THIRD WORKSHOP ON WATER AND ADAPTATION TO CLIMATE CHANGE IN TRANSBOUNDARY BASINS: Making adaptation work

Geneva, 25-26 April 2012

Report

Introduction

The third workshop on water and adaptation to climate change in transboundary basins: "Making adaptation work" stressed the importance of transboundary cooperation, a key - but often overlooked - dimension of water and climate change adaptation. This was done through analysis and exchange of best practices, success factors and lessons learned from adaptation in transboundary basins, addressing all those who are responsible for the process of developing an adaptation strategy and addressing climate change impacts on water resources and other dependant sectors (such as health, agriculture, energy, navigation, development, etc), at the national and transboundary levels. The workshop was organised under the auspices of the United Nations Economic Commission for Europe Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Water Convention) in cooperation with several national and international partners.

The workshop was attended by more than 130 participants from all over the world[1]. The conclusions from the workshop are summarized in this report[2].

Climate change impacts on water resources: Too much, too little and too dirty

Climate change impacts on water in transboundary basins may include multiplying the present-day issues of too much water (flooding), too little water (droughts) and dirty water (water quality deterioration). Often, all these impacts appear in the same basin or even the same location at different times. Extreme weather events, i.e. floods and droughts require an approach of risk management rather than crisis management.

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[1] The list of participants is available at : http://www.unece.org/fileadmin/DAM/env/documents/2012/wat/workshops/Transboundary_adaptation_april/LOP_workshop_FINAL.pdf

[2] All presentations are available at: http://www.unece.org/env/water/transboundary_adaptation_workshop_2012.html

Tackling the risks of flooding at the transboundary level should be an important priority in adaptation to climate change in view of the serious consequences that floods can have on society. Apart from infrastructural measures, possible measures include insurance schemes and restriction of urban development in flood-prone zones. Monitoring and early warning are essential elements in flood risk reduction and need to be coordinated at the transboundary level. Nevertheless, flooding can also be seen as an opportunity, for example for biodiversity and fisheries, as it entails a large availability of water. Floodplains are often very fertile lands.
Another important trend in water management is the increasing water scarcity. Droughts are natural phenomena that are expected to increase, leading to more severe water scarcity situations, even in regions previously considered as water-abundant. Water scarcity is however not just induced by climate change; an important cause of the problem is inadequate water management. Action is needed to counter these situations. Governments need to deal with droughts through better water management, better water supply and decreasing water demand. This can for example be done by investigating new sources of water such as in the Nile basin where research is conducted to develop new schemes for improving the water supply in the region.

Groundwater withdrawal and underground water storage are becoming increasingly important measures to address water scarcity. However, groundwater use needs to be sustainable. The reuse of water is increasingly considered to address water scarcity.

In situations of water scarcity, establishing priorities for water use is necessary, even more so in transboundary basins. Criteria need to be defined for this. In water-scarce regions, agriculture practice needs to be adapted, for example by diversification of crops. Pricing of water can be an important tool to decrease water demand but is a measure that should be implemented in normal times to make it acceptable in times of crises.
Other measures to address water scarcity and droughts include structural and awareness-raising measures.

The three major climate change impacts on water quality are the reduction of oxygen levels in the water through the increase of water temperature, the increase of transportation of pollutants through flooding, and the increase of the concentration of pollution in periods of droughts. To address these issues appropriate spatial planning and land management is needed to influence the location of human activities in relation to hydrological situation and regulation of flows. General measures to prevent water pollution are more important than ever when taking into account the impacts of climate change; reduction of the use of pesticides and phosphate is needed as well and prevention of soil erosion. Moreover, sources of contamination should be shielded off from water flow in case of flood situations.

Importance of data and information availability and exchange in vulnerability assessments
Lack of good data is a significant challenge for climate change adaptation. In many cases, data are politicized and not shared. The importance of data for research and decision-making needs to be better understood. This also entails that every request for data has to be made for a specific task.

In transboundary basins, vulnerability assessment needs to be prepared at the basin-level scale. Thus, data need to be exchanged between countries which is still lacking in many cases. If there is no or insufficient cooperation at the political level, experts can start by exchanging data.

Uncertainty is another important challenge in vulnerability assessments, even more in transboundary basins. Uncertainty should be quantified as much as possible and probability of events should be incorporated in the results as well. At the same time it must be clear that uncertainty is a common issue in decision making, it is not specific for climate change. It is, for instance, also present in the topic of economic development.

Vulnerability assessment is not an objective in itself. It should serve the development of an adaptation strategy and should be seen as a process instead of a product.

Every vulnerability assessment should start with a thorough analysis of already performed research. For example , in the Danube basin, a full basin-wide vulnerability assessment as such was not elaborated, but an assessment of the most vulnerable regions was done on the basis of available research and expert judgment.

The understanding of vulnerability assessment is increasingly enlarged, also taking into account social, economic, legal and institutional as well as governance aspects.

All in all, vulnerability should not only be seen as a problem, but also as an opportunity towards better organising water management.

Bring facts and figures to counter wrong belief, communicate hope instead of fear
Preparing a vulnerability assessment without linking it to decision-makers might lead to a vulnerability assessment without any impact on the policy level. Research alone has too little impact on politicians. Therefore, special attention is needed on connecting research with policy making. Such connection needs to be established from the beginning, by involving decision-makers already in the planning of vulnerability assessment. This can for example be done by creating a working group composed of experts and policy-makers which meets regularly during the project. Linking experts and decision-makers is even more important in transboundary basins where policy-makers from all riparian countries need to be involved.

Good communication requires knowing the audience, adapting the style of the messages and evaluating the impact of actions. It is important to bring facts and figures to counter wrong belief, and to communicate hope instead of fear. It is therefore crucial to communicate facts, opportunities, alternatives and good examples.

Scenarios can be useful to highlight risks and opportunities, as they show the range of possible futures. Scenarios should be developed and selected jointly in the case of transboundary basins.

Elaborating a vulnerability assessment should be combined with some concrete actions on the ground. The strategy chosen in the AMICE project is a combination of a vulnerability assessment, implementation of some concrete measures to show that they are able to act now and a communication strategy to spread the news of the results. This strategy has proven to be successful.

No adaptation for the sole purpose of climate change – adaptation has co-benefits
It will never be enough to try to reduce the uncertainty by generating more and better data and improving the models. Adaptation can start when the direction of change is known (in the case of stable trends). This is more important than knowing the exact magnitude of the change. Despite the uncertainty it is crucial to start adapting now by applying no and low- regret measures and win-win solutions. This includes non-structural measures like insurance options and long term flexible approaches.

Implementing integrated water resources management and transboundary water management is an important step towards more resilient water management. There is no better way to prepare for climate change than addressing the current climate variability and vulnerability in a sustainable way. Nevertheless, no action should be taken to address climate change alone; also other developments like demographic and economic changes should be taken into account.

In selecting measures, data and full information on the different option, cost-benefit analyses, decision-making tools such as multi-criteria decision-analysis are needed. Adaptation measures

should serve more than just the purpose of improving water management. Measures with co-benefits such as poverty reduction are more likely to be accepted and funded. In general, when selecting adaptation measures, the availability of financial, human and other resources in the basin needs to be considered.

Many adaptation measures are already identified and designed. However, implementation of such measures is still lacking or at its infancy. Implementation requires public participation and communication. At the implementation stage, political attention is even more important entailing the need for improved communication with the policy level. Most measures have clear benefits but the main constraint to act is the human factor: is there political support, is there a willingness to act? Additional attention for involvement of stakeholders and for ecosystem-based approaches is needed to account for this.

Ecosystem-based solutions

The general feeling during this workshop was that ecosystem based adaptation is a promising but a still rarely used approach. It should be incorporated into adaptation strategies along with structural measures. Ecosystem-based adaptation often has positive effects in addition to the direct effect on adaptation, such as improving the livelihoods of people. In other words, the ecosystem approach is often relatively cheap and cost-effective. Increasing ecosystems resilience can be done by including the ecosystem as 'water user' through environmental flows.

