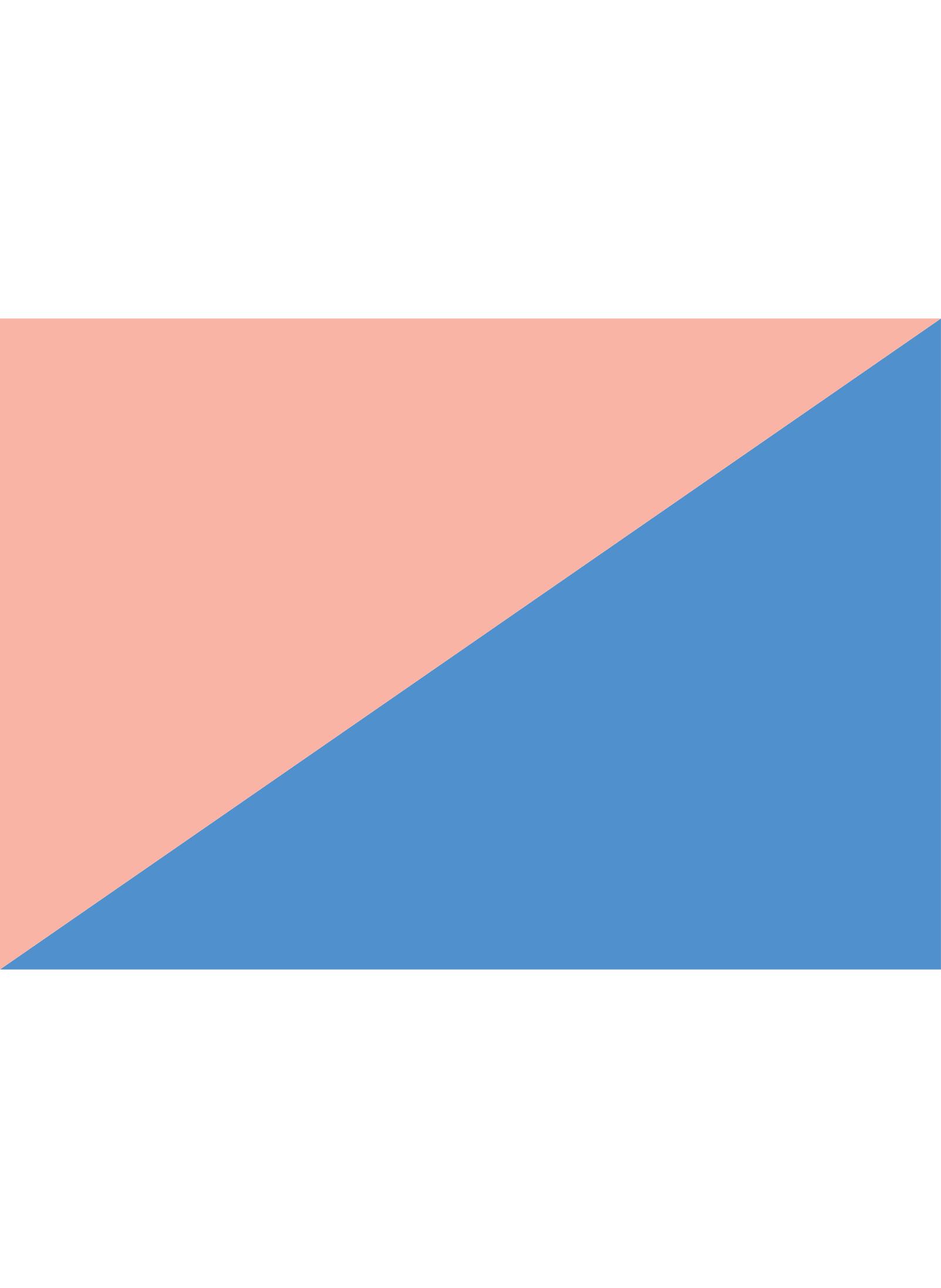


ADAPTATION ASSESSMENT, PLANNING AND PRACTICE:

**AN OVERVIEW FROM THE
NAIROBI WORK PROGRAMME
ON IMPACTS, VULNERABILITY
AND ADAPTATION
TO CLIMATE CHANGE**



UNFCCC

United Nations Framework Convention on Climate Change

ADAPTATION ASSESSMENT, PLANNING AND PRACTICE:

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TABLE OF CONTENTS

I. INTRODUCTION	11
II. THE POLICY CONTEXT	13
2.1. The need for adaptation	13
2.2. Types of adaptation	14
2.3. Adaptation frameworks	14
2.4. Adaptation under the UNFCCC and the Nairobi work programme	15
III. THE DATA AND INFORMATION BASE	19
3.1. Introduction	19
3.2. The information and data required for impact, vulnerability and adaptation assessment and planning	19
3.3. Initiatives to enhance the provision of data and information	19
3.3.1. Baseline climatic and non-climatic data	19
3.3.2. Climatic and non-climatic-scenarios	22
3.3.3. Local and traditional knowledge	27
3.4. Gaps and needs	27
3.4.1. Baseline climatic and non-climatic data	27
3.4.2. Scenario data	29
3.4.3. Local and traditional knowledge	30
3.5. Opportunities for further action	30
IV. THE ASSESSMENT PROCESS	35
4.1. Introduction	35
4.2. Current approaches to assessing impacts, vulnerabilities and adaptation	35
4.2.1. Methods and tools	36
4.2.2. Climate related risk assessment within the context of DRR	40
4.2.3. Sector-based assessments	40
4.2.4. Integrated assessments	42
4.2.5. Role of traditional knowledge	42
4.2.6. The NAPA process	43

TABLE OF CONTENTS

4.3.	Gaps and needs	43
4.3.1.	Integrated assessments	43
4.3.2.	Methods and tools	43
4.3.3.	Climate related risk assessment within the context of DRR	44
4.3.4.	Sector-based assessments	44
4.3.5.	Role of traditional knowledge	46
4.4.	Opportunities for further action	46
V.	PLANNING AND PRACTICE	51
5.1.	Introduction	51
5.2.	Current practices and lessons learned	51
5.2.1.	Decision making tools at different levels and in and across different sectors	52
5.2.2.	Climate related risk, risk management and DRR	53
5.2.3.	Integrating adaptation into development planning	58
5.3.	Gaps and needs	59
5.3.1.	Decision making at different levels and in and across different sectors	59
5.3.2.	Climate related risk, risk management and DRR	62
5.3.3.	Integrating adaptation into development planning	62
5.3.4.	Increasing economic resilience	62
5.4.	Opportunities for further action	63
5.5.	Adaptation planning and practice and sustainable development	68
VI.	KEY MESSAGES AND LOOKING FORWARD	71
VII.	REFERENCES	73

ACRONYMS AND ABBREVIATIONS

ACCC	Adapting to Climate Change in the Caribbean	CPACC	Caribbean Planning for Adaptation to Climate Change
ACCCA	Advancing Capacity to Support Climate Change Adaptation	CRAM	Canadian Regional Agricultural Model
AIACC	Assessment of Impacts and Adaptation to Climate Change	CRCM	Canadian Regional Climate Model
ALM	Adaptation Learning Mechanism	CREAS	Regional Climate Change Scenarios for South America
APF	Adaptation Policy Framework	CRISTAL	Community-based Risk Screening Tool – Adaptation and Livelihoods
ARISCC	Adaptation of Railway Infrastructure to Climate Change	CSAG	Climate Systems Analysis Group
AR4	IPCC Fourth Assessment Report	CSO	Civil Society Organizations
AR5	IPCC Fifth Assessment Report	DDC	IPCC data distribution centre
AWCI	Asian Water Cycle Initiative	DFID	United Kingdom Department for International Development
BCAS	Bangladesh Centre for Advanced Studies	DIVA	Dynamic Interactive Vulnerability Assessment model
CATHALAC	Water Centre for the Humid Tropics of Latin America and the Caribbean	DRR	Disaster risk reduction
CARICOM	Caribbean Community	D+O	Data and Observation
CBD	Convention on Biological Diversity	EBA	Ecosystems Based Approach
CBOs	Community-based organizations	EC	European Commission
CCAA	Climate Change Adaptation in Africa Research and Capacity Development Program	ECV	Essential climate variables
CCAIR	Climate Change Adaptation through Integrated Risk Reduction	EGTT	Expert group on technology transfer
cCASHh	climate Change and Adaptation Strategies for Human health	ENDA	Environmental Development Action in the Third World
CCCCC	Caribbean Community Climate Change Centre	EPIC	Environmental Policy Integrated Climate Model
CCIAV	Climate change impact, adaptation and vulnerability	EU	European Union
CEDRA	Climate Change and Environmental Degradation Risk and Adaptation assessment decision tool	FAO	Food and Agriculture Organization
CGE	Climate Change Explorer tool	FEWSNET	Famine Early Warning System
CGE	UNFCCC Consultative Group of Experts	GAW	WMO Global Atmosphere Watch
CGIAR	Consultative Group on International Agricultural Research	GCISC	Global Change Impact Studies Centre
CI:grasp	Climate Impacts: Global and Regional Adaptation Support Platform	GCM	General Circulation Model
CIESIN	Center for International Earth Science Information Network	GCOS	Global Climate Observing System
CIFOR	Centre for International Forestry Research	GDP	Gross Domestic Product
CLIMAG	Climate Protection and Agriculture Project	GEF	Global Environmental Facility
ClimDev Africa	Climate for Development in Africa programme	GEO	Global environment outlook
CO ₂	Carbon dioxide	GFCS	Global Framework for Climate Services
CoFCCA	Congo Basin Forests and Climate Change Adaptation project	GGCA	Gender and Climate Alliance
COP	Conference of the Parties	GHG	Greenhouse gases
		GIEWS	Global Information and Early Warning System
		GIS	Geographic information system
		GLCN	Global Land Cover Network tool
		GLIMS	Global Land Ice Measurements from Space
		GOOS	Global Ocean Observing System
		GOSIC	Global Observing Systems Information Center
		GRID-Arendal	A collaborating organization with UNEP

ACRONYMS AND ABBREVIATIONS

GRIP	Global Risk Identification Programme	MMS	Mauritius Meteorological Service
GTOS	Global Terrestrial Observing System	MNP	Netherlands Environmental Assessment Agency
HFA	Hyogo Framework for Action 2005 – 2015: Building the Resilience of Nations and Communities to Disasters	MRI-World Bank	Meteorological Research Institute World Bank partnership
IAD	Impacts, Adaptation and Vulnerability	NAPs	National action programmes to combat drought and desertification
ICPAC	Intergovernmental Authority on Development (IGAD) Climate Prediction and Applications Centre	NAPAs	National Adaptation Programmes of Action
ICSU	International Council for Science	NARCCAP	North American Regional Climate Change Assessment Programme
ICT	Information and Communication Technologies	NASA	National Aeronautics and Space Administration
ICTP	International Centre for Theoretical Physics	NCs	National Communications
IDS	Institute of Development Studies	NCSP	National Communications Support Programme
IEDM	International Environment and Disaster Management	NGOs	Non-governmental organizations
IGAD	Intergovernmental Authority on Development	NMHSS	National Meteorological and Hydrological Services
IGBP	International Geosphere-Biosphere Programme	NOAA	National Oceanic and Atmospheric Administration
IGES	Institute for Global Environmental Strategies	NWP	Nairobi Work Programme
IGOs	Intergovernmental organizations	ORA	Office of Agricultural Risk, Argentina
IIED	International Institute for Environment and Development	OSS	Sahara and Sahel Observatory
IISD	International Institute for Sustainable Development	PIACC	Ibero-American Programme on Adaptation to Climate Change
ILO	International Labour Organization	PI-GCOS	Pacific Island GCOS
INPE	National Institute for Space Research, Brazil	PIK	Potsdam Institute for Climate Impact Research
INSMET	Instituto de Meteorología de la República de Cuba	PRECIS	Providing Regional Climates for Impacts Studies
IPCC	Intergovernmental Panel on Climate Change	PRUDENCE	Prediction of Regional Scenarios and Uncertainties for Defining European Climate change risks and Effects tool
IRI	International Research Institute for Climate and Society	RCM	Regional Climate Model
ISDR	International Strategy for Disaster Reduction	RIOCC	The Ibero-American Network of Climate Change Offices (Red Iberoamericana de Oficinas de Cambio Climático)
ISSET	Institute for Social and Environmental Transition	RISA	Regional Integrated Science Assessment
ITUC	International Trade Union Confederation	SAGE	Centre for Sustainability and the Global Environment
IUCN	International Union for Conservation of Nature	SBI	Subsidiary body for implementation
IWMI	International Water Management Institute	SBSTA	Subsidiary Body for Scientific and Technological Advice
IWRM	Integrated water resources management	SEDAC	Socio-economic data and applications center
IUCN	International Union for Conservation of Nature	SEI	Stockholm Environment Institute
JACCO	Japanese Alliance for Climate Change Observation	SEI-US	U.S. Centre of the Stockholm Environment Centre
KMNI	The Royal Dutch Meteorological Institute	SERVIR	Regional Visualization & Monitoring System
LDCs	Least Developed Countries	SIDS	Small island developing States
LEG	Least Developed Countries Expert Group	SNCs	Second National Communications
LCA	Linking Climate Adaptation programme	SPACC	Special Programme for Adaptation to Climate Change
MACC	Mainstreaming Adaptation to Climate Change		
MACVAH/AREC	Models of Anomalies of Climate Variability and Change and their Impact on Human Health/Assessment of Epidemic Risk and Cost estimation		
MCA	Multi-criteria analysis		
MDGs	Millennium development goals		

ACRONYMS AND ABBREVIATIONS

SPREP	South Pacific Regional Environment Programme
SRES	IPCC Special Report on Emission Scenarios
STARDEX	Statistical and Regional dynamical Downscaling of Extremes for European regions
START	global System for Analysis, Research and Training
SUS	Satkhira Unnayan Sangstha
TEA-START	Temperate East Asia START Regional Center
TGICA	Task Group on Data and Scenario Support for Impact and Climate Analysis
TNAs	Technology Needs Assessments
TroFCCA	Tropical Forests and Climate Change Adaptation project
UCSIS	University Consortium of Small Island States
UK CIP	UK Climate Impacts Programme
UN	United Nations
UNAIDS	Joint United Nations Programme on HIV/AIDS
UNCCD	United Nations Convention to Combat Desertification
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNESCO/IOC	Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific and Cultural Organization
UN/ISDR	United Nations International Strategy for Disaster Reduction
UNHCR	United Nations High Commissioner for Refugees
UNITAR	United Nations Institute For Training and Research
UNSD	United Nations Statistics Division
UNU	United Nations University
USAID	United States Agency for International Development
VAM	Vulnerability Analysis and Mapping branch of the World Food Programme
VARG	Vulnerability and Adaptation Resource Group
WCDMP	WMO Climate Data and Monitoring Project
WCRP	World Climate Research Programme
WFP	World Food Programme
WHO	World Health Organization
WHOSIS	World Health Organization Statistical Information System
WIS	WMO Information System
WMO	World Meteorological Organization
WRI	World Resources Institute
WSAG	Water Systems Analysis Group
WWW	WMO World Weather Watch





I. INTRODUCTION

Given the past and present trends in global greenhouse gas (GHG) emissions as well as the considerable inertia within the socio-economic and biophysical systems, adaptation is required in the short and longer term to address impacts resulting from the warming that would occur even if the most stringent GHG mitigation efforts are undertaken. The latest assessment report of the Intergovernmental Panel on Climate Change (IPCC) concluded that even if the concentrations of all GHGs and aerosols had been kept constant at year 2000 levels, a further warming of about 0.1°C per decade would be expected over the next two decades.¹ Recognizing and in many cases experiencing first-hand the adverse impacts of climate change on the natural environment and human society, policy makers, business leaders and civil society have now attached greater significance to the adaptation agenda. Adaptation, along with mitigation, technology and finance, is an essential pillar of international discussions on a future climate regime under the United Nations Framework Convention on Climate Change (UNFCCC).

To enhance knowledge sharing and learning, and to catalyze actions on adaptation, the Subsidiary Body for Scientific and Technological Advice to the UNFCCC (SBSTA) launched a 5-year programme, the Nairobi work programme on impacts, vulnerability and adaptation to climate Change (the Nairobi work programme) in 2005. The objective of the Nairobi work programme (NWP) is to assist all Parties, in particular developing countries, including the least developed countries and small island developing States, to improve their understanding and assessment of impacts, vulnerability and adaptation, and to make informed decisions on practical adaptation actions and measures to respond to climate change on a sound scientific, technical and socio-economic basis, taking into account current and future climate change and variability.²

In accordance with relevant mandates, and under the guidance of the Chair of the SBSTA, a wide range of activities have been carried out under the NWP. These include, amongst others, organization of technical workshops, expert meetings, informal meetings of representatives from Parties and organizations, and focal point forums; submission of views and information; preparation of technical papers, reports, and other documents; and development and dissemination of information and knowledge products. A summary report on progress made during the first phase of the NWP (up to

June 2008) was considered by the SBSTA in December 2008. A summary report on progress made during the second phase of the Nairobi work programme will be made available for the consideration of the SBSTA at its 33rd session in December 2010. To date,³ the NWP has engaged over 170 partner organisations, issued 9 Calls for Action, and catalyzed 90 action pledges from 40 organisations. A large number of publications have also been developed to disseminate the information and knowledge generated through the implementation of the NWP.

Drawing on the work carried out under the NWP since its inception, this publication outlines the provision of data, information, methods and tools for climate risk assessments and adaptation decision making; summarizes a wide range of ongoing adaptation activities and case studies; and highlights good practices, gaps and needs, and opportunities to address these gaps. This is the second publication in a series produced by the UNFCCC secretariat, continuing the development of user-friendly outputs as requested by the SBSTA.⁴ This publication complements the first publication “Climate Change: Impacts, vulnerabilities and adaptation in developing countries” (UNFCCC 2007a).⁵

CHAPTER II sets out the basic concepts and policy context of adaptation. **CHAPTER III** discusses the provision of data and information to support policy relevant assessment and decision making for adaptation. **CHAPTER IV** explores how climate change impacts, vulnerability and adaptation assessments may be carried out. **CHAPTER V** details the range of adaptation plans and practices catalyzed by and/or reported to the NWP in and across all sectors and at different levels. Finally, **CHAPTER VI** concludes the publication with a set of key messages and opportunities to further enhance the support for adaptation actions through, inter alia, coordinated knowledge management and collaboration among different groups of adaptation stakeholders.

Lessons learned and good practices, gaps and needs, and opportunities identified in this publication can be used to support the implementation of adaptation action as part of an enhanced future adaptation response.

¹ PCC, 2007, Climate Change 2007: synthesis report (Summary for policy makers – <http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr_spm.pdf>).

² FCCC/CP/2005/5/Add.1.

³ As of March 2010.

⁴ <<http://unfccc.int/resource/docs/2008/sbsta/eng/06.pdf>>.

⁵ <<http://unfccc.int/resource/docs/publications/impacts.pdf>>.



II. THE POLICY CONTEXT

2.1 THE NEED FOR ADAPTATION

Assessing, planning and implementing adaptation actions is a necessity for all countries, particularly developing countries and especially least developed countries (LDCs), small developing States (SIDS), and countries in Africa suffering from drought and floods. Adaptation is needed to combat the impacts of climate change that are happening now; to increase resilience to future impacts for vulnerable populations, sectors, communities and ecosystems; and to enable climate-resilient development.

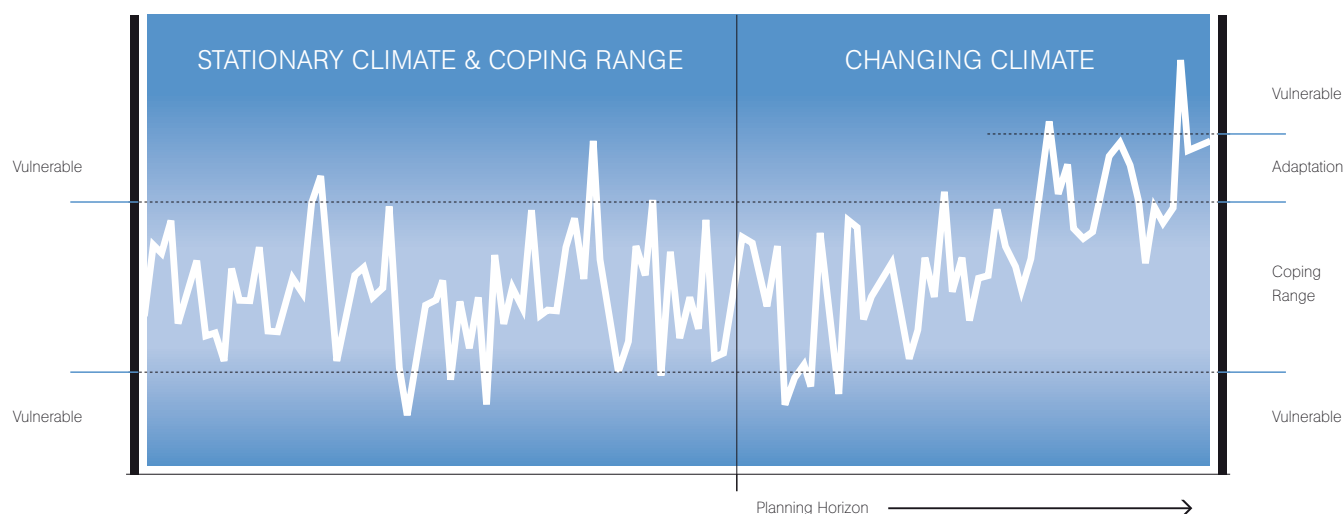
Adaptation enables an increase in the coping range through modification of the critical threshold, and thus helps limit vulnerability to climate change impacts (FIGURE II-1).

Climate change impacts on all aspects of sustainable development, and has the potential to push developing countries back into the poverty trap through undoing many achievements that have been made to date with regard to sustainable development, including towards achieving the Millennium Development Goals (MDGs).⁶ Future vulnerability depends not only on climate change but also on development pathways.

The equity dimensions of adaptation are an important part of international climate change discussions. Developing countries are the most vulnerable to climate change; they are often hardest hit by its impacts; and are least able to adapt as they have the least range of resources to cope – economically, socially and technologically.

⁶ <<http://www.un.org/millenniumgoals/>>.

Figure II-1. Conceptual illustration of a coping range showing that climate change increases the vulnerability of a system, and adaptation action can establish a new critical threshold and thus help reduce vulnerability



Source: CARTER TR, JONES RN, LU X, BHADWAL S, CONDE C, MEARNES LO, O'NEILL BC, ROUNSEVELL MDA AND ZUREK MB. 2007. New Assessment Methods and the Characterisation of Future Conditions. *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. PARRY ML, CANZIANI OF, PALUTIKOF JP, VAN DER LINDEN PJ AND HANSON CE (EDS). Cambridge University Press. Cambridge, UK. pp. 133 – 171.

