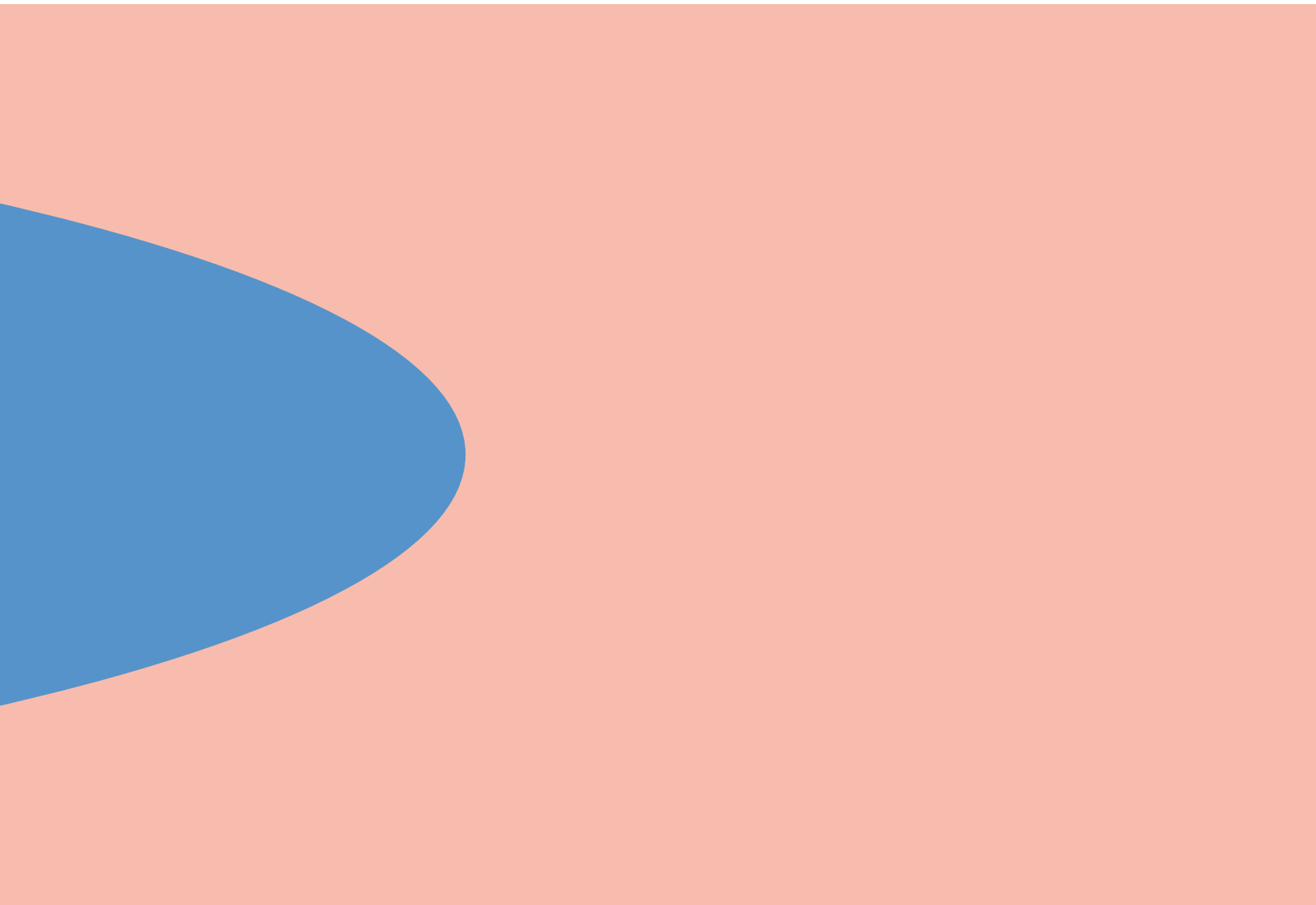


HIGHLIGHTS OF THE CONTRIBUTION OF
THE NAIROBI WORK PROGRAMME

**ASSESSING CLIMATE CHANGE
IMPACTS AND VULNERABILITY
MAKING INFORMED
ADAPTATION DECISIONS**



United Nations
Framework Convention on
Climate Change



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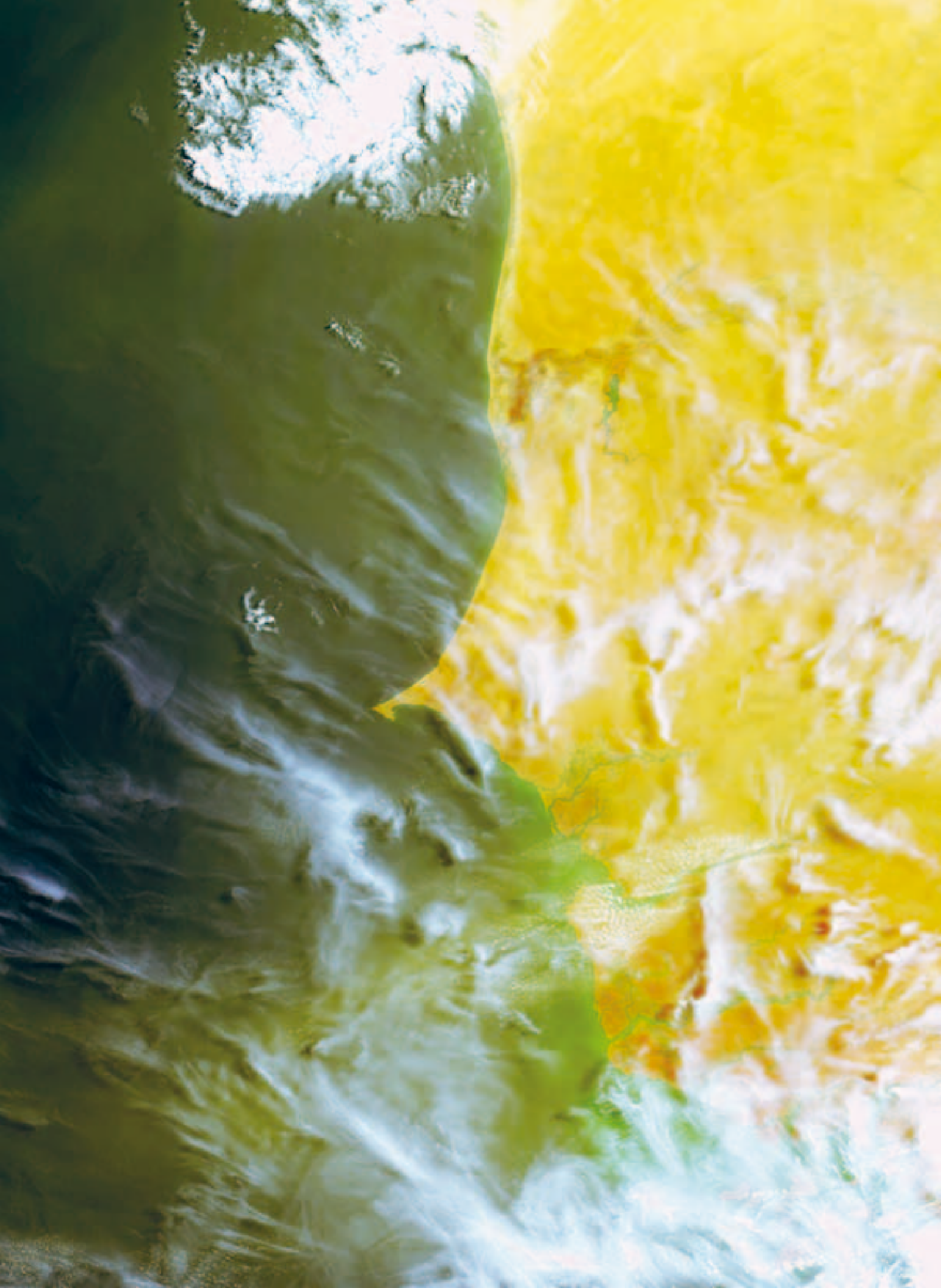


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INTRODUCTION

It is evident from the science of climate change and the experiences of nations and communities that adaptation actions, together with mitigation responses, are required in order to address the wide-ranging impacts of projected climate change. As shown in [FIGURE INTRO-1](#), the adaptation process consists of four key components: (i) the assessment of climate impacts and vulnerability; (ii) planning for adaptation; (iii) the implementation of adaptation measures; and (iv) the monitoring and evaluation of adaptation actions. Each of these components is associated with and/or supported by, relevant data and information, methods and tools, and practices. The Nairobi work programme on impacts, vulnerability and adaptation to climate change ([see BOX INTRO-1](#)), under its two thematic areas (impacts and vulnerability; and adaptation policies, measures and actions) and nine work areas, has made substantial contributions to advancing the work related to these four components of the adaptation process. Cutting across these components are stakeholder engagement and knowledge management, which serve to provide vital inputs and feedback to the entire adaptation process.

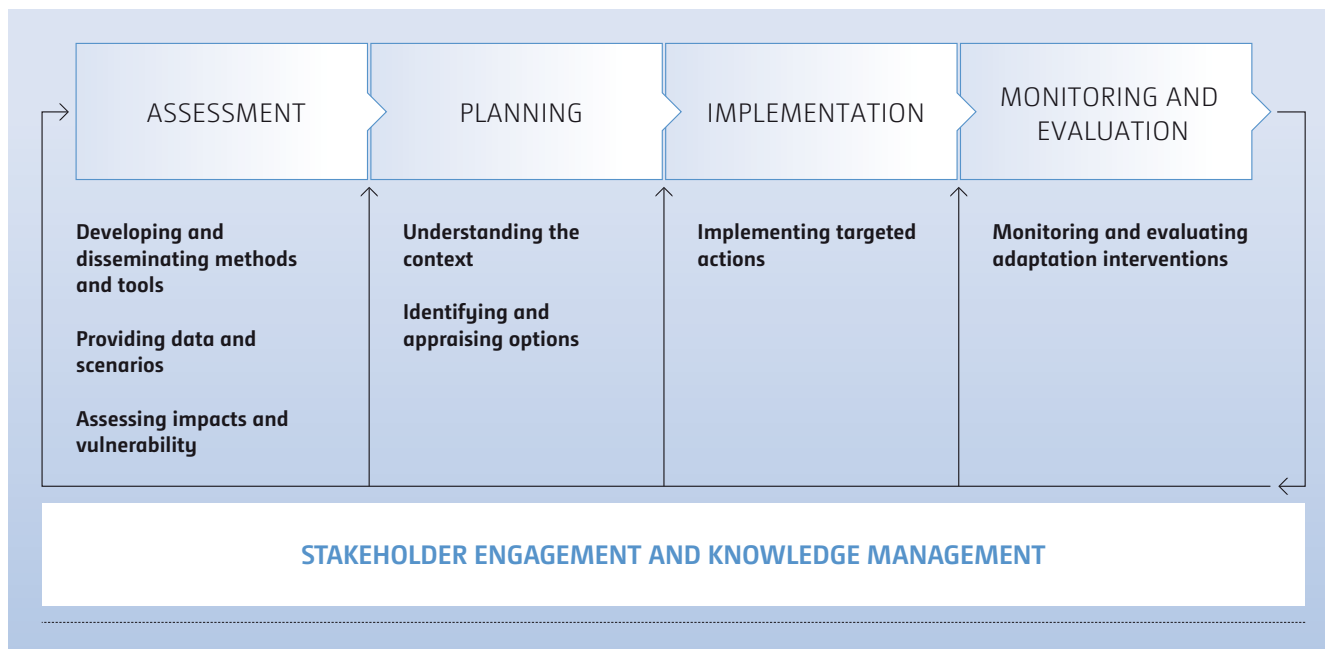
As a multilateral initiative under the United Nations Framework Convention on Climate Change (UNFCCC), the Nairobi work programme has been effective in engaging and motivating Parties and a wide range of stakeholders in activities relating to all four components of the adaptation process:

- It provides a valuable interface for direct interactions between UNFCCC Parties and a large number of organizations and experts, through which the needs/demands of Parties and activities and expertise supplied by organizations are identified, shared and communicated widely ([see FIGURE INTRO-2](#));
- Capitalizing on its unique convening power and facilitative role, the Nairobi work programme has been effective in catalysing targeted adaptation actions, and promoting knowledge sharing and learning on adaptation.

In addition, through the implementation of a diverse range of activities over the past five years, the Nairobi work programme has contributed to the development of a highly motivated and willing network of partner organizations, experts and community of adaptation practices, and the infrastructure (e.g. the Nairobi work programme partner organization database), instruments (e.g. Calls for Action and Action Pledges) and modalities (e.g. the joint development of knowledge products and the provision of technical assistance to Parties) for this network to stay active and focused, as well as a large number of information and knowledge products. Therefore, the Nairobi work programme, through its network of stakeholders and the associated infrastructure and knowledge resources, has the potential to play an important role in supporting the implementation of the Cancun Adaptation Framework (CAF). The CAF was adopted by Parties to enhance the implementation of and support for adaptation as part of a strengthened international agreement on climate change. Many countries called for incorporating and building upon the Nairobi work programme when embarking on the next phase of the adaptation regime. This could be done, for example, by building a strong two-way relationship between the new Adaptation Committee and the Nairobi work programme; using knowledge and information generated in implementing the work programme to address loss and damage associated with climate change impacts and engaging the Nairobi work programme's network of stakeholders in strengthening regional centres and networks.

This publication highlights the important contribution that the Nairobi work programme has made to advancing work related to the four components of climate change adaptation. Relevant information and knowledge products (e.g. technical workshop reports, synthesis reports) mandated by the Subsidiary Body for Scientific and Technological Advice (SBSTA) ([see TABLE INTRO-1](#)), as well as those contributed by Nairobi work programme partner organizations (e.g. Action Pledges and their updates) are the primary sources for the compilation of this summary note. As well as showcasing the valuable activities that have been catalysed under the Nairobi work programme, this note aims to provide an overview of the four core components of the adaptation process and their associated methodologies and information issues for stakeholders, including decision makers from the public and private sectors, sectoral practitioners, researchers and knowledge brokers at the national and subnational levels.

Figure Intro-1. The adaptation process and its four key components



Box Intro-1. The Nairobi work programme on impacts, vulnerability and adaptation to climate change

The Nairobi work programme on impacts, vulnerability and adaptation to climate change was launched at the eleventh session of the Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC) in 2005. The objective of this work programme of the Subsidiary Body for Scientific and Technological Advice (SBSTA) 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 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.

The implementation of the Nairobi work programme is structured around nine action-oriented work areas: methods and tools; data and observations; climate modelling, scenarios and downscaling; climate-related risks and extreme events; socio-economic information; adaptation planning and practices; research; technologies for adaptation; and economic diversification.

Towards the achievement of the objective of the Nairobi work programme, Parties to the UNFCCC, and many intergovernmental, governmental, and non-governmental organizations, the private sector and individual experts have been engaged in contributing to the implementation of the Nairobi work programme by carrying out a large number of mandated and pledged activities. Since its launch, the Nairobi work programme has played a key role under the UNFCCC process in engaging stakeholders, catalysing targeted action and facilitating knowledge sharing and learning on adaptation.

See <<http://unfccc.int/nwp>> for further details.

Figure Intro-2. The Nairobi work programme as an effective interface between the Parties to the UNFCCC and the diverse range of organizations and experts involved in adaptation



Table Intro-1. Summary of contributions relating to the adaptation process carried out by Parties and partner organizations under the Nairobi work programme

Activities	Outputs	Contributing to the adaptation process			
		1	2	3	4
SHARING KNOWLEDGE AND INFORMATION					
Submissions by WMO and its member states, GCOS secretariat and other relevant organizations on how their work could contribute to the improved understanding of the current and historical climate, and its impacts	Submissions of information and views from WMO and nine of its members states (Australia, Bolivia, China, Japan, Kazakhstan, Mexico, Russia and Uzbekistan as well as from Portugal on behalf of the European Community and its member states), three intergovernmental organizations (IPCC, GTOS, GCOS) (FCCC/SBSTA/2007/MISC.23), and one admitted non-governmental organization ¹	●			
Submissions from the IPCC, other relevant international, regional and national organizations, and modelling centres and agencies on ways in which they contribute to work on climate modelling, scenarios and downscaling	Submissions contained in FCCC/SBSTA/2007/MISC.24	●			
Submissions on relevant programmes, activities and views on the issues relating to climate related risks and extreme events	Submissions from Argentina, Australia, Germany on behalf of the European Community and its member states, India, Mexico, Morocco, New Zealand, Saudi Arabia, South Africa, Uzbekistan, United States of America and the Alliance of Small Island States (AOSIS) (FCCC/SBSTA/2007/MISC.4, Add.1 and Add.2); Submissions from FAO, UN/ISDR, WMO, IFRC, OECD, CARE Canada, Practical Action, German Committee for Disaster Reduction and Global Fire Monitoring Centre (GFMC) (FCCC/SBSTA/2007/MISC.5)	●	●		

Table Intro-1. Summary of contributions relating to the adaptation process carried out by Parties and partner organizations under the Nairobi work programme (continued)