Capacity building is also important to strengthen the sustainable use of water. An important part of climate change adaptation is training the local people, in order to make their livelihoods more resilient. An ecosystem based approach is usually best combined with capacity building.

Need for intersectoral cooperation

Mainstreaming climate change into common water management is necessary as most water management problems have no singular cause and solutions not only target one cause. This can for instance be achieved by incorporating climate change into the objectives of projects and in job descriptions of project managers to bridge the gap between engineering and day to day project management. An extra reason for mainstreaming climate change adaptation into water management is to avoid controversies about whether problems are due to climate change, climate variability or other causes.

As water is a crosscutting issue it connects between disciplines, sectors, economics, etc.
Water management is affected by and is itself affecting many other sectors such as agriculture, forestry, tourism, fisheries etc. Effective adaptation requires a cross-sectoral approach, including at the transboundary level, in order to prevent possible conflicts between different sectors.

Agriculture, the largest water user in many countries, needs to be included in every adaptation strategy, also due to its importance for poverty reduction. The focus in agriculture should be on improving water efficiency, for example through better irrigation systems.

Another example of an important sector is health. Apart from the well-known health issues like food security and sanitation, a less well known impact of climate change on health includes the psychological effects of disasters (loss of property and means of subsistence). When taking adaptation measures both agriculture and health issues as well as other important sectors should be considered.

In addition to intersectoral cooperation, such cooperation is also needed to increase synergies between adaptation activities at different spatial levels such as at the regional, transboundary, national and local levels.

Integrating different sectors and integrating different (governance or spatial) levels requires similar preconditions; comprehensive analysis and sufficient time allocated for interaction. To really involve other sectors and levels, more attention is needed for capacity building and awareness creation to enable comparable levels of discussions. It is crucial to search for mutual advantages. Other conditions that support cooperation between sectors and levels include an enabling environment with a legal basis for cooperation, institutions that are ready for cooperation, political support, a sound information basis and information exchange, and sufficient financial means.

All levels are beneficial and complementary to one another. There is therefore a need to combine top-down and bottom-up approaches and to strengthen the interaction between the two.

Climate change as a driver for transboundary cooperation

Climate change is not only a challenge but it can also be an opportunity; it can be a starting point for better communication between riparian countries and therewith it can serve as a driver for transboundary cooperation. Essential in transboundary cooperation is the joint assessment of problems, priorities and solutions. For a basin-wide vulnerability assessment it is important to create a joint group to perform the assessment, to harmonise the used tools, models and scenarios, to communicate knowledge to the political level, to exchange information, to involve stakeholders, and to cooperate with international organisations. Apart from interstate cooperation, transboundary cooperation could also refer to cooperation between different indigenous peoples.

At the transboundary level, discussions on adaptation should consider the following aspects:

- Assess potential transboundary effects of national and lower-level adaptation options
- Identify options for reducing negative transboundary effects
- Identify options for collective actions that promote positive transboundary effects

Joint bodies play an important role in transboundary cooperation. The success of transboundary cooperation in adaptation very much depends on the existence and strength of the joint river commission's secretariat that can play a coordinating role. A joint body with sufficient mandate can also strengthen the work of the national authorities. However, joint bodies need a legal basis and a mandate to deal with climate change which is often still missing.

Nevertheless, also in bigger transboundary basins it is important to give a voice to the local population.

Lessons learned from the pilot projects

Some lessons learned as reported from the pilot projects on transboundary cooperation under the UNECE Water Convention and the Environment and Security Initiative (ENVSEC):

- "Through the pilot project, for the first time we have combined all the scientists, data and knowledge; we could not have done this on our own";
- Working together between countries with different positions in EU accession and different levels of awareness among the general public makes cooperation a challenge;
- "Setting up transboundary teams leads to unique assessements, enables combination of national scientific potential and administrative authorities, sharing of work between teams and thereby doing more work than could have been done at the national level";
- Differences in organization and governance are often a greater challenge than cultural differences;
- The use of different methodologies is not always a constraint but can also improve national methodologies when there is room for consultation. Transboundary cooperation in climate change impact assessment can lead to more robust results;
- Pilot projects can play an important role but issues of replicability, sustainability and possibility for upscaling need to be considered;

- Games and role plays can be important tools to create mutual understanding.

Benefits of adaptation can strongly outweigh the costs
Damages from floods are projected to rise considerably by the end of this century. This is due to a combination of global warming, socio-economic changes such as increased exposure in flood-prone areas and to land-use dynamics such as continued urbanization, deforestation and loss of wetlands. Adaptation can considerably reduce negative consequences of climate change, often at a cost that is much lower compared to the avoided damages.

For the planning process of adaptation it is critical to assess the economic, environmental and social costs and benefits of different adaptation options, on the basis of which limited resources can be optimally prioritized. Involvement of local expertise hereby is of crucial importance, as the efficiency and implementability of alternative options depends on the local geophysical and socio-economic conditions. The need to recognize and work with uncertainty requires an iterative and flexible approach.

Final conclusions- from analyses towards decisions[3]
- There is a continuous need to improve communication between the 'water community' and the 'climate community'; Water people should go beyond just talking to the water people!
- There is a trend from looking for flexibility towards a long-term approach; more and more flexibility of agreements is changed into adaptability of agreements.
- There is a trend from analyses towards decisions; better information and analyses are available and the scenarios are known. Sufficient to base decision-making on.
- There is a trend from having sufficient financing towards the proper financing mechanisms; from large-scale projects towards targeted projects.
- The technical approach in adaptation is replaced by governance approaches.
- Emerging issues: disaster risk reduction, ecosystem-based approaches and environmental flows.

[3] Based on the final presentation by John Matthews (Conservation International, Alliance for Global Water Adaptation).

Annex 1: Summaries of the presentations

Contents

1 Water scarcity in the Netherlands, Mr. Jos Timmerman, Ministry of Infrastructure and the Environment, the Netherlands

The Netherlands is known for its water abundance. The country is shaped by its inhabitants struggling against water, creating polders, dams, weirs, etc. to ensure that the country would remain dry. Nevertheless, in years with little rainfall, both in The Netherlands and the upstream countries of the Rivers Rhine and Meuse, the amount of freshwater available may become too little to meet all demands; a situation of water scarcity. This may lead to, for instance, loss in crop yield, decreased navigation possibilities and restrictions in domestic water use. It also poses a threat to infrastructure as appeared in 2004 when a peat-dike collapsed because it dried out. This latter event stressed the need for a forward-looking approach to water scarcity in a similar way as the issue of safety against flooding was targeted.
The current water management policy on water scarcity focuses on providing sufficient freshwater of good quality on the right place at the right time for all users. All this is guaranteed by the water authorities. In situations when water becomes scarce, a priority list (figure) determines how the water is distributed over the users. As water scarce situations are rare, financial loss in such situations is accepted.