2.2 TYPES OF ADAPTATION

The IPCC (Adger *et al.* 2007) defines adaptation to climate change as an adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.

Adaptation can be planned or autonomous. Planned adaptation is implemented before the impacts of climate change are observed. This type of adaptation can respond to specific projected impacts of climate change. Autonomous adaptation does not constitute a deliberate response to climatic stimuli but is triggered by ecological changes in natural systems and by market or welfare changes in human systems. This type of adaptation often occurs at the community and local level. Action and policies by governments, international organizations and other stakeholders can often influence the autonomous adaptation action undertaken directly, for example by increasing the resources available on the ground, or indirectly through measures that shape the incentives, knowledge sharing and capacity available for autonomous adaptation.

Adaptation has also been characterised recently in the UNFCCC technical paper on investment and financial flows to address climate change (UNFCCC 2008a) into three broad categories:

- (1) Actions that climate-proof socio-economic activities by integrating future climate risk;
- (2) Actions that expand the adaptive capacity of socio-economic activities to deal with future and not only current climate risks;
- (3) Actions that are purely aimed at adapting to impacts of climate change and would not otherwise have been initiated.

Examples of adaptation options could include:

- Behaviour change at the individual level, such as the sparing use of water in times of drought;
- Technological options such as increased sea defenses or flood-proof houses;
- Early warning systems for extreme events;
- Improved risk management including insurance; and
- Biodiversity conservation to reduce the impacts of climate change on people, e.g. by conserving and restoring mangroves to protect people from storms.

2.3 ADAPTATION FRAMEWORKS

Adaptation policy frameworks provide a way to assist decision making on adaptation. A number of frameworks have been developed and designed at different levels for decision makers including, communities, development agencies, and local and national governments (Carter *et al.* 2007, Lu 2009).

Frameworks combine various approaches, including top-down and bottom-up, and one or a number of methods and tools. Although there are differences in the way that risks and impacts from climate change are framed in different policy frameworks, they share three main components to assist decision making:

- (1) Initial risk screening – to evaluate the potential impacts of climate change on a system, activity or sensitive sector (such as coastline, crop, community health project, water resource, etc.) and determine whether further analysis is needed. This entails a brief, often qualitative, analysis.
- (2) Detailed risk analysis – if the initial screening shows that a system is vulnerable, then detailed quantitative analysis can identify the risks to inform whether adaptation is needed and under what circumstances.
- (3) Assessing risk management options – a wide variety of tools and techniques, including costing, can help evaluate and prioritize management options and the types of intervention required as well as the temporal and geographical scale of the intervention.

2.4 ADAPTATION UNDER THE UNFCCC AND THE NAIROBI WORK PROGRAMME

The UNFCCC provides the international framework for concerted action on climate change. The Convention commits all Parties to make provisions that enable adaptation, particularly for the most vulnerable developing countries. Parties are required to formulate, implement, publish and update adaptation measures and to cooperate on adaptation. The Convention recognizes the need for a variety of support mechanisms for adaptation implementation, including measures on:

- The provision of funding;
- Insurance and technology transfer; and
- Scientific and technical assistance for all Parties to enhance their knowledge base.

Parties have presented a list of possible adaptation options in their national communications but few have not evaluated, prioritized and/or costed them, although some Parties used statistical methods and screening matrices to assess selected options (UNFCCC, 2005a). The most vulnerable sectors highlighted include: agriculture and food security, water resources, coastal zones and marine ecosystems, terrestrial ecosystems (forests, rangelands, etc.), human health and human settlements, fisheries, and others such as infrastructure, tourism and energy (see Table V-5, UNFCCC 2007a for a list of adaptation measures identified).

Most LDCs have produced National Adaptation Programmes of Action (NAPAs), which identify prioritized adaptation projects that address their most urgent and immediate needs. These projects should be carried out urgently as further delay could increase vulnerability and/or lead to increased costs in the future. NAPAs are developed by multidisciplinary teams, and draw on existing information and community-level input. As of April 2010, 44 LDCs have submitted their NAPAs to the UNFCCC secretariat detailing 439 projects. The total aggregate cost of these projects is USD 1.7 billion.⁷

As part of their technology needs assessments (TNAs),⁸ Parties identify a set of country-driven activities that respond to their technology needs for adaptation. The United Nations Development Programme (UNDP) and the UNFCCC secretariat have jointly developed the Handbook for Conducting Technology Needs Assessment for Climate Change.⁹ The Expert Group on Technology Transfer (EGTT) has produced a guidebook to assist Parties to prepare technology transfer projects for financing, which provides assistance to project developers in developing countries in converting ideas and concepts into proposals (UNFCCC 2006a). Technologies for Adaptation to Climate Change (UNFCCC 2006b) describes soft and hard as well as combined approaches that are used to adapt to climate change. In a recent paper by the EGTT, the technologies that have been included in both NAPAs and TNAs were identified in the following sectors (UNFCCC 2009a): coastal zones, energy, health, early warning and forecasting, infrastructure, terrestrial ecosystems, water resources, agriculture, livestock and fisheries. Four categories of technologies were identified: traditional and indigenous technologies, modern technologies, high technologies and future technologies. The paper also highlighted the importance of effective policies to enable technology transfer, as the speed at which appropriate adaptation technology is developed, deployed and diffused depends on the effectiveness of policies to stimulate adoption of a technology and the success of the innovation effort, as well as conducting the appropriate research.

The NWP is a five year work programme, established in order to assist all Parties, in particular developing countries including LDCs and SIDS to:

- Improve their understanding and assessment of impacts, vulnerability and adaptation to climate change;
- Make informed decisions on practical adaptation actions and measures to respond to climate change on a sound scientific, technical and socio-economic basis, taking into account current and future climate change and variability.

⁷ <<http://unfccc.int/4583.php>>.

⁸ <<http://unfccc.int/ttclear/jsp/CountryReports.jsp>>.

⁹ <<http://unfccc.int/ttclear/pdf/TNA%20Handbook%20-%20Advance%20Document%20June09.pdf>>.

The NWP identifies nine work areas to enable practical consideration of current and planned work, gaps and needs and potential action:

- (1) Methods and tools;
- (2) Data and observations;
- (3) Climate modelling, scenarios and downscaling;
- (4) Climate related risks and extreme events;
- (5) Socio-economic information;
- (6) Adaptation planning and practices;
- (7) Research;
- (8) Technologies for adaptation;
- (9) Economic diversification.

To facilitate knowledge sharing and learning, and catalyzing actions, the NWP is matching the identification of demand for adaptation activities with the supply of adaptation resources (FIGURE II-2). On the demand side, current practice, gaps and needs are identified at workshops and expert meetings as well as via the views of Parties through their submissions to the UNFCCC secretariat. Actions required to address gaps and needs are highlighted by the NWP through Calls for Actions,¹⁰ which are often produced as an output from expert meetings and workshops. On the supply side, NWP

partners, including Non-governmental organizations (NGOs), intergovernmental organizations (IGOs), community-based organizations (CBOs), the private sector, institutes and regional centres, provide information on their adaptation activities. Partners highlight actions that are being carried out and pledge further adaptation action in line with the goals and objectives of the NWP as well as in response to Calls for Action.

To support this work, the NWP provides a mechanism for facilitating mutual learning, collaboration and knowledge sharing on adaptation under the Convention. The NWP also draws on information mandated under other UNFCCC processes. For example, National communications,¹¹ NAPAs,¹² TNAs¹³ all provide details of adaptation needs and planning at various levels. The NWP is also mandated to consider the information provided in the IPCC's Fourth Assessment Report (AR4, IPCC 2007).

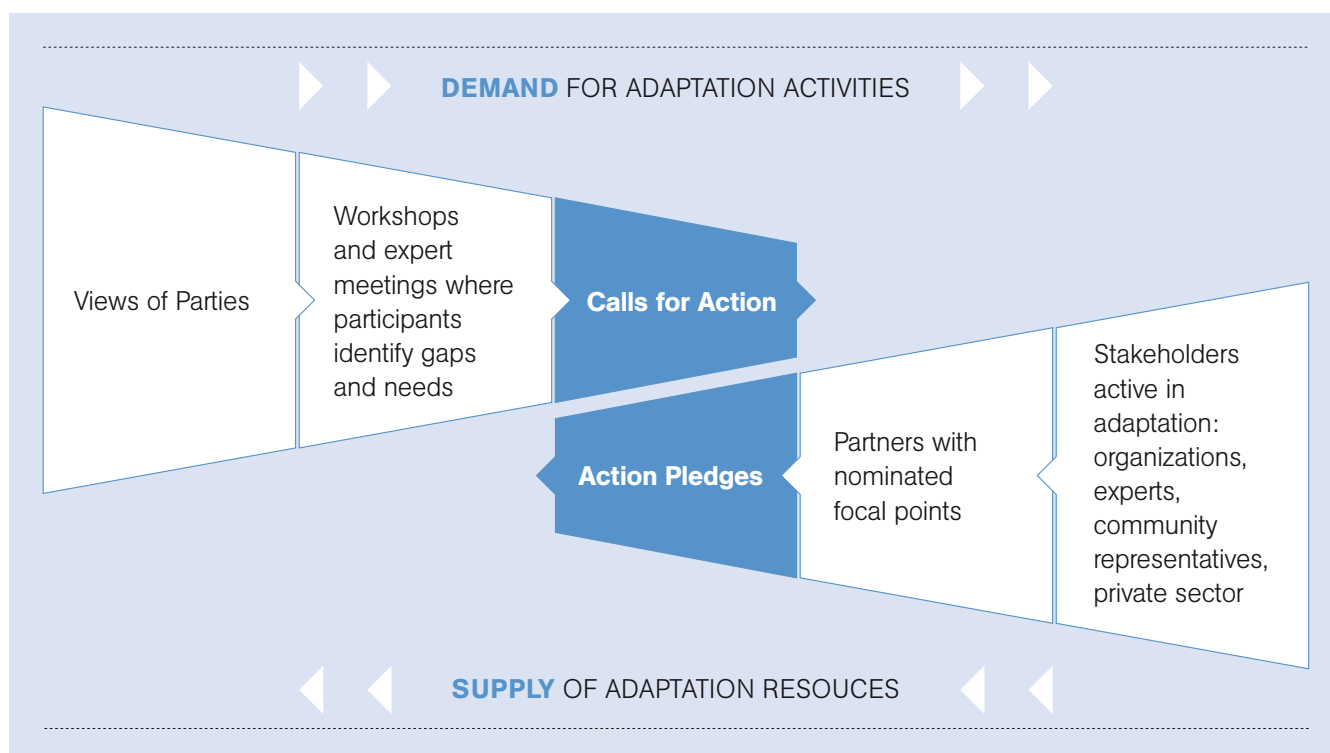
¹⁰ <<http://unfccc.int/4430.php>>.

¹¹ <<http://unfccc.int/1408.php>>.

¹² <<http://unfccc.int/4585.php>>.

¹³ <<http://unfccc.int/ttclear/jsp/TNAREports.jsp>>.

Figure II-2. Modalities of implementation of the NWP







III. THE DATA AND INFORMATION BASE

3.1. INTRODUCTION

In order to implement effective adaptation policies, plans and programmes, climatic and non-climatic information and data is required, in and across sectors at local, regional, national and global scales, supported by local knowledge and experience. The information base for adaptation not only includes past and current data and information, but also characterizations of future climatic environmental and socio-economic conditions, including scenarios.

This chapter explains the data and information needs for impact, vulnerability and adaptation assessment and adaptation planning. Through meetings, workshops, expert input and submissions under the NWP work areas, information and data has been provided by a wide range of organizations.

SECTION 3.2 describes the data and information required – both climatic and non-climatic.

SECTION 3.3 describes initiatives to enhance the provision of data and information.

SECTION 3.4 discusses the gaps and needs in the adaptation information base.

SECTION 3.5 discusses the opportunities, including knowledge sharing and capacity-building, for action in order to improve the information base for assessing, planning and implementing adaptation.

3.2. THE INFORMATION AND DATA REQUIRED FOR IMPACT, VULNERABILITY AND ADAPTATION ASSESSMENT AND PLANNING

Policy relevant impact and vulnerability assessment and effective adaptation planning requires a large range of data and information such as: climatic data, including systematic observations of temperature, precipitation, weather patterns and hazards; non-climatic data, including environmental, socio-economic and technical information and historic, local and traditional knowledge.

The IPCC provides comprehensive assessment reports of scientific, technical and socio-economic information relevant for the understanding of human-induced climate change, potential impacts of climate change and options for mitigation and adaptation. Four assessment reports have been completed in 1990, 1995, 2001 and 2007.

The latest assessment report AR4 (IPCC 2007) provides a comprehensive assessment of the climatic data and information for evaluating impacts of and vulnerability and adaptation to climate change in different sectors and regions.

3.3. INITIATIVES TO ENHANCE THE PROVISION OF DATA AND INFORMATION

3.3.1. BASELINE CLIMATIC AND NON-CLIMATIC DATA

BASELINE CLIMATE DATA

Continued accumulation of basic climate data and observations is essential to understand past and current climate variability and change, and to test, verify and improve global and regional models. Improving observation and management of climate data will improve projections of future climate and help develop effective adaptation strategies.

The global network of National Meteorological and Hydrological Services (NMHSs) of World Meteorological Organization (WMO) Member countries,¹⁴ and other national bodies concerned with monitoring the weather and climate, are able to provide local and national climate and weather information and forecasts. They provide regional climate information, knowledge of climate thresholds and extremes, local expertise, and exchange of data and knowledge that are all essential elements of understanding current climate variability and predicting future variability and change.

¹⁴ <http://www.wmo.int/pages/members/members_en.html>.

The WMO, with input from its NMHSs, 40 Regional Specialized Meteorological Centres and three World Meteorological Centres, implements a comprehensive integrating framework for all aspects of international climate related programmes, including data collection and climate system research, and provides a platform for obtaining the climate data needed for climate change detection and assessment of climate change impacts on vulnerable sectors, research, policy information and national economic development.¹⁵

The Global Climate Observing System¹⁶ (GCOS) is co-sponsored by WMO, the Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific and Cultural Organization (UNESCO/IOC), the United Nations Environment Programme (UNEP) and the International Council for Science (ICSU). The GCOS does not directly make observations – it is an internationally organized and climate-focused system of systems and networks through which all the global observing systems of WMO and its UN and non-UN system partners cooperate to meet all national and international needs for climate observations. Information on relevant work by GCOS on adaptation can be found in the paper “The role of observations in support of adaptation”, submitted under the NWP by GCOS in cooperation with the World Climate Research Programme (WCRP) and WMO (UNFCCC 2007f).

The Implementation Plan for the GCOS Observing System for Climate in Support of the UNFCCC (WMO 2004), the development of which was mandated at the ninth session of the Conference of the Parties, will enable member States to:

- Characterize the state of the global climate system and its variability;
- Monitor the forcing of the climate system, including both natural and anthropogenic forcing;
- Support the attribution of the causes of climate change;
- Support the prediction of global climate change;
- Enable projection of global climate change information down to regional and local scales.

The GCOS Regional workshop programme from 2000 to 2006, mandated by the UNFCCC COP, identified ten regional action plans for the Pacific Islands, Eastern and Southern Africa, Central America and the Caribbean, East and Southeast Asia, Western and Central Africa, South America, Central Asia, South and Southwest Asia, Eastern and Central Europe, and the Mediterranean Basin.¹⁷

There have been several actions to date to implement some of the recommendations in the GCOS regional plans (Box III-1).

Other initiatives include, at the National level, Japan’s Earth Observation System Promotion Program, launched in 2005 by the Ministry of Education, Culture, Sports, Science and Technology. The programme is improving the scientific understanding of global environment change including climate, and intends to promote research and development for the formation of the international observation network filling observation gaps in Asia-Pacific region as a high priority (UNFCCC 2007f).

Many major impacts of climate change will be a result of the increasing intensity and frequency of extreme climatic events, including tropical storms, sea surges, heavy rainfall, floods and droughts. A large body of data and information on climate related risks already exists in the disaster risk reduction (DRR) community, including from the secretariat of the United Nations International Strategy for Disaster Reduction (UN/ISDR) (UNFCCC 2007l), the UN/ISDR Prevention Web,¹⁸ the ProVention Consortium,¹⁹ and the Water Centre for the Humid Tropics of Latin America and the Caribbean (CATHALAC).²⁰

In Meso-America the Regional Visualization & Monitoring System (SERVIR),²¹ maintained by CATHALAC with support from NASA and USAID, is a free, open-access platform that provides Satellite and Other Geospatial Datasets, Interactive Online Maps, Thematic Decision Support Tools and 3D Interactive Visualizations, and integrates satellite and other geospatial data for improved scientific knowledge and decision making by managers, researchers, students, and the general public (see CATHALAC’s Action Pledge under the NWP). A SERVIR Hub to serve Africa is also currently being developed, supported by the US Agency for International Development (USAID). The hub will be based in Nairobi at the Regional Center for Mapping Resources for Sustainable Development.²²

The International Water Management Institute, part of the Consultative Group on International Agricultural Research (CGIAR) provides information on climate and moisture availability for agriculture through its World Water and Climate Atlas,²³ as outlined in its submission under the NWP.²⁴ This Atlas is of direct relevance to climate change researchers, planners and others carrying out adaptation activities.

The main resources for climate data identified under the NWP are provided in Box III-2.

Box III-1.

Examples of projects to assist in the implementation of the GCOS regional plans²⁵

- The **Climate for Development in Africa programme** (ClimDev Africa) evolved from the three regional action plans that were developed for subregions of Africa. It aims to improve the availability and use of quality climate information and services addressing needs of local, national and regional scale decision makers, in support of sustainable development and achievement of the MDGs, in critical climate-sensitive sectors and areas in Africa.
- The joint GCOS-WCRP-WMO-ICPAC project on **climate observations and regional modelling** in support of climate risk management and sustainable development, which is underway for the East African region with the support of the World Bank, aims to enhance regional capacity in the use of data and model projections, including the understanding of limitations, for adaptation planning. This project follows the submission of action pledge by the GCOS (in cooperation with the WCRP and WMO) under the NWP.
- In South America and the Caribbean, the **Ibero-American Programme on Adaptation to Climate Change** (PIACC), set up by the Ibero-American Network of Climate Change Offices (Red Iberoamericana de Oficinas de Cambio Climático, RIOCC) with financial support from Spain, is developing an implementation strategy for the South American plan in collaboration with GCOS (submitted as part of the RIOCC action pledge).
- The **Mainstreaming Adaptation to Climate Change** (MACC) project, executed by the Caribbean Community (CARICOM) Secretariat located in Georgetown, Guyana, enables collaboration with other countries in the region and international partners, covering, for example, installation of stations, the use and interpretation of models and downscaling and vulnerability assessments; and a workshop in January 2008²⁶ to promote implementation of the GCOS regional action plan in the region. Data and observations requirements for the region mainly concern data rescue, recovery and management. Opportunities involve, for example, the strengthening of regional and subregional data centres and Climate Outlook Fora.
- WMO is assisting **SIDS** in all regions to access the GCOS²⁷ network. For example, the Pacific Island GCOS (PI-GCOS) is intended to be a long-term, user-driven operational system capable of providing comprehensive observations required for monitoring the climate system, for detecting and attributing climate change, for assessing the impacts of climate variability and change, and for supporting research towards improved understanding, modelling and prediction of the climate system in the Pacific region. The Implementation Plan for the PI-GCOS includes research projects on assessment methodologies and tools. It is recognized that research on local level modification of technologies is needed. This would allow practitioners in different sectors to use technologies to plan for and implement adaptation in their communities.

BASELINE NON-CLIMATE DATA

Socio-economic information is a crucial part of any assessment of vulnerabilities and adaptive capacities of different economic sectors and communities.

In the context of impact and vulnerability assessments and adaptation planning, the demand for socio-economic information is wide-ranging, and is required at all levels and in and across all sectors. It includes data and information on demography, economics, natural resource use, health, employment, culture and governance (also see UNFCCC 2008c and UNDP 2007). The use of socio-economic data in adaptation assessments is at an early stage and is often lacking, or not always in a form that is useful for effective decision making.

¹⁵ <http://www.wmo.int/pages/summary/progs_struct_en.html>.

¹⁶ <<http://www.wmo.int/pages/prog/gcos/index.php>>.

¹⁷ <<http://www.wmo.ch/pages/prog/gcos/index.php?name=rwp>>.

¹⁸ <<http://www.preventionweb.net>>.

¹⁹ <<http://www.proventionconsortium.org>>.

²⁰ <<http://www.cathalac.org>>.

²¹ <<http://www.servir.net>>.

²² <http://unfccc.int/files/adaptation/sbsta_agenda_item_adaptation/application/pdf/us_access_to_info.pdf>.

²³ <<http://www.iwmi.cgiar.org/WAtlas>>.

²⁴ <http://unfccc.int/files/adaptation/sbsta_agenda_item_adaptation/application/pdf/iwmi_cc.pdf>.

²⁵ For more information, see <<http://wmo.int/pages/prog/gcos/index.php?name>AboutGCOS>>.

²⁶ <<http://www.wmo.ch/pages/prog/gcos/Publications/gcos-119.pdf>>.

²⁷ <<http://pi-gcos.org>>.

Box III-2. Examples of resources for climate data identified under the NWP

- **IPCC data distribution centre**²⁸ – provides climate, socio-economic and environmental data, both from the past and also in scenarios projected into the future. Technical guidelines on the selection and use of different types of data and scenarios in research and assessment are also provided.
- **Climate Systems Analysis Group (CSAG) Data Portal**²⁹ – provides downscaled global climate model projections of a number of climate variables. Both station data and gridded data is available depending on the region of interest.
- **Global Observing Systems Information Center (GOSIC)**³⁰ – provides a one-stop access to data and information identified by GCOS, GOOS and GTOS and their partner programs, such as the Global Atmosphere Watch.
- **NASA Global change master directory**³¹ – includes a large range of data sets on climate and on various sectors as well as a list of data set providers.
- **National Oceanic and Atmospheric Administration (NOAA) World Data Center System**³² – consists of a number of data centres providing access to solar, geophysical and related environmental data through assembling, scrutinizing, organizing and disseminating data and information.
- **WMO resources**, including climate system monitoring – global and regional climate³³ and other resources from the WMO scientific and technical programmes.³⁴
- **World Bank Climate change data portal**³⁵ – provides quick and readily accessible climate and climate related data to policy makers and development practitioners. The site also includes a mapping visualization tool (webGIS) that displays key climate variables and climate related data.

Demographic and economic data are often most readily available in most countries. However there is little qualitative or quantitative data available on such variables as governance, cultural values, indigenous knowledge, community dynamics and gender considerations.

Sources of socio-economic data were provided in submissions to the NWP (UNFCCC 2007n, 2007o, 2007p) and at the workshop on socio-economic information (UNFCCC 2008h),³⁶ including census, surveys, national accounts, informants (including communities and labour associations), traditional knowledge systems and local ecological knowledge and environmental monitoring programmes (TABLE III-1).