Activities	Outputs	Contributing to the adaptation process			
		1	2	3	4
Submissions on efforts undertaken to assess the costs and benefits of adaptation options , and views on lessons learned, good practices, gaps and needs	Submissions from the Russian Federation and from Sweden on behalf of the European Community and its member states (FCCC/SBSTA/2009/MISC.9/Rev.1, in English and Russian); A synthesis report based on these submissions and other relevant information sources (FCCC/SBSTA/2010/3, in Arabic , Chinese , English , French , Russian and Spanish)		●		
Submissions on approaches to and experiences in integrating and expanding adaptation planning and action at national, subnational, community and local levels, including scaling up of local and community-based adaptation; and on lessons learned, good practices, gaps, needs, barriers and constraints to adaptation, including implementation of adaptation projects	Submissions from Belize, Colombia, Costa Rica, Czech Republic on behalf of the European Community and its member states, Japan, New Zealand, Saudi Arabia, Sri Lanka, Uzbekistan, Caribbean Community Climate Change Centre, FAO and Practical Action (FCCC/SBSTA/2009/MISC.4); A synthesis paper based on these submissions and other relevant information sources (FCCC/SBSTA/2009/6, in Arabic , Chinese , English , French , Russian and Spanish)		●	●	
Submissions on 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	Submissions from Argentina, Australia, Bangladesh, Canada, Cuba, El Salvador, Germany on behalf of the European Community and its member States, Japan, Mexico, New Zealand, South Africa, Tajikistan and the United States of America (FCCC/SBSTA/2007/MISC.10 and Add.1); Submissions from the CBD Secretariat, FAO, UN/ISDR, UNDP Bureau for Crisis Prevention and Recovery, WFP, WMO and OECD (FCCC/SBSTA/2007/MISC.11); Submissions from admitted non-government organizations: the International Research Institute for Climate and Society, Practical Action and the Tyndall Centre for Climate Change Research ² ; A synthesis report based on submissions from Parties and relevant organizations (FCCC/SBSTA/2007/6, in Arabic , Chinese , English , French , Russian and Spanish)		●	●	
Submissions on information on examples of measures, methodologies and tools to increase the economic resilience of, and reduce reliance on, vulnerable sectors	Submissions from Bolivia, Japan, New Zealand, Portugal on behalf of the European Community and its member states and Saudi Arabia (FCCC/SBSTA/2007/MISC.15 and FCCC/SBSTA/2007/MISC.15/Add.1); Submission from the CBD secretariat (FCCC/SBSTA/2007/MISC.16); Submission from the International Trade Union Confederation ³ ; A synthesis report based on these submissions and other relevant information sources (FCCC/SBSTA/2007/14, in Arabic , Chinese , English , French , Russian and Spanish)		●	●	

Table Intro-1. Summary of contributions relating to the adaptation process carried out by Parties and partner organizations under the Nairobi work programme (continued)

Activities	Outputs	Contributing to the adaptation process			
		1	2	3	4
Submissions on additional information on examples of measures, methodologies and tools on increasing economic resilience to climate change and reducing reliance on vulnerable economic sectors, including through economic diversification	Submissions from Belize, Czech Republic on behalf of the European Community and its member states, Saudi Arabia, Sri Lanka, Uzbekistan and the Caribbean Community Climate Change Centre (FCCC/SBSTA/2009/MISC.6)		●	●	
Submissions on efforts undertaken to monitor and evaluate the implementation of adaptation projects, policies and programmes and the costs and effectiveness of completed projects, policies and programmes, as well as on lessons learned, good practices, gaps and needs	Submission to Sweden on behalf of the European Community and its member states (FCCC/SBSTA/2009/MISC.10); A synthesis report based on the submission and other relevant information sources (FCCC/SBSTA/2010/5, in Arabic, Chinese, English, French, Russian and Spanish)				●
PROMOTING DIALOGUE AND INTERACTION					
Technical workshop on climate-related risks and extreme events , Cairo, Egypt 18–20 June 2007	Presentations made by Parties, organizations and experts < http://unfccc.int/3953.php >; A report on the meeting (FCCC/SBSTA/2007/7, in Arabic, Chinese, English, French, Russian and Spanish); A Call for Action to advance work on methods and tools; A background paper on assessing, predicting and managing current and future climate variability and extreme events, and implications for sustainable development	●	●		
Expert meeting on methods and tools , and on data and scenarios, Mexico City, Mexico, 4–7 March 2008	Presentations made by Parties, organizations and experts < http://unfccc.int/4259.php >; A report on the meeting (FCCC/SBSTA/2008/3, in Arabic, Chinese, English, French, Russian and Spanish); A Call for Action to advance work on methods and tools; A Call for Action to advance work on data and observations	●	●		
Expert meeting on socio-economic information , Port of Spain, Trinidad and Tobago, 10–12 March 2008	Presentations made by Parties, organizations and experts < http://unfccc.int/4265.php >; A report on the meeting (FCCC/SBSTA/2008/2, in Arabic, Chinese, English, French, Russian and Spanish); A Call for Action to advance work on socio-economic information	●	●		
In-session workshop on climate modelling, scenarios and downscaling , Bonn, Germany, 7 June 2008	Presentations made by Parties, organizations and experts < http://unfccc.int/4377.php >; A report on the meeting (FCCC/SBSTA/2008/9, in Arabic, Chinese, English, French, Russian and Spanish); A Call for Action to advance work on climate modelling, scenarios and downscaling	●			

Table Intro-1. Summary of contributions relating to the adaptation process carried out by Parties and partner organizations under the Nairobi work programme (continued)

Activities	Outputs	Contributing to the adaptation process			
		1	2	3	4
Technical workshop on collaboration among regional centres and networks , Apia, Samoa, 2–5 March 2010	Presentations made by Parties, organizations and experts < http://unfccc.int/5258.php >; A report on the workshop (FCCC/SBSTA/2010/8, in Arabic , Chinese , English , French , Russian and Spanish); A Call for Action to enhance collaboration among regional centres and networks within the context of strengthening the provision, dissemination and application of methods and tools, data and observations, and scenarios	●	●		
Technical workshop on costs and benefits of adaptation options , Madrid, Spain, 22–24 June 2010	Presentations made by Parties, organizations and experts < http://unfccc.int/5283.php >; Summaries of efforts undertaken by Parties and organizations to assess the costs and the benefits of adaptation options < http://unfccc.int/5691.php >; Report on the workshop (FCCC/SBSTA/2010/9, in Arabic , Chinese , English , French , Russian and Spanish)		●	●	
Technical workshop on advancing the integration of approaches to adaptation planning , Bangkok, Thailand, 12–14 October 2009	Presentations made by Parties, organizations and experts < http://unfccc.int/4915.php >; A report of the workshop (FCCC/SBSTA/2010/2, in Arabic , Chinese , English , French , Russian and Spanish)		●	●	
Technical workshop on integrating practices, tools and systems for climate risk assessment and management and disaster risk reduction strategies into national policies and programmes , Havana, Cuba, 10–12 March 2009	Presentations made by Parties, organizations and experts < http://unfccc.int/4742.php >; A report of the workshop (FCCC/SBSTA/2009/5, in Arabic , Chinese , English , French , Russian and Spanish)	●	●	●	
Workshop on adaptation planning and practices , Rome, Italy, 10–12 September 2007	Presentations made by Parties, organizations and experts < http://unfccc.int/4036.php >; A report of the workshop (FCCC/SBSTA/2007/15, in Arabic , Chinese , English , French , Russian , Spanish)		●	●	
Workshop on increasing economic resilience to climate change and reducing reliance on vulnerable economic sectors, including through economic diversification, Cairo, Egypt, 28–30 April 2009	Presentations made by Parties, organizations and experts < http://unfccc.int/4781.php >; A report of the workshop (FCCC/SBSTA/2009/7, in Arabic , Chinese , English , French , Russian and Spanish)		●	●	
ENHANCING THE KNOWLEDGE BASE					
Technical paper on physical and socio-economic trends in climate-related risks and extreme events	A technical paper outlining the physical and socio-economic trends in climate-related risks and extreme events for developing countries, particularly for the least developed countries and small island developing States, and the implications for sustainable development (FCCC/TP/2008/3)	●	●		
Technical paper on integrating practices, tools and systems for climate risk assessment and management and DRR strategies into national policies and programmes	A technical paper outlining the needs, practices, tools and systems for advancing the integration of adaptation and disaster risk reduction into national policies and programmes (FCCC/TP/2008/4).	●	●		

Table Intro-1. Summary of contributions relating to the adaptation process carried out by Parties and partner organizations under the Nairobi work programme (continued)

Activities	Outputs	Contributing to the adaptation process			
		1	2	3	4
Technical paper on mechanisms to manage financial risks from direct impacts of climate change in developing countries	A technical paper providing information on the financial mechanisms used to manage risks from the direct impacts of climate change. The mechanisms described include both insurance mechanisms and other forms of risk spreading and sharing, referred to as non-insurance mechanisms (FCCC/TP/2008/9)	●	●		
UNFCCC compendium on methods and tools for assessing climate change impacts of, vulnerability and adaptation to climate change	A user-friendly, and fully searchable Compendium	●	●		
Web-based resources	Links to terrestrial, atmospheric and oceanic data, climatic and relevant non-climatic data and information that are available in public domain < http://unfccc.int/3923.php >	●	●		
Technical paper reviewing the existing literature on the potential costs and benefits of adaptation options	A technical paper analyzing the general methodological issues for estimating the costs and benefits of adaptation options, reviewing new studies on the economics of adaptation in light of these methodological issues, and discussing the strengths and weaknesses of the studies and methods (FCCC/TP/2009/2/Rev.1)	●	●		
Technical paper on integrating practices, tools and systems for climate risk assessment and management, and DRR strategies into national policies and programmes	A technical paper outlining the needs, practices, tools and systems for advancing the integration of adaptation and disaster risk reduction into national policies and programmes (FCCC/TP/2008/4)	●	●	●	
Adaptation assessment, planning and practice: An overview from the Nairobi work programme on impacts, vulnerability and adaptation to climate change	A publication discussing the provision of data, information, methods and tools for climate risk assessments and adaptation decision making; summarizing a wide range of ongoing adaptation activities and case studies; and highlighting good practices, gaps and needs, and opportunities to address these gaps < http://unfccc.int/4628.php >	●	●	●	
UNFCCC database on adaptation planning and practices	A searchable database containing all the submissions made by Parties and relevant organizations under the adaptation planning and practices area of the Nairobi work programme < http://maindb.unfccc.int/public/adaptation_planning >		●	●	

Abbreviations: 1 = Assessing climate impacts and vulnerability; 2 = Planning for adaptation; 3 = Implementing targeted adaptation actions; 4 = Monitoring and evaluating adaptation interventions

This note consists of three parts: **PART ONE** – the adaptation process and the Nairobi work programme, highlighting some of the activities carried out under the work programme with relation to the four components of the adaptation process, and emerging good practices and lessons learned; **PART TWO** – case studies including details of the case examples referred to in **PART ONE**; and **PART THREE** – further resources with reference materials and resources relating to the various components of the adaptation process.

¹ It is available at <http://unfccc.int/files/adaptation/sbsta_agenda_item_adaptation/application/pdf/200709_nwp_submission_nies_do.pdf>.

² Available at <<http://unfccc.int/4097.php>>.

³ Available at <http://unfccc.int/files/adaptation/sbsta_agenda_item_adaptation/application/pdf/nairobiwp_itucsubmissionecodiversification.pdf>.



Assessing Climate Change Impacts and Vulnerability

PART ONE

**THE ADAPTATION PROCESS AND
THE NAIROBI WORK PROGRAMME**

I. ASSESSING IMPACTS AND VULNERABILITY

At the outset of any adaptation initiative, an assessment of the implications of climate change for the composition and functioning of natural systems (e.g. agricultural productivity, water supplies), as well as the different aspects of human society (e.g. social well-being, economic activities) is required to determine whether, and the extent to which, climate change will have an impact. Once a decision has been made that climate change poses significant risks and that adaptation is needed to manage those risks, assessments are carried out to provide essential information to inform the subsequent components of the adaptation process: planning; implementation; and monitoring and evaluation (see [FIGURE I-3](#)).

Assessments of climate change impacts and vulnerability vary widely, depending on the subject matter (e.g. a natural resource/production system such as agriculture, or an economic activity such as investment in infrastructure development); time frame (e.g. near-term consistent with annual crop planning, or longer timeframe comparable to the design lifetime of road transport system); geographic coverage (e.g. a transboundary watershed or a single site); and purposes of the assessments (e.g. to raise awareness of climate change, or to inform the technical design of large/expensive infrastructure). Consequently, a wide range of methods and tools have been developed and applied to facilitate the assessments, with the support of appropriate data and information.

Under the Nairobi work programme, a large number of activities have been carried out by Parties and partner organizations to enhance the understanding and assessment of climate change impacts and vulnerability, through:

- The development and dissemination of methods and tools (see [SECTION 1.1.1](#));
- The provision of data and information (see [SECTION 1.1.2](#));
- The assessments of impacts and vulnerability at different scales and in different sectors (see [SECTION 1.1.3](#)).

Activities relevant to the assessments of impacts and vulnerability carried out under the Nairobi work programme are summarized in [TABLE INTRO-1](#) above, and additional activities undertaken by Nairobi work programme partners are profiled in the online searchable database at <http://unfccc.int/5005.php>.

Using case studies, this section highlights some of these activities, focusing on good practices and lessons learned, while details of case studies and further resources are provided in [PARTS TWO AND THREE](#) of this summary note, respectively.

1.1. HIGHLIGHTS OF ACTIVITIES

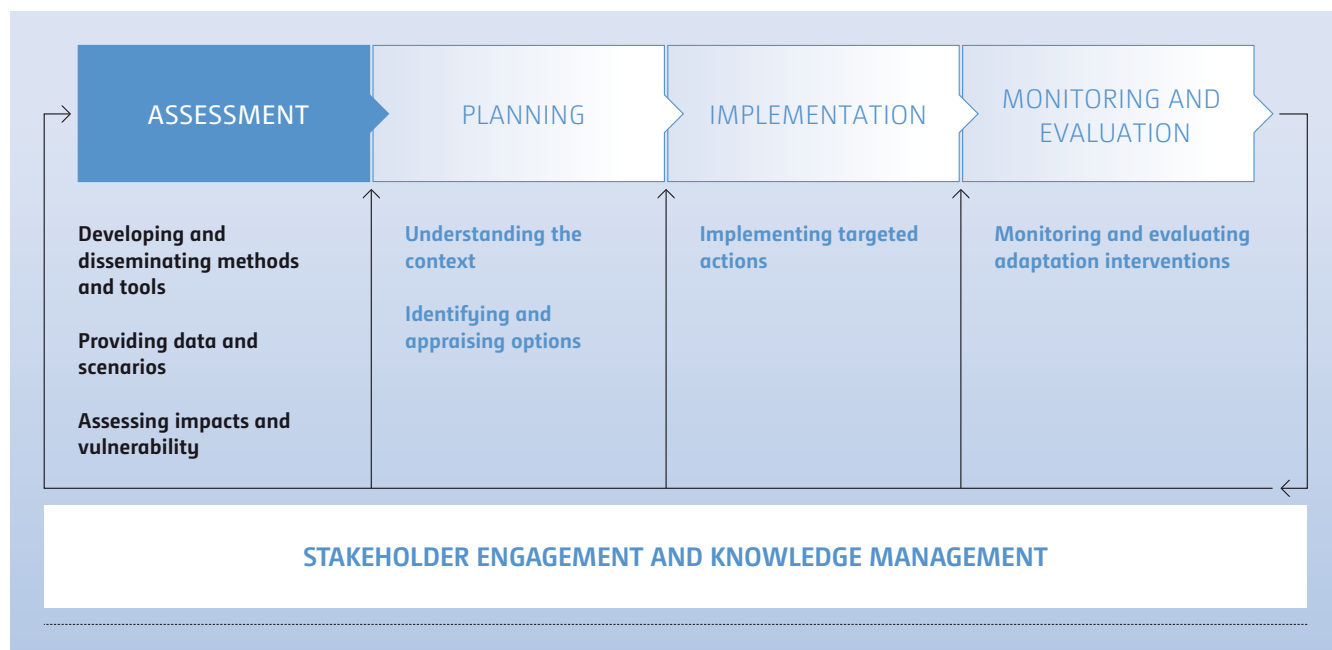
1.1.1. DEVELOPMENT AND DISSEMINATION OF METHODS AND TOOLS

Under the Nairobi work programme, a large number of activities have been carried out to develop and disseminate methods and tools, which target a variety of assessment tasks, contexts and scales.

As summarized in [TABLE I-2](#) below, a progressively more sophisticated and more decision-oriented set of approaches has emerged. Each approach has its own characteristics relating to the underlying motivation and practical goals, spatial scope and time horizon, associated methods and tools, and data needs (particularly those relating to future environmental and socio-economic conditions). However, in general, these approaches and their associated methods and tools have evolved to respond to the growing demand for policy-relevant information on potential impacts and vulnerability and on the alternative adaptation options. In so doing, they have gradually moved towards the greater integration of stakeholder inputs and the more robust treatment of uncertainties in the assessment and planning processes (see [TABLE I-2](#)).

The UNFCCC Compendium on methods and tools to evaluate impacts of, and vulnerability and adaptation to, climate change has collated a total of 126 entries to date.⁴ These methods and tools have been developed with specific sectoral and thematic focuses, and made available in different forms (see [TABLE I-3](#)).

Figure 1-3. Assessing climate risks and vulnerability as the starting point of the adaptation process to provide the essential information



A wide range of methodological frameworks, methods and tools have been developed by Parties and partner organizations. They span from comprehensive risk management and adaptation decision making frameworks, to sectoral and integrated assessment models, and practical tools to facilitate the engagement of stakeholder inputs to the assessment process. Examples of such methods and tools include:

- The Risk, Uncertainty and Decision-Making Framework by the United Kingdom Climate Impacts Programme (UKCIP) (see CASE STUDY 1 in PART TWO);
- The Public Infrastructure Engineering Vulnerability Committee (PIEVC) Engineering Protocol by the World Federation of Engineering Organizations (see CASE STUDY 2 in PART TWO);
- The Community-based Risk Screening Tool – Adaptation and Livelihoods (CRiSTAL) by the International Institute for Sustainable Development (IISD), the International Union for Conservation of Nature (IUCN), the Stockholm Environment Institute (SEI) and Intercooperation (see CASE STUDY 3 in PART TWO).

In addition to efforts made by the developers of methods and tools, a growing number of knowledge networks and platforms have been working to facilitate the wide dissemination of these tools, as well as the interactions between and among the developers and users of methods and tools. The Adaptation Learning Mechanism (ALM), managed by the United Nations Development Programme (UNDP), is such an example (see CASE STUDY 4 in PART TWO).

⁴ Available as a searchable database at <<http://unfccc.int/5457.php>>.