Category 1	Category 2	Category 3	Category 4
Safety and prevention of irreparable damage	Utilities	Small-scale high-quality use	Other interests (economic assessment, also regarding nature)
1. Stability of dams 2. Settlement of peat 3. Nature	1. Drinking water 2. Energy	•Temporary irrigation of capital-intensive crops •process water	•Shipping •Agriculture •Nature (except for irreparable damage) •Industry •Recreation •Fishery

Figure: List of priorities for use of the available water in times of scarcity

In rethinking the future of The Netherlands in view of climate change, the Delta Programme incorporates investigating the freshwater situation in the country to ensure sustainable supply of sufficient freshwater in 2050 and 2100. The task of the Freshwater programme is to develop strategies for freshwater management in the Netherlands in the long term as well as to identify short term (2015) no-regret measures. To this end, four different scenarios were developed ranging from modest to rapid climate change and from socio-economic decline to growth. In all the scenarios it proved that in the long run continuation of the current strategy would not be sustainable. Overall, five main problems are distinguished: 1) There is too little water in rivers and canals to provide for the water demand. This causes a decline in the groundwater table leading to damage in buildings and infrastructure because of soil settlement. 2) Increased salt intrusion leads to prolonged intake restrictions for drinking water affecting households and industry, and leading to damage to agriculture and nature. 3) Soil moisture deficits increase in the higher parts of the country leading to reduced water quality and reduced groundwater tables. Agriculture, urban areas and nature will be affected, while health risks may occur due to decreased water quality. 4) In the South-Western Delta the freshwater lenses may be depleted, affecting nature and agriculture. 5) The buffer capacity of the central Lake IJssel may not be sufficient to provide sufficient water for irrigation and even for drinking water intake in the northern part of the country, affecting agriculture, nature and human health.
To develop the possible strategies, four extreme strategies were developed. The policy options behind these strategies were full supply of the water need versus water demand is driven by water availability, and all water supply is arranged for through public means versus arrangements through private means. These four strategies form the outer ends of the possible options. From these strategies, some 5 to 7 ‘possible’, more realistic strategies will be developed. Each strategy will require regional elaboration. Rough calculations will be made of the hydrological and economic

consequences in view of achieving the goal of sustainable freshwater supply. Meanwhile, the administrative preferences will be assessed. Two or three strategies with the highest potential will be selected and detailed calculations will be performed on these 'promising' strategies. This leads to the selection of a preferred strategy that will be input for the 'Deltadecision', to be taken in 2014.
In all the assessment so far, little attention is paid to the transboundary aspect of the freshwater system. The greater part of the water originates in upstream countries, and climate change may influence the water consumption and use in these countries. In the upcoming analyses, the consequences of climate change on the freshwater flow that will be available to the Netherlands will be assessed. Options for dry periods, like agreements or retention options, will be studied.
Experiences from the programme have shown that involvement of local administrations and water users is essential to build such a programme. Moreover, the decision makers at the different administrative levels need to be involved. To achieve this, the process must be transparent. The programme also showed that there are limitations to technical and spatial possibilities. These have to be dealt with to achieve sustainable freshwater supply in the long term.

2 Mekong Climate Change and Adaptation Initiative, Ms. Nguyen Huong Thuy Phan, Mekong River Commission

The Lower Mekong countries (Lao PDR, Thailand, Cambodia and Viet Nam) are considered among the most vulnerable to climate risks such as floods, droughts, sea level rise, saline intrusion, extreme wind storms in terms of frequency, severity and duration. As a result many water-related sectors such as agriculture, hydropower, fisheries and wetland ecosystems would be dramatically affected putting millions of people at risk of declining food security and livelihoods.

Following these concerns, the Mekong River Commission (MRC) Climate Change and Adaptation Initiative (CCAI) was formulated and established during 2008 - 2009. Key purpose of the CCAI as a long-term regional initiative (until 2025) is to support the Lower Mekong Basin (LMB) countries in adapting to the new challenges posed by climate change, by building a systematic process of planning, implementation and learning.

The scope of the CCAI is **climate change impact assessment**, **adaptation planning** and **implementation** within the Mekong River Basin. Its main focus is the **basin wide integrated approach** consistent with IWRM and the MRC 1995 Agreement. The CCAI is by itself cross-cutting touching on almost every aspect of water management, including institutional, planning, environmental and socio-economic issues, as well as coping strategies and capacity building. The CCAI implementation approach involves **integrated efforts both horizontally** (among different MRC programmes and within each Member Country) **and vertically** (from regional experts, national governments to local communities).

The CCAI focuses initially on **basin wide and transboundary issues** and the sectors for which it has a mandate. **Basin scale activities** will address climate change impacts and adaptation options at basin planning level through integration with the Basin Development Plan on transboundary issues, e.g. wetlands, flood and drought vulnerability, food security and hydropower. At the same time it seeks to support adaptation planning and implementation at other levels, e.g. through the **local demonstration projects**. The CCAI will improve **capacity to adapt from local to regional levels** including in the use of tools for different adaptation planning stages and methods. It will support LMB governments in introducing and improving **strategies and plans for adaptation at various levels** and their integration with appropriate development plans via the regional outputs e.g. the report on **Status of Climate Change and Adaptation in the Mekong River Basin** and the **Mekong Adaptation Strategy and Action Plan**.

During its implementation, the CCAI has encountered various challenges in management and technical aspects. It is still a challenge to make regional cooperation more practical and beneficial for the Member Countries' governments, authorities and communities, especially when each country has different levels of technical capacity, available climate information and concerns.

To ensure that CCAI can assist the MRC member countries in their efforts to address climate change impacts and adaptation, technical competency of the Secretariat, meaningful partnerships and continuous information management are critical.

3 Assessment of climate change induced water stress in the Nile Basin, Mr. Mohamed Elrawady, Centre for Environment and Development for the Arab Region and Europe (CEDARE)

CEDARE has been involved in a multi-organization on-going project to assess and model climate change induced water stresses in the Nile Basin since January 2011. Partners include different national and International organizations inside and outside the Nile Basin. The main objective of the project is reaching a common joint assessment on climate change impact on the basin's water resources and formulating a hydrological model that will be capable of simulating different adaptation strategies to deal with different future scenarios.
The presentation showcased the different climatic zones in the Nile Basin and focused on some of the innovative assessment approaches adopted in the assessment including green and blue water assessment, accounting for land use change, and assessing terrestrial evapo-transpiration dynamics. It has been shown that the assessment didn't focus only on surface flows as the sole transboundary element in the basin, but also on transboundary groundwater aquifers within the basin which has been selected as a strategic adaptive measure to Climate Change, through controlling the factors that influence recharge.

4 Vulnerability assessment in Colombian transboundary basins, Mr. Fabio Andres Bernal, National Hydrological Institute, Colombia

The main Colombian transboundary river basins are Orinoco river basin (Colombia - Venezuela), Amazonas river basin (Colombia - Brazil - Ecuador), Catatumbo river basin (Colombia - Venezuela), as well as other minor river basins. Colombia does not have any transboundary project on adaptation to climate change whit other neighbour country. However, there are regional experiences in adaptation.

As a reference for the conditions of our transboundary river basins, some characteristics about the Amazon river Basin in Colombia were presented. The area of the Amazon basin produces 38% of the country's annual average flow (27830 m^3/s), divided as follows: 29% comes from the Andean region (Caquetá, Putumayo, and Yaré Caguan) and 71% is generated in the Amazon floodplain (Apaporis and Vaupés rivers). Climate Change Scenarios, and Scenarios of Environmental vulnerability of the territory (Land Potential impacts 2011-2040 in addition to Adaptation Capacity, Resilience) were made available for the Second National Communication on Climate. There are results of precipitation change, climate change sensibility and climate change vulnerability over three different time scenarios. There is information about average carbon stock in aboveground biomass of natural forests in Colombia and the potential of carbon stored in aboveground biomass in natural forests.

Difficulties Encountered - Transboundary Aspects

Perhaps there isn't a transboundary mitigation or adaptation project with other countries but there is a problem that challenges us to include that point of view in Colombian transboundary basins. In the Amazonas river basin problems exist with flooding over Leticia and Nazareth municipalities in Colombia, as well as Lateral erosion-sedimentation troubles on Leticia and Iquitos in Peru. Questions related to this are: How will climate change increase or reduce that problem? What could be the effect of climate change over climate variability in this river basin? (drought and flood periods).

Lessons Learnt That Could Be Of Use For Other Projects:

From the "*Joint Program Ecosystems Integration and Adaptation to climate change in the Macizo Colombiano*"

- Methodological proposal to allow building on the local and the communities' adaptive strategies.
- Upper basin of the Cauca River in the municipalities of Puracé and Popayan seeks to coordinate policies related to poverty, climate change and integrated management of water resources.

There are some ongoing projects related to climate change adaptation, using the model "AquaCrop" to estimate crop yields in Colombia under the Economic Impact Study on Climate Change (EIECC). (National Planning Department, Ministry of Agriculture and Rural Development and IDEAM, agricultural sector).