3.3.2. CLIMATIC AND NON-CLIMATIC SCENARIOS

Scenarios are commonly required in climate change impact, vulnerability and adaptation assessments. Based on inputs of, for example, forecasts relating to population, economy, technology, energy use, land use, agriculture and different trajectories of development, scenarios provide potential alternatives to how humankind's future may look. There are different categories of scenarios, including socio-economic scenarios, emissions scenarios, sea level rise scenarios and integrated scenarios (Carter *et al.* 2001).³⁷ They are important in providing a basis for modelling, assessing impacts and considering different adaptation strategies.

New Scenarios are under development for use in the preparation of the IPCC Fifth Assessment Report (AR5).

The scenarios from the Special Report on Emissions Scenarios (SRES) are the main socio-economic, emissions scenarios used to define climate and sea level scenarios at global and continental levels.

Climate models are used to describe and simulate processes of the climate system. Developments in climate modelling and understanding of the physical processes of the climate system over the years have led to a considerable increase in confidence in projecting future climate change on continental and larger scales (see Working Group I report of the AR4, IPCC 2007). General Circulation Models (GCMs) provide broad global projections and are the most complex and comprehensive computer models developed to date. Their grid cell horizontal resolution is typically 100 – 200 km and the cells are divided vertically into several levels covering the atmosphere and the ocean. The resolution of climate models is determined to a large extent by the limits of available computing power. As supercomputers become more powerful, this will enable the increase in resolution of GCMs.

For effective adaptation planning, more detailed information can be obtained from regional climate models (RCMs), statistical downscaling, weather typing and other downscaling techniques or approaches.

RCMs are important for providing climate scenarios that are more appropriate for national and sub-national level assessments. Some widely reported RCMs under the NWP include:

- Eta/CPTEC (Modelo Eta, Centro de Previsão de Tempo e Estudos Climáticos, Brazil),³⁸ based on the coupled global climate model of the Met Office Hadley Centre of the United Kingdom of Great Britain and Northern Ireland (HadCM3) and of the Max Planck Institute for Meteorology (ECHAM4), which enables vulnerability assessments in key sectors for watersheds, provinces or regions in South and Central America and the Caribbean, at a resolution of 40 km.
- PRECIS (Providing Regional Climates for Impacts Studies),³⁹ a dynamic model for generating high-resolution regional scenarios of future climate anywhere in the globe (See Box III-3).
- Earth Simulator,⁴⁰ a supercomputer that computes outputs at a resolution of 20 km to allow projections such as extreme weather events (e.g. tropical cyclones and heat waves) and diurnal precipitation change.
- CRCM (Canadian Regional Climate Model),⁴¹ a dynamic model, being refined by Ouranus to help determine the nature of potential climate changes at an appropriate scale in the various regions of Quebec as well as project vulnerabilities in the region and the province as a whole.
- The Royal Dutch Meteorological Institute (KMNI) uses the dynamic regional RACMO model for different regions (Western Europe, West Africa, Greenland and Antarctica).

²⁸ <<http://www.ipcc-data.org>>.

²⁹ <<http://data.csag.uct.ac.za>>.

³⁰ <<http://gosic.org>>.

³¹ <<http://gcmd.nasa.gov/index.html>>.

³² <<http://www.ngdc.noaa.gov/wdc>>.

³³ <http://www.wmo.int/pages/prog/wcp/wcdmp/csm/global_en.html>.

³⁴ <http://www.wmo.int/pages/summary/progs_struct_en.html>.

³⁵ <<http://sdwebx.worldbank.org/climateportal>>.

³⁶ <<http://unfccc.int/4265.php>>.

³⁷ <<http://www.ipcc.ch/ipccreports/tar/wg2/pdf/wg2TARchap3.pdf>>.

³⁸ <http://www.cptec.inpe.br/prevnum/modelo_eta/Met_Eta_BR.shtml>.

³⁹ <<http://precis.metoffice.com/index.html>>.

⁴⁰ <<http://www.jamstec.go.jp/esc/index.en.html>>.

⁴¹ <<http://www.cccma.ec.gc.ca/models/crcm.shtml>>.

Table III-1. Examples of sources of socio-economic data and information identified under the NWP

Description of information supplied	Provider of information
Emergency Events Database	Centre for Research on the Epidemiology of Disasters ⁴²
Data sets used by UNEP and its partners in the Global Environment Outlook report, including freshwater, population, disasters, health and Gross Domestic Product (GDP)	Global Environment Outlook (GEO) Data Portal ⁴³
Dynamic maps and data products, such as geophysical and socio-economic data in the area of managing malaria conditions, desert locust/food security crises, meningitis epidemics and other climate related threats	International Research Institute for Climate and Society (IRI) ⁴⁴
Endangered species	International Union for Conservation of Nature (IUCN) red list ⁴⁵
Interactive maps of natural hazards, extracts from the Munich Re NatCatSERVICE database and country profiles that include socio-economic and hazard data	Munich Re NATural Hazards Assessment Network ⁴⁶
Long-term socio-economic and biophysical data in Northern, Western and Eastern Africa	Sahara and Sahel Observatory (OSS) ⁴⁷
The IPCC baseline statistics for 195 countries that are representative of the early to mid 1990s. The data were collated from a variety of sources, such as the World Bank, UNEP and the Food and Agriculture Organization (FAO), and they include a range of factors organized into seven categories (IPCC, 1998): Population and human development, Economic Conditions, Land cover/land use, Water, Agriculture/food, Energy, Biodiversity	Socio-economic baseline statistics on the IPCC data distribution center (DDC), Socio-economic data and applications center (SEDAC), Center for International Earth Science Information Network (CIESIN) ⁴⁸
Statistics and data from across the UN organizations and agencies including: Commodity Trade Statistics Development Indicator Database Energy Statistics FAO Data Gender Info Human Development Report International Labour Organization (ILO) Data Indicators on women and men INDSTAT4 Industrial Commodity Statistics Key Global Indicators Millennium Development Goals National Accounts Estimates of Main Aggregates National Accounts Official Country Data UIS Data Center UN High Commissioner for Refugees (UNHCR) Statistical Database The State of the World's Children Joint UN Programme on HIV/AIDS (UNAIDS) Data UN Statistic Division (UNSD) Demographic Statistics WHO Data World Population Prospects World Telecommunication/information communication technologies (ICT) Indicators Database World Statistics Pocketbook World Tourism Organization Statistics	UNdata ⁴⁹

Table III-1. Examples of sources of socio-economic data and information identified under the NWP (continued)

Description of information supplied	Provider of information
Spatial data information on global risk from natural hazards	UNEP-GRID PREVIEW Global risk data platform ⁵⁰
Global time-critical humanitarian information on Complex Emergencies and Natural Disasters	United Nations Office for the Coordination of Humanitarian Affairs, Reliefweb ⁵¹
Water data	University of New Hampshire, Water Systems Analysis Group, WSAG ⁵²
Health statistics and data for WHO member states	World Health Organization (WHO), including: <ul style="list-style-type: none"> • WHO Statistical Information System (WHOSIS)⁵³ • World Health Report,⁵⁴ • Malnutrition,⁵⁵ • Water and sanitation⁵⁶
Information about disasters of small, medium and greater impact, based on pre-existing data, newspaper sources and institutional reports in nine countries in Latin America (Bolivia, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Panama, Peru, Venezuela)	LA RED ⁵⁷
The World Development Indicators 2009 provide a comprehensive overview of development drawing on data from the World Bank and more than 30 partners. It includes more than 800 indicators in over 90 tables organized in 6 sections: World View, People, Environment, Economy, States and Markets, and Global Links	World Bank ⁵⁸

⁴² <<http://www.emdat.be>>.

⁴³ <<http://geodata.grid.unep.ch>>.

⁴⁴ <<http://iridl.ldeo.columbia.edu/maproom/>>.

⁴⁵ <<http://www.iucnredlist.org>>.

⁴⁶ <<http://mrnathan.munichre.com/>>.

⁴⁷ <<http://www.oss-online.org>>.

⁴⁸ <<http://sedac.ciesin.columbia.edu/index.html>>.

⁴⁹ <<http://data.un.org>>.

⁵⁰ <<http://www.grid.unep.ch/activities/earlywarning/preview>>.

⁵¹ <<http://www.reliefweb.int/rw/dbc.nsf/doc100?OpenForm>>.

⁵² <<http://www.wsag.unh.edu/data.html>>.

⁵³ <<http://www.who.int/whosis/en/>>.

⁵⁴ <<http://www.who.int/whr>>.

⁵⁵ <<http://www.who.int/nutgrowthdb/en>>.

⁵⁶ <<http://www.euro.who.int/watsan>>.

⁵⁷ <<http://www.desinventar.org>>.

⁵⁸ <<http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/0,,menuPK:476823~pagePK:64165236~piPK:64165141~theSitePK:469372,00.html>>.

Box III-3. **Lessons learned from using PRECIS in the Caribbean**⁶⁹

The PRECIS-Caribbean initiative was initiated in 2003. It is a regional collaborative effort to share human and financial resources, experiences and results. Centres within the Caribbean are well committed and motivated, and the Caribbean Community Climate Change Centre (CCCCC)⁶⁰ and INSMET (Instituto de Meteorología de la República de Cuba) provide strong support.

The PRECIS model provides 25 and 50 km resolution climate projections for all the countries within the region as an input for their second National Communications (SNCs) to the UNFCCC.

CCCCC provides training for its members in installing and using the PRECIS model, including assisting regional institutions (INSMET, the University of the West Indies in Jamaica and Barbados, and CCCCC in Belize) in coordinating their modelling efforts. CCCCC is also sharing its experiences with counterparts in Central America through collaboration with Centro del Agua del Trópico Húmedo para América Latina y el Caribe.

PRECIS-Caribe, an online tool, has been developed to disseminate the PRECIS model outputs in the Caribbean region.⁶¹

For the Caribbean, PRECIS is more than a tool, it is an opportunity for capacity-building and technology transfer. Through its implementation, lessons learned in the region include the importance of modelling in the adaptation assessment process; the requirement for all stakeholders to share the task of producing relevant regional climate scenarios and share the results, experiences, region specific solutions (especially storage), problem solving and analysis techniques; and to address of uncertainties in a wider perspective.

Examples of high-resolution scenarios developed from regional climate models for various parts of the world include:

- In Europe, PRUDENCE⁶² (Prediction of Regional scenarios and Uncertainties for Defining European Climate change risks and Effects) and STARDEX⁶³ (Statistical and Regional dynamical Downscaling of Extremes for European regions).
- ENSEMBLES⁶⁴ in Europe and NARCCAP⁶⁵ in North America (North American Regional Climate Change Assessment Program) has downscaled several GCMs to provide high resolution climate change scenarios for each region.
- In South America: CREAS (Regional Climate Change Scenarios for South America) aims to provide high resolution climate change scenarios by downscaling three GCMs for assessing climate change impact, vulnerability and in designing adaptation measures.
- In Africa and Asia: The CSAG-UCT⁶⁶ statistically downscaled data for a number of AR4 GCMs. The Climate Change Explorer (CGE) tool allows users to download this data and explore changes in the seasonal cycle, histograms and frequency plots.⁶⁷

There are a number of tools for making outputs of climate models accessible to a wider range of adaptation practitioners, including decision makers. These tools include Climate Mapper,⁶⁸ which enables three-dimensional visualization of climate projections for a limited area.

Efforts reported on developing and providing training on a number of high-resolution models and scenarios for different parts of the world include those in Brazil on Eta/CPTEC in July 2008 in collaboration with the Government of Spain and the Ibero-American Network of Climate Change Offices (RIOCC), and those in Malaysia⁶⁹ and Botswana.⁷⁰ Further training activities include those run by the International Centre for Theoretical Physics (ICTP) (in various countries), National Institute for Space Research (INPE) Brazil-Government of Spain (in Latin American and Caribbean) and the meteorological-World Bank Partnership (MRI-World Bank) in the use of the Earth Simulator GCM (in Latin American and Caribbean) as well as training on PRECIS in a number of developing countries, which are now using this tool for their national assessment.

3.3.3. LOCAL AND TRADITIONAL KNOWLEDGE

Local and indigenous communities have much knowledge and experience in coping with climate variability through traditional agricultural methods and natural resource management, social solidarity networks, innovation and other traditional mechanisms.

The most effective strategies, however, are usually those that combine traditional and scientific knowledge.

Information and data on local coping strategies is available from a range of resources including the UNFCCC database on local coping strategies,⁷¹ which provides a collection of long-standing coping strategies, mechanisms, knowledge and experience from communities in developing countries that have had to adapt to specific hazards or climatic conditions. Making this information widely accessible to IGOs, NGO's and the general public is valuable, as it can now be used by communities that may be experiencing such climatic conditions as a result of climate change.

UNESCO has developed a grassroots observatory of climate change impacts using indigenous knowledge.⁷² The assessment process for many NAPAs⁷³ was based on local knowledge and traditional coping strategies as well as scientific assessment and research to help identify adaptation needs and priority adaptation projects.

3.4. GAPS AND NEEDS

3.4.1. BASELINE CLIMATIC AND NON-CLIMATIC DATA

Australia (Data and Observation [D+O] submission)

"NMHSs around the world are going to be central for efforts to adapt to climate change ... Administrators around the world need be aware of these increased demands and requirements on NMHSs and support them accordingly."

Kazakhstan (submission) and Portugal on behalf of the European Community, Finland, France, Germany, Italy, Latvia, Sweden, the Netherlands and the United Kingdom (submission)

"... note the importance of designing national GCOS implementation plans to improve systematic observations"

Mali (D+O expert meeting)

"The relationship between the climate and the different socio-economic sectors is complex and necessitates a multidisciplinary approach involving professionals from all sectors. Collaboration between the meteorological services, agriculture sector, research institutions and the media is essential to better use climatic services and data for sustainable development."

West Africa (D+O expert meeting)

"There is crucial need to restore and update hydrological data collection systems [which have declined in size and quality]; rescue historical hydrometric data and preserve all data newly collected; build capacity through raising awareness amongst policy makers of the economic value of climate information and of the need for sustained systematic climate observation systems."

Although a reasonable amount of information is now available to enable actions to adapt to climate change, there are a large number of gaps and needs in the information base for adaptation. Particularly on the regional, national and local level in developing countries. The main gaps and needs identified under the NWP are highlighted here.

⁵⁹ For more information, see <http://www.precis.metoffice.com/other_links.html>.

⁶⁰ <<http://www.caricom.org>>.

⁶¹ <<http://precis.insmet.cu/Precis-Caribe.htm>>.

⁶² <<http://prudence.dmi.dk/>>.

⁶³ <<http://www.cru.uea.ac.uk/projects/stardex/>>.

⁶⁴ <<http://ensembles-eu.metoffice.com/index.html>>.

⁶⁵ <<http://www.narccap.ucar.edu/>>.

⁶⁶ <<http://data.csag.uct.ac.za>>.

⁶⁷ <http://wikiadapt.org/index.php?title=The_Climate_Change_Explorer_Tool>.

⁶⁸ <<http://unfccc.int/files/adaptation/application/pdf/usa.pdf>>.

⁶⁹ <http://unfccc.int/files/adaptation/sbsta_agenda_item_adaptation/application/pdf/20080304_malaysia_mt.pdf>.

⁷⁰ <http://unfccc.int/files/adaptation/sbsta_agenda_item_adaptation/application/pdf/20080304_botswana_mt.pdf>.

⁷¹ <<http://maindb.unfccc.int/public/adaptation>>.

⁷² <<http://www.climatefrontlines.org>>.

⁷³ <<http://unfccc.int/4585.php>>.

BASELINE CLIMATIC DATA

Under the NWP, it has been noted that climate monitoring could be improved especially in denser regional networks to provide greater spatial and temporal detail; rescue of available historical data; improved regional climate models and projections, better communication of climatic and non-climatic data and information, and appropriate training and capacity-building.

In Africa, for example, there exists a scarcity of weather stations reporting to the WMO, and even where stations do exist, the quality of data is often unreliable although it is used in the production of climate modelling. Experiential evidence of climate change is important but also scarce. The problem particularly applies to historical data which is regularly incomplete. Thus a region such as the Upper Zambezi basin north of the Victoria Falls, a region the size of Germany and France combined, and with several climatological zones, has only one recognised recording station.⁷⁴ Much of the climate information in Africa is being produced either outside the region or at a very small number of well-equipped and well-staffed facilities in the region, creating a technological and informational divide. Improved availability of, and access to, high quality observational data are critical for model calibration and validation, and are essential for sectoral sensitivity analyses (e.g. for the purpose of identifying critical climatic thresholds). This calls for a range of actions, including: establishing new climate data recording facilities as well as sustaining existing ones; creating and maintaining networks of national and regional experts; and promoting the dissemination of existing local knowledge and data. The Climate for Development in Africa programme (ClimDev Africa) is helping support provision of climate information but more resources are needed to sustain long-term operation.

Improved access to the data and information held at meteorological and hydrological stations is also required for all users. In addition, some data is privately held and therefore costly or not possible to access.

Gaps and needs for monitoring of extreme events and other impacts include resources to improve climate and weather monitoring and systematic observations and availability and access to current and historical data. There is also a need for better integration of climate related data and models with sectoral data and models such as hydrological and groundwater models. A gap exists between climate information and agricultural information, which forms a barrier to the formulation of better forecasts of agricultural production. There are also information gaps in understanding risk. Better information on thresholds and extremes would help to plan risk reduction management and adaptation.

BASELINE NON-CLIMATIC DATA

CATHALAC (socio-economic workshop)⁷⁵

“We need georeferenced socio-economic and related data and inputs for vulnerability modelling”

Environmental Development Action in the Third World (ENDA) (socio-economic workshop)⁷⁶

“Much information is unreliable or involves high degrees of uncertainty especially socio-economic data”

There are two main types of gaps to be addressed regarding socio-economic data – the lack of data and different formats of data. Whereas some of the basic data is simply not collected, some are gathered in a way that is not useful for impact and vulnerability assessments. Consequently, there are large gaps in the data, including historical and geo-referenced data, particularly at smaller spatial scales. Gaps have been identified in socio-economic information in and across sectors and at different levels including in:

- Georeferenced data and analysis;
- User friendly visual representation or well packaged information;
- Costs of different adaptation options;
- Sustainability of data collection;
- Ecosystem services valuation;
- Alternative socio-economic scenarios and contingencies;
- Access to information on safety net programs;
- Technology to address production and processing challenges and options;
- Coping strategies at the community level.

Examples of practical needs in socio-economic information include:

- In the agriculture sector there is a need for more data on land use, including on historical patterns, and on impacts of land use change and micro-level data, as well as studies that focus on food produced for the export market;
- In the water sector, analyzing pricing and allocation and equitable distribution of water in the context of vulnerability and adaptation;
- In coastal zones, work is needed on spatially referencing disaggregated socio-economic data at smaller scales in order to capture the unique conditions of small island developing States;
- In the health sector, historical data is needed to verify whether a particular disease has always been present or was introduced as a result of climate change;
- Data related to climate related events such as cyclones, floods and droughts particularly in the African region;
- Availability and access to national data, including that held by private institutions and providing support to developing countries to collect basic socio-economic data;
- Disaggregated data collected at sub-district level should be disseminated in order to respond to specific assessment needs;
- Geophysical information should be combined with analyses on socio-economic costs in order to develop alternative development scenarios, response options and contingencies to various hazard events.

3.4.2. SCENARIO DATA

Barbados (socio-economic workshop)

“Current resolution and scenarios are too geographically small for small islands ... Small Island States however have a special interest in adaptation and therefore require model outputs that are more relevant to adaptation planning and implementation”

Task Group on Data and Scenario Support for Impact and Climate Analysis (IPCC socio-economic workshop)

“How do we effectively represent the needs and interests of the Impacts, Adaptation and Vulnerability (IAV) communities in scenarios?”

Jamaica (Submission under socio-economic information)

“The development of socio-economic scenarios is fundamental if Parties are to accurately determine the socio-economic impacts of climate change on their countries.”

The lack of suitable expertise and training for climate modelling, scenario development and downscaling are common concerns raised by the Parties, especially developing country Parties. For example, Uzbekistan has relied on scenarios to assess its future water resource and irrigation needs, but observed that the lack of qualified modelling specialists, research groups, and technical and financial resources has been problematic.

Significant gaps remain in providing model outputs and scenarios at finer spatial scales (regional, national and subnational), various temporal scales (sub-daily, daily, monthly, annual or decadal) and for shorter time horizons (5, 10, 15 years), particularly in Africa where limited downscaled data exists for a small number of GCMs and scenarios. In Central America, the Caribbean, the Indian subcontinent and SIDS there are gaps in regional and subregional climate projections. Similarly, a range of climatic differences within countries or regions with complex topography, such as coastlines and volcanic mountains, are not clearly represented in the global models of coarse resolution (UNFCCC 2008g). These limits, coupled with issues related to model uncertainties, have placed constraints on the development of regional and national climate scenarios, production of policy-relevant impact and vulnerability assessments and the ability of policy makers to understand what variables are expected to change so as to make appropriate decisions on adaptation action.

The application of RCMs in developing countries requires users to have access to adequate computational resources, local observational data for model evaluation and regional expertise to define and interpret the simulated regional features. Improved access to appropriate resources to run models and appropriate local training is needed, especially in developing countries.

⁷⁴ <<http://unfccc.int/files/adaptation/application/pdf/enda.pdf>>.

⁷⁵ <http://unfccc.int/files/adaptation/sbsta_agenda_item_adaptation/application/pdf/20080310_cathalac_water.pdf>.

⁷⁶ <http://unfccc.int/files/adaptation/application/pdf/20080311_enda_integration.pdf>.

3.4.3. LOCAL AND TRADITIONAL KNOWLEDGE

Malta (submission climate related risks and extreme events)

“There are two challenges that are worth noting ... 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 the rate at which such knowledge is lost with time unless documented.”

Some of the data needed for impacts, vulnerability and adaptation analysis is inherently local, and can be resource-intensive to obtain. The loss of traditional knowledge, due to changing societal norms and structures, has already constrained the present adaptive capacity of many communities.

A methodological framework or set of guidelines could help to record and incorporate traditional and indigenous knowledge and knowledge from local forecasters, as well as conventional climate-system data and observations and socio-economic information, into national assessments and eventually to facilitate adaptation on the ground.

3.5. OPPORTUNITIES FOR FURTHER ACTION

INCREASED SUPPORT FOR DATA COLLECTION

All countries, particularly developing countries, require capacity-building to take stock of, use and maintain the data held in their archives. Efforts by multilateral environmental agreements and international frameworks to encourage the collection and dissemination of data and information, including traditional knowledge, developing countries to collect data can help to bridge the gaps in data availability.

