenomena as mudflows, avalanches, frosts even with the knowledge of the change of the temperature and precipitation regime in future is the main **difficulty**. That is why the estimates includes often **the empirical correlations** calculated by observational data and suppose that these **correlations shall be preserved in future.**

We think that **strengthening the capacity** in this field is in the **development of the regional climate modeling** using high resolution models, **creation** of the **dense network** of automatic stations of observations, **development** of the relevant technologies of the data processing, **training of personnel** and **technical equipping**.

**c)** During the **last ten years** such extreme phenomena as droughts and heavy precipitation **occur more and more often** which manifests the increase of precipitation regime variability. Despite the intensive warming observed during the last ten years the variability of frosts does not reduce which demonstrates the increase of the temperature regime variability. Thus, even now the forced adaptation to the change of the climate variability with its warming takes place.

**Traditional approaches to the risks management** in case of such events are the **improvement of the forecasting services** including the **methods**, **development of the network** and **improvement of international data exchange** with the neighbour countries in operational regime.

**Risk mitigation** – is the development **of insurance system** (for the agricultural sector), improvement and extension of the **system of servicing** with hydrometeorological forecasts, with information related to climate and its periodical updating. This is the **main strategy for reducing the risk from the hazardous phenomena in the country.**

**d)** It is evident that the activities described in a) – c) **facilitates the sustainable development of the country** as the demand and interest to hydrometeorological forecasts and information increases more and

more. Strengthening and improvement of such activities is required in regard to climate change, however it is obvious that the **funds and human resources are insufficient**.

**e) The intensive involvement** of the national experts to the training programs, spreading of methods and models useful for the assessment and exchange of the results of studies is mainly facilitating the understanding of the climate change impact and vulnerability. Valuable contribution to these activities from the part of the National Communication Support Program and UN FCCC Secretariat are highly appreciated.

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