Colombia is participating in the project EUROCLIMA-RALCEA, a Europe and Latin America Regional Climate Change Programme. The Specific objective of this project is to improve knowledge of Latin American decision-makers and the scientific community on problems and consequences of climate change, particularly in view of integrating these issues into sustainable development strategies. The scientific component identifies, collects and integrates biophysical data that are susceptible to being affected by climate change. The water sub-component produces variability maps and analysis of hydrological balance. Under the RALCEA framework, the center of excellence in Colombia is the National University of Colombia, IDEAM. They supply the information for this product. The progress was presented in the Second RALCEA Program Regional Seminar which took place from 2 -4 May in La Ceiba, Honduras.

5 Glaciers and water use in Central Asia: results of an international scientific expedition, Mr. Abdylhamid Kayumov, State Agency for Hydrometeorology, Committee on the Environment of the Government, Republic of Tajikistan

Physiographic features of the structure and historical conditions of population and agricultural development of Central Asia have led to the fact that the runoff formation zone of almost all Central Asian rivers was within Tajikistan and Kyrgyzstan. Within these two countries no more than 25-28% of the water resources is used. The remainder of the runoff goes into their middle and lower reaches in Turkmenistan, Uzbekistan, and a number of areas southern Kazakhstan.

The amounts of water intake in Kazakhstan, Turkmenistan and Uzbekistan are much higher than the available water resources . A completely different situation is observed in Kyrgyzstan and Tajikistan, on whose territory is almost the entire runoff formation zone in Central Asia.

Despite some positive trends noted over the past two decades in reducing water use, we can not deny the fact that the water supply to the population is continuously declining. It is now only 2-4 m^3 per person per year within the basin of Amudarya and Syrdarya. Thus, according to international classification, water availability for populations in the region is characterized as low.

Under these circumstances, it is particularly relevant to study the runoff and the present and future characteristics of snow cover and glaciers- the main water resources in this region. This will allow us to develop measures to address the issue of transboundary waters.

In this case, considering the possible impact of glaciation on the degradation of river discharge and regional water resources, it is important to evaluate changes in glacial runoff associated with climate change. Due to the intensive melting of glaciers in Tajikistan in recent years, the glaciers are retreating, which is not compensated in winter. Ultimately this leads to the degradation of glaciation. In the near future, the area of Tajikistan's glaciers may be reduced by another 15-20%, which will lead to a reduction of water in the glaciers. If the current rates of glacial melting will remain in the next 40-50 years in Tajikistan, all small glaciers will disappear. This will affect the availability of water resources of the entire region of Central Asia.

However, it is difficult to explain the relation between the observed degradation rates of glaciers in the basins of the Vakhsh and Panj and the trends identified above. Many series of data are not complete and after 90 years the hydrological network is not functioning at the proper level, due to lack of finance and expertise.

Thus, to develop adequate adaptation to climate change, the most important task is to obtain new field data and to develop methodological approaches based on models of the runoff of transboundary rivers in a changing climate.

6 Water and Adaptation to Climate change in Myanmar, Ms. Tin Yi, Department of Meteorology and Hydrology, Myanmar

Climate change is not a distant threat anymore. Its impact is being experienced all over the world and Myanmar is also affected by the climate change impacts. According to the analysis of the historical meteorological and hydrological data observed at the Department of Meteorology and Hydrology (DMH) in Myanmar, the climate change also impacts Myanmar's weather, climate and water. Some climate change impacts in Myanmar include the following: late monsoon onset, early monsoon withdrawal, short monsoon duration, increase in retardation of monsoon advancement, intensification of cyclones and hurricanes caused by the rise of sea surface temperatures and extreme floods and droughts due to the changes of rainfall intensities and the increase in temperature.

Due to the climate changes, significant disasters occurred in Myanmar over the last decade. Severe cyclonic storms in the Bay of Bengals consecutively took place between 2006-2011. Myanmar was fortunate to have minor loss and damage due to cyclone until the cyclone NARGIS. This cyclone crossed Ayeyawady Delta on 2-3 May 2008, leaving high loss and damage in the region during decades. The track taken by the cyclone is believed to be the impact of changing storm climatology in the Indian Ocean. During the summer season in 2010, extreme temperatures were recorded in Myanmar and most places experienced drought and water scarcity. During 2011, heavy rainfalls were recorded during the summer and the peak monsoon period. Extreme floods were also recorded in deltaic area and lowest floods occurred in upper Myanmar. In 2011 four flash floods occurred.

In Myanmar, there are two transboundary rivers: Thanlwin and Mekong rivers. The Thanlwin river originates from China and flows through the eastern part (Shan plateau) of Myanmar. DMH installed only one gauging station along this river near the mouth to the sea. According to the analysis of data of this station, the floods generally took place every year. The Mekong river passes through only about 350 km on the Myanmar border with China and the Laos. There is no water level gauging along Mekong because this area is a remote area.

The climate change science and concepts have also been growing at an enormous pace renewing the hope to mitigate the causes and adapt to changing climatic system. Myanmar is also trying to adapt to climate change and to mitigate the damages from disasters. The Government of Myanmar signed the UNFCCC on 11 June 1992 and ratified the convention on 25 November 1994. Myanmar has submitted its Initial National Communication in 2010.

Under the Myanmar National Adaptation Plan of Action (NAPA),Vulnerability Assessment has been carried out and measured for reduction of impact and strategy for adaptation were prioritized. DMH cooperated in INC (Initial National Communication), a project of Myanmar under UNFCCC and also cooperated in the project NAPA (National Adaptation Plan of Action). DMH studied about the climate change impacts to Myanmar and prepared the climate change scenarios for Myanmar using MAGICC 5.3 model and the ECHAM5 Model.

Myanmar is one of the most vulnerable countries in ASEAN region to various kinds of natural disasters related to climate change. The climate change mainly affects the socio-economic sectors of Myanmar such as agriculture, forest, biodiversity, coastal zone, public health and water resources. Water and agriculture are very important sectors for Myanmar's economy. The relevant departments and organizations in Myanmar are cooperating in the climate change adaptation activities and are also cooperating in the regional and worldwide climate change adaptation.

7 Transboundary conservation of the mangrove ecosystem of Sundarbans, Mr. Laskar Muqsudur Rahman, Forest Department, Ministry of Environment and Forests, Bangladesh

Bangladesh and India share the largest single tract of estuarine mangrove forests in the world which is globally known as the Sundarbans. The dominant tree species of the Sundarban is Sundari (Heritiera fomes). Sundarban is listed as UNESCO World Heritage site in 1997 and included as Ramsar Wetland Site in 1992. The Sundarbans spans 10,000 km2, about 6,000 km2 of which is in Bangladesh. With its array of trees and wildlife the forest is a showpiece of natural history. It supports livelihood of people mainly through non-timber forest products such as honey and fish. It is also a wonderful site for ecotourism. Besides, it acts as a shelter belt against tropical cyclones and save the inland from damage to life and wealth. The forest consists of about 200 islands, separated by about 400 interconnected tidal rivers, creeks and canals.

Bangladesh is a riverine country having 310 large and small rivers of which 57 are Transboundary Rivers, 54 coming from India and 3 from Myanmar. Bangladesh is the common lower riparian of all these transboundary rivers. The annual renewable surface water amounts to 1160 billion m3. About 93% of the surface water of the river systems comes from adjacent countries. The diversion of Ganges water due to Farakka dam in the upstream in India reduced water availability in the country in general and increased river and soil salinity in and around Sundarbans forests in particular. It was increasingly difficult to maintain the in-stream flow requirement essential for the maintenance of river and terrestrial ecosystems. The Joint Rivers Commission (JRC), established on 19 March 1972, holds data on Transboundary Rivers. The JRC maintains liaison between the participating countries in order to ensure the most effective joint efforts in maximising the benefits from common river systems to both the countries. After several years' of dialogue and negotiation, Bangladesh and India resolved the dispute over the Ganges water equitable sharing through signing the Ganges Treaty on 12 December 1996.