Under the NWP, UNEP/GRID-Arendal pledged to increase its efforts in respect to Polar View,⁷⁷ a part of the Global Monitoring for Environment and Security initiative that provides monitoring and forecasting services in the Polar region. Polar View promotes the use of satellites for the public good and in support of public policy in the area of sustainable development, marine safety and environment. Its operational monitoring provides day-to-day and year-to-year services to people to enable them to adjust to climate.

The 10 GCOS regional action plans provide an excellent basis for regions and countries to improve observing systems. However, the actions identified in those plans, to a large extent, remain to be implemented. GCOS, WCRP and WMO have recommended a set of three interlinked workshops in each of the 10 regions to address the regional observation needs and climate modelling for adaptation-mentioned under the NWP (see UNFCCC 2007f: pp. 62 – 63).

Coordinating and strengthening subregional Climate Outlook Fora would also advance regional initiatives.

The application of cost-benefit analyses and addressing the cost of inaction can help policy makers become aware of the importance of strengthening the information base for adaptation. Improved dialogue between researchers, data providers and policy makers on the outputs from data, scenarios and models will help inform analysts and researchers of how they should proceed to best meet adaptation information needs and inform policy makers of the risks represented by the uncertainty of the information and to take those risks into account in policymaking and decision making.

The Task Group on Data and Scenario Support for Impact and Climate Analysis (TGICA) and the DDC are currently working to update and expand the baseline socio-economic data. More details are available from the CIESIN DDC web-site and from submissions to the UNFCCC secretariat by the IPCC (UNFCCC 2007f, UNFCCC 2007g, UNFCCC 2007p).

ALTERNATIVE DATA SUPPLY

Alternative ways of supplying data are required to enable access by those users without high-end computers and broadband internet access. Open source technology was proposed to this end.

Web-based databases can provide specific data, both climatic and non-climatic for international or regional communities for vulnerability and adaptation assessments. A number of online resources are available including CIESIN,⁷⁸ SERVIR,⁷⁹ Climate Change Explorer,⁸⁰ World Bank Climate Change Data Portal,⁸¹ and Climate Impacts: Global and Regional Adaptation Support Platform (CI:grasp).⁸² The international project Global Land Ice Measurements from Space (GLIMS)⁸³ is currently creating a unique glacier inventory, the GLIMS glacier database,⁸⁴ which stores information about the extent and rates of change of all the world's glacial resources.

DATA RECOVERY

In order to improve the use of data and observations, there is a need for training/retraining in statistics and in computational technologies. Resources are also needed to help recover long-term, high-quality, high-resolution historical climate data sets on a regional scale so as to improve knowledge of historical climate variability and change, reduce uncertainties, and ensure more robust and reliable climate scenarios.⁸⁵ One such example initiative is the Mediterranean Data Rescue Climate Initiative.⁸⁶

Experts from Africa, Asia, Europe, Australia and the Americas are working to develop new schema for improving the Archiving and Discovery of Climate Data.⁸⁷ Currently, only a fraction of climate data is disseminated through WMO Information System (WIS) for near real time purposes. A large part of climate data is archived at national level at the NMHSs and in most developing countries. A project aiming at improved discovery and dissemination of these data through WIS constitutes currently one of the major priority activities of the WMO Climate Data and Monitoring Programme (WCDMP), and includes the provision of assistance to developing and least developed countries to access modern climate data management systems and climate data rescue technology.

DATA ACCESS AND SHARING

A key barrier identified in exchanging data and information, besides the fact that some data is privately held, is that the mandates of institutions holding data are not necessarily aligned with the needs of users for impacts, vulnerability and adaptation work. Promotion of open access, or easier access, to data from both observations and models, and in more user-friendly formats, would make the necessary data available to researchers around the world.

Strengthened networks of regional and national experts would help to increase data availability and collaboration at regional and country levels. Strengthening links among international organizations that are already working in specialized sectors would help collaboration over information sharing within their respective sectors. This includes encouraging the private sector to share its data.

Further identification of data needs and barriers to data dissemination would assist the development of a legal framework for data and information sharing. This may include: working closely with partner international agencies for access to data collected under their programmes, clearly identifying the costs of ‘free

exchange’ of data to give providers arguments in raising funds; and securing high-level political support for improving data and information exchange, highlighting the importance of free access to data needed under the Convention; as well as the use of indicators that are appropriate in terms of temporal and spatial scales to suit specific analyses and to facilitate transformation of data for wider use.

Partners under the NWP are sharing information on climate data and information. The global System for Analysis, Research and Training (START) in Africa⁸⁸ undertakes activities on climate change data and observations, including the Climate Systems Analysis Group (CSAG), which is developing a database of long-term weather observations across sub-Saharan Africa, and the Temperate East Asia START Regional Center (TEA-START), which maintains climatological data for the monsoon Asia region. UNDP has developed country-level climate profiles⁸⁹ as part of its action pledges to the NWP.

ENDA, with the United Nations Institute For Training and Research (UNITAR) Climate Change Capacity Development (C3D) partnership, is currently planning to create an indigenous knowledge bank on climate, including evidence of climate change and vulnerability, coping strategies and a knowledge exchange network for local communities, civil society organizations (CSOs)/ CBOs, local livelihood groups, local decision makers and adaptation specialists for Africa which it intends to share with other regions such as the Caribbean, Indian Ocean and Pacific regions. This should promote the use of climate science to support and explain the real life experience of affected communities.

⁷⁷ <<http://www.polarview.org/>>. Action Pledge <<http://unfccc.int/4330.php>>.

⁷⁸ <<http://www.ipcc-data.org/>>.

⁷⁹ <<http://www.servir.net/>>.

⁸⁰ <<http://wikiadapt.org/>>.

⁸¹ <<http://sdwebx.worldbank.org/climateportal/>>.

⁸² <<http://www.ci-grasp.org/>>.

⁸³ <<http://www.glims.org/>>.

⁸⁴ <<http://nsidc.org/data/nsidc-0272.html>>.

⁸⁵ <http://unfccc.int/files/adaptation/sbsta_agenda_item_adaptation/application/pdf/20080306_spain_data.pdf>.

⁸⁶ <<http://www.omm.urv.cat/MEDARE/index.html>>.

⁸⁷ <http://unfccc.int/files/adaptation/application/pdf/wmo_update_april_09.pdf>.

⁸⁸ <<http://www.start.org/Program/vuladap.html>>.

⁸⁹ <<http://country-profiles.geog.ox.ac.uk/>>.

TRAINING AND CAPACITY-BUILDING

Given the wide range of assumptions that different models make, inconsistencies between projections and observations, and the inherent variability of both models and the natural climate system, the variability factor becomes more significant on smaller spatial scales (e.g. region, country). Despite a number of international collaboration efforts to provide practical training for researchers and practitioners in various parts of the world, challenges remain in improving the ability of users to interpret complex model outputs and effectively make use of them, particularly among stakeholders in developing country Parties.

Examples of capacity improvement efforts include the Assessment of Impacts and Adaptation to Climate Change (AIACC) programme, and START's work with NASA to facilitate the participation of developing country scientists in the Global Observation of Forest and Land Cover Dynamics project.

Regional centres are a vital resource to assist in training and capacity-building at the regional and national level. For example START are supporting research and training in Africa, as indicated in their action pledge to the NWP.

Inadequate resources hinder the dissemination of existing local data and knowledge. Creating networks of experts in the region has been found to be useful for improving the availability of data. Long-term training (such as fellowships or masters degree programmes hosted at African universities) is needed to foster ownership and to increase national capacity to develop and use climate models. An absence of training centres for each of the linguistically different regions in Africa was also viewed as a limitation in building capacity.





IV. THE ASSESSMENT PROCESS

4.1. INTRODUCTION

One of the two main objectives of the NWP is to assist Parties to improve their understanding and assessment of impacts, vulnerability and adaptation to climate change. This chapter discusses assessment of impact, vulnerability and adaptation to climate change. Information in this chapter is drawn from meetings, workshops, expert input and submissions provided under the NWP work areas *methods and tools*⁹⁰, *data and observations*⁹¹, *climate modelling, scenarios and downscaling*⁹², *climate related risks and extreme events*⁹³, *socio-economic information*⁹⁴, *research*⁹⁵, *technologies for adaptation*⁹⁶; the Technical papers⁹⁷ and the Information note⁹⁸; the Calls for Action;⁹⁹ Action Pledges¹⁰⁰; as well as other information as referenced.

SECTION 4.2 explores the range of frameworks, methods and tools available for impact, vulnerability and adaptation assessments, including those for climate risk and DRR, as well as examples of assessments and lessons learned, as highlighted through the NWP.

SECTION 4.3 discusses gaps, needs, barriers and constraints that need to be addressed in order to make assessment of impacts, vulnerability and adaptation more useful to practitioners.

SECTION 4.4 looks at the opportunities for developing and refining existing tools, facilitating training, sharing lessons learned and encouraging greater use of integrated and interdisciplinary assessment approaches.

4.2. CURRENT APPROACHES TO ASSESSING IMPACTS, VULNERABILITIES AND ADAPTATION

A range of different types of assessment can be carried out in order to help decision makers to understand the impacts, vulnerability and adaptation in a region, country, community or sector.

Top-down assessments are often used to measure the potential impacts of climate change using a scenario and modelling driven approach. Bottom-up assessments are often used to determine the vulnerability of different groups to current and/or future climate change and their adaptation options, using stakeholder intervention and analyzing socio-economic conditions and livelihoods.

A combination of integrated top-down and bottom-up approaches and a range of climatic and non-climatic data and information are used to assess social, economic and environmental impacts of climate change and account for the interaction between climate change and other processes.

Chapter 2 of the Working Group II report of the AR4 (IPCC 2007) provides further details of the significant developments in methods and approaches for climate change impact, adaptation and vulnerability (CCIAV) assessment.

It is worth noting that some climate change impacts, vulnerability and adaptation measures can be assessed without sophisticated models and high-resolution scenarios, a good example of this is the process for preparing NAPAs.

⁹⁰ UNFCCC 2007c, 2007d, 2007e, 2007q, 2008f.

⁹¹ UNFCCC 2007f, 2008f.

⁹² UNFCCC 2007g, 2007h, 2008g.

⁹³ UNFCCC 2007i, 2007j, 2007k, 2007m.

⁹⁴ UNFCCC 2007n, 2007o, 2007p, 2008h.

⁹⁵ UNFCCC 2007w.

⁹⁶ UNFCCC 2007r, 2007s, 2007t, 2007u, 2007v, 2007y, 2008i.

⁹⁷ UNFCCC 2008c, 2008d.

⁹⁸ UNFCCC 2008e.

⁹⁹ <<http://unfccc.int/4430.php>>.

¹⁰⁰ <<http://unfccc.int/5005.php>>.

Other approaches to assessment include a risk assessment approach (also referred to as a risk management or risk-based approach). This approach enables the systematic management of current and future risks from the impacts of climate variability and change. Feeding in historic knowledge to assessment helps to understand extreme events and identify measures to adapt to their increasing occurrence in the future. Alternatively an ecosystem approach is a strategy for the integrated management of land, water and living resources that promotes sustainable development and conservation of these resources. This approach is useful as it can take into account direct and indirect impacts as well as the effects of adaptation measures.

4.2.1. METHODS AND TOOLS

There is a range of methods and tools available for researching and understanding climate change impacts, vulnerabilities and risks, and assessing climate change adaptation options, including risk reduction.

It is important to understand the users of these methods and tools, and the unique context in which they are being used, as well as how they can be combined. Methods and tools were highlighted as well received when they:

- Can be used to address adaptation at different temporal and spatial scales;
- Are developed and applied in a transparent, flexible and participatory manner, taking into account multiple perspectives and interests, in particular those of end users;
- Can be applied in a number of research contexts, or can be modified in such a way as to accommodate multiple applications;
- Are simple, requiring little input data or specialist knowledge;
- Adopt a holistic approach to hazards, translating disaster risk management plans and materials into local languages if assessing risk;
- Test scenarios appropriately.

The UNFCCC Compendium on Methods and Tools¹⁰¹ identifies the following types of tools: frameworks, climate change scenarios, socio-economic scenarios, decision tools, stakeholder approaches and sector specific modelling tools (including for agriculture, water resources, coastal resources, human health and vegetation). The UNFCCC Expert Group on Technology Transfer (EGTT) technical paper “Application of environmentally sound technologies for adaptation to climate change”¹⁰² provides a comprehensive overview of methods and tools for selecting technologies for adaptation, with examples from five sectors (agriculture, coastal zones, infrastructure, public health and water resources). Several technologies and tools are available to develop information and raise awareness, to plan and design, to implement and to monitor and evaluate the performance of adaptation strategies. The EGTT has contributed to the development of the UNDP-GEF handbook for conducting technology needs assessments (TNAs), which includes guidance on identification and prioritization of needs for technological adaptation to climate change (UNDP 2009).¹⁰³

National communications, NAPAs and submissions under the NWP from Parties and organizations also highlight a range of methods and tools used for impact, vulnerability and adaptation assessment. A number of countries and organizations are also developing their own methods and tools for assessment (UNFCCC 2007c, 2007d, 2007e). For example, European Union (EU) Member States provided a detailed list of existing and emerging assessment methodologies and tools used (UNFCCC 2007c).

Examples of assessment methods and tools include:

- Costing methodologies – the “Economic Issues Relevant to Costing Climate Change Impacts”¹⁰⁴ study of the Australian Greenhouse Office (UNFCCC 2007c) explores a range of economic assessment methods useful for estimating the costs of climate change impacts and the benefits and costs resulting from investment and other actions to reduce impact costs through adaptation. The Convention on Biological Diversity (CBD) process has directed its efforts toward the valuation of biodiversity resources to assist with decision making. A UNFCCC technical paper reviews the existing literature on the potential costs and benefits of adaptation options (UNFCCC 2009e).

- Decision support tools offer a useful starting point for discussing climate change adaptation, particularly for decision makers who have previously had limited exposure to this kind of information. Eururalis was developed to support decision makers in discussions and decision making on rural areas in Europe.
- Ecosystems-based approach (EBA) methods and tools – highlighted by the CBD.¹⁰⁵ The CBD has pledged action to strengthen research on, and links between, biodiversity and climate change in order to reduce scientific uncertainties and thus improve the quality of scenarios and increase the confidence of decision makers in climate and climate impacts information.
- Gender mainstreaming tools – Certain NGOs and networks, such as the Gender and Climate Alliance (GGCA), undertake training for policy-makers, which has been well-received by national-level decision makers.
- Multi-criteria analysis (MCA) – highlighted as a useful tool that allows for the integration of views of stakeholder groups and used to make a comparative assessment of multiple adaptation activities. It has been used for prioritizing adaptation options in NAPAs.

Countries are also carrying out research to advance the suitability, applicability and application of methods and tools (UNFCCC 2007c). A large number of countries, organizations and initiatives are disseminating practices and sharing experiences on methods and tools including through compendiums, guidebooks and online resources, for example visualization techniques using graphically based mapping systems, such as layers on Google Earth. Training is also an important way to share experience and improve capacity, such as UNITARs C3D project.¹⁰⁶ Examples of sources for methods and tools by UN organizations and agencies, multilateral and bilateral programmes and national and regional initiatives, as highlighted under the NWP, are detailed in [TABLE IV-2](#).

¹⁰¹ <<http://unfccc.int/5457>>.

¹⁰² FCCC/TP/2006/2. This document has also been converted into a brochure available at <http://unfccc.int/resource/docs/ublications/tech_for_adaptation_06.pdf>.

¹⁰³ Also see <<http://ttclear.unfccc.int/ttclear/jsp/>> for 34 TNA studies and document FCCC/SBSTA/2006/INF.1 for a synthesis of 23 TNAs and 25 national communications.

¹⁰⁴ Australian Greenhouse Office. 2004. Economic Issues Relevant to Costing Climate Change Impacts. Canberra: AGO.

¹⁰⁵ <<http://adaptation.cbd.int>>.

¹⁰⁶ <<http://www.c3d-unitar.org/c3d>>.

Table IV-2. Examples of sources for methods and tools

Resource	Description	Implemented by
Examples of work by UN organizations and agencies		
Compendium on Methods and Tools ¹⁰⁷	A web-based resource that provides information on available frameworks, methods and tools, and their special features. It is designed to assist Parties and other potential users in selecting the most appropriate methodology for assessments of impacts and vulnerability, and preparing for adaptation to climate change.	UNFCCC
Training package for methods and tools ¹⁰⁸	A training resource that focuses on top-down approaches derived from GCMs to describe sectoral (agriculture, coastal zones, health and water) methods and tools, and integrated approaches to vulnerability and adaptation assessments. It was developed by the UNFCCC Consultative Group of Experts for use in the regional hands-on training workshops in the Africa, Asia and Pacific, and Latin America and Caribbean regions during 2005 – 2006 ¹⁰⁹ to assist experts in developing their national communications.	UNFCCC
Adaptation Learning Mechanism (ALM) ¹¹⁰	A web-based resource for tools and information to support adaptation practices on the ground; integration of climate change risks and adaptation into development policy, planning and operations; and capacity-building for adaptation.	UNDP
National Communications Support Programme (NCSP) ¹¹¹	A web-based resource centre containing a wide range of literature, models and tools, and sources of data for undertaking vulnerability and adaptation assessments. The resource materials are organized around different thematic areas and by geographic region.	UNDP
Assessments of Impacts and Adaptations to Climate Change in Multiple Regions and Sectors (AIACC) ¹¹²	A global initiative, developed in collaboration with UNEP/WMO and the IPCC and funded by the Global Environment Facility, to advance scientific understanding of climate change vulnerabilities and adaptation options in developing countries. It involved 46 case studies in developing countries and regional assessments in Africa, Asia, Latin America and small island developing States (SIDS). Outputs to assist assessment of adaptation options include Lessons learned pamphlets "For Whom the Bell Tolls, Vulnerabilities in a Changing Climate" and "A Stitch in Time, Adapting to a Changing Climate" and books "Climate change and vulnerability", Leary <i>et al.</i> (2008a), and "Climate change and adaptation," Leary <i>et al.</i> (2008b). UNEP aims to advance methodological work and knowledge creation further through the second phase of the AIACC programme.	UNEP
Examples of Multilateral and bilateral programmes		
Advancing Capacity to Support Climate Change Adaptation (ACCCA) ¹¹³	This project draws on lessons learned about communicating climate risk information in clear terms that are relevant to decision makers; addressing climate risks and adaptation in an integrated, multidisciplinary way; the importance of engaging stakeholders substantively; and the long-term benefits of partnering institutions from scientific and policy communities for understanding and managing climate change risks. They are running a number of pilot projects to assess and prioritize climate risks and develop adaptation options including improving communication and identifying knowledge gaps.	UNITAR, ENDA-TM, Stockholm Environment Institute (SEI), CSAG-UCT, START
Linking Climate Adaptation (LCA) ¹¹⁴	A community of over 900 practitioners, stakeholders, researchers and policy makers exchanging information on climate adaptation research and practice, including assessment methods and tools from around the globe via the Networks email list.	Eldis, Institute of Development Studies (IDS)
weADAPT ¹¹⁵	A web-based resource for collaboration between leading organizations on climate adaptation, which includes new and innovative tools and methods, datasets, experience and guidance. SEI pledged this action under the NNWP. The platform provides the opportunity to widen geographical coverage and deepen the level of understanding across the spectrum of adaptation advice. The collective platform can bring a large number of contributors and partners together to shape new, innovative and practical tools, and to build competence through learning by doing.	Stockholm Environment Institute (SEI)

Table IV-2. Examples of sources for methods and tools (continued)

Resource	Description	Implemented by
World Bank Climate Change Portal ¹¹⁶	A web-based resource that provides access to global climate and climate-related data and serves as a launching point for climate change adaptation tools (including the Climate Risk Screening Tool, ADAPT, as well as those tools developed by other institutions).	World Bank
Examples of national and regional initiatives		
UK Climate Impacts Programme (UK CIP)	Since 1997 UK CIP has been working with the public, private and voluntary sectors to assess how a changing climate will affect a range of issues including construction, working practices, demand for goods and services, biodiversity, service delivery and health. It provides resources including tools, scenarios, adaptation decision framework and adaptation wizard.	Department for Environment, Food and Rural Affairs, UK Government
The Greenhouse Office (Australia)	Methods and tools utilized by the Australian Government were highlighted in their submission (UNFCCC 2007c) and are detailed on their webpage. ¹¹⁷	Department of Climate Change, Australian Government
US Climate Change Science Programme	USAID has developed a Climate Change Adaptation Guidance Manual to enable development partners to assess and understand the vulnerabilities of projects and adapt their designs to increase resilience. ¹¹⁸	UNEP, USAID
RIOCC	Facilitating the development and the implementation of methods and tools for assessing impacts, vulnerability and adaptation to climate change in different sectors and systems in Ibero-America. Two regional projects, identified in RIOCC's action pledge to the NWP will be launched to promote development and use of common methodologies and tools to assess climate change impacts and vulnerabilities and to integrate adaptation considerations into sectoral planning and management: <ul style="list-style-type: none"> • Vulnerability assessment to climate change in marine and coastal areas of Ibero-America • Co-operative project on Mitigation and Adaptation to Climate Change in Sustainable Forest Management in Ibero-America. 	RIOCC
START	START are contributing to disseminating work on adaptation assessment in the Africa region as indicated in its action pledge to better document and disseminate information about methods and tools for vulnerability and adaptation assessment from the AIACC and CLIMAG projects. They also plan to seek opportunities and partnerships to build capacity for the use of vulnerability and adaptation assessment methods and tools through new education programs, advanced study institutes, fellowships and small grants.	START

¹⁰⁷ <<http://unfccc.int/2674.php>>.

¹⁰⁸ <http://unfccc.int/resource/cd_roms/na1/v_and_a/index.htm>.

¹⁰⁹ Information on these workshops can be found in the UNFCCC documents FCCC/SBI/2005/22, FCCC/SBI/2006/8 and FCCC/SBI/2006/25.

¹¹⁰ <<http://www.adaptationlearning.net>>.

¹¹¹ <<http://ncsp.undp.org/>>.

¹¹² <<http://www.aiaccproject.org>>.

¹¹³ <<http://www.acccaproject.org/accca>>.

¹¹⁴ <<http://www.eldis.org/go/topics/dossiers/climate-change-adaptation/contact-us#1>>.

¹¹⁵ <<http://www.weadapt.org>>.

¹¹⁶ <<http://sdwebx.worldbank.org/climateportal>>.

¹¹⁷ <<http://www.climatechange.gov.au>>.

¹¹⁸ <http://www.usaid.gov/our_work/environment/climate/docs/reports/cc_vamannual.pdf>.