Table 1-2. Summary of existing and emerging approaches to impacts, vulnerability and adaptation assessments, and their associated methods and tools

APPROACH	KEY FEATURES		
	Motivation	Practical goals	Underlying methods
Impact-based	Research-driven	Actions to reduce risks	<ul style="list-style-type: none"> – Standard methods following the scenarios → biophysical impacts → socio-economic implications sequence – ‘Driver-pressure-state-impact-response’ (DPSIR) methods – Hazard-driven risk assessment methods
Vulnerability-based	Research-/ stakeholder-driven	Actions to reduce vulnerability	<ul style="list-style-type: none"> – Vulnerability indicators and profiles – Past and present climate risks
Adaptation-based	Research-/ stakeholder-driven	Actions to improve adaptation	<ul style="list-style-type: none"> – Livelihood analysis – Agent-based methods – Narrative methods – Risk perception including critical thresholds – Development/sustainability policy performance – Relationship of adaptive capacity to sustainable development
Integrated assessment	Research-/ stakeholder-driven	Global climate policy options and their economic implications	<ul style="list-style-type: none"> – Integrated assessment modelling – Cross-sectoral interactions – Integration of climate with other drivers – Stakeholder discussions – Linking models across types and scales – Combining assessment approaches/methods
Risk management	Decision making-driven	Robust climate risk management decisions	<ul style="list-style-type: none"> – Methods applied under all other approaches – Methods for characterizing and managing uncertainties

Source: adapted from Carter et al. 2007.⁵

Table 1-3. Sectoral and thematic focuses, and forms of methods and tools included in the UNFCCC Compendium on methods and tools

Sectoral focus	Thematic focus	Forms
<ul style="list-style-type: none"> – Generic to all sectors – Multiple sectors – Agriculture – Coastal zones – Human health – Terrestrial ecosystems – Water resources 	<ul style="list-style-type: none"> – Adaptation evaluation – Adaptation planning – Climate scenarios – Economic analysis – Impact assessment – Mainstreaming – Methodological frameworks – Sea-level rise scenarios – Socio-economic scenarios – Stakeholder engagement – Vulnerability mapping 	<ul style="list-style-type: none"> – Guidance document – Knowledge platform – Modelling tool – Resources (case studies) – Resources (data) – Risk screening and adaptation decision support tool

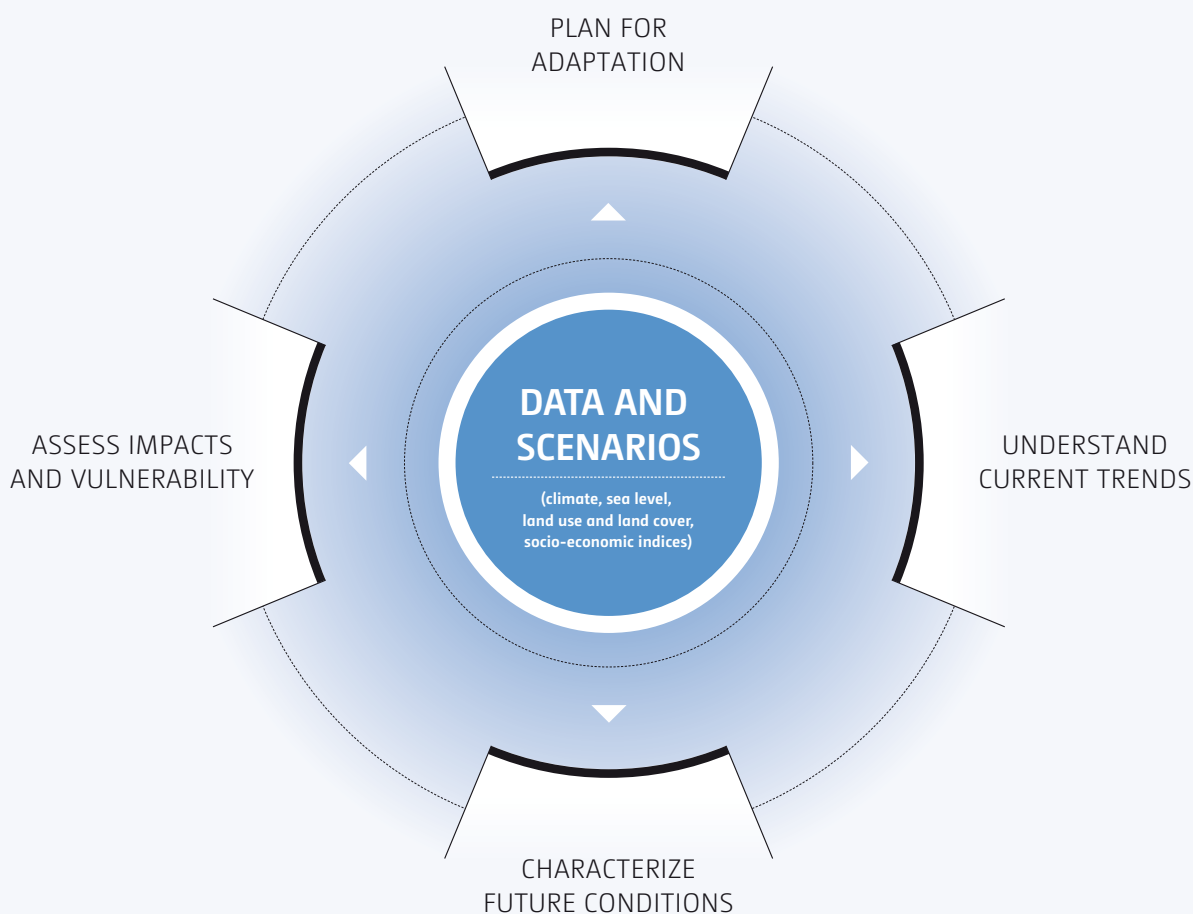
1.1.2. PROVISION OF DATA AND INFORMATION: OBSERVATIONS
AND SCENARIOS

Box I-2. Data and information needs for climate change impacts and vulnerability assessments

As shown in Figure I-4 below, the provision of observational data as well as characterizations of future conditions on the key environmental and socio-economic variables are essential to the assessment of climate change impacts and adaptation planning. Data from observations and statistical records are important for understanding ongoing trends and key processes within and between the natural and socio-economic systems. Characterizations of future conditions are required to assess the likely implications for the states of the natural environment and human society in a changing climate.

Since climate change is, in many cases, only one factor contributing to the vulnerability of communities and natural systems, policy-relevant assessments and adaptation planning need to consider other environmental as well as socio-economic drivers for vulnerability. Therefore, data and scenario information on non-climatic environmental variables (e.g. land use and land cover, air pollutants), as well as socio-economic indices (e.g. demography, access to basic public services) are as important as climatic information as inputs for policy-relevant assessments and informed adaptation decisions.

Figure I-4. Data and information on environmental (including climatic) and socio-economic variables as an integral part of the knowledge support system for adaptation



⁵ CARTER, T.R., R.N. JONES, X. LU, S. BHADWAL, C. CONDE, L.O. MEARN, B.C. O'NEILL, M.D.A. ROUNSEVELL AND M.B. ZUREK, 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, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge, UK, 133–171.

A wide range of activities contributing to the development and dissemination of data and scenarios have been undertaken, either as Action Pledges by partner organizations or mandated by the SBSTA under most Nairobi work programme work areas: data and observations; climate modelling, scenarios and downscaling; climate-related risks and extreme events; socio-economic information; and research.⁶ Parties and partner organizations have also shared experiences and views on good practices and lessons learned relating to their efforts on the provision of data and scenario support for policy-relevant impacts and vulnerability assessments and adaptation planning.

CLIMATE OBSERVATIONS AND BASELINE SOCIO-ECONOMIC INFORMATION

Climate observations are important not only for understanding the complex processes and feedbacks within the climate system; observed climate data are needed to provide a baseline against which the potential impacts of climate change on the natural environment and human society can be measured.

As a partner organization of the Nairobi work programme, the World Meteorological Organization (WMO) has made 17 Action Pledges towards the programme's work areas. With technical guidance and support from WMO, National Meteorological and Hydrological Services (NMHS) usually assume the primary responsibilities for the operation of climate observations, the management of the associated data products, and the provision of relevant data products and services.

Led by WMO, its associated programmes (e.g. the Global Climate Observing System (GCOS) and the World Climate Research Programme (WCRP)) and partners at the regional and national level (see [CASE STUDY 5 in PART TWO](#)), increasing efforts have been made to promote the implementation of systematic observations of the Earth System, and to enhance the provision of basic climate data and information essential to support the assessment of climate change and variability, and adaptation planning.

In addition to coordinating the implementation of climate observing systems, WMO, through its various programmes and partners, also provides training and capacity-building on the management and application of observed climate data and associated observation products. For example, WMO's Education and Training Programme serves as an advisory body on all aspects of technical and scientific education and training in meteorology and operational hydrology. It organizes/co-sponsors training courses, workshops and

seminars, prepares and disseminates training materials and runs a Training Library including a Virtual Training Library, provides long- and short-term fellowships, and supports School and Popular Meteorological, Hydrological and Oceanographic Education.⁷

Further, WMO also promotes and contributes to the development of regional initiatives to enhance climate observing systems and the associated data and information services. Ten regional workshops were held under the GCOS Regional Workshop Programme in order to, among other things, identify national/ regional needs and deficiencies in climate data and to initiate the development of Regional Action Plans for improving climate observing systems. Ten Regional Action Plans were elaborated and regional implementation is being initiated (see [CASE STUDY 6 in PART TWO](#) for an example in Africa).

As noted above, socio-economic data and scenarios are important inputs, in addition to climatic information, for assessing climate change impacts, vulnerability and adaptation. Specifically, they are needed to:

- Characterize the demographic, socio-economic and technological drivers underlying current vulnerabilities of communities and natural systems;
- Characterize the sensitivity, adaptive capacity and vulnerability of social and economic systems in a changing future climate.

In comparison with the work on the provision of climate data and scenarios, work on socio-economic data and scenarios in support of climate change impacts and vulnerability assessments and adaptation planning is relatively recent and represents an area which requires greater attention. Activities undertaken by Parties and partner organizations of the Nairobi work programme focusing on the provision of both baseline and projected socio-economic data and information are highlighted in [CASE STUDIES 7 and 8 in PART TWO](#) of this note.

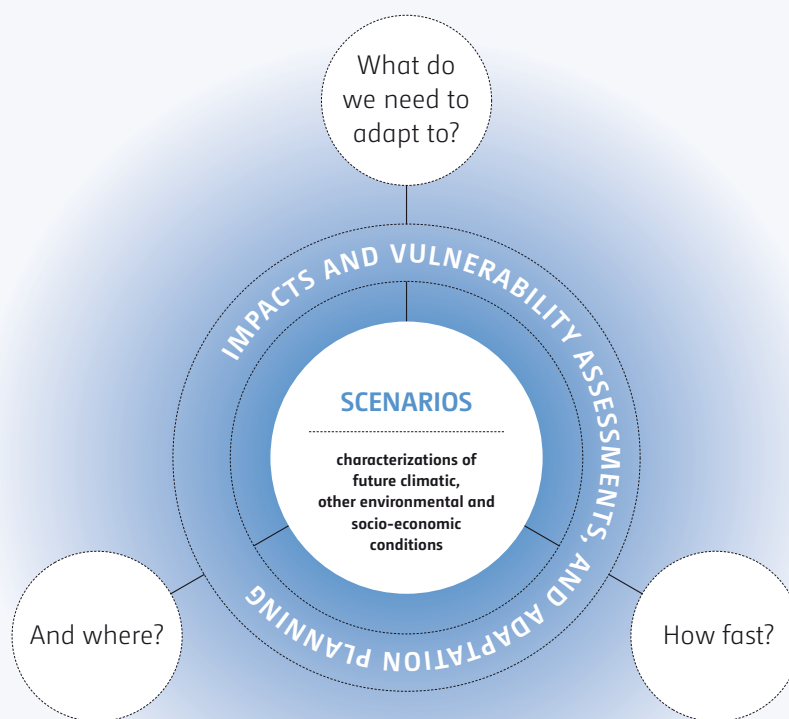
SCENARIOS

Box 1-3. The role of scenarios in assessing climate change impacts and vulnerability

As shown in Figure 1-5, characterizations of future climatic (and other environmental and socio-economic) conditions are critical inputs to impacts and vulnerability assessments and adaptation planning. Essentially, they help provide insights on the scope, focus and timeline for adaptation inventions to address potential climate change impacts and vulnerability. Climate models (computer-based, internally consistent numerical descriptions of key processes of the climate system) have been widely used to provide such characterizations. Due to the inherent uncertainties

within the climate system, scenarios have been derived from climate model outputs to provide alternative views of what the world climate would look like.⁸ Given the “mismatch” between the scale at which climate models perform with reasonable confidences and that of most adaptation policy decisions and actions, the downscaling, or regionalization, of global/large-scale climate model outputs is needed to support policy-relevant impact and vulnerability assessments and adaptation planning at different levels.

Figure 1-5. Scenarios as essential inputs to impacts and vulnerability assessments and adaptation planning



⁶ Details on activities undertaken and associated outputs under each work area are available at <<http://www.unfccc.int/5137.php>>.

⁷ See <<http://www.wmo.int/pages/prog/dra/etrp.php>> for details of the programme.

⁸ The IPCC defines a scenario as a “plausible and often simplified description of how the future may develop, based on a coherent and internally consistent set of assumptions about driving forces and key relationships”. Although the majority of scenarios are based on results from computer models (climate or other system models to simulate aspects of socio-economic systems such as demography, energy consumption), there are other types of scenarios that are derived from largely qualitative insights, often from particular groups such as experts or members of local communities.

Under a Nairobi work programme Action Pledge, WMO's WCRP and its partners (e.g. the various climate modelling centres) have been leading the efforts in developing climate models, coordinating model experiments and disseminating model outputs. They have been working to improve global climate models, refine downscaling techniques and evaluate regional model outputs with users in different regions.⁹ Most notably, WCRP, through its Climate Variability and Predictability (CLIVAR) project, has coordinated the global climate model simulations and the dissemination of model outputs associated with the Intergovernmental Panel on Climate Change (IPCC) Assessment Reports. A new round of climate model experiments is currently under way and is expected to provide new climate scenarios for impacts, vulnerability and adaptation assessments to be considered in the IPCC Fifth Assessment Report. Standardized outputs from these climate model simulations will be made available through the fifth phase of the Coupled Model Intercomparison Project (CMIP5)¹⁰ and a network of regional centres.

In addition to the efforts by WCRP to disseminate global climate model outputs, the IPCC Task Group on Data and Scenario Support for Impacts and Climate Analysis (TGICA) is mandated to facilitate the wide availability of climate change related data and scenarios to enable research and sharing of information across the three IPCC working groups. Through its Data Distribution Centre (DDC), the TGICA facilitates the timely distribution of a consistent set of up-to-date data and scenarios of changes in climate and related environmental and socio-economic factors for use in climate change impact, adaptation and vulnerability (IAV) studies.

To address the inadequacy of global climate models (GCMs) in simulating key regional/local climate features, statistical and dynamical downscaling techniques have been developed to provide additional regional details in climate scenarios. Dynamical downscaling, where a regional climate model with finer resolution is embedded in a global model, is better able to simulate regional climate features, such as monsoon rainfall and other extreme weather events. On the other hand, statistical downscaling, where large-scale climate features are statistically related to fine scale climate for the region, can easily incorporate observations into the method.

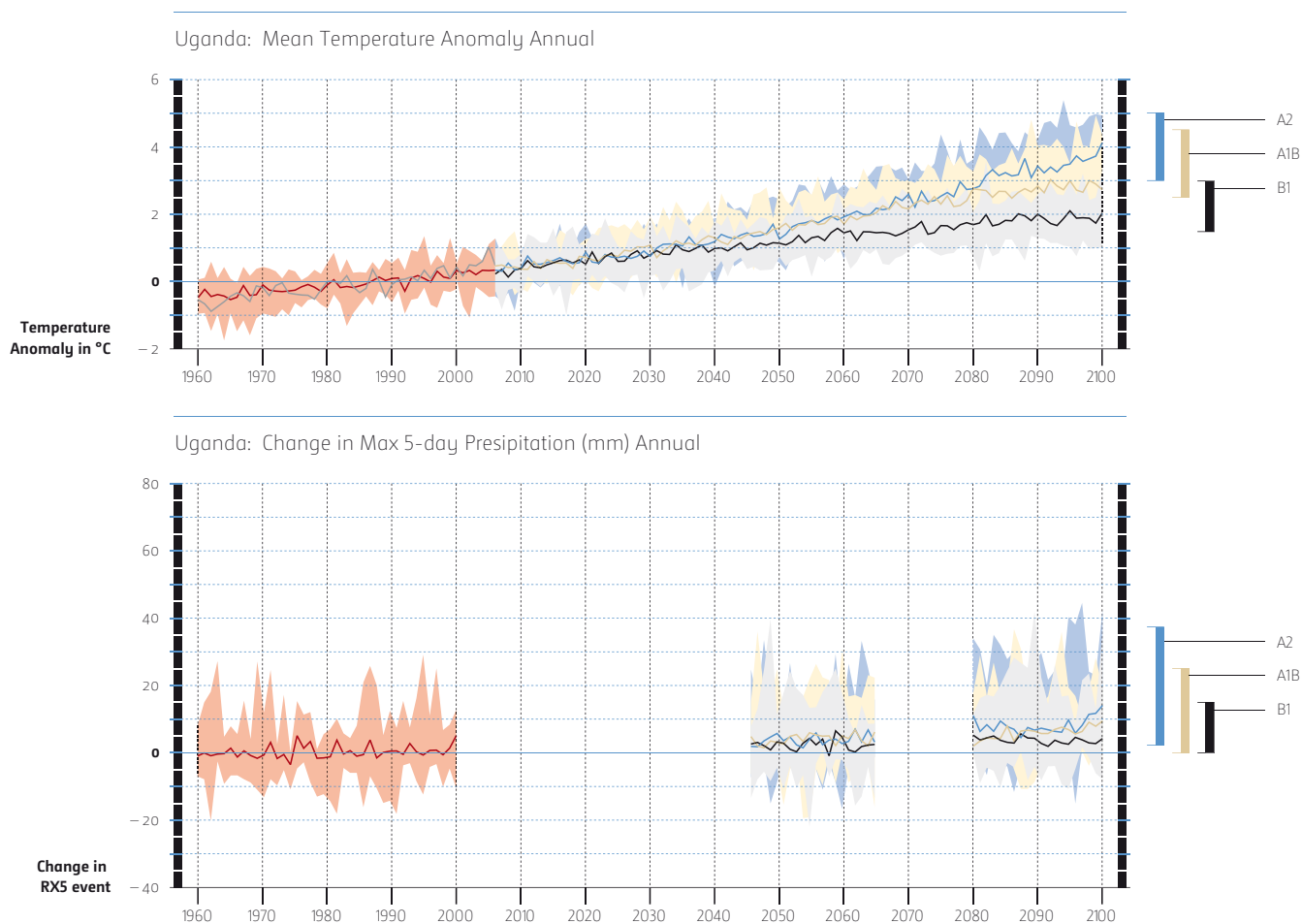
A large number of initiatives have been undertaken to provide regional climate scenarios, using both downscaling approaches.