Meanwhile significant damage has been done to the dominant tree species of Sundarbans. About 45 million Heritiera fomes trees (dominant tree species of Sunderbanbs) were seriously affected with top-dying due to increase in salinity (>10 ppt) and high sedimentation. Salinity also changed species composition of the Sundarbans. At places Sundari is replaced by Gewa (Excoecaria agallocha) and Gewa is replaced by Goran (Ceriops decandra). In general, the forest structure is becoming simpler and the average height of the trees is decreasing. The situation is likely to aggravate due to climate change which might reduce rainfall during rainy season with consequent increase in salinity.

Bangladesh and India signed a bilateral Memorandum of Understanding on September 6, 2011 for joint conservation and protection of natural resources of the Sundarbans for sustaining the productivity and environmental functions of the ecosystem.

In Bangladesh the Ganges Barrage Project was conceived to augment flow of water during dry seasons into the Gorai River that originates from the Ganges. The foundation stone was laid in 1980, but the project is yet to start. For meeting minimum requirement of water, dredging and re-excavation of the Gorai River is essential. Negotiation with India for equitable share of transboundary river flows based on existing treaties backed by research data at all possible levels should be continued. Bangladesh also should continue discussion with neighboring countries in different fora including South Asian Association for Regional Cooperation (SAARC) meeting for sustained transboundary river inflow.

8 Building regionally and nationally tailored-based Ecosystem based Adaptation (EbA) in Mesoamerica, Mr. Juan Carlos Sanchez, International Union for the Conservation of Nature (IUCN)

The presentation aimsed at showcasing evidence of ecosystem based adaptation practices and how these are being used to influence the policy development arena in Costa Rica. The project which sets up the framework for this to happen is called: "Building regionally and nationally tailored Ecosystem-based Adaptation (EbA) in Mesoamerica. It is a project implemented in 4 different transboundary river basins in Central America and the Southern State of Mexico, Chiapas.[4]

The presentation highlighted practical examples of ecosystem based adaptation practices and also touched upon its rationale for influencing policy, based on the results achieved on the working pilot sites. This meant that the presentation aimed at answering the question of: "how to build up discourse and mainstream the ecosystem based approach into planning, policy development and legal and institutional reform".

The project builds upon the need for strong governance structures in order to increase water management capacity through stakeholder empowerment. Combining a bottom-up approach with the traditional policy reform cycle (top-down), it aims to seize opportunities of formal change while at the same time preparing at the local level for in-the-field implementation. Doing this implies strengthening livelihoods and building the resilience of ecosystems, mainly at the micro basin level, gaining sufficient evidence and experience to allow an up-scaling of the knowledge gathered into decision making platforms at the basin and national / bi-national level.

The presentation also highlighted the methodology used at the local level to select the adaptation measures that are being implemented in each pilot site. The project implemented a tool called CRiSTAL (Community-based Risk Screening Tool – Adaptation and Livelihoods), which is designed to integrate risk reduction and climate change adaptation into community-level projects. Applied to the Sixaola river basin context, particularly in the micro-basin context, of Lower Yorkin, several adaptation measures were selected.

From an ecosystem-based adaptation perspective, the project and the communities are focusing on the recovery of areas with steep slopes, given the geology of the site, and also on soil conservation and reforestation as a means to reduce sedimentation and flash flooding - which has a direct impact on the community transport system, their economy and their general well being.

The other adaptation measures being implemented are organic cocoa management and staple grain diversification, which is part of a strategy to deal with the proliferation of a fungi that attacks the cocoa plant and has reduced the yield income of the production to 80%.

Considering that the focus of the project is also on transboundary water governance, efforts have been made to strengthen local water governance capacities by working with the local governance structures, such as the micro water committee, and at the same time working with the basin authorities. This has led to a recognition of very local governance structures within the basin authority, providing a voice and a space for the Yorkin community to participate in the decision making process of the Sixaola basin management and adaptation plans.

On both ends of the adaptation and the governance measures, very satisfactory results are being achieved, which has allowed for the up-scaling of the ecosystem-based adaptation as part of the Costa Rican portfolio for dealing with climate variability at a national level.

[4] The project is being implemented in the following hydrological basins: 1) Tacana river basin system (Coatán and Caohacán) which is a system of small river basins shared between Mexico and Guatemala; 2) Lempa and 3) Paz river basins, which are both shared between Guatemala and El Salvador; and 4) the Sixaola watershed, shared between Costa Rica and Panama.

9 Management of scarce water resources for rehabilitation of degraded lands in arid and semi-arid region of Southern Pakistan, Mr. Sahibzada Irfannullah Khan, Sustainable Land Management Project (SLMP), Ministry of Environment in Pakistan

Drylands in southern Pakistan are home to communities living in poverty and depending on livestock rearing for their livelihood. The subsistence agriculture is losing its importance under the effects of climate change i.e. uncertain rainfall and very low productivity. Due to increasing population of livestock, the pressure on silvo-pastures is increasing resulting in degradation of natural resources and loss of soil fertility, a fact that adversely affects the livelihood of communities. The Farm Forestry Support Project (FFSP) of the Intercooperation (IC) and Swiss Agency for Development & Cooperation (SDC), initiated rehabilitation work in 2003 in extreme dry region of Karak using the silvo-pastoral system with hillside ditches and sand dune stabilization techniques. The objective was to recover vegetation and increase productivity of the area with minimum cost and hence support livelihoods. The activity was carried out with participation of civil society organizations and farmers' associations.
The results recorded in 2008 showed a profuse plant growth in terms of trees, shrubs and grasses with a potential to provide timber, fuel wood and fodder for livestock. Maximum harvesting of rainwater and conservation of moisture also resulted in growth of natural grasses and shrubs. Within a short period of 5 years, plant growth in height and diameter of 6 meters and 20 centimeters respectively was recorded. The average vegetation cover of 45% and increase in soil organic mater and nitrogen content was also recorded. All this happened with a minimum cost of US$ 82 per hectare. The rejuvenation of wells in few cases was an additional positive affect of the activity. On the other hand, an annual income of US$ 735 per hectare from Saccharum spontaneum planted in sand dunes was a real benefit to farmers against the other land-uses in dry sand dunes.
Conclusions
The drylands are unique ecosystems that are important from social, ecological and economic point of view. These are home to poor and marginalized people, a rich biodiversity that is almost under threat from over utilization and mismanagement, and no doubt these lands and ecosystems support livelihoods of billions of people world wide.
There is utmost need to resolve the ecosystem related problems faced communities and thus support their livelihoods through rehabilitation. Water harvesting techniques are only one of the many possible solutions. However the importance of water harvesting and conservation for biological purposes is important because these are a effective answer to increasing water shortage due to changing climatic patterns. The interventions made in participation of local pastoral communities in drylands resulted in interesting results where not only the revival of local vegetation cover was enhanced, but an additional benefit of ground water recharge was obtained. And all this happened with a nominal cost as compared to other conventional measures adopted by natural resources department.
The rehabilitation measures however demand care of the land and protection from grazing for initial two years to provide relief to the recovering vegetation. Without attending to the protection parameters, activity in some places have resulted in no conspicuous results after the planted seedlings and shrubs were completely clean washed by roaming herds of goats and sheep.
On the other hand, it is a common concept among local people that investing on silvo-pastures is a profit-less venture. Failures due to water shortage in past and the lack of protection from free grazing animals have further strengthened this perception. The already marginalized communities therefore find it very difficult to invest on pasture development.
The interventions in silvo-pasture development have proved significant in overcoming the water shortage and rejuvenating the vegetation for the benefit of human beings and livestock. The cost of these activities is also very low and within the bearing capacity of farmers. These facts and results need to be spread wide through extension and mobilization of communities at regional level. The matter of free livestock grazing should be dealt with at regional and not at local level. Communities should be facilitated to reach a mutual consensus for protecting sites under treatment and keeping their animals grazing in other areas. A controlled grazing system in which area is divided into blocks, keeping one block under protection on rotational basis may also be one of the options.