4.2.2 CLIMATE RELATED RISK ASSESSMENT WITHIN THE CONTEXT OF DRR

The International Strategy for Disaster Reduction (ISDR) promotes and coordinates global efforts to reduce disaster risk and increase resilience through implementation of the Hyogo Framework for Action 2005 – 2015: Building the Resilience of Nations and Communities to Disasters (HFA).¹¹⁹ ISDR advocates the use and scaling up of tools and measures to reduce disaster risk as a way of adapting to climate change; encourages collaboration between disaster risk reduction (DRR) and climate change managers; and supports improved methods for predictive multi-risk assessments and socio-economic cost-benefit analysis of risk reduction actions at all levels, including incorporating these methods into decision making processes at regional, national and local levels.

The ISDR process identified a number of guidelines and tools currently being used by the DRR community and developed by a range of institutions including research centres, government agencies, intergovernmental organizations and NGOs (UNFCCC 2007e). These tools are designed to be used at a range of spatial levels, to be implemented in cooperation with diverse partners, and to respond to numerous hazards with an emphasis on taking a holistic view of DRR. Examples of DRR methods and tools include impact modelling, environmental impact assessments, strategic environmental assessments and hazard risk mapping, such as:

- Modelling tools, e.g. the MONSAC storm surge model developed by experts in Cuba;
- Extreme event databases, e.g. IMFREX database on climate change scenarios in France;
- Stakeholder analysis tools, e.g. mapping vulnerabilities to extreme climate events;
- Frameworks, e.g. the CCAIR (Climate Change Adaptation through Integrated Risk Reduction) framework and methodology developed by the International Global Change Institute.

In addition to ISDR, there are a number of other organizations that are improving assessment of risk and developing methods and tools for risk assessment. The WMO Disaster Risk Reduction programme is improving the development and delivery of DRR methods and tools so as to strengthen international and national collaboration in DRR.¹²⁰ The Provention Consortium has developed a number of tools and methodologies for DRR, including cost-benefit analysis and community risk assessment.¹²¹ The Institute for Social and Environmental Transition (ISET) is carrying out a number of programmes to improve

risk management and adaptation option assessment decisions, by assessing costs and benefits, understanding the autonomous process of adaptation taken by actors at all levels and seeking to support interventions that increase diversification of livelihood options and economic systems. ISET programmes include the *From Risk to Resilience Programme*¹²² and the *Adaptation to Climatic Variability and Change Programme*.

Case studies on assessment of adaptation and risk and improvements to assessment capacity and risk management, for a large variety of risks, can be found in UNFCCC 2007i, 2007j, 2007k, 2007l. Examples include the *Climate Change Adaptation in Africa Research and Capacity Development Program (CCAA)*,¹²³ the Australian Government's report *Climate Change Risk and Vulnerability: Promoting an Efficient Adaptation Response in Australia*,¹²⁴ and the EC-funded project on behalf of the Vulnerability and Adaptation Resource Group (VARG) Linking climate change adaptation and disaster risk management for sustainable poverty reduction.¹²⁵

An example of integrating risk assessments into practice was highlighted by the Mauritius Meteorological Service (MMS). The MMS assesses and reports on impacts, distribution and frequencies of tropical cyclones, vulnerable areas prone to flash flood, and areas prone to landslide. After the 2004 Indian Ocean tsunami, the MMS began to issue multi-hazard warnings instead of only tsunami warnings, in order to include hazards such as storm surges, flooding and disease outbreaks. The warnings from the MMS are evaluated by an interdisciplinary national committee, which decides on appropriate steps. Thus the MMS aims to predict impacts rather than just the occurrence of extreme events.

4.2.3 SECTOR-BASED ASSESSMENTS

Assessment of impacts, vulnerability and adaptation is being undertaken across sectors, and for sectoral-based DRR and stakeholder analysis (see UNFCCC Compendium on methods and tools and UNFCCC 2007c, 2007d, 2007e, 2007q).

Examples of assessment in the sectors of agriculture and food security, water, coastal zone and human health, highlighted under the NWP, include:

AGRICULTURE

The Food and Agriculture Organization of the United Nations (FAO) has developed a number of climate impact assessment tools to support efforts to render agriculture more resilient and responsive on various spatial scales. Tools include agroclimatic water stress mapping, AgrometShell (software designed to assess the impact of climatic conditions on crops, conduct climatic risk analysis and forecast regional crop yields), AquaCrop (an irrigation model) and CLIMWAT 2.0 (a climatic database for AquaCrop). Methodologies include agroecological zoning, and related decision-support tools, used for the analysis of land productivity, crop intensification, food production and sustainability issues (UNFCCC 2007e). The International Research Institute for Climate and Society¹²⁶ has shown that communication between forecasters and the users of their predictions can be improved, and capacity built, through regional outlook forums, for example for droughts. The Vulnerability Analysis and Mapping branch (VAM) of the World Food Programme (WFP)¹²⁷ undertakes in-depth assessments to understand the nature of food insecurity and the risks to livelihoods, and monitors emerging food security problems. VAM's analyses support WFP decision making in designing and managing emergency and development programmes to target the poorest people and those most affected by food insecurity.

WATER

The International Water Management Institute (IWMI) has developed a global model (WATERSIM) to analyze various scenarios of the food-water-environment nexus.¹²⁸ IWMI are contributing to the development of further monitoring tools for assessing the role of water and the adaptive capacity of agro-ecosystems. The IUCN CHANGE toolkit is helping to develop integrated water resource management adaptation responses through the IUCN Water and Nature Initiative and has been applied to strengthen local capacity to cope with and respond to floods and droughts in pilot countries – Guatemala, Tanzania and Nigeria.

COASTAL ZONES

DIVA (Dynamic Interactive Vulnerability Assessment) is being used by a number of European Community countries for assessing coastal vulnerability to sea-level rise and exploring different adaptation strategies. Currently, DIVA is also being applied in an integrated vulnerability assessment of coastal areas in the Southeast Asia and East Asian Region (UNFCCC 2007c).

HUMAN HEALTH

MACVAH/AREC (models of anomalies of climate variability and change and their impact on human health/assessment of epidemic risk and cost estimation), have been used in Cuba and other Latin American countries with good results. The EU is implementing the climate Change and Adaptation Strategies for Human health (cCASHh) project, which combines a number of approaches, including a conceptual framework, vulnerability assessments, policy analysis, economic analysis and integrated assessment models to investigate the health effects of heat and cold; the health effects of extreme weather events; vector-borne and rodent-borne diseases; and water-borne and food-borne diseases (UNFCCC 2007c).

Active involvement of stakeholders at national and local levels including business, local and regional decision makers, research institutions and local communities is important, otherwise any adaptation measures may fail because of a lack of ownership. At the national level, consensus conferences and workshops have proved to be successful in securing the involvement of stakeholders. At the community level, engagement of stakeholders through for example farmers associations and rapid rural appraisal has been useful.

¹¹⁹ Hyogo Framework for Action 2005 – 2015: Building the Resilience of Nations and Communities to Disasters <<http://www.unisdr.org/eng/hfa/hfa.htm>>.

¹²⁰ <<http://www.wmo.int/pages/prog/drr/>>.

¹²¹ <<http://www.proventionconsortium.org/>>.

¹²² <<http://climate-transitions.org/climate/>>.

¹²³ <<http://www.idrc.ca/ccaa/>>.

¹²⁴ <www.greenhouse.gov.au/impacts/publications/pubs/risk-vulnerability.pdf>.

¹²⁵ <http://ec.europa.eu/development/icenter/repository/env_cc_varg_adaptation_en.pdf>.

¹²⁶ <portal.iri.columbia.edu>.

¹²⁷ <vam.wfp.org>.

¹²⁸ <http://unfccc.int/files/adaptation/sbsta_agenda_item_adaptation/application/pdf/iwmi_cc.pdf>.

4.2.4. INTEGRATED ASSESSMENTS

Integrated assessments are an effective way to comprehensively assess social, economic and environmental impacts of climate change and plan for adaptation, while also accounting for the linkages, feedbacks and interactions between climate, environmental and socio-economic factors and other processes (UNFCCC 2008j). Integrated assessments enable planning of adaptation at national and regional level, and strengthening of adaptive capacity while increasing resilience to long-term climate change impacts and vulnerability. A number of methodological frameworks have been developed to carry out integrated assessment and thus help consider the required adaptation options (for summaries see Carter *et al.* 2007, Lu 2009).

Parties have reported the importance of using the results from integrated assessment for decision making on adaptation to climate change in their National Communications and their submissions under the NWP. Results have been used for integrated coastal zone management, integrated pest management and integrated water resource management (UNFCCC 2005a, UNFCCC 2007c, 2007d).

In Canada integrated regional/sectoral assessment focuses on agriculture production on the Canadian prairies, using combined biophysical (Environmental Policy Integrated Climate Model – EPIC) and socio-economic models (Canadian Regional Agriculture Model – CRAM) to assess future benefits and risks, and evaluate possible adaptation responses (UNFCCC 2007d). In the United States, NOAA is conducting Regional Integrated Science Assessments (RISAs) to assist decision makers in coping with drought, understand climatic influences on farming, ranching, water management, and wildfire, and assess climate impacts on the transportation sector, coastal communities and human health. Stakeholders can use such information to evaluate potential climate change impacts on water supplies and hydroelectric power and support disaster management planning.¹²⁹ El Salvador has conducted integrated assessment of current and future climate vulnerability, considering socio-economic and climate scenarios as part of their project Vulnerability and Adaptation to Climate Change of rural people living in the central coastal plain of El Salvador (UNFCCC 2007c).¹³⁰

The International Union of Railways, has undertaken an extensive feasibility study analyzing the impacts of climate change on rail transportation infrastructure. This study takes stock of ongoing and planned work on climate change adaptation in European, Canadian, Australian and

Indian railway companies, including case studies of the UK West Coast and the German Rhine Valley. This led to the Adaptation of Railway Infrastructure to Climate Change (ARISCC) project that will produce information on the costs of adaptation, risk assessments, potential damages; a toolbox for identifying vulnerable assets and locations for a given line; a good practices collection; and options for adopting standards to climate-proof new and existing infrastructure to climate change impacts.

Other groups are also developing methodologies for carrying out integrated assessment at the global and regional levels. These include the World Resources Institute (WRI),¹³¹ the Stockholm Environment Institute (SEI),¹³² the Netherlands Environmental Assessment Agency (MNP),¹³³ the Potsdam Institute for Climate Impact Research (PIK),¹³⁴ the Center for Sustainability and the Global Environment (SAGE),¹³⁵ the University of Wisconsin as well as the CBD's work on assessment using the ecosystem based approach (UNFCCC 2007e).

4.2.5. ROLE OF TRADITIONAL KNOWLEDGE

Community-level interests are a key driver of many assessments. Traditional and local knowledge can enrich vulnerability and adaptation assessments, including those relating to risk identification and early warning. Traditional knowledge can complement other scientific sources of knowledge. In many communities there is local knowledge available on climate related risks as well as local awareness of the causes, impacts and responses to climate change.

Canada has shown the advantages of using both traditional knowledge and modern science to better understand and explain climate and environmental change issues in northern Canadian communities.¹³⁶ The Arctic Climate Impact Assessment¹³⁷ also attempted to combine indigenous knowledge with data from scientific research.

Examples of documenting and sharing traditional knowledge for use in assessments include the UNFCCC database on local coping strategies¹³⁸ and the UNEP/GRID-Arendal Many Strong Voices Programme,¹³⁹ which brings together local, national and regional stakeholders from the Arctic and the SIDS to collaboratively assess and devise strategic solutions to the challenges confronting coastal communities in these regions as a result of climate change.

4.2.6. THE NAPA PROCESS

The NAPAs¹⁴⁰ enable LDCs to identify and prioritize their urgent adaptation needs. NAPA activities complement in many cases longer-term adaptation requirements that are commonly expressed through national communications. The assessment process for developing NAPAs focuses on enhancing adaptive capacity to climate change. The framework for NAPA preparation is bottom-up, requiring stakeholder inputs in defining urgent adaptation needs and actions, as well as in the choice of priorities. It relies on existing information and assessments, and therefore does not require comprehensive additional assessments involving analysis of new climate change scenarios or impact modelling.

The Least Developed Countries Expert Group (LEG) “Annotated guidelines for the preparation of national adaptation programmes of action”¹⁴¹ were developed to expand on the guidelines for the preparation of NAPAs. They elaborate on methods for key aspects of this process, and on selection and prioritization of adaptation options. Work by the LEG provides information on how Parties prepare NAPAs and which methods and tools are commonly used. For example, Bhutan¹⁴² applied multicriteria analysis to select the country’s top priority NAPA projects, whereas Samoa¹⁴³ used community consensus-building to rank its needs.

4.3. GAPS AND NEEDS

4.3.1. INTEGRATED ASSESSMENTS

UK Department for International Development (DFID)¹⁴⁴ (Methods and tools workshop)

“Further work needed to: assess sensitivity, assess adaptive capacity (institutional needs), [provide] guide[s] for selecting cost effective adaptation, dealing with uncertainty (adaptation roadmaps?), adapting national development plans. Working with others needed to promote sharing amongst tool developers [and] harmonise approaches”

Cook Islands¹⁴⁵ (Methods and tools workshop)

“[We need to] develop guidelines that address ‘people’”

Integrated approaches are critical for identifying and responding to the social, economic and environmental impacts of climate change, and are quickly emerging mechanisms to address the multifaceted nature of climate change in a comprehensive manner.

The capacity to undertake integrated assessments is still absent in many countries, and the tools needed to facilitate such assessments are not always available or readily accessible. Developing country Parties, in particular, have stressed the need for greater capacity to undertake integrated assessments at the subnational and national levels.

4.3.2. METHODS AND TOOLS

World Bank¹⁴⁶ (Methods and tools workshop)

“As a number of people become engaged in adaptation activities ... We need to have resources that point people in the right direction.”

There is a need to promote the use of common methods and tools with a view to standardizing assessments and enhancing coordination, particularly among bilateral and multilateral programmes or projects. Many decision makers do not have sufficient awareness of the implications and importance of climate change to be able to select and use a particular method or tool. Therefore potential users need to be more engaged in the development of methods and tools. Limited technological know-how and capacity have been highlighted under the NWP as major barriers in selecting and using appropriate methods.

¹²⁹ <http://www.climate.noaa.gov/cpo_pa/risa>.

¹³⁰ <<http://www.marn.gob.sv/>>.

¹³¹ <<http://www.wri.org/>>.

¹³² <<http://www.sei.se/>>.

¹³³ <<http://www.pbl.nl/en/index.html>>.

¹³⁴ <<http://www.pik-potsdam.de/>>.

¹³⁵ <<http://www.sage.wisc.edu/>>.

¹³⁶ <http://www.msc-smc.ec.gc.ca/saib/atmosphere/atmch_e.html>.

¹³⁷ <<http://amap.no/acia/>>.

¹³⁸ <<http://maindb.unfccc.int/public/adaptation>>.

¹³⁹ <<http://www.manystrongvoices.org>>.

¹⁴⁰ <<http://unfccc.int/4585.php>>.

¹⁴¹ <http://unfccc.int/files/cooperation_and_support/ldc/application/pdf/annguide.pdf>.

¹⁴² “Bhutan National Adaptation Programme of Action (2006)”, available at <<http://unfccc.int/resource/docs/napa/btn01.pdf>>.

¹⁴³ “National Adaptation Programme Of Action Samoa (2005)”, available at <<http://unfccc.int/resource/docs/napa/sam01.pdf>>.

¹⁴⁴ <http://unfccc.int/files/adaptation/sbsta_agenda_item_adaptation/application/pdf/20080304_uk_mt.pdf>.

¹⁴⁵ <http://unfccc.int/files/adaptation/sbsta_agenda_item_adaptation/application/pdf/20080305_cooks_mt.pdf>.

¹⁴⁶ <http://unfccc.int/files/adaptation/sbsta_agenda_item_adaptation/application/pdf/20080304_world_bank_mt.pdf>.

Gaps include the lack of relevant guidance on methods and tools and guidance on their appropriate use. There is also limited sharing of the research results and lessons learned from the application of methods and tools.

Effective assessments need to take account of diverse case-specific information on socio-economic, biophysical, geophysical, political and cultural factors. There is currently no single method to integrate all the necessary socio-economic information into assessments. Enhanced stakeholder involvement may contribute to more effective integration of assessments into development policy. For example, the International Institute for Environment and Development (IIED) has revealed information on users' needs in southern African countries for tools and information to integrate socio-economic information into analyses of impacts, with particular attention to the specific context of each user (UNFCCC 2008h).

4.3.3. CLIMATE RELATED RISK ASSESSMENT WITHIN THE CONTEXT OF DRR

IPCC – Carter *et al.*, 2007 (IPCC Fourth assessment report)

“Growing sense of urgency for adaptation has created increasing demand for policy relevant information from climate change impacts, vulnerability and adaptation assessments. ... This has led to the expansive application of methods and tools developed in other related fields, e.g. risk management, in climate assessments.”

Many of the tools currently available for climate related risk assessment were developed to deal with existing climate related risks. New risks, or the aggravation of existing risks by climate change, may need to be more comprehensively addressed in DRR tools.

Due to resource constraints, risk assessments at the national level are often project-based, using environmental impact assessments instead of being comprehensive assessments for all risks. For example, in Central America, land-use maps are increasingly used for coastal zones to identify areas that are at risk and need to be protected. There are also difficulties in integrating the risk assessments of various hazards. Fragmentation of risk assessments caused by different data sets being used and the different roles of institutions involved in prediction is a concern, as the applicability of the type of data collected to the relevant risk assessment effort. For example, risk assessment in the Cook Islands has shown gaps in cyclone assessments, as the current assessments focus on wind speed rather than on resulting storm surges, which cause more damage.

Local and global risk assessments can be disconnected in terms of geographical detail and timescales, which makes it harder to compare their results for purposes of decision making. Gaps exist in terms of cooperation and collaboration between weather forecasters and climate modellers in the agriculture and food security, coastal zones and health sectors.

Needs include better access to relevant data archives and databases necessary for risk assessment and prediction, higher resolution models, assimilation of used data sets to increase the accuracy of models.

Dialogues between the climate change, sectoral and DRR communities are needed in order to discuss the potential methods and tools for developing adaptation responses. These dialogues help build capacity, including for the integration of climate-based information and services in the form of agricultural and food security outlook forums or health outlook forums, especially for malaria.

4.3.4. SECTOR-BASED ASSESSMENTS

RIOCC¹⁴⁷ (Methods and tools workshop)

“There is a need to have a strong support at the highest level in order to strengthen the institutional framework; build confidence and share procedures in the identification of common needs and priorities”.

At present, there is limited capacity for local and sectoral assessments. There is a need for strengthened institutional capacity for carrying out local and sectoral assessments (including strengthening capacity for regional climate modelling), for promoting intersectoral integrated assessments, and for sharing experiences on criteria and decision making in different sectors.

There is a need to substantially increase involvement by relevant sectors in assessments, for example ensuring greater input from town planners and engineers, and to engage the private sector. There is a need to bring together the climate science community and adaptation practitioners, including decision makers, in order to determine requirements and parameters for modelling activities so that model outputs may be more relevant to impact and vulnerability assessments in key sectors. This would also increase support for adaptation planning at all levels.

AGRICULTURE AND FOOD SECURITY

While farmers have, to some extent, adapted to dealing with current risks such as variability in precipitation, new risks that farmers have not yet adapted to, such as the salinization of soil due to sea level rise, pose new threats to agricultural production systems and livelihoods. In order for farmers to be involved in risk assessment, they need to be able to understand not only climate variability, but also climate change.

An economic assessment of impacts in the agriculture and food security sector at the national level is as important as assessment at the farming level. Quantitative information on the societal costs and benefits of impacts is also needed for assessment and for the design of appropriate response strategies.

WATER

Integrated assessments are vital to enable effective water management, and should be improved. Views on water management of neighbouring countries often conflict with one another, making assessment of regional adaptation measures difficult. Integrated Water Resource Management (IWRM) may help to address this, as it takes into account the interests of different sectors and hierarchy levels, and involves multiple stakeholders in the decision making process.

COASTAL ZONES

Countries with vulnerable coastal zones often lack the capacity to evaluate environmental and ecosystem services, to undertake cost benefit analyses of potential responses to climate change in order to make investment decisions, and to carry out vulnerability and impact assessments. To encourage exchange of knowledge, data and experiences applicable to specific regions, establishing focal points, such as regional networks and centres, would help to leverage existing information. Furthermore, early warning systems need to be made more effective so that warnings are issued in a timely manner. For example, owing to the centralized warning approach in the Pacific Ocean, countries such as the Cook Islands sometimes receive warnings from the tropical cyclone centre of Fiji ¹⁴⁸ hours after the cyclone has made landfall and damage has occurred.

HUMAN HEALTH

Existing tools and methods for risk assessment of health are very general and, so far, there has been little progress in integrating health aspects into climate change risk assessments. Due to the diversity of climate-sensitive health risks, it is important to consider the integration of disease-specific socio-economic information into health assessments in order to increase their effectiveness. For example, socio-economic data needed to assess risks of heat stresses, which are directly caused by extreme weather events, differ from the dataset needed to assess vulnerability to malnutrition, which is an indirect result of the impacts of climate change on other sectors, such as crop production. Health assessment guidelines produced in the past tend to be based on model results, and do not adequately address issues that are important for policy makers, such as identification of information needs and assessment of obstacles to adaptation. More recent guidelines have a strong focus on current vulnerability, and on integrating adaptation to climate change into national policy and current practices. However, they do not adequately address the prioritization of adaptation actions, disease-specific methods and tools, and cross-sectoral integration. Commonly agreed metrics on health impacts should be established in order to monitor changes in these impacts.

ECOSYSTEMS

Assessment of ecosystem structure and function is important to understand potential contributors to the vulnerability of communities and their livelihoods. There is a need to further explore the top-down approach while gathering information in a bottom-up fashion.

¹⁴⁷ <http://unfccc.int/files/adaptation/sbsta_agenda_item_adaptation/application/pdf/20080305_spain_mt.pdf>.

¹⁴⁸ The Regional Specialized Meteorological Centre (RSMC) in Nadi, Fiji, is one of six RSMCs specializing in tropical cyclones designated under the World Weather Watch programme of the World Meteorological Organization. They are tasked with providing 'first level' information on tropical cyclones (i.e. basic information covering the present and forecast position, movement and intensity of the tropical cyclone) in the South-West Pacific Ocean.

4.3.5. ROLE OF TRADITIONAL KNOWLEDGE

Traditional knowledge is an important part of the assessment process. Traditional knowledge needs to be documented in order to assist local and national adaptation assessment (and planning), such as through the UNFCCC local coping strategies database¹⁴⁹ and the Community-based adaptation exchange.¹⁵⁰ There should be greater integration and more use of such knowledge in the assessment and management of adaptation, particularly through partnerships with grass-roots organizations.

The research community needs to validate traditional knowledge and practices in order to improve and reinforce scientific research focused on practical actions to address climate related risks and impacts in the agriculture, water resources, coastal zones and human health sectors. Research institutes at the national, regional and global levels can devise ways to assess how indigenous practices can be blended with scientific knowledge in the assessment, prediction and management of adaptation, including climate related risks.