Statistically downscaled data based on outputs from seven to eight IPCC Fourth Assessment Report (AR4) GCMs have been made available by the University of Cape Town (South Africa) for a large number of stations across Africa and Asia. In South America, under the Climate Change Scenarios for South America programme, high-resolution climate change scenarios have been developed for impacts and vulnerability assessments.¹¹

The Hadley Centre for Climate Prediction and Research of the United Kingdom Met Office, also a partner of the Nairobi work programme, has been working with countries to develop regional climate scenarios through the application of the regional climate model Providing REgional Climates for Impacts Studies (PRECIS). Data provision, training modules and workbooks, supplemented by technical backstopping, form an integral set of support services to promote the dissemination and application of PRECIS in over 100 countries (see [CASE STUDY 9 in PART TWO](#)).

WCRP recently launched the Coordinated Regional Climate Downscaling Experiment (CORDEX) initiative. It aims to provide quality-controlled Regional Climate Downscaling (RCD)-based data sets for the recent past and projections for the twenty-first century, covering the majority of populated land regions in the world. The RCD information will sample uncertainties in regional climate change associated with: (i) varying GCM simulations; (ii) varying greenhouse gas (GHG) concentration scenarios; (iii) natural climate variability; and (iv) different downscaling methods. The CORDEX downscaling activities will be based on the latest set of GCM climate scenarios and predictions produced within CMIP5.¹²

Figure 1-6. An example of country-level climate scenarios for the twenty-first century as part of the country-level climate profiles provided by the United Nations Development Programme through the National Communications Support Programme¹³



Source: adapted from C. McSweeney, M. New and G. Lizcano, UNDP Climate Change Country Profiles: Uganda (available at <http://country-profiles.geog.ox.ac.uk/index.html?country=Uganda&d1=Reports>).

⁹ See http://unfccc.int/files/adaptation/application/pdf/wmo_update_world_climate_res_prog_april_09.pdf for details.

¹⁰ See <http://cmip-pcmdi.llnl.gov/cmip5/> for details.

¹¹ See <http://data.csag.uct.ac.za/> for details.

¹² See http://unfccc.int/files/adaptation/application/pdf/action_pledge-wcrp2_sep_10_15.pdf for details.

¹³ The annual temperature (top panel) and maximum five-day rainfall (bottom panel) trends for the recent past and projected future, relative to the 1970–1999 mean climate. Light blue curves show the mean of observed data from 1960 to 2006, Red curves show the median (solid line) and range (shading) of model simulations of recent climate across an ensemble of 15 models. Coloured lines from 2006 onwards show the median (solid line) and range (shading) of the ensemble projections of climate under three emissions scenarios. Coloured bars on the right-hand side of the projections summarise the range of mean 2090–2100 climates simulated by the 15 models for each emissions scenario.

In addition, UNDP, through the National Communications Support Programme (NCSP) which is managed by UNDP and UNEP, developed 52 sets of country-level climate profiles, including historic trends and projected future changes, using outputs from the GCM experiments assessed in the IPCC AR4 and robust analytical tools. Each country profile contains a set of maps and diagrams presenting the observed and projected national climates as well as maps depicting changes on a 2.5° grid, with summary tables of the data. The files are user-friendly, manageable and in textual format, which can easily be downloaded, reviewed and manipulated (see [FIGURE I-6](#) for an example of the diagrams forming part of a country-level climate profile).¹⁴

Given the technical complexity (including the consideration of uncertainties) associated with climate scenarios, significant capacity-building efforts have been made to enhance the technical capacity, particularly in developing countries, to enable the development, interpretation and application of climate scenarios. These include, among others, training workshops and programmes at international, regional and national levels, supported by a large variety of institutions and funding windows.

Within the framework of supporting developing countries in preparing their national communications to the UNFCCC, the NCSP held a series of regional technical workshops focusing on the development and application of regional climate scenarios.¹⁵ In collaboration with regional centres and other partners (e.g. the International Centre for Theoretical Physics (ICTP); the global change System for Analysis, Research and Training (START)) WCRP held training workshops on the use of climate model outputs.

As illuminated by the Nairobi work programme, regional centres and initiatives, such as the Caribbean Community Climate Change Centre (CCCC) and the Ibero-American Network of Climate Change Offices (RIOCC) have been coordinating regional capacity-building efforts on regional climate modelling (see [CASE STUDY 10 IN PART TWO](#)).

The International Research Institute for Climate and Society (IRI) has been developing and disseminating learning materials to enable the widest possible uptake of climate modelling tools and associated outputs. These materials include curricula, training modules, training courses, workshops, academic graduate programmes, and visiting scientist/scholar programmes.

Further, IPCC's TGICA has developed guidelines on the use of climate scenarios developed from GCMs, as well as different downscaling approaches for impacts and vulnerability assessments.¹⁶

Concurrent with variations in climate, variations in other environmental variables can also have a direct effect on an exposure unit. Therefore, baseline data and scenario information for these variables are also required for impacts, vulnerability and adaptation assessments. Despite its importance, work in this area is relatively scarce and represents a direction where greater attention is needed.

The TGICA's general guidelines on the use of scenario data for climate impact and adaptation assessment include relevant advice on how to develop baselines and scenarios for variables characterizing the atmospheric, terrestrial and hydrological environments.¹⁷ In addition, its DDC provides access to baseline and scenario data for a range of variables describing the atmospheric, aquatic and terrestrial environments. These include data on atmospheric composition (e.g. carbon dioxide, ozone), land use and land cover, sea level, and water availability and quality. Most projections are consistent with the driving factors and emissions presented in the IPCC *Special Report on Emissions Scenarios* (SRES).

The full range of data and scenarios, and guidance material offered by the DDC is summarized in [FIGURE I-7](#).

Climate information for decision making under uncertainty is another important area of policy-related research (i.e. how best to provide information to policymakers in a form that they will understand and which leads them to incorporate the findings into policy). The United Kingdom Climate Projections 09 (UKCP09) provide probabilities of future climate scenarios, but whether such probabilistic scenarios improve the incorporation of climate change information into decision making remains to be seen (for more information, see <http://ukclimateprojections.defra.gov.uk>).

¹⁴ These country-level profiles, as well as detailed documentation, are available at <http://country-profiles.geog.ox.ac.uk/>.

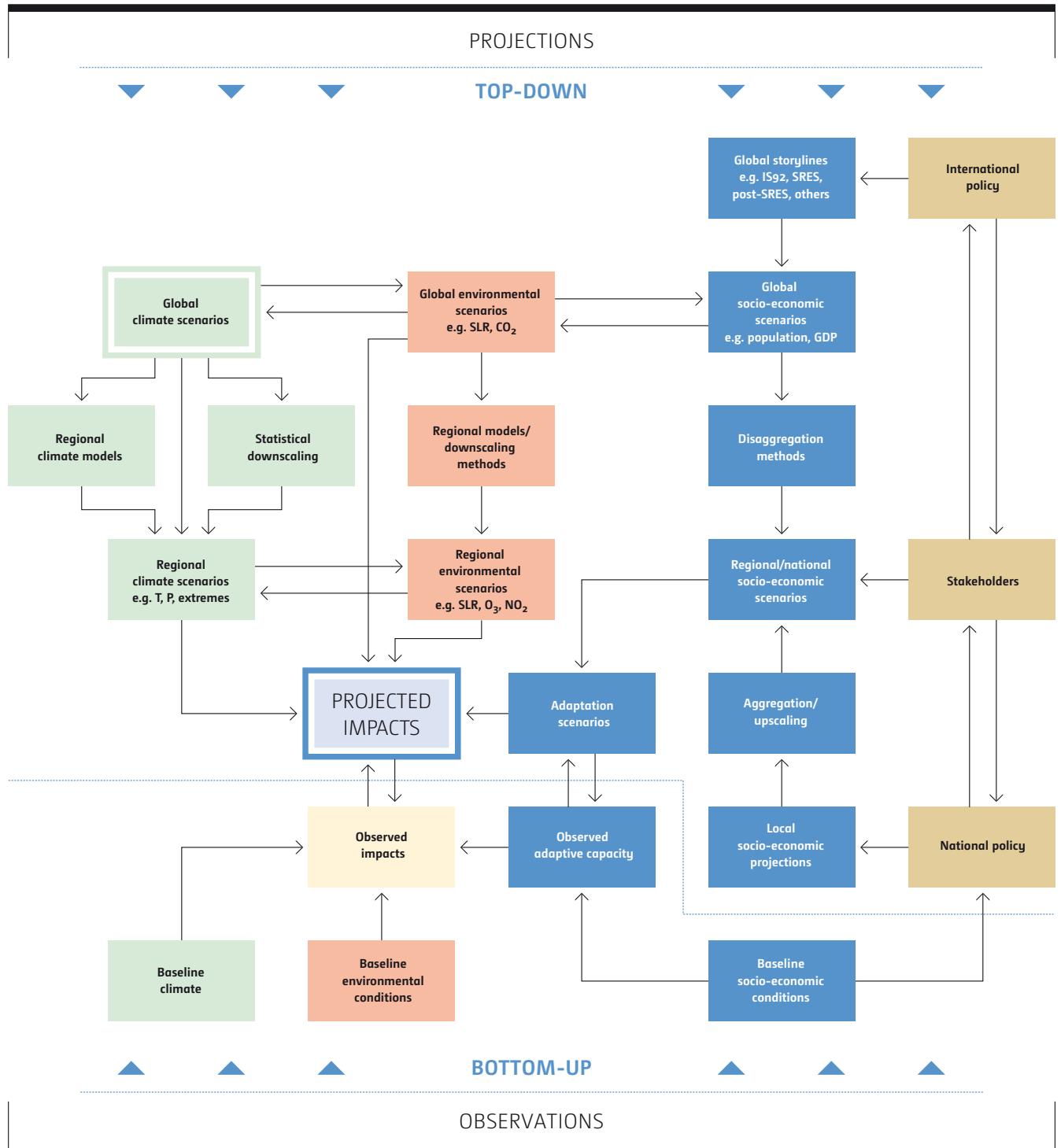
¹⁵ See http://unfccc.int/files/adaptation/application/pdf/climate_info_for_decision_making.pdf for an example of training materials.

¹⁶ Available at <http://www.ipcc-data.org/guidelines/index.html>.

¹⁷ See chapter 4 of the guidelines http://www.ipcc-data.org/guidelines/TGICA_guidance_sdciaa_v2_final.pdf.

¹⁸ Data can be accessed at http://www.ipcc-data.org/ddc_envdata.html.

Figure 1-7. Guidance documents provided by the Intergovernmental Panel on Climate Change (IPCC) Task Group on Data and Scenario Support for Impacts and Climate Analysis (TGICA) through its Data Distribution Centre



Source: based on information on the DDC website <<http://www.ipcc-data.org>>.
 Abbreviations: GDP = gross domestic product; T=Temperature; P=Precipitation; SLR=Sea Level Rise; SRES=Special Report on Emissions Scenarios.

1.1.3. ASSESSMENT OF CLIMATE IMPACTS AND VULNERABILITY

As shown in [FIGURE 11 in CASE STUDY 1 in PART TWO](#) (illustrating the eight-step risk management framework developed by UKCIP), assessments of impacts and vulnerability of natural systems, social groups and economic activities constitute the first major step within the “adaptation cycle”.

A variety of methods and tools have been applied to assess impacts and vulnerability in climate-sensitive sectors. A selection of such assessments are presented in [CASE STUDY 11 in PART TWO](#).

Assessments have also been carried out at different scales – global, regional, national and subnational/local – to examine the implications of climate change and inform adaptation decisions at specific levels. Examples of such assessments are included in [CASE STUDY 12 in PART TWO](#).

Recognizing the important interactions between sectors and different levels, which often lead to compound impacts and vulnerability for a particular sector or geographic unit, integrated assessments have also been carried out to account for these cross-sectoral and cross-level relationships. Taking a holistic perspective, these assessments either focus on a geographic area (e.g. a watershed) and related communities, or a particular natural system (e.g. ecosystems), considering impacts and vulnerability in more than a single sector or at more than one particular level. An example of the former is provided in [CASE STUDY 13 in PART TWO](#).

1.2. GOOD PRACTICES AND LESSONS LEARNED

1.2.1. DEVELOPMENT AND DISSEMINATION OF METHODS AND TOOLS

[TABLE I-4, I-5, and I-6](#) below highlight good practices and lessons learned under the Nairobi work programme on: the development, dissemination and application of methods and tools (case studies are presented in [CASE STUDIES 14–16 in PART TWO](#)); the provision of data and information; and climate risk and vulnerability assessment efforts, respectively.

Table I-4. Summary of good practices and lessons learned in developing, disseminating and applying methods and tools

<p>Development of methods and tools</p>	<ul style="list-style-type: none"> – A wealth of methods and tools developed from other fields of work (e.g. disaster risk reduction (DRR), strategic environmental assessments (SEA), integrated water management) exist and could easily be adopted for climate change vulnerability assessments and adaptation planning. Not only have they been field-tested, but relevant data sets and technical expertise for their application have also been accumulated over time and constitute valuable additional resources to support the assessment and planning for climate change adaptation (see case study 14 in part Two). – Professionals from other relevant fields, such as engineering and development assistance, and other stakeholders (including local and traditional communities), can make substantial contributions to the development of climate change adaptation methods and tools. – Engaging potential users, including local and traditional communities, in the process of developing methods and tools is critical to ensuring the relevance of the methodological products and the subsequent uptake/application through the creation of ownership. – For methods and tools to be accessible and applicable, developers need to provide, as an integral part of the methods, detailed documentation on the strengths, limitations, potential applications, data and expertise requirements of, and provisions for, training on their use.
<p>Dissemination of methods and tools</p>	<ul style="list-style-type: none"> – The format, platform and language for disseminating methods and tools need to be tailored to the targeted end-users. Apart from computer-based digital media and websites in the English language, other forms (e.g. paper maps), platforms (e.g. mobile phone networks, university curricula), and local languages could be used to improve the dissemination of methods and tools, particularly to stakeholders who do not have ready access to conventional information and resources. – To improve the accessibility and practicality of the methods and tools, developers may consider offering more user-friendly guidebooks and supporting resources to accompany the main products. This could take the form of, for example, an interactive stepwise user guide (see case study 15 in part Two). – The dissemination of methods and tools can be greatly helped by offering training sessions. Potential users could be informed, directly by the developers of the tool, of its key features, including possible areas of application, as well as the data and technical requirements for its application.
<p>Application of methods and tools</p>	<ul style="list-style-type: none"> – The selection and application of methods and tools needs to be guided by pragmatism: considering the need to ensure the robustness of methods and tools on the one hand, and the practicality within the context of decisions to be made, as well as the availability of data and resources, on the other (see case study 16 in part Two). In addition, methods and tools are only a means to an end – their application facilitates informed decisions through the provision of insights, but does not provide all the answers to policy decision questions. The engagement of and inputs from key stakeholders are essential to provide the critical information on the context of the decisions at hand and the key parameters for decision making. – “Bottom-up” approaches (based on the analysis of existing socio-economic conditions and livelihoods) are generally more suitable for addressing current vulnerabilities and adaptive capacity than for assessing future climate change impacts and large-scale vulnerabilities, while “top-down” approaches (scenario- and model-driven) are more suited for estimating climate change impacts, particularly on a large scale, but may not be appropriate on a smaller geographical scale and may fail to provide information on, for example, extreme events. A combination of both should be used to plan for adaptation, strengthen adaptive capacity and effectively incorporate insights from stakeholders, while addressing long-term climate change impacts and vulnerability and representing uncertainties.

Table 1-5. Good practices and lessons learned in developing and disseminating observational and scenario data and information

<p>Development of data and information</p>	<ul style="list-style-type: none"> – The implementation of the Global Climate Observing System (GCOS) since 2004 has shown that, to develop, operate and maintain a functional global climate observing system, dedicated resources with full-time personnel, solid planning and well-informed design, together with the engagement of key stakeholders (including those outside the meteorology community) and partnerships, including with donor agencies, are essential. – Participation, inputs and feedback from end-users on their needs are critically important to ensure the adequacy and relevance of data and scenarios to be developed (see case study 17 in part Two of this note for a participatory approach to developing climate outlook products in the Greater Horn of Africa region). – The selection of downscaling approaches should be guided by the need, the assessment and adaptation decision contexts, and the availability of resources and time. If the goal is to reproduce extreme characteristics, a more sophisticated, computationally demanding, and resource-intensive approach may be warranted. – Detailed documentation, including raw data sources and methods used, guidance material, and training sessions for potential users should be an integral part of the data and scenario products.
<p>Dissemination of data and information</p>	<ul style="list-style-type: none"> – Innovative methods of dissemination, particularly those taking advantage of modern telecommunications, should be explored to broaden and facilitate the reach of climate information to end-users. For example, the Agroclimate Centre in Egypt has been disseminating seasonal weather forecasts to local-level users through mobile phones, taking advantage of the development in telecommunications in many developing countries. – Regional centres and knowledge networks can play a key role in disseminating data and scenarios, facilitating the exchange of experiences in and providing training and technical assistance on the use of data and scenarios.