10 Improving common flood risk management in transboundary basins, Mr. Bart Swanenvleugel, Flood Wise International Cooperation Project

What is FLOOD-WISE?
FLOOD-WISE is an INTERREG IV-C funded project that deals with integrated flood risk management in a transboundary setting. In six international rivers, the FLOOD-WISE partners develop cross border approaches for dealing with extreme flood events, following the principles of the EU Flood Risk Management Directive (FRMD). These rivers are the Bug, Elbe, Meuse, Rur, Somes and Sotla. From every river 2 or 3 riparian countries are involved.
Why a cross border approach?
In FLOOD-WISE we distinguished three tools for flood risk management that are addressed in the FRMD: 1) preliminary flood risk assessment; 2) flood risk maps, and; 3) flood risk management plans. FLOOD-WISE chooses a cross border approach in order to:

- Increase the availability of data and information.
- Extend the room for and effectiveness of possible solutions.
- Extend the transboundary network of responsible authorities in the river basins.

Achievements towards cross border flood risk management
The partners of the river *Elbe* developed a joint catalogue of objectives and possible measures for flood risk management, addressing the themes hazard prevention, hazard defence, hazard response, recovery and preparedness. The catalogue contains a variety of possible measures and provides a basis for prioritization of measures. In the transboundary practice of the Elbe it appears to be difficult to realize hydraulic interventions, because of a lack of a common model for the river. The partners however, agreed upon more generic cross border measures, like data exchange, early warning, transboundary communication and information. In addition joint measures for disaster management however have been agreed upon on state level.
At the project start, data, models and detailed maps were absent in the river *Bug* that is shared by Belarus, Poland and Ukraine. The main focus therefore is on information exchange, building relations and cross border contacts. Now, the partners developed a common hydraulic and hydrologic model for the whole river. For defining a combination of climate change adaptation measures with flood protection measures and restoration measures, a common approach will be followed, based on the Polish practice of flood risk management.
In all rivers involved in the project, partners made an effort to harmonize data, models and objectives. This resulted in the development of joint transboundary flood risk and flood hazard maps for various scenarios. Attention has been paid to economic, ecologic and social/cultural values in de areas involved. In the last phase of the project transboundary measures and plans for flood risk management and adaptation strategies will be defined. In for example the Somes region, the partners agreed on transboundary inspections and measurements and mutual assistance during calamities.

Intermediate results of FLOOD-WISE
From 22 – 24 October 2012, the results of FLOOD-WISE will be presented during a final conference in Maastricht, The Netherlands. At the moment, the following intermediate results are available:

- A project statement with recommendations for dealing with transboundary flood risk management (available on www.flood-wise.eu).
- A collection of good practices of transboundary flood risk management (available through www.wise-rtd.info).
- A *serious game* in which participants can experience and practice, what working in a transboundary setting means. The game will be freely available soon.

11 The Zambezi River Basin Initiative (ZRBI): Build and strengthen resilienc, Ms. Hilary Motsiri, International Federation of the Red Cross

Background

The Zambezi river has been experiencing increased disasters floods, droughts, migration, hail storms, malaria, cholera and HIV/AIDS infection. The economic and social cost of disasters continues to sore as recurrent disasters negatively impact on community livelihoods and hamper sustainable development along the Basin.

The Zambezi River Basin Initiative (ZRBI) represents a shared vision amongst Southern Africa National Societies.(Angola, Botswana, Malawi, Mozambique, Namibia, Zambia and Zimbabwe.) The program was initiated in 2009 at the Southern African Partnership of Red Cross Societies (SAPRCS) to maximize the impact of Red Cross interventions in an integrated and holistic way. The initiative became in the wake of recent Red Cross regional relief operations for flooding in all seven countries. Flood related disasters over the past decades, have become almost an annual occurrence, affecting communities living along the basin to varying degrees. While Red Cross flood operations managed to avert loss of life and livestock and prevent disease outbreaks, the challenges faced by communities along the Zambezi are beyond the scope of disaster response. It was therefore felt that an integrated and comprehensive long-term approach to reduce vulnerability to flooding and other risks, taking into account the challenges brought about by climate change, was needed.

The Initiative aims to: "*build and strengthen resilience of 235,800 people living along the Zambezi river basin through an integrated programme approach.:*`

- Reduce the risk of and impacts of current and future disasters
- Increase access to adequate and nutritious food commodities
- Reduce the number of deaths and illnesses
- Strengthen the capacity of the 7 NSs to effectively implement disaster preparedness, response and recovery operations

Partners:

The ZRBI programme is built on partnerships between NS with local, regional and multilateral organizations. Some of the key partners are World Meteorological Organization, USAID, World Food Programme, Food and Agriculture Organization, Office of Coordination of Humanitarian Aid, UN habitat, Department of Finance and International Development. The Netherlands Red Cross Climate Change Centre, European Union and Southern Africa Development Community.

Lessons learnt that could be of use for other projects

- Through use of participatory approaches and community based methodologies response to disasters has improved and death rates have declined.
- Through use of early warning systems, establishment of functional community disaster risk reduction teams, National Disaster Reduction Teams (NDRT) preparedness and response period is shorter
- Partnerships and networking supported NS with different capacities ,skills and improved indigenous knowledge with scientific research.
- Integrated approach for DM, Health and Care and Organizational development activities proved to be cost effective
- The organizational skills and leadership training capacitated women to take leadership roles and responsibilities in the programmee.

Difficulties encountered

- Building community confidence to take full charge of the development of the programmes to reduce disaster risk.
- Limited funding for proposed activities
- Gender inequalities still a challenge in some of the remote parts along the basin

Transnational -boundary aspects

Flooding risks in the watershed spinning to multiple challenges
Disease out breaks across the borders a challenge for human and animals.

12 Management Tools of Extreme Weather Events in Morocco, Mr. Abdeslam Ziyad, Ministry of Energy, Mines, Water and Environment, Morocco

Due to its location, Morocco is subject to extreme weather events, such as droughts, which are expected to grow increasingly frequent in the future as a result of climate change.
Several sequences of drought have been observed, the most severe ones in 1981-1985, 1991-1995 and 1998-2001 and 2006-2007. During these periods, chronic rainfall deficits were observed, reaching in some areas 50 to 60%. Hydrologic deficits were even greater, reaching in some areas 70% or 80%. As a result, dams' water reserves have declined significantly. Overall filling rate of dam reservoirs fell to 15% through the cycle of drought from 1980 to 1985, 25% in August 1993 and 23% in October 1995.
These water shortages have resulted in the disruption of drinking water supply especially in rural areas, large declines in agricultural output (reduction of 60% in agricultural GDP) and degradation of the quality of water resources.
The major lessons that can be drawn from the analysis of past experiences are that drought is a structural characteristic of Moroccan climate and the mitigation of its effects cannot be improvised, and drought affects heavily agriculture and drinking water in rural areas. Instead, it must embody in an integrated way national development strategies and management of water resources to avoid the implementation of exceptional measures that may require heavy and inefficient investments.
This is all the more true since the hydrological context is fragile given the aridity, the irregularity of the climate and the continued pressure on water resources by users, whose requests are increasingly confrontational.
A retrospective analysis of past management has shown the lack of preparedness to cope with shortages of water. In some cases, decisions to initiate the necessary steps to reduce the impact of drought were excessively delayed. (Authorities being forced to transport drinking water by tankers for Tangier city during the summer of 1995 marked the memories).
To avoid such improvisation, and to take upfront any management decisions based on target indicators, river basin agencies have begun to set up systems for monitoring the water situation and drought, through hydro-climatic indicators providing adequate information in order to declare drought levels and corresponding alerts in a timely manner. Each alert level should trigger upon the measures or action plans established in advance, developed in consultation as part of integrated plan for proactive drought management.
Recommended indicators for characterizing drought take into account its duration, frequency and intensity. They are grouped in two categories, namely climate indicators that are based on quan tification of precipitation deficits at different time scales, and hydrological indicators that are based on assessment of water supplies through indices of severity of the hydrologic and hydraulic drought.
To mitigate the effect of drought and to better manage this extreme event, the best practices are as follows:

- Move from reactive actions to the proactive management approach which is built on two pillars. The first one is focused on drought characterization through some hydro-climatic indicators (climatic, hydrologic, water storages, ...) in order to declare drought levels and corresponding alerts. The second pillar includes different measures or action plans to mitigate drought impact, established in advance and developed in consultation with all stakeholders;

- Integrate the drought in water resources planning process;

- Diversifying sources of water mobilization and interconnection of water supply systems by promoting systems less vulnerable to climate change :(Improve inter-annual regulation of river flows and promote desalination of seawater to secure drinking water supply in coastal cities);

- Integrate Water Management: Conjunctive use of both surface water and groundwater: Strategic role of groundwater during drought periods;
- Promote water demand management and improve efficiency of water use, such as structural adaptation measures to climate change;
- Promote the economic and financial measures: Insurance, natural disasters funds.