4.4. OPPORTUNITIES FOR FURTHER ACTION

Sustained political momentum behind climate change is raising the level of resources for and activity in adaptation assessment. Furthermore, the scope and pace of climate change reinforces the need for more rapid development of assessment tools and methods, and of adaptation options for communities that integrate the consideration of such issues as sustainable development, poverty, gender and environmental impact.

LEARNING AND TRAINING

Training at all levels is a vital requirement of improving adaptation assessment capacity, particularly for stakeholders in developing countries.

The WMO Climate Information and Prediction Services Project and the Regional Climate Outlook Forums are good examples of initiatives that focus on capacity-building and training in methods and tools, as well as on providing greater national and regional coordination of climate products and services, particularly in developing countries. The Global Change Impact Studies Centre (GCISC) organize a range of research and regional and national training on climate change simulation models and vulnerability assessment.

Some training opportunities are already integrated into existing projects and adaptation initiatives, and are therefore geared toward helping make specific tools more widely usable. For example, FAO noted that all its climate impact assessment tools are intended for use by agrometeorological, agricultural and extension services professionals with the appropriate background and experience, and therefore developed a training package called “Crop Monitoring Box” for this purpose. The FAO also developed regional and national training workshops for its Global Land Cover Network (GLCN) tool.

The Secretariat of the Pacific Regional Environment Programme (SPREP) identified the University Consortium of Small Island States (UCSIS) as an example of a way to offer training opportunities to SIDS. UCSIS brings together five regional and national SIDS universities and draws on their respective strengths to offer enhanced educational opportunities. Part of the challenge, however, is finding ways to attract and retain personnel who have been trained in climate change matters. Certain specialist professionals such as coastal zone managers and coastal engineers are mostly unavailable to SIDS governments.

COOPERATION AND COOPERATIVE RESEARCH PROGRAMMES

Enhanced coordination of dissemination, training and use of methods and tools is required, particularly among bilateral and multilateral programmes and projects, to ensure the dissemination of good practices and lessons learned, taking into account the experiences and expertise accumulated outside the climate change community. Some developing country Parties have called for more cooperative research programmes as well as postgraduate programmes for young researchers to help augment the research capacity in these countries.

The World Health Organization (WHO)¹⁵¹ is developing capacity to assess and respond to health risks from climate change. This includes an action pledge to the NWP, which, among other actions, involves defining a set of indicators for the monitoring of vulnerability to climate change, and encourages Member States to strengthen the capacity of their health systems for monitoring and minimizing the public health impacts of climate change through adequate preventive measures, preparedness, timely response and effective management of natural disasters.

Under the NWP, the Center for International Forestry Research (CIFOR)¹⁵² has pledged to develop a number of integrated assessment methodologies and frameworks through their two ongoing projects: Tropical Forests and Climate Change Adaptation (TroFCCA) – a global project implemented in three regions across eight countries – Central America: Costa Rica, Nicaragua and Honduras; West Africa: Mali, Burkina Faso, Ghana; and Southeast Asia: Indonesia, Philippines; and the Congo Basin Forests and Climate Change Adaptation (CoFCCA) project – implemented in the Democratic Republic of Congo, the Central African Republic and Cameroon.

KNOWLEDGE SHARING

FACE-TO-FACE KNOWLEDGE SHARING

Additional work is required to increase the level of interaction between members of the adaptation community through face-to-face knowledge transfer. This could include development of practitioners' networks to help users come together and share experiences and insights on methods and tools for assessment and international conferences to share experiences.

This work could entail encouraging centres of excellence and regional centres such as the Sahara and Sahel Observatory (OSS) to disseminate information on methods and tools, including information gathered through surveys to facilitate the obtaining of tools. For example, OSS carries out a range of data collection, research and project development in Africa on adaptation. In the next few years OSS plans to initiate and implement a capacity-building programme on vulnerability and adaptation assessment, on the basis of the work undertaken until now on development needs of its member countries.

The capability of stakeholders (e.g. policy makers at all levels, adaptation practitioners, researchers, etc.), needs to be strengthened in order for them to analyse and interpret existing climate information, and apply the results to planning for adaptation measures. A series of activities (e.g. conferences and workshops) at national, regional and international level using known impacts of climate change to make actors (sectoral ministries, local governments, communities, etc.) aware of the changing climate and its consequences at all levels would assist dissemination of methods and tools. Participatory approaches to collecting and disseminating socio-economic data may also help to create ownership among the users of the assessments, capturing community ideas and local knowledge and making the assessments more responsive

to community priorities. An action pledge by WMO aims to bring together climate and sectoral experts from international, regional and national institutions to identify and understand the needs of core socio-economic sectors for climate risk management and adaptation at various levels.

ELECTRONIC KNOWLEDGE SHARING

Electronic knowledge transfer is an important means of outreach and knowledge sharing. The World Wide Web provides many opportunities for the dissemination of methods and tools. Some Parties suggested developing downloadable programs and simple Web-based interfaces to facilitate the use of tools, whereas others suggested using flexible, open Web-based platforms, such as we-ADAPT¹⁵³ and CBA-X,¹⁵⁴ to allow users to post their questions, experiences, suggested adjustments, etc., regarding specific methods and tools.

In order to effectively make use of this medium, it is important to ensure that practitioners, particularly those in developing countries, have access to information and communications technology. With this in mind, a collaborative platform could be developed where users could share feedback on scenario products, available data, methods and tools.

DOCUMENTATION AND DISSEMINATION

Documenting local knowledge in parallel with scientific assessments is important, particularly for LDCs and SIDS, where the population relies heavily on such knowledge to make decisions. There is a need to gather information on the extent to which local predictions based on traditional knowledge are effective in the light of changes in the climate, and to analyse observed changes and practices undertaken as a result of impacts. Lack of resources to undertake such research has been identified as a key barrier.

¹⁴⁹ <<http://maindb.unfccc.int/public/adaptation>>.

¹⁵⁰ <<http://community.eldis.org/cbax>>.

¹⁵¹ <<http://www.who.int/globalchange/en>>.

¹⁵² <<http://www.cifor.cgiar.org/>>.

¹⁵³ <<http://www.weadapt.org/>>.

¹⁵⁴ <<http://community.eldis.org/cbax>>.

Dissemination activities to publish results and case studies should include not only a description of methods and tools, but also the results of the application of these methods and tools. Publication of the main features of methods and tools as well as relevant project results and case studies would be of great benefit to current and potential users, for example as on the ALM.¹⁵⁵

This information would improve the representation and communication of uncertainties to ensure the credibility of model outputs and climate data, and to increase their potential application.

REGIONAL CENTRES

Regional centres are recognised under the UNFCCC process as playing a key role in producing regionally relevant information and knowledge and implementing capacity-building for adaptation. They facilitate collaboration through the exchange of experiences and region-specific solutions, especially regarding data collection and storage; coordination of efforts to incorporate diverse models when constructing regional scenarios; provision of technical advice and consultancy; facilitation of capacity-building for national and regional experts; and collaboration with international organizations. It is therefore important to strengthen the role of regional centres to assist in the training of national experts. This would promote efficient sharing and transfer of knowledge, collaboration on scenario development using various models, and capacity building at regional and national levels.

Centres of excellence were deemed essential for training, and for sharing expertise and experiences in the application of methods and tools. Regional initiatives were thought to be particularly valuable for sharing experiences on a regular basis, as done by, for example, RIOCC, CCCCC and START.

¹⁵⁵ <<http://www.adaptationlearning.net>>.





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V. PLANNING AND PRACTICE

5.1. INTRODUCTION

The defining characteristic of all projects and programmes on adaptation is that each one is multidimensional but also case specific. There is no 'one size fits all' with adaptation. Each adaptation action is different, and depends on the level(s), sector(s), support (financial, technological, capacity-building, educational) and stakeholders involved.

Knowledge sharing and stakeholder engagement are important for improving the capacity of decision makers to understand the complexity and uncertainties surrounding decisions on adaptation. Actions in one sector or location can help guide how another sector or location deals with a new risk that is just starting to emerge due to climate change.

This chapter discusses adaptation planning and practice. Information in this chapter is drawn from meetings, workshops, expert input and submissions provided under the NWP work areas *climate related risks and extreme events*¹⁵⁶; *socio-economic information*¹⁵⁷; *adaptation planning and practices*¹⁵⁸; *research*¹⁵⁹; *technologies for adaptation*¹⁶⁰; and *economic diversification*¹⁶¹; the Calls for Action;¹⁶² Action Pledges¹⁶³; as well as other information as referenced.

SECTION 5.2 explores current practices and lessons learned.

SECTION 5.3 examines the gaps and needs.

SECTION 5.4 looks at opportunities and ways forward to improve current adaptation planning and to increase resilience.

SECTION 5.5 explores the importance of integrating adaptation planning and practice into development planning for sustainable development in the face of climate change.

5.2. CURRENT PRACTICES AND LESSONS LEARNED

Through the NWP, Parties and organizations have provided structured submissions on adaptation approaches, strategies, practices and technologies for adaptation, at the regional, national and local levels in different sectors, as well as on experiences, needs and concerns (UNFCCC 2007r, 2007s, 2007t). In order to facilitate adaptation planning, this information was compiled into a database on adaptation planning and practices under the NWP.¹⁶⁴ The NWP has also developed the adaptation practices interface to provide information on practices on adaptation worldwide¹⁶⁵ and its NWP partners database provides easy access to information on ongoing adaptation activities.¹⁶⁶

The specific expertise of the private sector, its capacity to innovate and produce new technologies for adaptation, and its financial leverage can form an important part in the multi-sectoral partnership that is required for planning and implementation of adaptation. The NWP's Private Sector Initiative catalyzes the involvement of the private sector with the wider adaptation community.¹⁶⁷

Engagement with the private sector is recognised under the NWP as an important element to increase planning and practice on adaptation. Businesses are undertaking a large range of ongoing practices in a range of sectors, that they are carrying out as part of their strategic business practices that enhance adaptive capacity and expand the coping range of communities. For example, Siemens have developed a range of systems to assist water management in developing countries such as the SkyHydrant System.

NCs, NAPAs and TNAs from Parties to the UNFCCC, NAPs (National action programmes to combat drought and desertification) of Parties to the United Nations Convention to Combat Desertification (UNCCD), and UN/ISDR's national platforms for DRR, contain information relevant for adaptation planning.

¹⁵⁶ UNFCCC 2007i, 2007j, 2007k, 2007l, 2007m.

¹⁵⁷ UNFCCC 2007n, 2007o, 2007p, 2008h.

¹⁵⁸ UNFCCC 2007r, 2007s, 2007t, 2007u, 2007v, 2007x, 2009b, 2009c, 2009f, 2009g.

¹⁵⁹ UNFCCC 2007w.

¹⁶⁰ UNFCCC 2007r, 2007s, 2007t, 2007u, 2007v, 2007y, 2008i.

¹⁶¹ UNFCCC 2007aa, 2007bb, 2007cc, 2007dd, 2009d.

¹⁶² <<http://unfccc.int/4430.php>>.

¹⁶³ <<http://unfccc.int/5005.php>>.

¹⁶⁴ <http://maindb.unfccc.int/public/adaptation_planning/>.

¹⁶⁵ <<http://unfccc.int/4555.php>>.

¹⁶⁶ <<http://unfccc.int/nwp>>.

¹⁶⁷ <<http://unfccc.int/4623.php>>.

5.2.1. DECISION MAKING TOOLS AT DIFFERENT LEVELS AND IN AND ACROSS DIFFERENT SECTORS

Appropriate decision making on adaptation depends on multiple factors such as the level, sector and location at which adaptation will take place as well as who is making the decisions and carrying out the action. This could be an individual, community, NGO, IGO, local or national government. It also depends on the funding available, the assessments carried out and the knowledge, including traditional knowledge, and research available, as well as the timing and time horizon of the adaptation action.

Decision making tools include cost-benefit analysis; cost-effectiveness analysis; multi-criteria analysis; checklist analysis using indicators, criteria and considerations; consensus or voting to establish an order of preference of options; modelling and scenario development; and project baseline analysis to compare actions as a result of climate change against what would be done if there was no climate change. An adaptation decision making framework (also see SUB-CHAPTER 2.2) is an increasingly used approach to managing decision making, because of the huge range of variables and uncertainties involved.

In order to further knowledge on climate change adaptation McKinsey & Company is for example undertaking studies on the economics of adaptation – the physical impact of climate change on the social and economic well-being of societies around the world – through a partnership between the firm’s Climate Change Special Initiative and the Social Sector Office. Efforts are focused on providing pragmatic fact based information to decision makers by assessing the impacts of climate change as well as a range of adaptation measures including risk avoidance, risk reduction, and risk transfer.

Existing frameworks include the UNDP Adaptation Policy Framework (APF),¹⁶⁸ the IPCC seven step approach, the Australian Greenhouse Office’s climate risk management guidance, the framework provided in Climate Adaptation: Risk, Uncertainty and Decision Making by UK CIP,¹⁶⁹ and the USAID guidance on integrating adaptation into development projects.¹⁷⁰

Although a precise evaluation of frameworks used by Parties has not, as yet, been provided in submissions, some governments have begun to analyze the applicability of frameworks. Argentina, for example, saw the potential for the APF to be used at the national and regional levels, but acknowledged that most of the strategies and policies developed using this framework are still under consideration and have not yet been implemented.

Examples of country level frameworks include Belize’s adaptation policy framework, which was used as the basis to convene national consultations to develop a comprehensive national adaptation policy; El Salvador’s conceptual framework to assess climate vulnerability and develop an adaptation strategy for rural populations in the country’s coastal plains; and the Japan-led Asian Water Cycle Initiative (AWCI) (UNFCCC 2009b).

At the community level, Tearfund has developed the Climate Change and Environmental Degradation Risk and Adaptation assessment (CEDRA) decision tool.¹⁷¹ The decision support tool CRiSTAL (Community-based Risk Screening Tool – Adaptation and Livelihoods), developed by International Institute for Sustainable Development (IISD), IUCN, US Center of the Stockholm Environment Institute (SEI-US) and Intercooperation, helps communities, project planners and managers to understand the links between climate-related risks, people’s livelihoods, and the implications of project activities.

Examples of integrated approaches to planning are provided in TABLE V-3.

A range of international, regional and national organizations and agencies are assisting in facilitating decision making on adaptation planning and practice. Adaptation was a major focus of the AIACC project. Practices and recommendations for adaptation planning are synthesized in ‘A Stitch in Time, Lessons for Climate Change Adaptation from the AIACC Project’ (Leary *et al.* 2008b). Traditional knowledge was an important factor in several of the assessments (e.g. Botswana, Sudan and Nigeria). Many of the institutions, investigators and stakeholders that participated in the AIACC project are working together to apply some of the lessons in planning and promoting adaptation actions.

Box V-4 provides examples of action and experience from NWP partners, and in some cases lessons learned, as reported in action pledge updates. The NWP synthesis publication (UNFCCC 2009h) complements the information provided here with further details on key outputs from a number of partners on their activities taken as action pledges including emerging good practices and lessons learned.

5.2.2. CLIMATE RELATED RISK, RISK MANAGEMENT AND DRR

As climate change is expected to increase the severity of many climate related hazards, and thus vulnerability to climate related disasters through its impacts on ecosystems, livelihoods and health, DRR is now recognized as one of the important components of adaptation planning (UNFCCC 2008d). Proactive DRR addresses existing and future vulnerabilities and impacts, and provides a no regrets approach to address the uncertainties of climate change. Through promotion of resilience into decision making, the Hyogo Framework for Action 2005 – 2015: building the resilience of nations and communities to disasters, provides a foundation for implementing DRR.¹⁷²

Risk management, especially as it relates to adaptation to climate related risks, is in many cases at a preliminary stage, in both developed and developing countries. Management measures include structural and non-structural measures to avoid (risk prevention) or limit (risk mitigation and preparedness) adverse effects of hazards such as early warning systems, socio-environmental safety nets and risk-sharing mechanisms such as insurance (UNFCCC 2008k).

Climate monitoring and climate outlook forums are some of the best strategies for communicating hazards and managing climate related risks. Issuing early warnings involves a trade-off between accuracy of prediction and efficiency and effectiveness of associated responses. Communication techniques for early warnings include personal communication, radio, television, the Internet and mobile phones, which are used for warning of risks.

There are many ways to provide and improve practical warnings, such as by translating messages into practical yield forecasts that are understandable to farmers. For instance the Intergovernmental Authority on Development (IGAD) Climate Prediction and Applications Centre (ICPAC) plays an important role in providing the Greater Horn of Africa subregion with early warnings on extreme climate events as well as with weather and climate advisories. Various Governments in this subregion are now successfully using ICPAC's predictions products to put measures in place to mitigate against some of the adverse impacts of extreme climate events.

A number of Parties and NWP partners are implementing DRR in the context of adaptation, documenting practice on sectoral approaches at different levels and disseminating knowledge sharing.¹⁷³ For example, national DRR strategies have been developed and implemented in some countries (e.g. China, Peru, the Philippines and Switzerland). Further examples of DRR are provided in [TABLE V-4](#) for different levels and [TABLE V-5](#) for different sectors.

Management of risks may also be carried out through risk-sharing instruments and mechanisms such as insurance. In addition to accelerating economic and social recovery following a disaster, insurance, when available, can act as a deterrent for new unsustainable development in hazard-prone areas. Countries require a portfolio of mechanisms, which may include insurance, to manage risks, as no one mechanism can meet the range of circumstances faced by different countries. The issues, challenges and potential options were discussed in detail in the UNFCCC Technical paper "Mechanisms to manage financial risks from direct impacts of climate change in developing countries" (UNFCCC 2008k). As a partner to the NWP, the Munich Climate Insurance Initiative (MCII) has pledged to assist Parties with technical and other information that will enable a sound assessment of the benefits of insurance mechanisms to facilitate and realize adaptation to climate change. The Allianz Group is insuring against climate impacts and rewarding sustainable business practice.¹⁷⁴ Allianz has developed a number of adaptation-related products including insurance through catastrophe bonds, micro-insurance, and an Eco-Trends Fund.¹⁷⁵

¹⁶⁸ <<http://www.undp.org/climatechange/adapt/apf.html>>.

¹⁶⁹ <http://www.ukcip.org.uk/index.php?option=com_content&task=view&id=62>.

¹⁷⁰ <http://pdf.usaid.gov/pdf_docs/PDADM036.pdf>.

¹⁷¹ <<http://tilz.tearfund.org/Topics/Environmental+Sustainability/CEDRA.htm>>.

¹⁷² <<http://www.unisdr.org/we/inform/intergov/official-doc/L-docs/Hyogo-framework-for-action-english.pdf>>.

¹⁷³ <<http://unfccc.int/4742.php>>.

¹⁷⁴ <<http://unfccc.int/4748.php>>.

¹⁷⁵ <<http://unfccc.int/4970.php>>.

Table V-3. Examples of integrated approaches to adaptation planning at regional, national and local level to support decision/policy making as highlighted by Parties in submissions under the NWP

Level	Example of adaptation planning
Regional	<p>Caribbean Community</p> <p>The Caribbean Community Climate Change Centre coordinates the Caribbean region's response to climate change. The Members of the Caribbean Community have participated in regional climate change adaptation projects since 1997. These include</p> <ul style="list-style-type: none"> • Caribbean Planning for Adaptation to Climate Change (CPACC) Project (1997 – 2001) • Adapting to Climate Change in the Caribbean (ACCC) Project (2001 – 2004) • Mainstreaming Adaptation to Climate Change (MACC) Project (2004 – 2008) • Special Programme for Adaptation to Climate Change (SPACC) (2007 – 2011) <p>SPACC, funded by the Global Environmental Facility (GEF)/World Bank, will implement concrete adaptation interventions in Dominica, Saint Lucia, and Saint Vincent and the Grenadines. One component in Saint Lucia has led to the modification of its building codes to incorporate climate change. The strengthened codes are presently being considered by the government for its adoption. Upon approval, the codes will be used in the retrofitting of a building designated as a hurricane shelter on the island.</p> <p>Lessons learned from the regional adaptation projects include the importance of developing and retaining local capacity. In several instances the adoption of sector specific or national adaptation policies and strategies have been delayed because of changes of decision makers, political portfolios and/or political directorate. Subsequent rounds of awareness building, identification of new champions and amendments to policies and strategies are then required but these usually exceed the project funding and execution cycle. Consequently, efforts are now underway to develop a strategy to enable countries to develop the capacity for adopting and implementing national adaptation policies and strategies. This will require further capacity-building and financial resources.</p> <p>Asia</p> <p>Regional work cited in Japan's submission includes the Asian Water Cycle Initiative (AWCI)¹⁷⁶ and the Study on Advanced Prediction System and Counter Measures of Regional- and Meso-scale Water Cycle.¹⁷⁷ Lessons learned include the importance of assessment of the climate change impacts on floods and droughts and the improvement of flood control and water use management, and the importance of technology transfer in applying adaptation technologies for water management.</p>

Table V-3.

Examples of integrated approaches to adaptation planning at regional, national and local level to support decision/policy making as highlighted by Parties in submissions under the NWP (continued)

Level	Example of adaptation planning
National	<p>Costa Rica</p> <p>The national development plans of Costa Rica integrate adaptation in different scales and sectors including in the energy, freshwater, biodiversity and agriculture sectors. Work undertaken as part of these plans showed that, for example in the agriculture sector, agricultural producer organizations were important as a platform to launch coordinated actions to promote adaptation strategies at local and sectoral level by seeking out reduced adaptation costs. In the water sector, adaptation plans are being developed for each region in the country. These plans will assign responsibilities to the different institutions in the region which will allocate the required resources.</p> <p>United Kingdom</p> <p>The environment ministry, Department of Environment, Food and Rural Affairs (Defra) launched an Adaptation Policy Framework in 2008.¹⁷⁸ The Adapting to Climate Change Programme (ACC) has been set up to drive forward the development of work on adaptation in the UK on a national basis. In November 2008 the Climate Change Act came into force, requiring the government to undertake a national climate change risk assessment every 5 years (the first due in 2011), and established an Adaptation Sub-committee to provide advice and scrutiny to the ACC programme. Defra has funded development of new UK Climate Projections in collaboration with the UK Meteorological Office (Hadley Centre) and academic community to provide future climate scenarios, ensuring that these are relevant to users and policy makers through stakeholder engagement. At the local level, Other nationally inspired but community-led initiatives to assist in the integration of adaptation planning and action include local authority targets and other community based initiatives, such as local authority partnerships involving private and public bodies working at the community level to identify best practices and address adaptation needs. On a sectoral level, adaptation planning has been embedded into a number of projects, such as the Future Farming project on agriculture, Making Space for Water and the TE2100 project on water resources and coastal flooding. A part of the UK adaptation architecture to provide a linkage between the top down approach and bottom up or community based approach, is the UK Climate Impacts Programme (UKCIP), which works with stakeholders to assist them in planning and taking action in their communities through a range of tools provided on their website.¹⁷⁹ UKCIP also works closely with the research community to help co-ordinate scientific research on impacts and adaptation. Experience has shown that key to successfully delivering this research is the engagement of stakeholders as partners throughout the research process (e.g. Building Knowledge for a Changing Climate).</p>
Local	<p>France</p> <p>The heat wave, which took place over Europe in 2003, increased the awareness of the population and of the policy makers on climate change. In France, a heat wave plan has been developed and is activated every summer under the responsibility of the Ministry of health (Direction générale de la santé). The system is perennial and covers the whole country, involves many ministries including Interior and when necessary Defence, and is relayed by local plans, especially in large cities (e.g. Mairie de Paris).</p> <p>New Zealand</p> <p>In New Zealand, local government is responsible for a range of functions that may be affected by climate change. These responsibilities occur under the Local Government Act 2002, the Resource Management Act 1991 and other legislation. Local authorities have both social and legal obligations to take climate change effects into account in their community planning. Guidance includes general guidance for local Government in New Zealand,¹⁸⁰ as well as guidance for local government for specific sectors such as coastal zones.¹⁸¹</p>

¹⁷⁶ <<http://monsoon.t.u-tokyo.ac.jp/AWCI>>.