Table I-6. Good practices and lessons learned in assessing climate change impacts and vulnerability

Scope	Upfront efforts to engage all relevant stakeholders, analyse the natural and social contexts, and determine the focus and expected outputs of the assessment will prove time well spent.
Selection of methods and tools	The selection of assessment approaches, methods and tools needs to be guided by the purpose of the assessment, the availability of resources and time, as well as pragmatism.
Qualitative as well as quantitative	Both qualitative and quantitative analyses are helpful. This is particularly important when traditional knowledge and inputs from indigenous communities are incorporated into the assessment process.
Present versus future	Detailed analyses on current trends in climatic patterns, socio-economic trends and adaptation responses could provide many insights into how changes in the future may affect the natural and social systems, and which adaptation options may help to reduce vulnerability. This is particularly important to bear in mind if analyses on future impacts and vulnerability are impeded by uncertainties associated with, among others, climatic and socio-economic scenarios.
Stakeholders	Key stakeholders need to be involved throughout the entire assessment process – they can provide important inputs to the assessment process, as well as validate the interim results.
Collaboration	Inputs from a wide range of disciplines (e.g. natural science, social science, engineering, economics) are often required. Effective collaboration among experts and stakeholders from different disciplines/sectors are important to ensure the credibility of the assessment results.
Transparency	For the results of assessments to be effectively and appropriately used in adaptation decision planning, it is important to be transparent about the underlying assumptions and caveats of the assessment process and its results.



II. PLANNING FOR ADAPTATION

Adaptation planning entails the identification of adaptation activities and their appraisal in order to choose appropriately between the options available. Adaptation planning helps avoid the duplication of activities, prevent maladaptation and ensure that adaptation activities are sufficiently integrated into government policies and programmes. Adaptation planning follows and builds upon an assessment of the impacts of and vulnerability to climate change, and outcomes from the process inform the implementation of adaptation (see [FIGURE II-8](#)).

Specific adaptation planning activities take place within a unique context, depending on the level (regional, national, subnational or local), the level of integration across sectors and with adaptation and development planning, and the level of support, including levels of funding, technology and capacity available, and types of stakeholders.

Under the Nairobi work programme, a large number of activities have been carried out by Parties and partner organizations to enhance adaptation planning through the work areas of: climate-related risks and extreme

events; socio-economic information; adaptation planning and practices, and economic diversification. Relevant activities undertaken and their associated outputs are summarized in [TABLE INTRO-1](#), and additional activities undertaken by Nairobi work programme partners are profiled in the online searchable database at <http://unfccc.int/5005.php>.

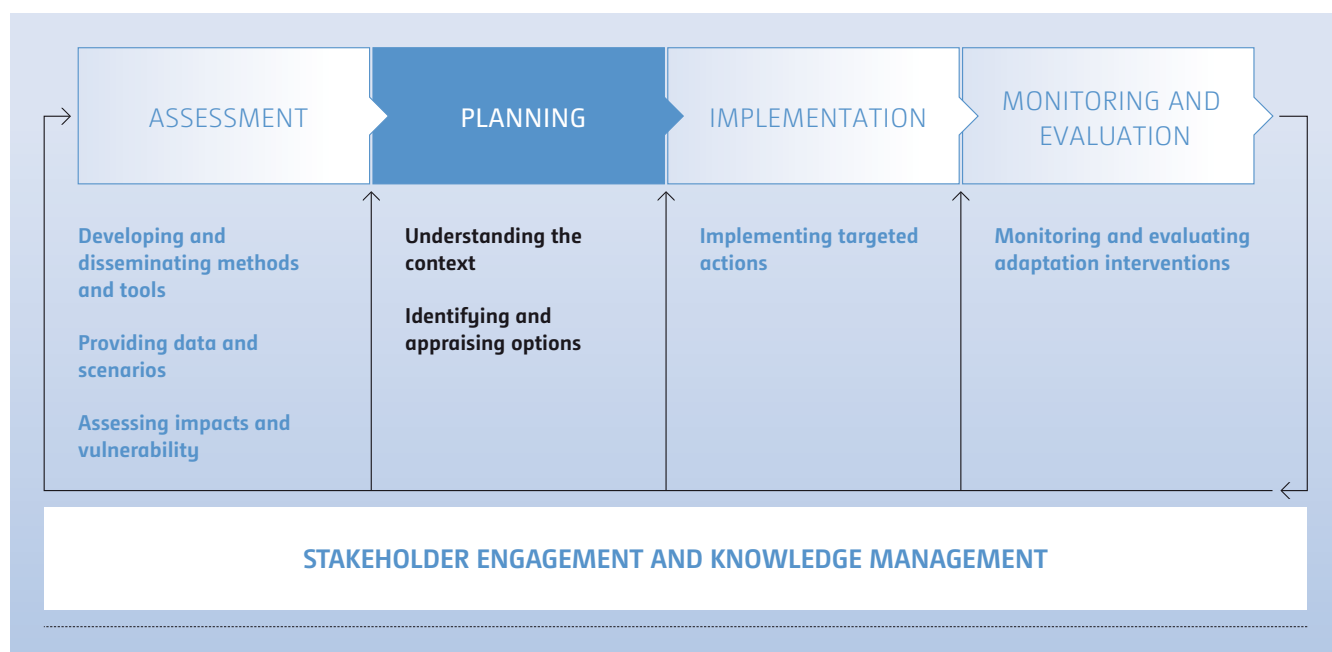
Using case studies, this section highlights some of these activities, focusing on good practices and lessons learned, while details of case studies and relevant additional resources are provided in [PARTS TWO AND THREE](#) of this note, respectively.

2.1. HIGHLIGHTS OF ACTIVITIES

2.1.1. UNDERSTANDING THE CONTEXT

The adaptation research community has developed a wide variety of methodological frameworks and associated methods and tools for facilitating adaptation planning. Useful planning frameworks, at various levels of governance, have been produced by the IPCC, UNDP, UKCIP and the Governments of Australia and the United States of America. Details of examples of these frameworks can be found in [SECTION 1.1](#) and in [CASE STUDY 1](#) in [PART TWO](#) of this summary note.

Figure II-8. Adaptation planning as the second component in the adaptation process, using outputs from impacts and vulnerability assessments, and feeding into implementation



There is no single best method, tool or process for adaptation planning; the selection of methods, tools and processes should be tailored to the specific planning context, including the objectives, scope, stakeholders involved, time constraints, and technological and financial resources available.

A wide range of approaches to integrate adaptation planning and practice activities across administrative levels, sectors and with adaptation and development planning, including the preparation of national communications and National Adaptation Programmes of Action (NAPAs) by Parties, national and global policy frameworks, poverty reduction strategy papers, and national adaptation plans, have been presented by Parties and Nairobi work programme partner organizations in workshops and Action Pledges.

In collaboration with each other and with other organizations, Nairobi work programme partners have carried out a range of activities at various levels towards integrating practices, tools and systems for climate risk assessment and management and DRR strategies into national policies and programmes by: providing financial support; strengthening the capacity of communities to monitor and respond to risk; supporting governments to develop initiatives that reduce current and future climate risk; and assessing vulnerability (see [CASE STUDY 18 in PART TWO](#)).

2.1.2. IDENTIFICATION OF ADAPTATION OPTIONS

After the impacts and vulnerability assessments have determined the need for adaptation, the range of possible adaptation options has to be identified. Activities under the Nairobi work programme are helping Parties to plan for adaptation by providing information on the range of adaptation options available.

At an intergovernmental level, RIOCC is working to increase the portfolio of adaptation projects and to disseminate information and lessons learned from these projects (see [CASE STUDY 19 in PART TWO](#)).

At the local level, START is working to increase capacity in developing countries for the understanding, communication and management of climate risks, through the implementation of pilot projects (see [CASE STUDY 20 in PART TWO](#)).

Community-based approaches respond to the needs of the most vulnerable with techniques that are developed with (rather than imposed on) communities, who have the vital knowledge and experience of their local setting, often living in the most extreme and risk-prone areas, but they now need to be linked with external actors, such as scientists or policymakers, in order to deal with the new threat posed by climate change.

2.1.3. APPRAISAL OF ADAPTATION OPTIONS

The evaluation of adaptation options is undertaken at different levels, depending on the policy questions that they are meant to address, and uses a variety of methodologies, including computable general equilibrium model analysis, investment and financial flow analysis, and economic appraisal methods.

Some of the most commonly used methods used to appraise adaptation actions include cost-benefit analysis, cost-effectiveness analysis and multi-criteria analysis; they are intended for application in different contexts, and each has its own strengths and weaknesses (see [TABLE II-7](#)).

Various analytical techniques can be used, based on the type of assessment and the availability of data to carry out the assessment (see [CASE STUDY 21 in PART TWO](#) for examples). The general characteristics of successful appraisal are summarized in [BOX II-4](#).

Table II-7. Selected approaches to the appraisal of adaptation options

Analysis	Context	Advantages/strengths	Disadvantages/weaknesses
Cost-benefit	Costs and benefits can be quantified in monetary terms and when the necessary data are available.	Monetizing allows quantitative comparison between diverse costs and benefits.	Non-market costs and benefits (e.g. ecological and cultural values), as well as distributional aspects, are difficult to include.
Cost-effectiveness	Objectives of adaptation measures have been identified, and the lowest-cost option is sought.	It allows an analysis to be carried out on non-monetary costs and benefits such as health and ecosystem services.	It cannot evaluate whether a measure is justified.
Multi-criteria	Data are not fully available, factors are not easily quantified and monetary benefits may be only one of many criteria used.	Criteria can be optimized to national and local priorities; allows for stakeholder engagement.	Lack of monetary terms may weaken economic case for the justification of measures.

Box II-4. Characteristics of successful appraisal

<p>Practical</p> <ul style="list-style-type: none"> – Suitable for the cultural and socio-economic setting – Takes into account data constraints 	<p>Robust</p> <ul style="list-style-type: none"> – Transparent and consistent within and across sectors regarding the underlying climatic and socio-economic assumptions, expert judgments and uncertainties
<p>Relevant</p> <ul style="list-style-type: none"> – Results are presented in a timely manner – Results are presented in a format compatible with existing decision making 	<p>Comprehensive</p> <ul style="list-style-type: none"> – Assesses a wide range of options, including inaction, and action outside sectoral boundaries – Assesses ancillary impacts

2.2. GOOD PRACTICES AND LESSONS LEARNED

With the growing amount of efforts being made to place more emphasis on adaptation planning and practices, Parties and Nairobi work programme partner organizations have been documenting and sharing good practices and lessons learned from relevant activities. These are summarized in [TABLE II-8](#).

Table II-8. Summary of good practices and lessons learned in planning for adaptation

Understanding the context	Integrating disaster risk reduction: <ul style="list-style-type: none"> – High-level and cross- or interdepartmental groups to ensure the inclusion of climate change related risks into government policies exist in many countries. – Institutional barriers (structural, managerial, informational or financial) must be overcome to facilitate the integration of knowledge, experience and information and to establish working relationships between experts in the fields of climate change adaptation, disaster risk reduction and development.
Appraising and understanding risks and impacts	<ul style="list-style-type: none"> – Adaptation options should be chosen based on the results of impact and vulnerability assessments, prioritizing those options that address adaptation of the most vulnerable groups and/or of sectors and livelihoods that are socio-economically important and vulnerable to the adverse impacts of climate change. – The selected options should be consistent with national and sectoral development priorities and socio-economic contexts, meaning that they should be socially acceptable and politically feasible.

III. IMPLEMENTING TARGETED ADAPTATION ACTIONS

After assessment and planning, targeted adaptation actions can be implemented (see FIGURE III-9). The implementation of adaptation activities yields tangible results and benefits, although it can be the most challenging aspect of the adaptation process.

Similar to adaptation planning, adaptation actions and the context that they are implemented within are unique. There is no single best method for implementation. The actions implemented and methods adopted for implementing should be tailored to the specific context, including the objectives, scope, stakeholders involved, time constraints, and technological and financial resources available. Adaptation actions can be implemented at various levels (local, national, sub-regional, regional) and through projects, programmes, policies or strategies. The implementation of actions may be a stand alone process or fully integrated or mainstreamed with sectoral policies, and sustainable development plans. Availability of funding, capacity and technology, and stakeholder engagement also provide a unique context for the implementation of adaptation actions. On this basis, the

implementation of adaptation actions needs to be tailored to local and sectoral circumstances. As well as funding and capacity to support the implementation of adaptation actions, technology is vital.

Under the Nairobi work programme, a large number of activities have been carried out towards the implementation of adaptation actions. Relevant activities and their associated outputs are summarized in TABLE INTRO-1, and additional activities undertaken by Nairobi work programme partners are profiled in the online searchable database at <<http://unfccc.int/5005.php>>.

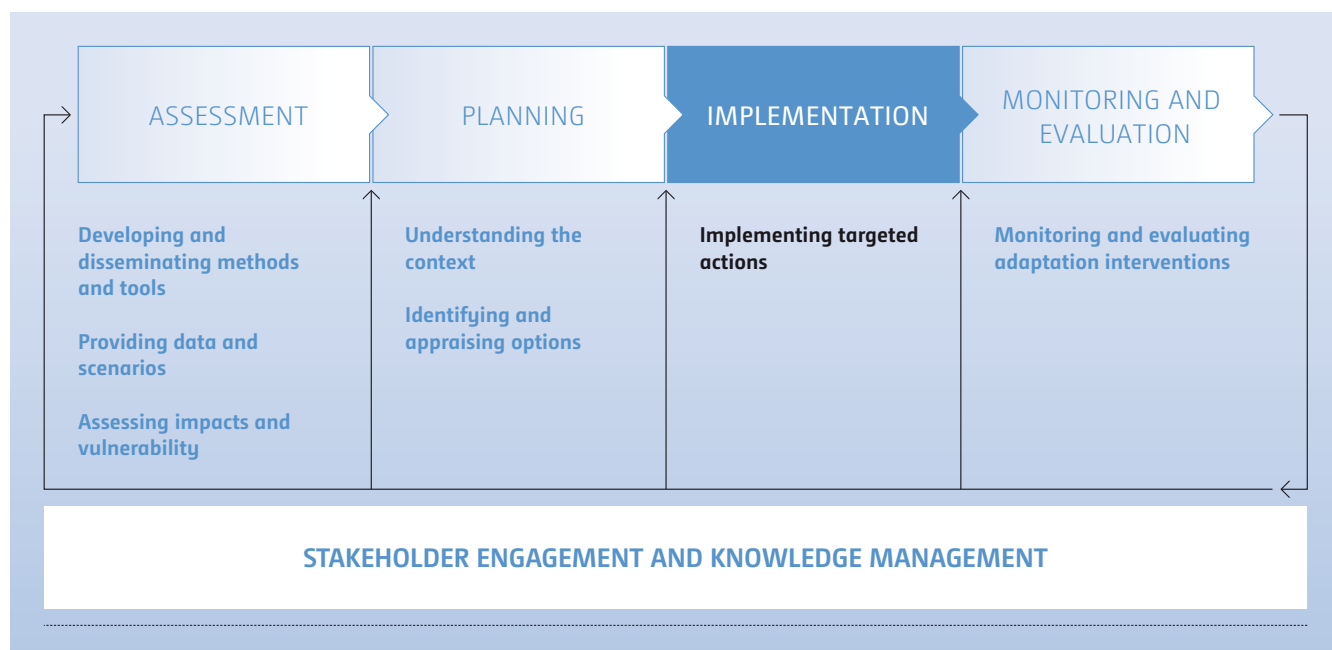
3.1. HIGHLIGHTS OF ACTIVITIES

Many examples of efforts in implementing adaptation actions have been highlighted through the Nairobi work programme, and are featured in three main databases maintained by the UNFCCC secretariat:

- The Nairobi work programme partners, experts and Action Pledges database;¹⁹
- The adaptation practices interface;²⁰ and
- The local coping strategies database.²¹

Significant efforts to diversify economies and livelihoods, and to develop, deploy and apply technologies for adaptation have been made, and are summarized in more detail below.

Figure III-9. The implementation of adaptation activities as the third component of the adaptation process



3.1.1. ECONOMIC AND LIVELIHOODS DIVERSIFICATION

Economic diversification is a common practice in implementing adaptation actions. It can take place at various levels and across different sectors. At the national level, economic diversification entails reducing over-dependence on a narrow economic base, while at the sectoral level, economic diversification involves adapting existing practices to reduce exposure to risk. At the community level, livelihood diversification has been a long-standing strategy to cope with external shocks including those that are climate-related.

Economic diversification, both across and within sectors, can be and already is a viable adaptation response strategy, particularly where there are limited alternative adaptation options within a sector (see [CASE STUDY 22 in PART TWO](#) for examples in the Caribbean). Activities to reduce the vulnerability of economically important sectors are common, for example in the agriculture sector. Diversification away from economic sectors vulnerable to climate change is occurring within the winter sports industry in some countries. Lessons can be learned from past experiences in restructuring economic activities.

At the local level, risk and financial management schemes can improve the resilience of smallholder farmers to climate variability but are also valuable in improving rural livelihoods.

3.1.2. TECHNOLOGIES FOR ADAPTATION

Needs-based technology transfer is important for helping countries adapt to climate change. Most methods of adaptation involve some form of technology, which in the broadest sense includes not just material and equipment but also diverse forms of knowledge. Promoting the development and diffusion of technologies, know-how, and practices for adaptation are important activities for improving and enabling adaptation to climate change. Technologies have an important role to play in any effective adaptation action. For example, sustainable urban drainage systems reduce flood risks; cyclone shelters, protective structures and early warning systems reduce the vulnerability of communities living in coastal zones; and water-use management systems are an important step in promoting collaboration on adaptation in the agriculture sector and reducing the risk of drought.

Successful adaptation action typically combines both hard and soft technologies. Traditional technologies and know-how are important for adaptation. They already exist, are suitable for many developing countries, and can potentially be improved by local communities to address their specific adaptation needs. The UNFCCC local coping strategies database provides an overview of a wide range of long-standing coping strategies/mechanisms, knowledge and experience from communities that have had to adapt to specific hazards or climatic conditions. Many Nairobi work programme partners have used adaptation technologies to implement adaptation actions. Examples can be found in the Nairobi work programme partners, experts and Action Pledges database, including actions pledged by the Ecologic Institute for International and European Environmental Policy, and the WMO (see [CASE STUDIES 23 and 24 in PART TWO](#), respectively).