13 Transnational adaptation measures against floods and low-flows: The AMICE project on the Meuse river basin, Ms. Maité Fournier, Public Management of the Meuse and its Tributaries (EPAMA), France

Achievements

The presentation describes 5 water management measures that are implemented against both floods and low-flows and that require international cooperation:

Ecologically efficient

1. restoring wetlands in the Ardennes massif for their buffer effect on the water levels : analysis of discharge measurements and ecological surveys;

Flexible infrastructures

2. creation of multifunctional areas nearby cities that can be used for temporary water storages in case of extremely high waters: the examples of 's-Hertogenbosch and Steenbergen.

Positive spill-over effects

3. modification of the management rules of the Rur reservoirs system to guarantee water provision to all users (drinking water production, hydroelectricity, cooling water for industry, leisure) in the future decades;

Win-win measure

4. installation of fish-friendly pumps on the Albert canal to reduce water consumption on sluices and improve both navigation on the canal and discharges on the Meuse river during drought spells: the Lock of Ham;

No-regret measure

5. international flood crisis management exercises involving all levels of responsibilities to improve reaction to extreme situations: the Meusex / Hydrotest exercise of November 2011 that mobilized 300 participants over a week;

Difficulties

There are no true difficulties to be reported, but instead, all these measures had to integrate a large number of local and international interests, regulations and financial constraints.

Transboundary aspects

For each measure, the transnational context is given whether it is about sharing (too little or too much) water, defining priority sectors or sharing information. A Meuse treaty exists in case of extreme low-flows, which had to be taken into account when designing the measures.

The level of transnationality ranges from site visits to share practices, to international working groups meeting on a bimonthly basis.

Lessons learnt

The human factor is more limiting than climate change. In spite of the large uncertainties in the future projections, the technical solution to take into account climate change is quite easily found. But taking action can be jeopardized by private interests, financial profitability or lack of political involvement.

No climate-proofing measure can be designed only for climate adaptation, but it has to yield other advantages and be part of a larger sustainable development approach.

14 Introduction: Integrating different levels and sectors in the Danube, Mr. Raimund Mair, International Commission for the Protection of the Danube River (ICPDR)

The International Commission for the Protection of the Danube River (ICPDR) is a transnational body established by the Danube River Protection Convention, comprising as contracting parties 14 Danube countries and the European Union. The ICPDR is charged with coordinating the trans-boundary aspects for the implementation of the EU Water Framework Directive (WFD) as well as the European Floods Directive (EFD) in the Danube River Basin and is developing until the end of 2012 an Adaptation Strategy to Climate Change.

Climate change is causing impacts on different sectors on a transboundary scale. This requires to take adaptation steps on different levels (regional or within the borders of an international river basin, national and local) and by integrating different stakeholders and interest groups. The approach to address this need which is currently under discussion in the frame of the ICPDR is to take advantage and to make best use of existing structures and instruments for integrated water resource management in the Danube basin.

The implementation of the WFD and the EFD already requires the integration of different levels and sectors. The ICPDR for instance is coordinating the trans-boundary aspects for the implementation of the WFD and EFD on the basin-wide level (level A), whereas further detailed planning takes place on sub-basin or national level (level B) as well as in many cases on sub-unit level, defined as catchments within national territories (level C). Exchange and coordination between those different levels, in particular between the international basin-wide (A) and national or sub-basin level (B), takes place in the frame of the different Expert Groups and Task Groups, working on various topical fields (e.g. flood risk management, monitoring and assessment, pressures and measures, hydromorphology, etc.), where national representatives are having an exchange on issues relevant for the international basin-wide level.

Next to national experts, also representatives from different sectors and stakeholder groups (e.g. representatives from different industries and environmental groups) are participating in those discussions, allowing for the required exchange and integration between the different sectors. This is also facilitate by specific public participation requirements enshrined in the WFD and EFD. In addition, the ICPDR launched specific activities on issues of major relevance for the basin (e.g. navigation and hydropower), where targeted exchange is further facilitated.

By making best use of existing structures and instruments, the ICPDR is currently discussing the approach to take adaptation to climate change on board in the respective discussions of relevant Expert Groups and Task Groups (existing structures) towards the development of the next river basin and flood risk management plans (existing instruments), due by 2015, where adaptation to climate change should be fully integrated and updated according to the 6-years planning cycles as asked for in the WFD and EFD.

Finally, facilitation of exchange and specific input on climate adaptation activities (with specific sectors) also outside ICPDR core-activities, where necessary, appropriate and useful, is under discussion. Further details on the approach will be included in the ICPDR Strategy on the Adaptation to Climate Change, which is planned to be finalized by the end of 2012.

15 Addressing Risks and Uncertainty: the Role of Economic Instruments and Financing Mechanisms, Ms. Kathleen Dominique, Organisation for Economic Co-operation and Development (OECD)

The impacts of climate change on the water cycle are already evident and projected to increase substantially over time, with consequences for the quantity, quality and reliability of freshwater resources and the frequency of extreme events (*e.g.* floods and droughts)[5]. Even if more ambitious actions to mitigate climate change were taken today, a certain amount of climate change is already locked-in. While climate change is only one of many drivers shifting patterns of supply and demand for water resources and the risk of extreme events, its impact is projected to be significant and to accelerate over time. Climate change reinforces and adds urgency to the case for good water resources management more generally. It also increases climate risks and introduces a greater degree of uncertainty beyond what water managers have traditionally had to cope with. Manifestations of climate change impacts will be highly context specific and much uncertainty remains regarding the precise nature, magnitude and timing of these impacts. The OECD is currently undertaking work to provide guidance on how economic instruments and financing mechanisms can facilitate efficient adaptation (and avoid mal-adaptation) to climate change and risk management for water systems in the face of growing uncertainty.

Given the significant investment requirements for water systems to respond to a range of stressors – including climate risks at all time scales (current variability and future changes), a focus on the policy environment is particularly important to ensure investments are well-spent. Scaled-up funding for adaptation can also provide a window of opportunity to invest in developing the policy framework, which in turn can provide an enabling context for adaptation at project level. One source of scaled up funding for adaptation is bilateral aid to developing countries, which are often among the most vulnerable to climate change impacts. Recent figures from OECD indicate that in 2010, total bilateral climate change adaptation-related aid by members of OECD's Development Assistance Committee (DAC) was an estimated USD 9.3 billion. An estimated USD 1.8 billion of this amount was allocated to the water supply and sanitation sector.[6]

From an economic perspective, climate change poses several challenges for water policy and for investments in water infrastructures. In general terms, an efficient level of adaptation occurs only if the costs of making the effort are less than the resulting benefits. In the context of risk and uncertainty, decisions are informed by weighing *expected* costs and benefits – that is, the probability-weighted mean over the range of possible outcomes. In the case of climate change adaptation, the costs of actions are more likely to be known and incurred in the near term, while many of the benefits (avoided climate impacts) will accrue far into the future and will not be known with certainty. The pervasive uncertainty introduced by climate change poses challenges for investing in water infrastructures, which are typically lumpy, long-lived and irreversible and have long lead times. The timing of adaptation actions will also have an important impact on the overall costs and benefits of adaptation. Timing errors – either taking action too early (for example by over-investing in augmenting water supply prematurely) or taking action too late are likely in a situation of imperfect information and uncertainty. A risk-based approach can identify the principal risks that need to be addressed in the context of climate change adaptation and how they can be shared. It can also inform the selection and design of policy responses and help to ensure that responses are proportional to potential negative impacts and their likelihood.