¹⁷⁷ <<http://www.kakushin21.jp/kyousei/k051open/index.html>>.

¹⁷⁸ <<http://www.defra.gov.uk/adaptation>>.

¹⁷⁹ <<http://www.ukcip.org.uk>>.

¹⁸⁰ <<http://www.mfe.govt.nz/publications/climate/preparing-for-climate-change-guide-for-local-govt>>.

¹⁸¹ <<http://www.mfe.govt.nz/publications/climate/preparing-for-coastal-change-guide-for-local-govt>>.

Box V-4. Examples of support for decision making and action on adaptation planning and practice and lessons learned by NWP partners, as reported through updates on action pledges**Environment Development Action in the Third World (ENDA)**

ENDA is coordinating a mapping exercise in Africa on skills, training, research and information on all themes relating to climate and development to produce a network that will enable ENDA to mediate demand and supply of appropriate information, technical advice tools and direction of research, and unleash previously little-known African knowledge, experience and research activities. This Africa-wide network can provide expertise to help decision making on adaptation and DRR, and mediate regional demand with the supply of information, technical advice tools and direction of research. ENDA is currently working with several organizations to expand this network, including IDS on the Africa-Adapt project.¹⁸²

As part of its community based adaptation actions in 2009, ENDA is experimenting in the creation of sustainable income through farming for a community based organization in Western Zambia that will, it is hoped, produce surpluses that can be used to address the adaptation agendas of household and focus group initiatives in local villages independent of outside assistance.

LI-BIRD

LI-BIRD in collaboration with Bioversity International conducted a study related to existing policies in Nepal that enable or inhibit the wider use of agro biodiversity. The study was intended to synthesize and make widely available the current state of knowledge in the area of agro-biodiversity, and secondly identify key research that needs to be undertaken within policy frameworks as part of the Nepalese National Adaptation Programme of Action to improve, explore and use of agro biodiversity to help cope with climate change.

The Office of Agricultural Risk (ORA), Argentina

ORA¹⁸³ is developing activities, with other countries in the region, to improve the information for the evaluation of agricultural risk and to develop strategies of prevention to extreme events. Implemented work to assist in decision making on adaptation includes improved water, precipitation and temperature monitoring, ENSO forecasting, and advice on agricultural assurances.

Practical Action

Practical Action is documenting and publishing useful experiences from their work on community-based adaptation in South Asia. They have published the book "Understanding climate change adaptation: lessons from community based approaches" which documents 8 case studies from South Asia, Peru and Africa,

analyzing them within a conceptual framework.¹⁸⁴ A version of the framework more suitable for practitioners is in preparation. DVDs of Practical Action's first projects in four South Asian countries on CBA have been produced. Copies have been widely circulated in these countries, and versions run at conferences and workshops.

START

Building Long Term Capacity for Managing and Adapting to Climate Change in Africa and Asia: START, together with SEI, recently implemented the first phase of a SIDA-funded programme. The programme aims to enhance capacity in least developed countries across Africa and South and Southeast Asia to better understand and manage risks associated with global change, particularly climate change and variability. The first phase of the programme assessed targeted countries' current education and training capacities for improving research and understanding of vulnerability, adaptation and resilience to climate risks and relevant capacity-building priorities. During its next phase, the programme plans to convene and enhance the capacity of national level interdisciplinary resource groups that include representatives from universities, scientific research institutes, government, industry, NGOs, and others. Future activities also include regional workshops and training seminars, development of curricula and training materials, and support for traveling faculty and research fellowships.

World Food Programme (WFP)

As part of their work, WFP are strengthening vulnerability analysis and food security monitoring capacity of the Permanent Inter-State Committee for Drought Control in the Sahel and the Southern Africa Development Community to improve the formulation of food security policies, early-warning and emergency preparedness.

World Meteorological Organization (WMO)

WMO is bringing together experts from national meteorological/hydrological and agricultural departments, international and regional organizations and institutions; and policy makers from national planning/financial departments to present state-of-the-art papers, real world applications and innovative techniques for coping with climate change and offer recommendations for planning and implementing an effective Regional Framework for Adaptation of Agriculture to Climate Change in South Asia and West Africa. This includes fostering information exchange on climate change impacts and adaptation amongst different countries in these regions.

Table V-4. Examples of DRR planning and practices at different levels

Level	
Regional	The EU cohesion policy is contributing to climate proofing of activities in the EU, with a major focus on adaptation and risk prevention (6.3 billion Euros are planned to be invested in 2007 – 2013), as well as networking and sharing good practice on adaptation strategies/measures among regions and key operators/stakeholders.
National	<p>UNDP focuses on climate risk “hot spots” where vulnerability to climate change and climate hazards are highest. Through its programmes, UNDP is disseminating case studies and lessons learned.</p> <p>Belgium – The risk of sea level rise and risk of floods are incorporated in the Flemish Sigma-plan. The protection level for 2100 will be reached in 2020 (based on IPCC AR4). Besides the Sigma plan, the Flemish authorities have decided to protect the coastal zone for storms with a return period of 1/1000 year. The research is going on for this protection level.</p> <p>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.</p> <p>In its submission, FAO highlighted the importance of social safety nets in Madagascar and Haiti to assist in disaster risk management and protect the affected communities. For example, in 2000, the World Bank started a watershed development and management project (PGBV) in Madagascar with the support of FAO to balance the goals of climate risk prevention and environmental protection as well as the economic objectives of productive development.</p>
Local	<p>The Institute for Social and Environmental Transition (ISET) Adaptation and Livelihood Resilience Programme seeks to improve adaptation and livelihood resilience in communities throughout South Asia that are vulnerable to climate change and variability, particularly in the Nepal Tarai, Eastern Uttar Pradesh and Bihar, and coastal and drought prone areas in Gujarat and Tamil Nadu (Submitted as action pledge to the NWP).</p> <p>WFP implements and promotes response to climate-related risks by responding to climate related emergencies and scaling up local and community-based projects to reduce the vulnerabilities of communities. This includes is undertaken its Vulnerability Analysis and Mapping capacity and through making Comprehensive Food Security Vulnerability Analyses (CFSVAs) an integral part of local and regional programme planning.¹⁸⁵</p>

¹⁸² <<http://www.africa-adapt.net>>.

¹⁸³ <<http://www.ora.gov.ar>>.

¹⁸⁴ <www.practicalactionpublishing.org.uk>.

¹⁸⁵ <<http://unfccc.int/4111.php>>.

Table V-5. Examples of DRR planning and practices in different sectors

Sector	
Cross-sectoral	UN ISDR is supporting the development of legal and institutional frameworks to enhance cross-sectoral collaboration on adaptation, using existing platforms to bring together sectoral stakeholders (e.g. including supporting the development of adaptation strategies) in Viet Nam, India and Indonesia, support the development of Peru's guidelines for the National Adaptation Strategy to include DRR, build upon regional network activities on risk reduction such as the Second Africa Regional Platform and Second African Ministerial Conference on DRR, 2010.
Agriculture and water	<p>At the national level, seasonal weather forecasts and early warning systems, more informed choice of agricultural policies, practices and technologies to ensure optimal management; new cultivars; large-scale expansion of irrigation to areas previously dependent on rain; and fertilizer application. For example, as one of their action pledges to the NWP, FAO is incorporating Rapid Agricultural Disaster Assessment Routine (RADAR) into an agriculture disaster management project on a pilot basis in a flood-prone area of China as a pre-disaster impact assessment tool for early warning system. A technical report on the RADAR is now available on the FAO website and introduces the concept with an application to a 1998 hurricane disaster in Honduras.¹⁸⁶</p> <p>At the farm level, interventions include the choice of crop varieties, changes in planting dates and local irrigation techniques, and diversification of the crops grown instead of reliance on single crops that are vulnerable to the adverse effects of climate change.</p>
Coastal zones	An integrated coastal zone management approach is becoming increasingly needed to manage climatic and non-climatic factors. Coordinated early warning systems assist preparation for weather-related risks, for example the Cuba Cyclone Early warning and the Cyclone preparedness programme in Bangladesh.
Human Health	Surveillance and early warning systems assist in managing and limiting the health impacts of climate related risks. Heat/health early warning systems have been implemented in some countries, for example France and the United Kingdom of Great Britain and Northern Ireland. The warning is normally issued by the health sector, based on the model run by the national meteorological agency. The systems often include outreach, education and interventions by the health and social care sectors for the most vulnerable groups in order to achieve appropriate responses to the warnings. Early warning systems for disease outbreaks are being developed, such as malaria early warning systems, ¹⁸⁷ which use simple disease-transmission risk indicators such as excess rainfall.

5.2.3. INTEGRATING ADAPTATION INTO DEVELOPMENT PLANNING

Efforts are increasingly focusing on building resilience into investments and development. Information on ongoing efforts to integrate adaptation and risk management into development planning been submitted to the NWP by Parties and relevant organizations (UNFCCC 2009b), and was discussed at the technical workshop on integrating practices, tools and systems for climate risk assessment and management and DRR strategies into national policies and programmes, Havana, Cuba, 10 – 12 March 2009.¹⁸⁸ Two broad types of strategies emerged from discussions at the workshop – a long-term perspective focusing on adaptive capacity and policy development and a near-term risk reduction strategy. Both strategies are needed and are complementary to each other.

A range of tools and processes are facilitating integration of adaptation into planning, including the preparation by Parties of NCs and NAPAs, both of which involve multiple stakeholders (UNFCCC 2009c). Entry points for integration of adaptation and risk management include national and global policy frameworks, poverty reduction strategy papers, as well as national adaptation plans.

Tools to help integration include the Global Risk Identification Programme (GRIP)¹⁸⁹ of the UNDP Bureau for Crisis Prevention and Discovery, which provides a framework for supporting risk estimation. GRIP aims to improve the availability of information on and analysis of disaster risks and risk factors (e.g. hazard characterization and data, vulnerability assessment and risk indices).

Reported examples of integration at the national level include the work by the United Kingdom Department for International Development (DFID) which is now screening its development programmes for risks of climate change. Further work is needed on assessing sensitivity and adaptive capacity (including institutional needs); guidance on selecting cost-effective adaptation; and dealing with uncertainty (possibly adopting adaptation road maps). In this light, FAO is supporting Nigeria in assessing adaptation requirements in the Agriculture sector. As a follow-up, the goal is now to incorporate Climate Change Adaptation into the Government of Nigeria's National Programme for Food Security (NPFS) to assist the assessment of institutional and technical capacity needs to address climate change adaptation as an integral part of NPFS.

An example of work at a community level is the improvement of resilience to drought is being improved in Kenya's Makueni District. The project has enabled social learning by enhancing common knowledge, awareness, and skills by engaging different stakeholders in sharing diverse perspectives, and thinking and acting together.¹⁹⁰

ECONOMIC DIVERSITY

Parties and organizations have submitted information on increasing economic resilience to climate change and reducing reliance on vulnerable economic sectors, including through economic diversification (UNFCCC 2009d). To further knowledge exchange and learning, a technical workshop was also held on this subject the NWP in Cairo, Egypt, 28 – 30 April 2009.¹⁹¹ Participants at the workshop identified vulnerable sectors that could benefit from increased economic resilience to climate change, including agriculture (food cropping, fisheries, forestry, horticulture, range land), tourism, water resources, energy and industry, health, salt pan industry, ecosystems, and coastal and low lying areas.

It was noted that there are limited experiences documented about economic diversification as a response to climate change. Mauritius indicated that it had achieved success in reducing its reliance on sugar exports and had diversified into other food products, tea, textiles, tourism, and information and communication technology. Cuba also reported that it reduced reliance on the sugarcane industry; and Bangladesh reduced reliance on agriculture and diversified into the garment industry.

However, the experience in Kenya was different. Kenya's efforts to diversify into horticulture and flower exports were negatively impacted by the requirement of importers to cut down the carbon footprint. Win-win strategies were identified in the energy sector especially in the Middle East and North African countries where it is anticipated that solar power will provide the bulk of electricity supply by 2050. These regions are also endowed with resources of wind energy, geothermal power, hydropower and biomass.

5.3. GAPS AND NEEDS

Botswana (methods and tools workshop)¹⁹²

"We want to move from Assessment to Action ..."

5.3.1. DECISION MAKING AT DIFFERENT LEVELS AND IN AND ACROSS DIFFERENT SECTORS

Mexico (submission UNFCCC 2007n)

"For Mexico, one of the major challenges of adapting to climate change is to understand and characterize its vulnerability, while ensuring that the adaptation measures and policies chosen are compatible with the goals of sustainable development. Adaptation should be economically efficient, and adaptation options should be designed to contribute as much as possible to the objectives of the national economic well-being. Adaptation should also help in advancing toward social goals and should be environmentally sustainable"

World Resource Institute (workshop on advancing the integration of approaches to adaptation planning)¹⁹³

"Integrating approaches matters because: No one can succeed alone; No single approach is sufficient; Un-integrated approaches may make planning even harder!"

¹⁸⁶ <http://www.fao.org/nr/climpag/nat_1_en.asp> and <<http://www.fao.org/docrep/011/i0183e/i0183e00.htm>>.

¹⁸⁷ <<http://malaria.who.int/epidemicnews.html>>.

¹⁸⁸ <http://unfccc.int/adaptation/sbsta_agenda_item_adaptation/items/4742.php>.

¹⁸⁹ <<http://www.gripweb.org>>.

¹⁹⁰ <http://unfccc.int/files/adaptation/application/pdf/20080311_kenya_integration.pdf>.

¹⁹¹ <<http://unfccc.int/4781.php>>.

¹⁹² <http://unfccc.int/files/adaptation/sbsta_agenda_item_adaptation/application/pdf/20080304_botswana_mt.pdf>.

¹⁹³ <http://unfccc.int/files/adaptation/application/pdf/nwp_integration_mcgray.pdf>.

Successful adaptation decision making must involve adoption of good practices, dissemination of relevant knowledge and technologies, and building of capacity amongst stakeholders. Consideration must also be made to incorporate sound ecosystem management into adaptation planning at all levels and scaling up of community based adaptation. A range of gaps and needs in specific sectors have been highlighted under the NWP, and examples are provided in [TABLE V-6](#).

There is a need to address the following gaps:

- Coordination – including developing a common understanding of the threats and opportunities and identifying roles and responsibilities;
- Political willingness – including early engagement of stakeholders;
- Scaling – to a suitable level in spatial and temporal terms;
- Finance – relating both to insufficient budget and to the nature of the funds available, which are often deemed to be inappropriate for the kind of cross-sectoral, multi-level and flexible approach needed for adaptation.

A conceptual framework for adaptation is needed that would assist in identifying the range of available adaptation practices while at the same time providing for flexibility and redesigning practices as clarity emerges regarding the level of change or impacts to which different sectors and levels need to adapt. Planning would be assisted by the identification of appropriate adaptation variables to help assess adaptation options and technologies; prioritize sectors, regions and locations for adaptation investment; facilitate adaptive capacity-building processes; establish possible inter-institutional coordination; and assist in the estimation of the costs and benefits of adaptation measures.

There is also a need for:

- Identifying the primary stressors experienced by stakeholders and linking them to climate variability and change;
- Case studies, with tangible and specific results and lessons learned;
- Identifying opportunities for co-benefits across sectors and programmes;
- Integration of adaptation options across economic sectors and at different levels;
- Establishing programmes to coordinate research based on stakeholders' needs;
- Raising global awareness of the impacts on different sectors from climate change at national and international levels, as well as enhancing political attention and awareness.

Decision making at the community level is also faced with a number of challenges. For example, issues involved in scaling up community-based adaptation work were identified by Practical action (UNFCCC 2009b) ([Box V-5](#)).

Table V-6. Examples of gaps and needs highlighted in different sectors during NWP workshops

Sector	
Agriculture	<p>In order for farmers to be involved in adaptation and risk management, they need to be able to understand not only climate variability, but also climate change. The new risks that farmers have not yet adapted to, such as the salinization of soil due to sea level rise, pose new threats to agricultural production systems and livelihoods.</p> <p>Economic assessment of impacts in the agriculture and food security sector at the national level is as important as assessment at the farming level. Quantitative information on the societal costs and benefits of impacts is also needed for their assessment and for the design of appropriate response strategies.</p> <p>Activities to help include actively diversifying farming systems, especially away from cash crops, strengthening agricultural extension services so that knowledge and new adaptive farming practices can be faster and more effectively disseminated and incorporated, and climate-proofing rural development plans.</p>
Coastal zones	<p>Non-climatic stresses, such as environmental degradation and population growth, play a major role in increasing coastal vulnerability to climate change impacts, including those related to extreme events. An integrated coastal zone management approach is needed to manage climatic and non-climatic factors involving multiple levels, sectors and stakeholders. Legal frameworks as part of sustainable development strategies would support this for empowering coastal communities to plan and manage resources.</p>
Water	<p>Planning in the water sector needs to be cross-sectoral as changes in the water sector affect other sectors such as agriculture, health, energy and infrastructure. Research and guidance are needed to better understand availability, accessibility and competition for water. Integrated water resource management, including through appropriate pricing of water resources (which incorporates social and environmental valuation) is an important option.</p>
Human Health	<p>Development policy decisions need to take account of input from sources at the local level, particularly from the groups most at risk. More progress in integrating top-down and bottom-up methodologies, and closer interaction between health care providers and climate change, risk reduction and development experts and practitioners is needed. Adaptation implementation would be assisted through modifying existing programmes – to take climate change risks into account, stakeholder involvement and awareness is crucial. Short- and long-term health management strategies are also needed. Economic growth can only reduce some of the impacts of climate change if it comes with accompanying benefits such as education and awareness, health care and improved public health infrastructure.</p>
Populations and human settlements	<p>The adverse effects of climate change could exacerbate the vulnerability of individuals who are employed but earn inadequate income and those who are unemployed in both urban and rural environments. Adaptation measures in the employment and income sector may limit the negative effects of climate change.</p>

Box V-5.

Practical Action experience on community extension work

Improved livestock health is crucial in strengthening resilience in the face of climate change, and the additional health hazards likely to arise. Most governments, favour a top-down approach with government experts sent out to farmers. Yet, with too few professionals available in government service, and many communities in remote areas where professionals do not wish to work, such systems often fail to deliver. A community based extension system can be viable financially but needs to be supported by government line departments that commit to update technical skills, and by private agricultural service providers operating as a channel for inputs such as seeds and other materials.

Community-based adaptation programmes need a commitment on the part of local government to listen to the voices of the small farmer producers' groups, and facilitate implementation of

plans developed by local communities which meet their priorities. Local NGOs and CBOs will need to work together in partnership with local government, involving the target beneficiaries in decision making processes and in project design and implementation.

Changing policy at national level is one hurdle. Another is changing practice. National Research Institutes must take up the research needs of smallholders on food production, processing and marketing. Research institutes will need to commit to run training courses for local farmers' organizations and local development NGOs to update their skills, since climate change is ongoing and will require ongoing review of appropriate technologies for adaptation strategies. Government and NGOs need to allocate resources to promote exchange visits and farmer-to-farmer extension, as part of the learning and sharing effort.

5.3.2. CLIMATE-RELATED RISK, RISK MANAGEMENT AND DRR

Red Cross/Red Crescent Centre on Climate Change and DRR

(Climate related risks and extreme events workshop)

"Climate risk reduction is a key entry point for cooperation between the humanitarian, development and environmental communities. This is necessary and possible at all levels (international, national, local and community level). Climate change related and extreme events can be the trigger for change. Climate risk reduction strategies and programmes have to be embedded in and beneficial to ongoing programmes."

Risk reduction is an important part of adaptation to climate change. Gaps include limited cross-sectoral or ministerial coordination at the policy, strategic development and implementation levels, and lack of enabling environments, knowledge sharing, technical capacity and financial commitment to build and sustain capacities. Well-developed institutional frameworks, technical tools and practical experiences to manage weather and climate risks and DRR policies and practices are needed to provide an important basis for climate change adaptation. Efforts are also needed to enhance the integration of the work undertaken by the DRR and adaptation communities, as well as the integration of DRR and adaptation into national and sectoral plans and policies.

5.3.3. INTEGRATING ADAPTATION INTO DEVELOPMENT PLANNING

Strategies that would facilitate integration of adaptation into development planning include a political environment that identifies the importance of integration of risk management and adaptation into policy; improving the availability of knowledge and information; enhancing engagement of stakeholders and regional networks; and improving communication. A pragmatic approach is needed to manage uncertainties that provides flexibility in planning and implementation and a learning by doing approach. Regional cooperation and networks can assist understanding and sharing of lessons learned on integration.

5.3.4. INCREASING ECONOMIC RESILIENCE

Cook Islands (Methods and tools workshop)¹⁹⁴

"The way forward ... More input from engineers and planners, incorporate the ecosystem approach more ..., develop revised guidelines that ... address people, operationalize climate change in national plans, economic diversification to build resilience"

Gaps and barriers include lack of effective and adequate early warning systems; lack of knowledge of new markets, industries and technology, and of impacts of climate change on vulnerable sectors; lack of appropriate meteorological, socio-economic, statistical and agricultural data; lack of availability of technology and funding; and the lack of structures of social dialogue and of social protection.

Research and development, and strengthened institutional capacity and improved training, are urgently needed in developing countries. The participation of key stakeholders; integration of economic and social concerns into development planning; and the provision of appropriate enabling environments including financial incentives, technological innovation, financial services and insurance, would also help increase economic resilience. At the international level, increasing access to the expertise of specialized intergovernmental agencies and organizations (e.g. FAO, UNCTAD, ILO, WTO), utilising expertise within centres of excellence and the creation of regional economic groups (e.g. CARICOM, IGAD) are also deemed useful.