Discussions under the Nairobi work programme have shown that technologies for adaptation can be advanced through identifying and evaluating technologies for adaptation appropriate for different sectors, regions and stages of economic development; strengthening technology needs assessments through integrating their results into national and sectoral development and adaptation plans, for example National Adaptation Programmes of Action; and enhancing financial and institutional support, information-sharing, capacity-building and enabling environments.

3.2. GOOD PRACTICES AND LESSONS LEARNED

3.2.1. ECONOMIC DIVERSIFICATION

Past experiences of economic diversification (e.g. Austria restructuring its fur trade or Cuba's transformation of the sugar cane industry) were seen as being able to provide valuable lessons as countries consider how to reduce their economic vulnerability to climate change. With regard to reducing reliance on vulnerable economic sectors, activities are taking place at various scales, from lobbying for the better inclusion of the employment dimension into national climate change policies to removing barriers for economic diversification in resource-dependent communities. An enabling environment can be created through improving the investment climate in a country, such as through efficient administration, the rule of law, a stable macroeconomic environment, an efficient and effective infrastructure and manageable political risks.

3.2.2. LEARNING BY DOING

Learning by doing is also a valuable approach in implementing adaptation actions. It can provide opportunities for comparing actual experience with intended outcome, and enables implementers to understand the impacts of adaptation actions and 'change course' to enable more successful adaptation if necessary.

3.2.3. STAKEHOLDER ENGAGEMENT

Engaging as many stakeholders as possible in adaptation planning and implementation can enable a democratic and transparent approach to deciding on the actions to implement, and can ensure buy-in and maximum support for implementation. There are many examples of successful stakeholder engagement at various levels that have been identified under the Nairobi work programme. The Institute for Social and Environmental Transition (ISET) and the World Food Programme (WFP) have engaged local communities in their adaptation activities (see CASE STUDIES 25 and 26 in PART TWO respectively).

3.2.4. KNOWLEDGE-SHARING

Although the effectiveness of a practice tends to be context-specific, there is still much value in sharing knowledge and information on practices so that they can be considered, replicated, improved and/or adapted to suit different needs, scales and geographic locations. Sharing knowledge, lessons learned and good practices from past and current adaptation activities with a wide stakeholder community can assist future adaptation planning and implementation of practices. This exposure to a wide range of options enables consideration of the complexity and uncertainties surrounding decisions on adaptation, the adoption of more successful practices, and the avoidance of mal-adaptation. Actions in one sector or location can help guide how another sector or location prepares for and responds to new risks emerging due to climate change. The ALM provides an effective web platform to facilitate knowledge sharing and learning on adaptation (see CASE STUDY 4 in PART TWO). In addition, regional knowledge platforms have also been developed to facilitate in-person interactions amongst practitioners. For example, adaptation stakeholders in Asia can interact and share knowledge at the bi-monthly adaptation knowledge sharing and learning seminar series organised by the Regional Climate Change Adaptation Knowledge Platform for Asia.²²

¹⁹ Available at <<http://www.unfccc.int/5005.php>>.

²⁰ Available at <<http://www.unfccc.int/4555.php>>.

²¹ Available at <<http://maindb.unfccc.int/public/adaptation/>>.

²² See <<http://www.climateadapt.asia/>> for details.

IV. MONITORING AND EVALUATING ADAPTATION INTERVENTIONS

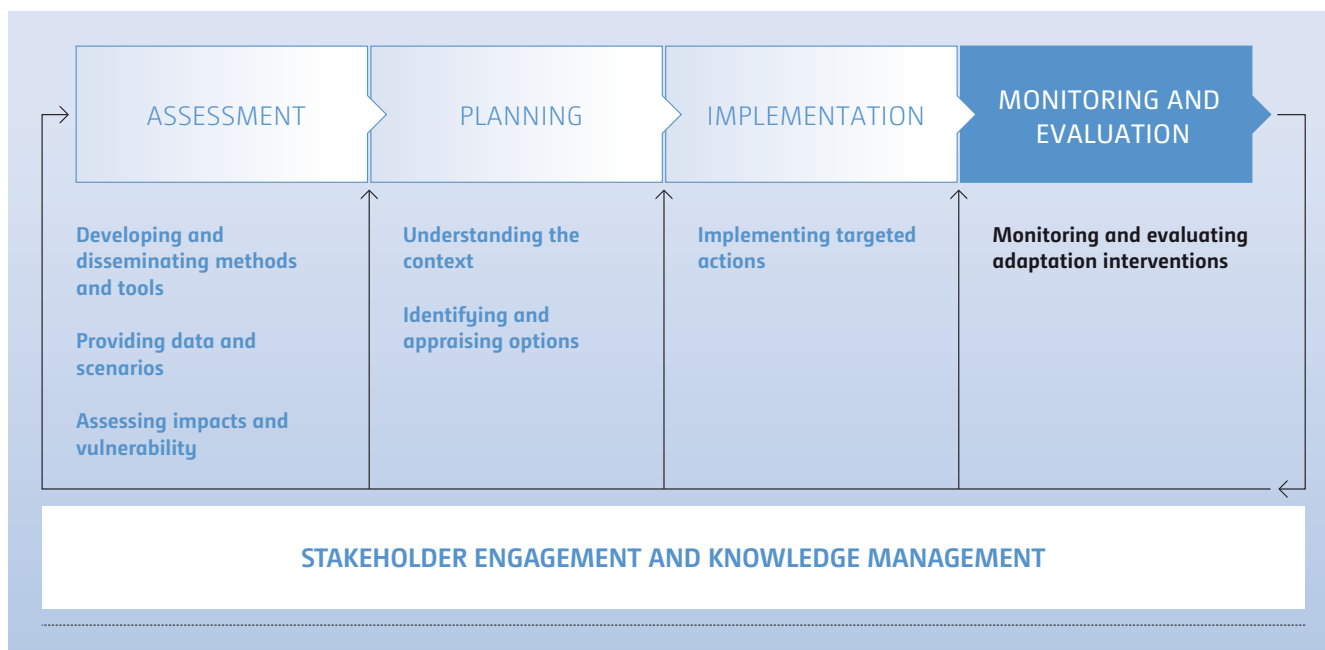
The monitoring and evaluation of adaptation actions, including projects, policies and programmes, can be undertaken throughout the adaptation process in addition to after adaptation actions have been implemented (FIGURE IV-10). Knowledge and information gained from monitoring and evaluation of adaptation actions is fed back into the adaptation process to ensure future adaptation efforts are successful.

The purpose of monitoring is to keep a record of progress made in implementing a specific adaptation measure in relation to its objectives and inputs, including financial resources. Monitoring enables planners and practitioners to improve adaptation efforts by adjusting processes and targets. Monitoring should be carried out during implementation, as well as during the lifetime of the adaptation action and in some cases beyond. Monitoring may be undertaken with the help of indicators (discussed further below), which may evolve over time as the adaptation process matures and is mainstreamed.

Evaluation is a process for systematically and objectively determining the effectiveness of an adaptation action in the light of its objectives. Evaluation can be carried out during implementation (ongoing evaluation), at the completion of implementation (final evaluation), and/or some years after completion (post evaluation). Assessing effectiveness involves two questions: first, have the objectives and targets been achieved? And second, can this be attributed to the adaptation measure taken? Evaluation may include internal and external components.

Indicators provide a basis for ‘before’ and ‘after’ analysis, and describe the positive and negative, anticipated and unanticipated, intended and unintended effects of adaptation actions. Indicators can be used to compare the situation after the adaptation measure was implemented with the initial conditions prior to implementation. They usually vary depending on the unique adaptation action and context, but may be process-based, and/or outcome-based, quantitative and/or qualitative and should include both outputs and outcomes/impacts. Indicators can be usefully formulated in a specific, measurable, achievable, relevant and time-bound (SMART) manner. To enable more accurate monitoring and evaluation, socio-economic indicators are used to assess the vulnerability of certain sectors to climate change.

Figure IV-10. Monitoring and evaluation as the fourth component of the adaptation process



Given the complexity and long-term nature of climate change, it is essential that adaptation be designed as a continuous and flexible process, and subjected to periodic review. The implementation of adaptation needs to be monitored, regularly evaluated and revised, both in terms of the validity of the underlying scientific assumptions and the appropriateness of projects, policies and programmes, including their effectiveness, efficiency and overall utility. Lessons learned and good practices identified during the monitoring and evaluation of ongoing and completed projects, policies and programmes should inform future actions, creating an iterative and evolutionary adaptation process. A monitoring and evaluation framework may be developed to ensure clearly formulated goals, objectives and output measures as well as the availability of good quality data.

Under the Nairobi work programme, Parties and relevant organizations were invited to submit their views and information on efforts undertaken to monitor and evaluate the implementation of adaptation projects, policies and programmes and the costs and effectiveness of completed projects, policies and programmes as well as views on lessons learned, good practices, gaps and needs.²³ A synthesis report based on these submissions and other relevant sources of information was also developed.²⁴

4.1 HIGHLIGHTS OF ACTIVITIES

4.1.1 MONITORING AND EVALUATION

Many adaptation decision frameworks, including those developed by UKCIP (see [CASE STUDY 1 in PART TWO](#)) and UNDP (see [TABLE VII-14 in PART THREE](#)), include monitoring and evaluation as an integral part of the adaptation process. Participatory monitoring and evaluation in support of adaptation can help build a comprehensive picture of the effectiveness of adaptation actions.

4.1.2 INDICATORS

Harley and van Minnen (2009) recommend that planners and practitioners consider the following issues when developing adaptation indicators:²⁵

- **Availability:** do appropriate data and indicators already exist?
- **Potential availability:** are reliable data available in areas where indicators have not yet been developed?
- **Representativeness:** are indicators available to measure progress on important or determining factors, rather than less significant issues?
- **Continuity:** are data readily available over an unbroken time series for the indicators under consideration?

At a national level, Costa Rica, in developing its National Climate Change Strategy, identified additional criteria for selecting indicators, including whether the indicator is easily measurable, whether the indicator is applicable to a range of adaptation outcomes at different spatial and temporal scales, and whether the costs of obtaining data are justified (see [CASE STUDY 27 in PART TWO](#)).

In the UKCIP risk, uncertainty and decision-making framework, groups of indicators were selected to describe multiple categories/sectors, including economic development, planning and built environment, agriculture, water, biodiversity and coastal zone management (see [CASE STUDY 1 in PART TWO](#)).

Within the disaster risk reduction community, national disaster risk has been described by the Americas Programme of the Inter-American Development Bank through four socio-economic indices: the Disaster Deficit Index, the Local Disaster Index, Prevalent Vulnerability Index, and the Risk Management Index (see [CASE STUDY 28 in PART TWO](#)).

²³ These submissions are contained in document FCCC/SBSTA/2009/MISC.10.

²⁴ This report is contained in document FCCC/SBSTA/2010/5, which is available in Arabic, Chinese, English, French, Russian and Spanish.

²⁵ Source: Harley M. and van Minnen J. (2009), Development of adaptation indicators, ETC/ACC Technical Paper 2009/6, Bilthoven, the Netherlands, pp.16 <http://air-climate.eionet.europa.eu/docs/ETCACC_TP_2009_6_Adaptation_Indicators.pdf>.

Indicators of effective adaptation are also important for community-based adaptation. Monitoring and evaluation for community-based adaptation is a relatively new field. UNDP’s community-based adaptation project is piloting innovative approaches to evaluating the success of adaptation projects undertaken at community level, and generating lessons to inform ongoing practice, as described in [CASE STUDY 29 in PART TWO](#).

4.2. GOOD PRACTICES AND LESSONS LEARNED

A number of good practices and lessons learned on the development and use of monitoring and evaluation systems have emerged from the implementation of the Nairobi work programme, particularly with relation to the use of indicators. These are summarized in [TABLE IV-9](#).

Table IV-9. Good practices and lessons learned for monitoring and evaluating adaptation interventions

Monitoring and evaluation	<ul style="list-style-type: none"> – Consideration of monitoring and evaluation systems for adaptation projects, policies and programmes should be included in the design of adaptation actions. This may include: <ul style="list-style-type: none"> (1) Making use of existing monitoring and evaluation systems to the extent possible; (2) Engaging broadly with stakeholders at all levels and in and across all relevant sectors; and (3) Agreeing on mechanisms, institutions and criteria, including roles and responsibilities, for monitoring and evaluation. – Many efforts, such as the Mainstreaming Adaptation to Climate Change (MACC) project,²⁶ have shown that monitoring and evaluation systems are essential for ensuring the success of adaptation interventions. Continued monitoring and regular evaluation can ensure that good as well as maladaptive practices are recognized and can then be shared with a large number of adaptation stakeholders, and appropriate adjustments to the intervention considered and implemented. – According to the UKCIP adaptation wizard tool, the system should define measures of success; consider performance relative to expectations; describe how results of the monitoring and evaluation will be fed back into the ongoing adaptation policy process; and allow for the inclusion of new information and revision of adaptation projects, policies and programmes.
Use of indicators	<ul style="list-style-type: none"> – Process-based and outcome-based indicators both play an important role in understanding the effectiveness of adaptation actions. – Adaptation planners and practitioners should select a mix of quantitative, qualitative and narrative tools, including surveys and scorecards, so that results can be triangulated to give the most accurate picture possible of progress for adaptation and the elements involved.

²⁶ Details can be found at <http://go.worldbank.org/BO6IL089K0>.

V. LOOKING FORWARD

With the growing awareness of the need for reducing the vulnerability of natural environment and human society to adverse impacts posed by inevitable climate change, concerted efforts have been made to enhance the understanding of potential climate risks and to plan for and implement adaptive responses. This, not at the least, has been evident in the large number of organizations, from intergovernmental to local community-based non-governmental organizations, that have joined the Nairobi work programme and actively contributed to the implementation of the numerous activities under the work programme.

With the broad support and active engagement of Parties and organizations, the Nairobi work programme has made important contributions to advancing global action on adaptation to climate change, through the establishment of a wide global network of adaptation partner organizations, catalyzing of a large number of adaptation actions, the development and dissemination of a wealth of adaptation information and knowledge products, and the creation of an inclusive platform and forum for knowledge sharing and learning on adaptation.

As summarized in this note, the implementation of the Nairobi work programme has made significant contributions towards advancing the four core components of the adaptation process:

ASSESSING CLIMATE RISKS AND VULNERABILITY

A rapidly expanding array of research and earth system observation programmes and capacity building initiatives have been launched and planned to improve the understanding and assessment of climate change impacts and vulnerability, and the scientific and technical basis for adaptation planning and decision making. Assessments are increasingly driven by policy decision needs, as opposed to academic curiosity, and following more participatory and integrated approaches. Greater efforts are also being made to communicate the results of assessments and to ensure their relevance to and appropriate use by different stakeholders.

PLANNING FOR ADAPTATION

Activities directly mandated under the Nairobi work programme and carried out by partner organizations have contributed to enhanced understanding of the highly complex

bio-physical, socio-economic as well as political contexts within which adaptation takes place. Progress has also been made towards the assessment of existing methodological frameworks, the development, dissemination and application of new methods and tools for identifying and evaluating adaptation options, including those for carrying out cost and benefit analyses.

IMPLEMENTING TARGETED ADAPTATION ACTIONS

Drawing on experiences and traditional knowledge as well as modern technologies, targeted adaptive actions have been undertaken to, among other things, enhance the resilience of livelihoods and economies. The Nairobi work programme has facilitated exchange of experiences and lessons learned in current adaptation practices, and deepened the understanding of the enabling factors and opportunities for successful implementation of adaptation actions.

MONITORING AND EVALUATING ADAPTATION INTERVENTIONS

Under the Nairobi work programme, Parties and partner organizations shared views on and experiences in developing methodological frameworks and applying indicators for tracking progress on adaptation action and identifying potential pitfalls. Efforts are being made to explore practical and effective ways to monitor and evaluate adaptation interventions, one core component of the adaptation process that will become even more important as the implementation of enhanced adaptation action gathers pace under the Cancun Adaptation Framework.

Moving forward, and given its linkage to the UNFCCC process, the Nairobi work programme can play a unique role at the global level, in coordinating and facilitating work on the scientific and technical aspects of climate change impacts, vulnerability and adaptation to climate change, alongside the Cancun Adaptation Framework. This is made ever more critical with the adaptation landscape becoming increasingly dynamic and complex. In addition, capitalizing on infrastructure, instruments and modalities developed during the course of the work programme, and building on its success to date in engaging stakeholders, catalyzing adaptation action, and facilitating knowledge sharing and learning, the Nairobi work programme, in collaboration and coordination with other relevant initiatives and institutional arrangements within and outside the Convention, is well positioned to further strengthen its support for the implementation of enhanced adaptation action in all Parties to the Convention.



Assessing Climate Change Impacts and Vulnerability

PART TWO
CASE STUDIES

VI. CASE STUDIES

This part of the summary note provides details of the case studies highlighted in [PART ONE](#). This material is intended to supplement the overviews presented in [PART ONE](#) with details of the various activities catalyzed under the Nairobi work programme.

Mirroring the structure of [PART ONE](#), the case studies presented here are organized around the four core adaptation components, and [TABLE VI-10](#) provides a quick overview of these case examples.