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[5] Bates B, Kundzewicz Z, Wu S and Palutikof J (eds.) (2008), "Climate Change and Water", Technical Paper VI, Intergovernmental Panel on Climate Change (IPCC), Secretariat, Geneva.

[6] Full definitions and methodological notes on climate change markers are available at www.oecd.org/dac/stats/reioconventions. Further information on aid to water supply and sanitation can be found at www.oecd.org/dac/stats/water.

As much adaptation will take place in a decentralised manner within a broader socio-economic context, a key question for policymakers is how to facilitate timely and efficient adaptation and manage climate risks. Economic instruments (*e.g.* pricing, water markets, insurance schemes, tax incentives, payments for ecosystem services) and financing mechanisms (*e.g.* infrastructure banks, microfinance) can be employed as key elements within an appropriate policy mix in the context of a broader adaptation strategy. These instruments are particularly relevant in an adaptation context, given that they can provide flexibility in the context of changing conditions and uncertainty. Specifically, they can promote efficiency in water use and allocation; promote low-cost adaptation options; signal scarcity and optimal timing for new investments; provide incentives to reduce risk exposure; spread risk; and reduce financial constraints to taking timely adaptation actions and recovering from water-related disasters. In a transboundary context, economic instruments can signal the value of adaptation on both sides of the border, highlight the benefits of a co-ordinated approach to adaptation and help to share adaptation costs across boundaries.

16 The impacts and economic costs of river floods in the European Union and the costs and benefits of adaptation, Mr. Luc Feyen, European Commission, DG Joint Research Centre

This work has evaluated the implications of climate and socio-economic changes for future fluvial flood risk in Europe, as well as the costs of adaptation. The analysis used the LISFLOOD model and considered future climate and socio-economic changes under the SRES A1B emission scenario.

The Expected Annual Damage (EAD) in the baseline climate period (1961-1990 but with current socio-economic conditions) is estimated at around €5.5 billion in the EU27. The EAD for the A1B scenario is estimated at €20 billion by the 2020s (2011-2040), €46 billion by the 2050s (2041-2070) and €98 billion by the 2080s (2071-2100) (mean ensemble results, current values, undiscounted) in the EU27. However, a large part of this is due to socio-economic change (economic growth). The marginal effect of climate change is estimated at €9 billion/year by the 2020s, €19 billion/year by the 2050s and €50 billion/year by the 2080s. Analysis at the country level shows high climate-related costs in the UK, Ireland, Italy, the Netherlands and Belgium.

There is, however, a very wide range around these central (mean) estimates, representing the range of results from different climate models. The study considered 12 alternative climate outputs (GCM-RCM combinations). These reveal that the potential costs vary by a factor of two (higher or lower). These differences are even more significant at the country level, with some models even reporting differences in the effects of climate change (i.e. some models project relative reductions in future flood risk from climate change for some areas). This highlights the need to consider this variability (uncertainty) in formulating adaptation strategies.

The study also assessed the costs and benefits of adaptation. The benefits (i.e. the reduction in damages) of maintaining 1 in 100-year levels of flood protection across Europe in future time periods is estimated at €8 billion/year by the 2020s, €19 billion/year by the 2050s and €50 billion/year by the 2080s for the results (mean ensemble, EU27, climate and socio-economic change, current values, undiscounted). Based on information from detailed protection studies indicative costs of adaptation at the European scale have been derived. The costs to maintain minimum protection levels are estimated at €1.7 billion/year by the 2020s, €3.4 billion/year by the 2050s and €7.9 billion/year by the 2080s for the EU (mean ensemble, A1B, undiscounted). It should be noted that the costs of adaptation vary significantly with the level of future climate change, the level of acceptable risk protection and the framework of analysis (risks protection versus economic efficiency).

The socio-economic uncertainty and climate-model variability make a large difference to the actual adaptation response at a country level. The need to recognise and work with uncertainty – as part of integrated and sustainable policies – requires an iterative and flexible approach.

17 Economy-wide analysis of climate change impacts on the Sava River Basin countries, Ms. Sebnem Sahin, World Bank

The objective of the economic analysis is to measure the magnitude and distributional costs of climate change impacts and adaptation options under alternative water regime scenarios in the Sava River Basin (Albania, Bosnia and Herzegovina, Croatia, Macedonia, Serbia and Slovenia). The analysis proceeds along two tracks - one at the project level and one at the sector/economy-wide level.

Project level analysis

The project level analysis formulates best-practice guidance in benefit-cost analysis (BCA) of the World Bank water-related projects. This includes a sensitivity analysis following different climate scenarios and provides estimate bounds reflecting uncertainty in benefit and cost expectations, with and without adaptation options. The results identify particular areas within the design that are more, or less, resilient to climate-induced water variability and help identify the level of adaptation that may be necessary to offset these changes from an economic perspective. The analysis takes advantage of several water sector projects currently in the pipeline and at varying stages of development.[7]

Sector/economy-wide level analysis

The second track of the economic analysis focuses on the macro-level impacts of climate change through country and inter-regional computable general equilibrium analyses (CGE). 30 years continuous data for selected climate variables was collected. The methodology to determine the climate variability is based on a historic regression between climate variables and crop production (31 types). An incremental change is applied to the climate variables. The change to the climate variables is a steady change over the time period 2010-2030. The results from the trend analysis is introduced into the CGE model. Overall impact on SRB countries' GDP, consumption and agricultural productions seems to be negative over the next 20 years. Slovenia is one of the most severely affected economies due to an adverse impact on its trade balance. The link between the economy and resource use is quite strong for all SRB countries, thus as the adaptation to climate change will improve so will their economic welfare.

[7] Candidate projects include: (i) the **Sava Waterway Rehabilitation Project**, which aims to improve the navigability of the inland waterway, and could be impacted by climate change-induced changes in run-off and stream flow; (ii) the **Croatia and Bosnia Irrigation Development Projects**, which aim to increase the profitability and productivity of irrigated areas, and could be impacted by climate change-induced changes in precipitation, evapo-transpiration and resulting crop water demand; and (iii) the **Croatia Inland Waters Project**, which includes flood protection works and potable water supply, both of which are susceptible to the effects of climate change on water resources. Also, the activity complements a study recently initiated on the water-energy nexus in the Vrbas, one of the main tributaries to the Sava with significant hydropower potential, located in Bosnia and Herzegovina.

18 Making adaptation work: Reflection on the issues discussed during the workshop, Mr. John Matthews, Conservation International, Alliance for Global Water Adaptation

Water management faces special challenges in light of climate change, but significant progress is occurring as represented by this conference. Major points of progress and tension I noted during the two-day meeting include:

There is still an active discussion about how to make assessment processes feed decision-making processes. Vulnerability appears to have developed a relatively uniform technical framework and there is no longer a palpable desire to create a standard methodology for assessing vulnerability, but there are often struggles in the transition to relate vulnerability to the needs/viewpoints of water managers and decision makers.

Water has been viewed as a sector, but water is more often being viewed as a "connector" between sectors, institutions, governance systems, disciplines, and ecological and hydrological systems. Political boundaries are essentially a proxy for other types of barriers to water management. Viewing water as a connector can help us move beyond issues of the "tragedy of the commons."

Agreements about eco-hydrological conditions are a prerequisite for political and governance progress, but good data does not automatically result in effective political dialogue, much less workable political agreements.

Transboundary frameworks that are designed to be flexible in terms of allocation mechanisms are the most likely means of creating long-lasting frameworks as climate, economic, political, and demographic conditions change. There are a number of such frameworks developing globally, but they remain relatively rare. Inflexible agreements risk creating new "stationarities."

Discussions about the amount of finance necessary to enable good transboundary agreements are shifting into discussions about how that finance should be structured so as to enable the most effective management mechanisms and that can mainstream climate adaptation and water management practice together.