5.4. OPPORTUNITIES FOR FURTHER ACTION

Relevant actions have been proposed under the NWP, including in the Calls for Action, as highlighted for each area of work.

REGIONAL CENTRES

Adaptation action would be greatly supported by the strengthening and support of regional centres and networks for adaptation knowledge exchange and capacity-building, with a view to supporting adaptation at the national level. Regional organizations and their meetings, such as regional United Nations economic commissions, could enhance cross-sectoral collaboration on adaptation through awareness-raising, information exchange and common projects.

Many regional centres and partners to the NWP, including IGAD, CATIE, RIOCC, the Cuban Meteorology Institute, the Bangladesh Centre for Advanced Studies (BCAS) and START are all enhancing their technical capacity and outreach such as through training workshops for scientists and decision makers, and learning-by-doing initiatives at a range of levels.

Regional outlook forums are an important method of communication between forecasters and the users of their outputs. For example, the International Research Institute for Climate and Society¹⁹⁵ has shown that regional outlook forums can improve and build capacity for adaptation. In the Pacific, SPREP has established a regional roundtable on climate change to provide a major opportunity for the Governments and communities to build consensus on what actions should be taken to alleviate climate change impacts and undertake practical work through regional and national policies as part of regional projects, and through NAPAs and National Communications.¹⁹⁶

NATIONAL AND SECTORAL PLANNING

Preparation and implementation of national adaptation plans, building on the experience of the NAPAs, coupled with appropriate technological and financial resources and development of people-centred capacity, have been recognised under the NWP as a necessary step in planning and action on adaptation to climate change.

Decision making frameworks need to link climate change adaptation strategies, DRR strategies and poverty reduction strategies; focus on addressing underlying risk drivers and sustainable development; and be actionable and support local initiatives.

Using integrated approaches to planning across economic sectors, at different levels and for different hazard types as well as integrating adaptation and DRR into national and sectoral development plans is important. Some countries are already assisting planning and integration of adaptation and DRR into development, for example by formally assigning DRR and adaptation to one ministry (UNFCCC 2008l).

¹⁹⁴ <http://unfccc.int/files/adaptation/sbsta_agenda_item_adaptation/application/pdf/20080305_cooks_mt.pdf>.

¹⁹⁵ <<http://portal.iri.columbia.edu>>.

¹⁹⁶ <http://unfccc.int/files/adaptation/sbsta_agenda_item_adaptation/application/pdf/20080310_sprep_coast.pdf>.

Some of the important areas of action could be drawn from extensive national and international experience in implementing the HFA. These areas include: national planning for adaptation; sector-specific risk reduction plans; risk assessments; early warning systems and emergency preparedness; risk-based economics and financing; and knowledge and tools development.

Integrating approaches to planning for climate hazards could be improved through encouraging stakeholder participation; best use of existing institutional knowledge and resources; the facilitation of information exchange at all levels; recognising the value of legal instruments to incentivise adaptation planning; and capacity building for hazard mapping to facilitate adaptation planning specifically at community and national levels.

Cisco Systems is supporting research about an initiative to reduce emissions from deforestation in developing countries with co-benefits for climate change adaptation and the conservation of forest ecosystems. Cisco Systems are developing proof-of-concepts and prototypes which help manage decision making processes in deforestation hotspots by monetising forest property rights so that carbon sequestration services can be priced and managed. The ‘rainforest skin’ is an open network platform for real-time, highly distributed mass remote sensing, certification and monitoring of carbon stocks and flows that generates trust and enables collaboration between different actors in government, communities/NGOs/scientific organizations and the private sector. This platform will use a ‘mash-up’ of geo-referenced satellite, unmanned aerial vehicle and multiple ground based sensor networks to estimate the forest’s carbon stock and flow dynamics and then allow for trading and risk management of this new commodity.

DOCUMENTATION AND DISSEMINATION

Appropriate packaging of knowledge and research on adaptation, including climate predictions, socio-economic information, local knowledge as well as documenting case studies and lessons learned, needs to be done using language and styles appropriate to the decision makers targeted. These communication materials must be accessible, relevant and practical.

“Case study libraries” of successful tools and good practices as well as lessons learned are important for planning, including on economic resilience. With regard to integration, documentation should include a ‘How to’ document to provide guidance on integration that includes integrated planning tools to assess possible trade-offs and case studies of projects with sectoral synergies.

Examples of documentation and dissemination available include OECD policy guidance (OECD 2009); risk management guidelines for climate change adaptation decision making from the ACCC project in the Caribbean; and the Spanish Network of Cities for Climate, an initiative to provide technical support to local entities for climate-proof sustainable policies and supported by the Spanish Ministry of Environment and Rural and Marine Affairs.¹⁹⁷ Furthermore, a range of partners through their action pledges, are improving documentation and dissemination of information.¹⁹⁸

KNOWLEDGE SHARING

FACE-TO-FACE

The importance of sharing knowledge, especially on good practices and lessons learned, has become recognized as a vital part of assisting, planning and implementing adaptation activities. This also includes enhancing education and learning on adaptation to climate change for all ages from students to policy makers.

Face to face meetings can be used to disseminate results from pilot adaptation projects on the ground (such as those relating to crop diversification, micro-finance and crop insurance schemes) and comprehensive livelihood programmes (in urban and rural areas), in order to engage and sensitize stakeholders. Networks could be built to exchange knowledge and good practices, provide training, identify champions of adaptation in different sectors and engage decision makers.

START, as part of their action pledge, in partnership with the IPCC, UNEP, WMO, the University of Ghana, the University of Dar es Salaam, and the Bangladesh Centre for Advanced Studies, are conducting climate change science-policy dialogues during 2009 – 2010 under the project 'Integrating Climate Change Mitigation and Adaptation into Development Planning'. National dialogues will take place in Ghana, Nigeria, Senegal, Tanzania, Rwanda, Burundi, Nepal, Bhutan, and Bangladesh, with the objective of broadening support for the integration of climate change mitigation and adaptation knowledge into national strategies for sustainable development and poverty reduction. The dialogues are intended to inject the best available scientific knowledge from the IPCC Climate Change 2007 report and other sources into policy processes and decision making in the targeted countries, and to engage the science and policy communities of the targeted regions to develop a shared vision of research and assessment needed to serve climate change decision making needs.

ELECTRONIC

Electronic communication and technology can be used to map and take stock of regional and international institutions, networks and projects to facilitate awareness and coordination of adaptation actions, enhance synergies and ensure that needs are fulfilled.

The internet is a useful resource for sharing climate change adaptation knowledge across internet platforms and linking this with geographic information systems. The NWP aims to be the central knowledge sharing hub and learning platform on adaptation planning for all partners to assist this learning process.

In addition to the web resources offered by the NWP,¹⁹⁹ a number of organizations are playing an important role in knowledge sharing on adaptation for decision making. Examples include the work identified under the NWP by partners, to assist in education and knowledge sharing on adaptation (Box V-6).

LEARNING AND EDUCATION

Training for stakeholders could increase understanding and knowledge exchange on climate science and model output, decision making, consequences of climate change adaptation for sustainable development, costing, practices and lessons learned.

The International Environment and Disaster Management (IEDM) of Kyoto University's Graduate School of Global Environmental Studies has pledged to focus on improving knowledge generation and provision of expert advice and technical assistance on DRR and climate change adaptation in Asia. It aims to compile principles, case studies, good practices of community based adaptation, DRR and indigenous knowledge, increase North-South and South-South cooperation among the universities and research organizations in Asia and incorporate climate change adaptation in educational programmes/curriculum in the region. CATHALAC has designed the Regional Master's degree in Climate Change from the Latin American perspective, and submitted this as a NWP action pledge. The degree aims to train professionals to develop solutions and long term sustainable development projects in order to reduce vulnerability, propose adaptation measures and mitigation strategies customized to the local context in this region. Suntory Limited, a NWP private sector partner, has recently opened the Suntory School of Forest and Water to provide environmental education for elementary school children.

¹⁹⁷ <<http://www.redciudadesclima.es/index.php>>.

¹⁹⁸ <http://unfccc.int/adaptation/nairobi_work_programme/partners_and_action_pledges/items/5005.php>.

¹⁹⁹ <<http://unfccc.int/nwp>>.

Box V-6. Examples of knowledge sharing for adaptation decision making

Institute of Development Studies (IDS) – hosts a suite of knowledge services to help development research and knowledge reach those who can use it to reduce poverty and injustice.²⁰⁰

- (1) The Eldis Climate Change Resource Guide²⁰¹ acts as a focal point for all climate change knowledge services from IDS. This coordination has extended beyond IDS to harmonise with the Adaptation Learning Mechanism (ALM) themes and the IDRC supported AfricaAdapt network to enable content sharing between platforms.
- (2) Frontline Knowledge²⁰² – aims to provide online resources for contributing to and accelerate learning related to climate change adaptation by synthesising knowledge and experiences related to a relevant theme. The first theme chosen was linkages between DRR and Climate Change Adaptation.
- (3) Community Based Adaptation Exchange²⁰³ – an interactive shared online resource designed to bring together and grow the CBA community. It provides a site for the exchange of up-to-date information about community-based adaptation, including news, events, case-studies, tools, policy resources, and videos.
- (4) AfricaAdapt – in cooperation with three African partner institutes ENDA, FARA and ICPAC, to provide a bilingual knowledge sharing network on climate change adaptation in Africa. The network uses collaborative online technologies, print and radio, and face-to-face gatherings for sharing resources; facilitating learning; and strengthening the African adaptation community.

Stockholm Environment Institute (SEI) – has developed the weADAPT²⁰⁴ platform which provides guidance by pooling expertise from a wide range of organizations that contribute to adaptation science and practice. Features include tools and methods, data sets and guidance for planning adaptation. The platform includes the wikiADAPT tool which is highly collaborative and based on the sharing of experiences and co-production of knowledge by all users of the site.

UNDP – Adaptation Learning Mechanism²⁰⁵ is a knowledge sharing platform that aims to map good practices, providing information, building knowledge and networks on climate change adaptation.

UNEP Global Climate Change Adaptation Network – UNEP, in partnership with the NWP and other organizations such as CGIAR, Chinese Academy of Sciences, Columbia University (IRI), IGES, IIED, ILTER, IUCN, Keio University, Korea Environment Institute, National Institute of Environmental Research (Korea), SEI, UNDP, UNFCCC Secretariat, UNITAR, WMO, WWF and others has developed a Global Climate Change Adaptation Network which will consist of a series of selected ground facilities, regional centers and an international support group of technical institutions, building upon existing networks of facilities and centres. The Network aims to enhance knowledge sharing and capacity-building on adaptation to meet the increasing needs (both immediate and long-term) of developing countries for adaptation data, knowledge, technology and policy support.

UNESCO-IHE Institute for Water Education

UNESCO-IHE is a postgraduate institute for water education, focusing on developing countries and countries in transition, that aims to integrate climate change into its teaching and research.²⁰⁶ It collaborates closely with the Co-operate Programme on Water and Climate on training and education.²⁰⁷

PUBLIC AWARENESS

The importance of public awareness on climate change and adaptation is widely recognized. At the community and individual level this includes improved weather warnings, understanding of climate impacts, knowledge of ways to improve current livelihood and/or alternative livelihood options.

The NWP partner organization Satkhira Unnayan Sangstha (SUS) is working to improve understanding and awareness of the south-west coastal community in Bangladesh on climate change related variability, extreme events and its impacts on their lives and livelihoods. It aims to raise public awareness on climate change issues and impacts in these communities so that:

- The south-west community of Bangladesh will be more responsive about climate change issues.
- School children and adolescents are aware about climate change and natural disasters.
- Local or community based adaptation or practices are documented, and disseminated regularly to the community and different stakeholders.

Practical Action is working to increase the understanding of communities through video-based learning. DVDs of Practical Action's work on DRR through strengthening livelihoods are being prepared for wide circulation on the YouTube website, as well as on Practical Action's website.

Public awareness raising is also important at national, regional and international level to ensure understanding of and integration of climate change adaptation and DRR into decision making. A range of NWP partners have included public awareness raising in their activities and action pledges. For example, Christian Aid is lobbying governments to raise awareness of climate change issues. ICLEI – Local Governments for Sustainability through its Resilient Cities 2010 project aims to provide a global forum for exchange, learning, networking, debating and policy making on approaches and solutions for climate change adaptation and resilience building in cities.

CAPACITY-BUILDING THROUGH RESEARCH

Further research is needed on climate change impacts, vulnerabilities and adaptation, in all sectors, particularly in regards to the socio-economic effects on communities as well as cross-sectoral issues. This research would help guide decision making at all levels. Partners are carrying out work in this regard under their action pledges.

For example the International Union of Forest Research Organizations aims to contribute to the NWP by (i) providing a global assessment of scientific information about the impacts of climate change on forests, their implications for human wellbeing, and options for adaptation, (ii) effectively disseminating the assessment results to policy makers, stakeholders and the public, and (iii) developing follow-up activities supporting the objectives and activities of the second phase of the NWP. ICRISAT's action pledge is based on a range of on-going climate risk and adaptation research projects in the semi-arid tropics of Sub-Saharan Africa and Asia. One example is Community management of crop diversity to enhance resilience, yield stability and income generation in changing West African climates. The Commonwealth Scientific and Industrial Research Organisation's (CSIRO) Climate Adaptation Flagship contributes, through a range of inter-related research projects, to enhance the Asia-Pacific region's effort in adaptation to climate change through informing planning, regulation and investment decisions.

Under the NWP private sector initiative, Caisse des Dépôts reported its international research programme on adaptation, launched in 2008 and focussed on designing and funding infrastructure. The international research programme addresses five themes (North-South problems; cities and local government; water, agriculture and forests; industrial infrastructure; and the financial sector) as well as economic and financial instruments.

²⁰⁰ <<http://www.ids.ac.uk/go/knowledge-services>>.

²⁰¹ <<http://www.eldis.org>>.

²⁰² <http://wikiadapt.org/index.php?title=Frontline_Knowledge_Explorer>.

²⁰³ <<http://www.cba-exchange.org>>.

²⁰⁴ <<http://www.weadapt.org>>.

²⁰⁵ <<http://adaptationlearning.net>>.

²⁰⁶ <<http://www.unesco-ihe.org>>.

²⁰⁷ <www.waterandclimate.org>.

5.5. ADAPTATION PLANNING AND PRACTICE AND SUSTAINABLE DEVELOPMENT

Climate change impacts have the potential to push developing countries back into the poverty trap, and to undo many achievements that have been made towards attaining development goals including the MDGs (Table V-6, UNFCCC 2007a). Future vulnerability depends not only on the magnitude of climate change but also on development pathways. Sustainable development in turn can reduce vulnerability to climate change and assist adaptation by increasing resilience to climate change impacts.

In order to achieve effective implementation of adaptation, it is important that it is integrated into the national and international sustainable development priorities and national and sectoral development plans.

Many countries are starting to take concrete action on adaptation to climate change and integrating adaptation into planning (FCCC/SBSTA/2007/MISC.10 and Add.1, FCCC/SBSTA/2009/MISC.4).

A number of organizations have reported on their work related to adaptation action to support sustainable development in many countries. For example, UNDP assists countries to strengthen domestic policies and practices, and/or adopt new ones, so as to achieve MDGs in the face of climate change and its associated impacts. As part of the programme 'Supporting Integrated and Comprehensive Approaches to Climate Change Adaptation in Africa', UNDP will support 21 countries in implementing integrated and comprehensive adaptation actions and resilience plans. The USD 92.1 million initiative is funded by the Government of Japan and seeks to ensure that national development processes incorporate climate change risks and opportunities in order to secure development gains under a changing climate. UNDP helps countries establish an enabling environment and develop the capacity required to design, finance, implement and monitor long-term and cost-effective adaptation policies and plans.





VI. KEY MESSAGES AND LOOKING FORWARD

Adaptation is an essential pillar of any comprehensive policy response to climate change. Given the context-specific nature of adaptation, learning by doing can enhance our understanding of the adaptation process and build the knowledge base to facilitate effective adaptation actions.

Adaptation to the impacts of climate change will continue to be a necessity for all countries, particularly developing countries, especially the LDCs, SIDS and countries in Africa suffering from drought, desertification and floods.

The adaptation policy context, information base, assessment process and planning and practices explained in this publication, including the valuable experiences gained, and gaps, needs and opportunities identified, can be used to support the implementation of adaptation action as part of an enhanced adaptation response in the future.

The NWP has played a significant catalytic and facilitative role in promoting stakeholder engagement, knowledge sharing and learning, and targeted adaptation actions.

Through a wide range of submissions, workshops, expert meetings, stakeholder involvement and links with other UNFCCC processes, the NWP has helped identify gaps, needs, opportunities and possible further actions that could be carried out to advance actions on adaptation. The NWP has engaged organizations, institutions and businesses at all levels and in a large range of sectors as well as adaptation experts through action pledges²⁰⁸. Calls for action²⁰⁹ catalyze adaptation activities at international, regional, national and subnational levels. These have enhanced efforts for adaptation between partners and on the ground (UNFCCC 2009h).

Although substantial progress has been made, opportunities for further progress remain.

Important opportunities include: maintaining and enhancing communication and exploiting opportunities for collaboration on efforts and sharing of practices between Parties and stakeholders, between sectors, and across levels; bridging data gaps, making provisions of relevant data, information and knowledge at all levels in particular traditional knowledge, tools and methods, and good practices and practical lessons learned; building capacity for the ongoing implementation of adaptation

across all sectors and levels, including ensuring appropriate education and training opportunities and research efforts to continue developing the adaptation knowledge base; and continuing the integration of adaptation activities into sustainable development efforts. Rising availability of financial resources, in particular for developing countries, is crucial. Increased investment in adaptive capacity, such as strengthening the ability of countries to reduce disaster risk, will safeguard economic progress already made, and enable climate-resilient development.

Looking to the future, much progress can be made with political momentum, increasing interest from the public and private sectors, as well as enhanced investment.

The growing level of public awareness and stakeholder engagement could further catalyze investment and targeted actions. Lessons learned and good practices from early adaptation actions are now more visible and can provide much needed evidence-based knowledge sharing and learning opportunities for adaptation. With strengthened public-private sector partnerships, the private sector is well supported and is ready to play an important role in advancing the adaptation agenda through a wide variety of actions including being adaptation champions, and providing crucial investment in climate risk management schemes.

Other initiatives under the UNFCCC processes, and the UN at large, are further supporting the adaptation information base, adaptation assessment, and planning and practice, including research, technology and capacity-building. This includes the development and implementation of a new Global Framework for Climate Services (GFCS), adopted at WCC-3, the research dialogues under the UNFCCC, TT-Clear, the UN Delivering As One on adaptation across all organizations and agencies (UNFCCC 2008e) and work with LDCs (UNFCCC 2009d).

Looking to the future, an enhanced future adaptation regime will benefit from an expanded knowledge sharing and dissemination system, as well as further engagement of organizations. The NWP has successfully created a network of partners and stakeholders and a substantial knowledge base, and is poised to respond to the evolving needs of countries in the context of an enhanced future adaptation regime.

²⁰⁸ <<http://unfccc.int/5005.php>>.

²⁰⁹ <<http://unfccc.int/4430.php>>.



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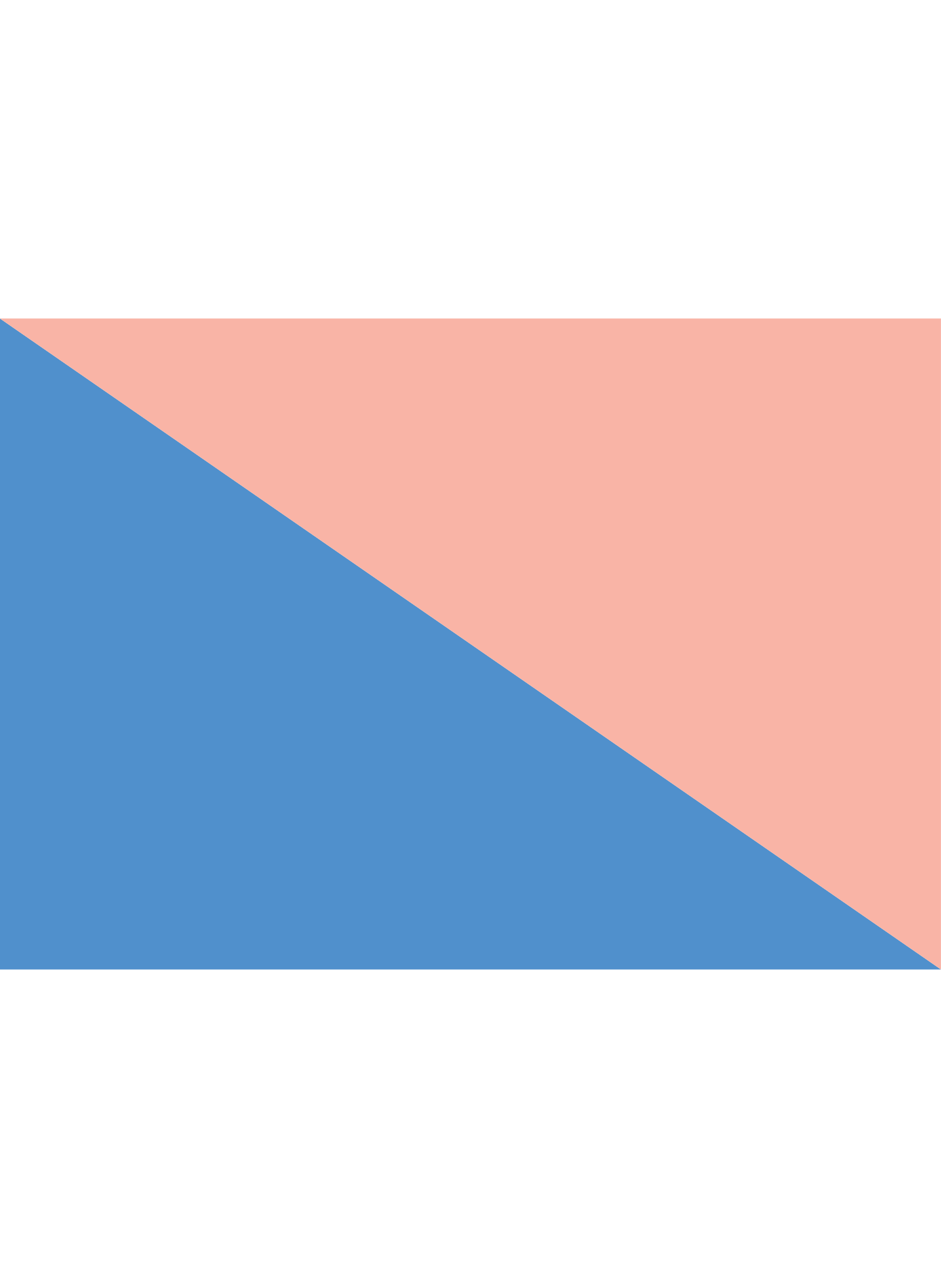
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