Table VI-10. Summary of case studies presented in this summary note

Case study	Relevance to the key component of adaptation process			
	Assessing climate impacts and vulnerability	Planning for adaptation	Implementing targeted adaptation actions	Monitoring and evaluating adaptation interventions
(1) The United Kingdom Climate Impacts Programme (UKCIP) risk, uncertainty and decision-making framework	●	●	●	●
(2) The Public Infrastructure Engineering Vulnerability Committee (PIEVC) Engineering Protocol	●	●		
(3) The Community-based Risk Screening Tool – Adaptation and Livelihoods (CRISTAL)	●	●		
(4) The Adaptation Learning Mechanism	As a learning platform for exchange and sharing of knowledge and experience on all aspects of the adaptation process			
(5) A comprehensive global operational network for climate data collection and application, and climate research	●			
(6) Climate for Development in Africa (ClimDev-Africa)	●	●	●	
(7) Global initiatives for the provision of socio-economic data and scenarios for climate change analyses and adaptation planning	●	●		
(8) National- and subnational-level initiatives for the provision of socio-economic data and scenarios for climate change analyses and adaptation planning	●	●		
(9) The Hadley Centre for Climate Prediction and Research, United Kingdom Met Office, supporting the provision of regional climate information through the development and delivery of an integrated package of climate modelling tools and advisory services	●	●		
(10) Regional collaboration in Latin America and the Caribbean for the development and application of regional climate scenarios	●			

Table VI-10. Summary of case studies presented in this summary note (continued)

Case study	Relevance to the key component of adaptation process			
	Assessing climate impacts and vulnerability	Planning for adaptation	Implementing targeted adaptation actions	Monitoring and evaluating adaptation interventions
(11) Assessing impacts and vulnerability – sectors	●			
(12) Assessing climate change impacts and vulnerability – scales	●			
(13) Integrated assessment focusing on a geographic area/particular communities	●	●		
(14) Developing weather risk management tools through better alignment with incentives for disaster risk reduction	●	●		
(15) Offering user-friendly guidebooks and relevant resources as an effective way of disseminating methods and tools	●			
(16) Decision context and stakeholder inputs guiding the selection and application of methods and tools	●	●		
(17) The Greater Horn of Africa Climate Outlook Forum (GHACOF)	●	●		
(18) Integration of approaches to adaptation across levels, sectors and hazards		●	●	
(19) Increasing the portfolio of adaptation projects, especially trans-frontier projects, trans-sectoral projects and/or pan-sectoral projects		●	●	
(20) START (global change SysTem for Analysis, Research and Training) activities on adaptation planning		●		
(21) Three common approaches to appraising adaptation options	●	●		
(22) Economic diversification as an adaptation strategy in the Caribbean Region			●	
(23) Developing regional adaptation strategies through dialogues among stakeholders		●	●	
(24) Regional frameworks for adaptation of agriculture to climate		●	●	
(25) Adaptation planning and implementation through stakeholder engagement and application of technologies		●	●	
(26) Engaging stakeholders in adaptation planning and implementation		●	●	
(27) Costa Rica's monitoring and evaluation indicators				●
(28) Inter American Development Bank's indicators for disaster risk reduction				●
(29) Monitoring and evaluation under the UNDP community-based adaptation (CBA) Programme				●

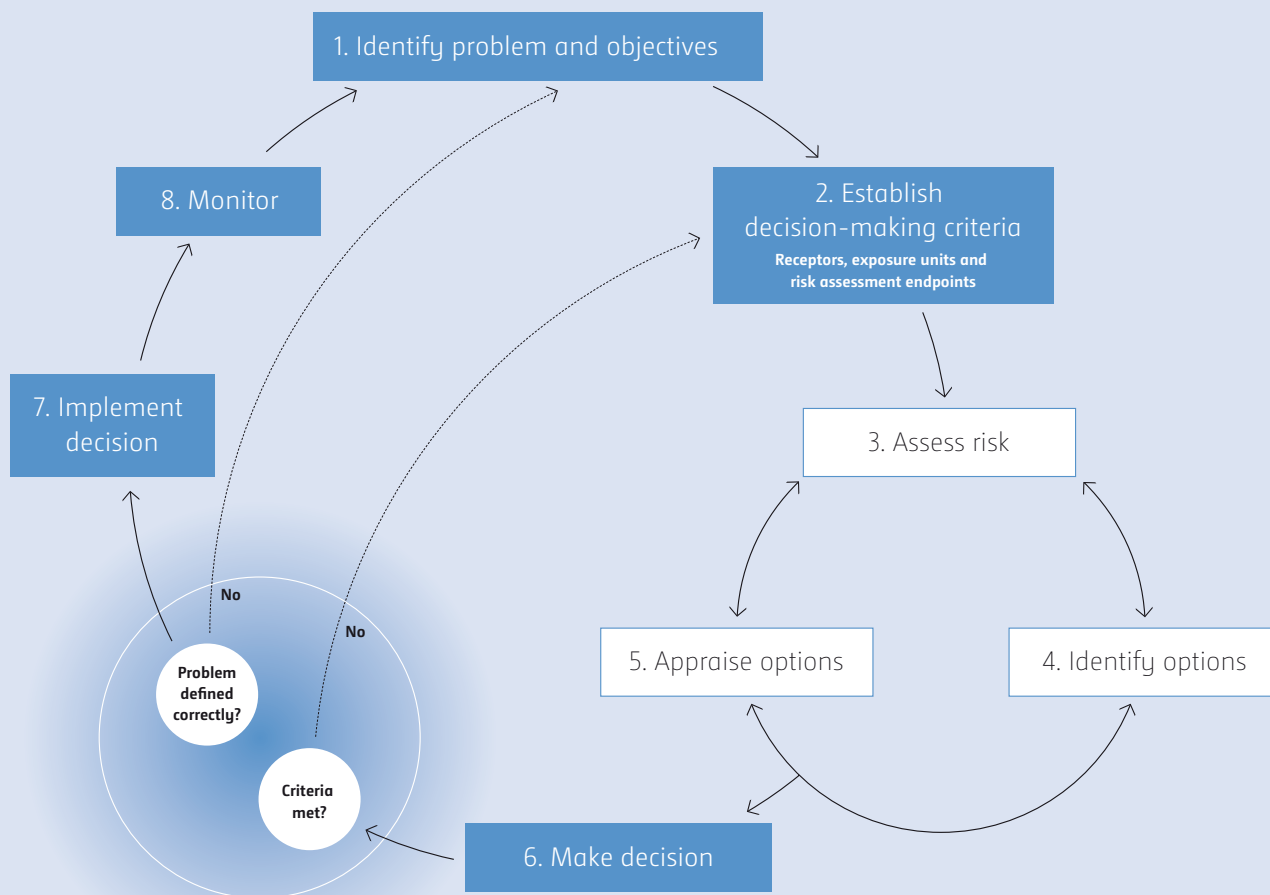
6.1. ASSESSING THE IMPACTS OF AND VULNERABILITY TO CLIMATE CHANGE

CASE STUDY 1. The Risk, Uncertainty and Decision-Making Framework

To help decision makers identify and manage their climate risks in the face of uncertainty under a changing climate, the United Kingdom Climate Impacts Programme (UKCIP) developed the Risk, Uncertainty and Decision-Making Framework,²⁷ which is essentially an eight-step iterative process. It is based on standard decision making and

risk principles, and encourages users to consider their climate risks alongside non-climate risks. The eight key steps are illustrated in figure VI-11. An Adaptation Wizard,²⁸ the online version of the framework, has also been made available by UKCIP to further guide users through each of the steps within the framework.

Figure VI-11. The eight-steps constituting an iterative process in UKCIP's Risk, Uncertainty and Decision-Making Framework



Source: adapted from UKCIP. <<http://www.ukcip.org.uk/risk/what-is-risk-framework/>>.

CASE STUDY 2. The Public Infrastructure Engineering Vulnerability Committee (PIEVC) Engineering Protocol

The World Federation of Engineering Organizations (WFEO) developed a formalized risk assessment procedural tool, the PIEVC Engineering Protocol (the Protocol), as a practical tool to facilitate the adaptation of infrastructure to climate vulnerability. The Protocol systematically reviews historical climate information and projects the nature, severity and probability of future climate changes and events with the adaptive capacity of an individual infrastructure as determined by its design, operation and maintenance. It includes an estimate of the severity of climate impacts on the components of the infrastructure (i.e.

deterioration, damage or destruction) to enable the identification of higher-risk components and the nature of the threat from the climate change impact. This information can be used to make informed engineering judgements on which components require adaptation as well as how to adapt them (e.g. design adjustments, changes to operational or maintenance procedures).

Case studies applying the Protocol and further details of the Protocol are available at http://www.pievc.ca/e/index_.cfm.

CASE STUDY 3. The Community-based Risk Screening Tool – Adaptation and Livelihoods (CRiSTAL)

CRiSTAL was developed by the International Institute for Sustainable Development (IISD), the International Union for Conservation of Nature (IUCN), the Stockholm Environment Institute (SEI) and Intercooperation. It is intended to help project designers and managers integrate risk reduction and climate change adaptation into community-level projects.

CRiSTAL can be used through a Microsoft Excel interface or by reading the accompanying user's manual. Training in CRiSTAL has been undertaken in Africa, Asia and Latin America, and feedback from these

sessions is used to continually update and revise the tool. Use of the tool requires a basic knowledge of climate change and adaptation, and field visits and community consultations are used to generate material for analysis. Training workshops are offered in partnership with CARE International and their Climate Vulnerability and Capacity Analysis (CVCA) framework.

Details on the CRiSTAL tool, and case studies of its applications in Africa, Asia, and Latin America and the Caribbean are available online at www.cristaltool.org.

CASE STUDY 4. The Adaptation Learning Mechanism

The Adaptation Learning Mechanism (ALM), launched in 2007 and facilitated by the United Nations Development Programme (UNDP), aims to address adaptation knowledge needs. It represents a collaborative, global learning process, with leadership, facilitation and strong participation by Southern institutions. The ALM seeks to bridge adaptation knowledge gaps by, among other things, developing and disseminating tools and resources to support adaptation practices and capacity-building.

The ALM has developed/collated and made available a large number of resources, including guidance material and tools for assessing impacts, vulnerability and adaptation, case studies of their application in assessments, and training materials on some of the tools.

Details on the ALM and the large range of methods and tools are available at <http://www.adaptationlearning.net>.

Other knowledge networks, such as weADAPT, an online collaboration platform on adaptation led by the Stockholm Environment Institute and Eldis, one of a family of knowledge services from the Institute²⁹ of Development Studies, Sussex, United Kingdom, have collated and made available a wide range of methods and tools.³⁰

²⁷ A full technical report on the framework entitled Climate Adaptation: Risks, Uncertainty and Decision-making is available online at the UKCIP website (<http://www.ukcip.org.uk>) and on a CD which can be ordered from the UKCIP office.

²⁸ Available at <http://www.ukcip.org.uk/wizard>.

²⁹ A wide variety of methods and tools collated and disseminated by we Adapt are available at <http://www.weadapt.org/knowledge-base/guidance/knowledge-base>.

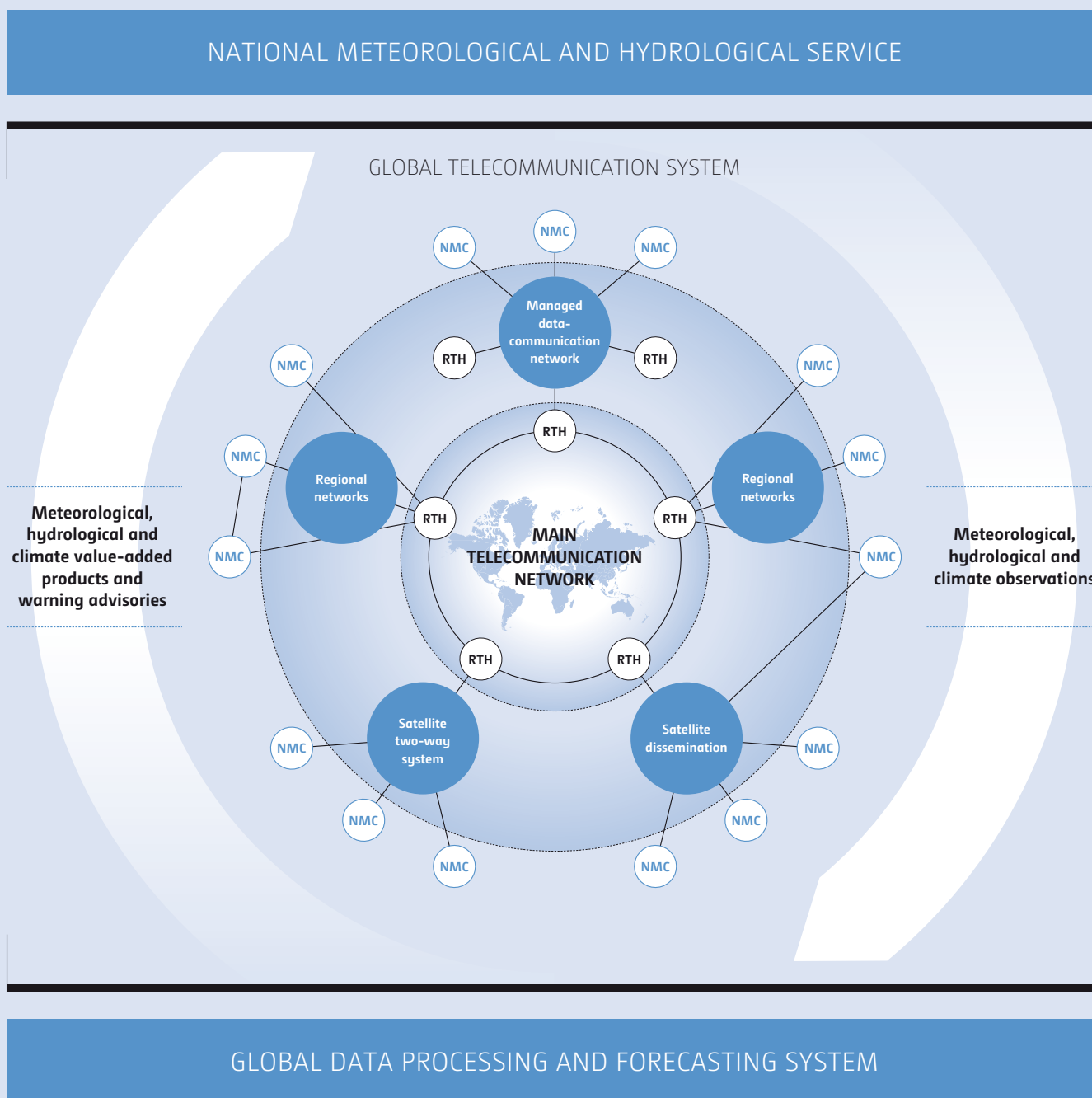
³⁰ Details of methods and tools disseminated by Eldis are available at <http://www.eldis.org/go/topics/dossiers/climate-change-adaptation/themes/methods-and-tools>.

CASE STUDY 5. A comprehensive global operational network for climate data collection and application, and climate research

Through the coordination of an operational network of its 188 members' National Meteorological and Hydrological Services (NMHS), three world meteorological centres, 40 regional specialized meteorological centres, 10 scientific and technical programmes and 30 regional meteorological training centres, WMO leverages capacities so that NMHS can deliver

the vital climate information, products and services to enable adaptation to climate change and variability. The WMO Global Operational Network includes: (i) the WMO Global Observing System; (ii) the WMO Global Telecommunication System; and (iii) the WMO Global Data Processing and Forecasting System (figure VI-12).

Figure VI-12. WMO's Global Operational Network



Abbreviations: RTC = regional telecommunication hub; NMC = national meteorological centre.
 Source: adapted from figure 1 of "Background on the new initiative for the provision of meteorological services for improved humanitarian emergency planning and responses", WMO (<http://www.wmo.int/pages/prog/drr/events/humanitarian/Documents/HumanitarianBackground%20document.pdf>).

CASE STUDY 6. Climate for Development in Africa (ClimDev-Africa)³¹

A joint initiative of the African Development Bank, the Commission of the African Union and the United Nations Economic Commission for Africa, ClimDev-Africa implements the Africa Regional Action Plan developed under the GCOS Regional Workshop Programme. It has received strong political endorsement from African Union (AU) Heads of State and Government, African ministers, several key stakeholders and the international community.

ClimDev-Africa has three components: (i) capacity-building for African climate institutions to generate and widely disseminate climate information necessary for planning; (ii) capacity-building for end-users, particularly national development policymakers, in order to mainstream climate change into development plans on the continent; and (iii) adaptation programmes and projects that incorporate climate-related information to learn the lessons and define good climate change adaptation practices.

CASE STUDY 7. Global initiatives for the provision of socio-economic data and scenarios for climate change analyses and adaptation planning

Multilateral banks and specialized United Nations agencies, such as the World Bank, UNDP, the United Nations Population Fund (UNFPA) and the World Health Organization (WHO), and international research institutions and initiatives, such as the International Institute for Applied Systems Analysis (IIASA) and the Centre for International Earth Science Information Network (CIESIN), have developed and made available data sets (e.g. statistics at different time scales) on a wide range of socio-economic indicators. They are important inputs for analysing the underlying drivers of the current vulnerability of communities and natural systems.

UNDP, through the National Communications Support Programme (NCSP), has developed a handbook for developing socio-economic scenarios to support such assessments.³²

A few global-scale assessments have also produced relevant data and information to derive socio-economic scenarios for climate change analyses. These include: the IPCC Special Report on Emissions Scenarios (SRES)³³, the Global Environment Outlook,³⁴ the Millennium Ecosystem Assessment (MEA)³⁵ and the United Nations World Water Development Report.³⁶

To assess the potential impacts of projected future climate change and vulnerability, characterizations of future demography, technology trends and socio-economic development pathways are required. The

³¹ See <<http://www.afdb.org/en/topics-and-sectors/initiatives-partnerships/climate-for-development-in-africa-climdev-africa-initiative/>>.

³² Available at <http://ncsp.undp.org/sites/default/files/Socio_economicScenarios_guidance_0.pdf>.

³³ Associated data sets are available at <http://sres.ciesin.org/final_data.html>.

³⁴ See <<http://www.unep.org/geo>> for details.

³⁵ Reports from the assessment are available at <<http://www.maweb.org/en/Reports.aspx>>.

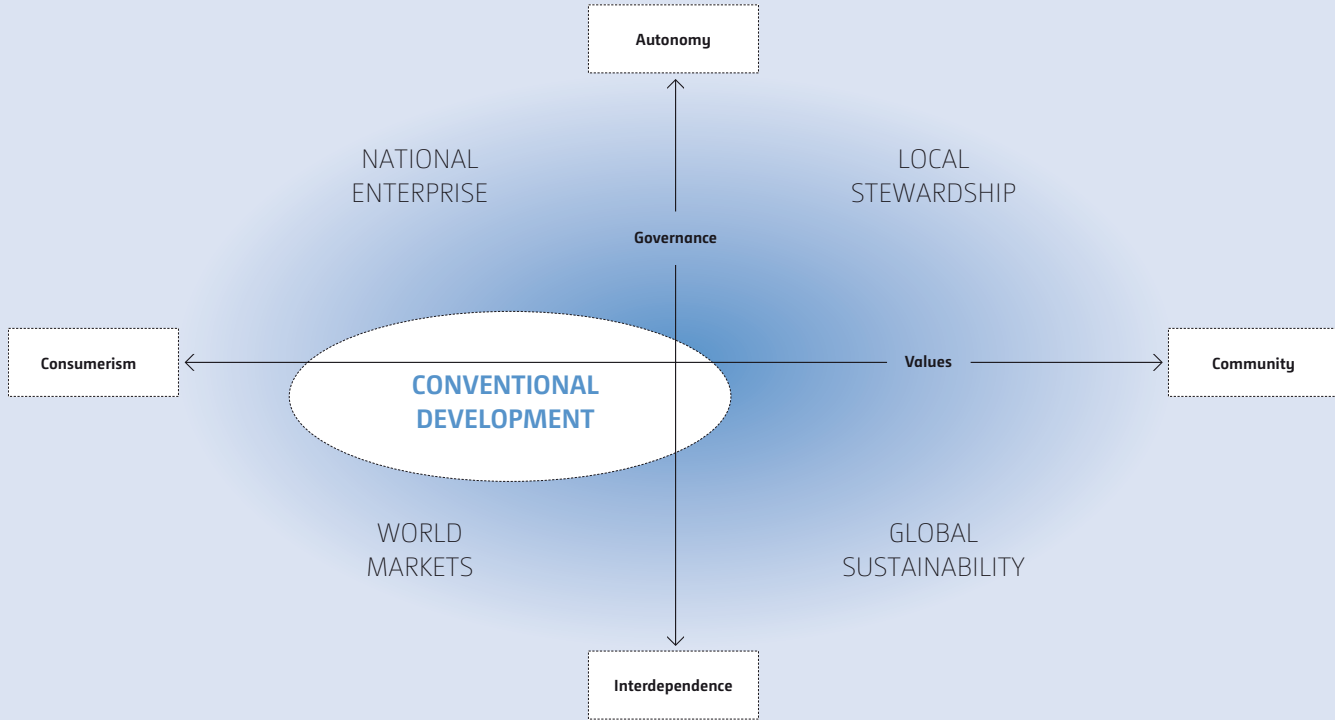
³⁶ See <<http://www.unesco.org/water/wwap/wwdr/>> for details.

CASE STUDY 8. National- and subnational-level initiatives for the provision of socio-economic data and scenarios for climate change analyses and adaptation planning

At the national and subnational level, the United Kingdom Climate Impacts Programme (UKCIP) provides comprehensive socio-economic scenarios for use in impacts assessment. Four socio-economic

scenarios, distinguished by the dimensions of governance and political and social values, were derived for use in climate change impact studies (see figure VI-13).

Figure VI-13. Four socio-economic scenarios for the United Kingdom



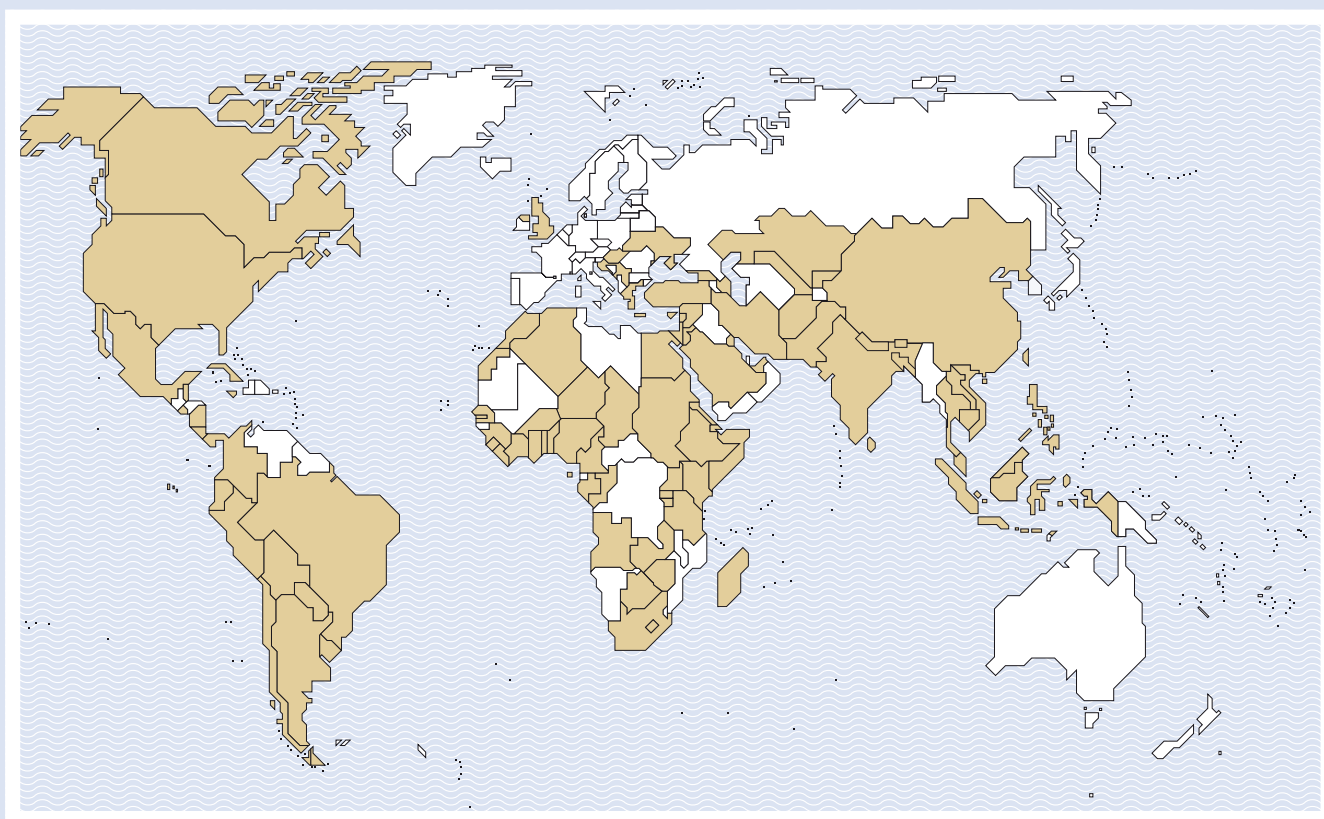
Source: adapted from UKCIP. 2000. Socio-economic Scenarios for Climate Change Impact Assessment: A Guide to Their Use in the UK Climate Impacts Programme. Oxford: UKCIP. Available at http://www.ukcip.org.uk/wordpress/wp-content/PDFs/socioeconomic_tec.pdf.

CASE STUDY 9. The Hadley Centre for Climate Prediction and Research, United Kingdom Met Office, supporting the provision of regional climate information through the development and delivery of an integrated package of climate modelling tools and advisory services

Collaborating with international, regional and national partners, the Hadley Centre has been supporting a large number of countries, mostly developing countries and countries with economies in transition. Within the context of the use of the regional climate model, Providing REgional Climates for Impacts Studies (PRECIS), scientific and technical training in regional climate modelling and analyses has

been provided to professionals in 104 countries (see figure VI-14). In addition, ongoing advisory services aimed at the appropriate use of climate scenarios and strengthening regional collaboration and funding opportunities to support work on regional climate scenarios are also provided upon request.

Figure VI-14. Countries (shaded in brown) hosting institutions with professional staff who have received training at a PRECIS workshop



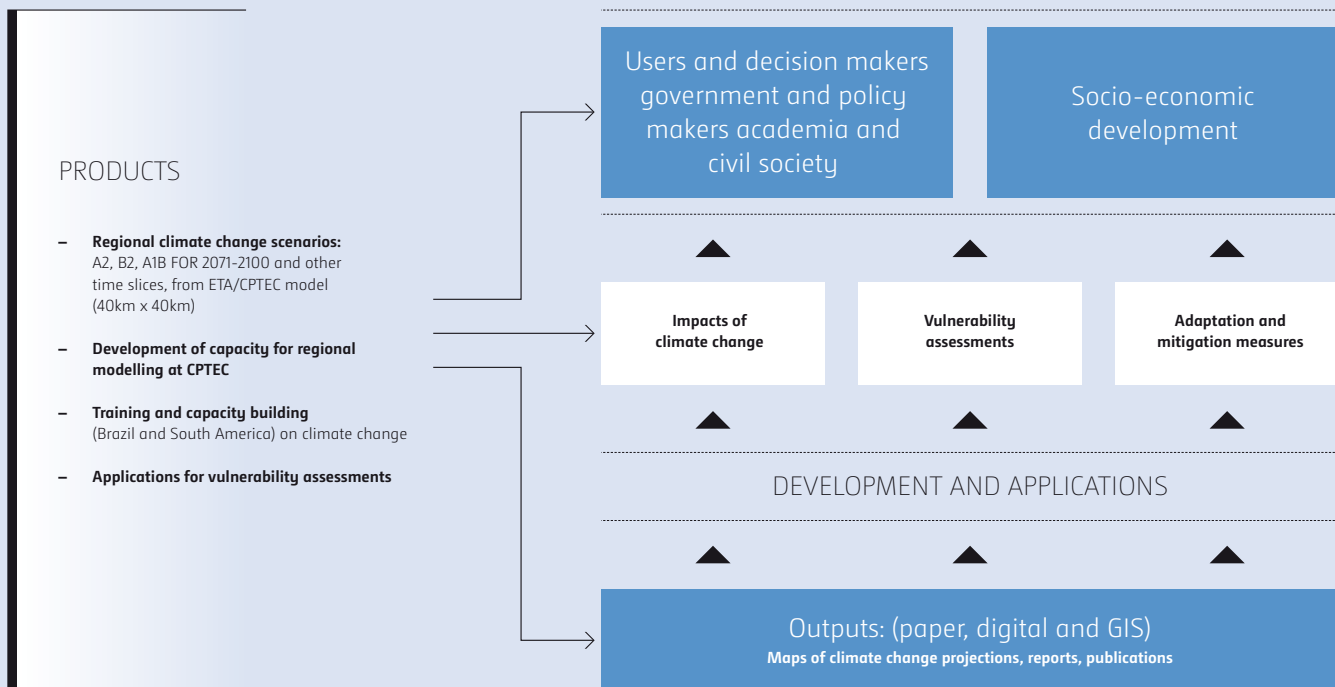
Source: adapted from Hadley Centre for Climate Prediction and Research, United Kingdom Met Office (<<http://www.metoffice.gov.uk/precis>>).

CASE STUDY 10. Regional collaboration in Latin America and the Caribbean for the development and application of regional climate scenarios

Within the context of the PRECIS-Caribbean initiative, centres of excellence in the region, the Caribbean Community Climate Change Centre (CCCCC) and the Cuban Institute of Meteorology (INSMET), have provided strong support to participating countries through a variety of regional climate modelling and subsequent impact assessment activities. Model experiments at 25 km and 50 km resolutions were carried out and the results were made available to all countries in the region and applied in the assessments of their second national communications to the UNFCCC.³⁷

In Latin America, countries have benefited from the expertise in regional climate modelling offered by the Centre for Weather Forecasts and Climate Studies (CPTEC) (Brazil) (see <<http://www.cptec.inpe.br/>>). Coordinated by the Ibero-American Network of Climate Change Offices (RIOCC), with support from the Governments of Spain and Brazil, regional workshops were held to train scientists from the region on the use of the CPTEC regional climate model ETA/CPTEC, and the application of outputs from running the model to impact and vulnerability assessments in the agriculture and health sectors (see figure VI-15).³⁸

Figure VI-15. Regional collaboration in the development and application of climate scenarios in Latin America



Source: adapted from presentation made by Brazil at the NWP in-session workshop in June 2008, available at <<http://unfccc.int/files/adaptation/application/pdf/brazil.pdf>>.

CASE STUDY 11. Assessing impacts and vulnerability – sectors

Water resources, food production, coastal zones, human health, and natural ecosystems and terrestrial carbon sinks

Following the publication of the IPCC Special Report on Emissions Scenarios (SRES) and associated climate model experiments, UK Department for Environment, Food and Rural Affairs supported a series of global-scale studies to assess impacts on water resources, food production, coastal zones (flooding and wetlands loss), human health

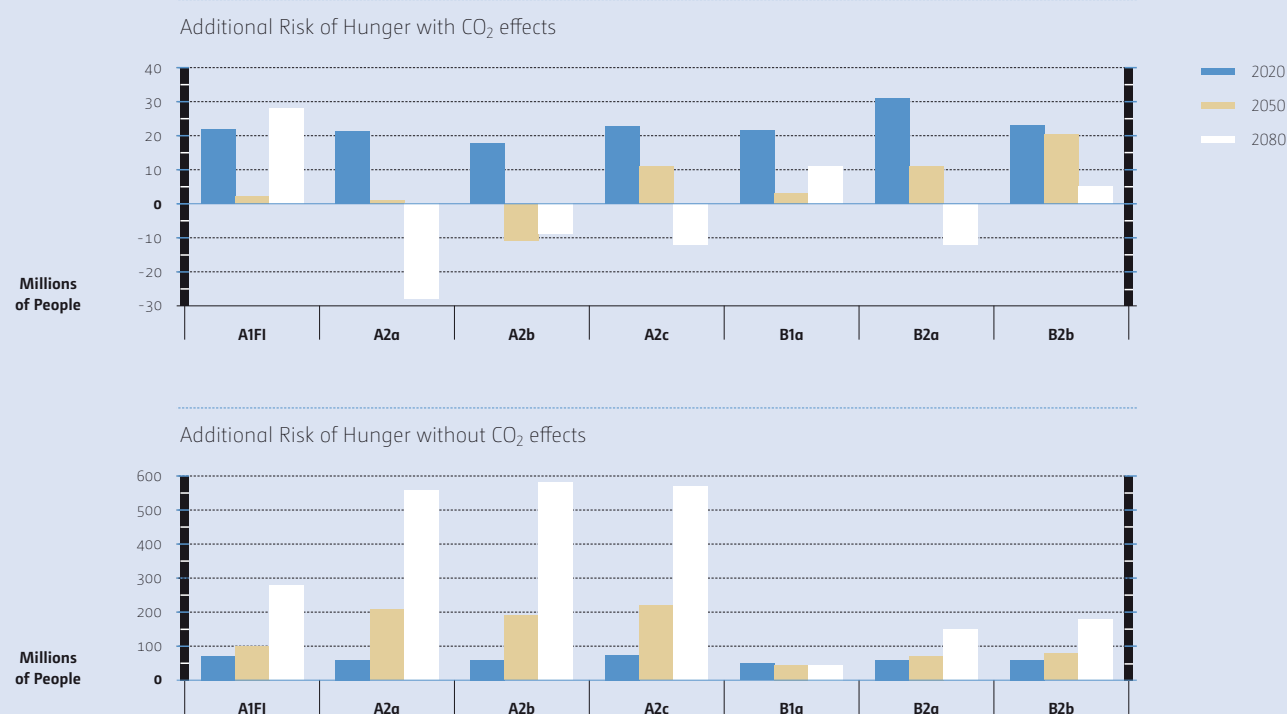
(malaria), and natural ecosystems and terrestrial carbon sinks. These assessments used a set of common SRES-based scenarios, including climatic, sea-level, environmental and socio-economic components. The assessments, together with the underlying climatic and socio-economic scenarios, were published in a special issue of *Global Environmental Change*. Figure VI-16 below is an example of the results from the assessment on food production.

Forestry

The International Union of Forest Research Organizations (IUFRO) led the first global scientific assessment, **Adaptation of Forests and People to Climate Change**, with a specific focus on the relationship between climate change, forests and people. The assessment was carried out by a panel of experts from around the world and included assessments of forest responses and vulnerabilities to recent climate change, future environmental and socio-economic impacts and vulnerabilities, current adaptation measures and policies, and management, governance, and policy formulation for adaptation. Details of the assessment and the report are available at <http://www.iufro.org/science/gfep/adaptaion-panel/the-report/>.

In addition to these global-level assessments, numerous regional-, national- and local-scale studies have also been carried out on a wide range of sectors/systems. These assessments were synthesized in the IPCC Fourth Assessment Report (AR4), and dedicated chapters of the IPCC Working Group II (WGII) contribution provide the most up-to-date information on climate change impacts, vulnerability and adaptation needs for the following sectors/systems: **freshwater resources and their management; ecosystems, their properties, goods and services; food, fibre and forest products; coastal systems and low-lying areas; industry, settlement and society; and human health.**³⁹

Figure VI-16. Additional population at risk of hunger under the IPCC SRES-based climate and socio-economic scenarios



Source: adapted from Parry ML, Rosenzweig C, Iglesias A, Livermore M, Fischer G. Effects of climate change on global food production under SRES emissions and socio-economic scenarios. *Global Environmental Change*. 14(1): pp. 53–67.

³⁷ See <http://unfccc.int/files/adaptation/application/pdf/cuba.pdf> for details.

³⁸ See <http://unfccc.int/files/adaptation/application/pdf/brazil.pdf> for details.

³⁹ These chapters are available at http://www.ipcc.ch/publications_and_data/ar4/wg2/en/contents.html.

CASE STUDY 12. Assessing climate change impacts and vulnerability – scales

Global-scale assessments focusing on specific sectors/systems.

The sectoral assessments summarized in [case study 11](#) above are some of the examples of global-scale assessments. They are being updated with new scientific insights and information, and emerging developments relating to international climate policies, particularly those under the UNFCCC process. These assessments will be reviewed and synthesized in the IPCC Fifth Assessment Report (AR5) to be made available in 2014.⁴⁰

Regional assessments

Assessments on impacts and vulnerability of climate change have been carried out at the regional level, usually focusing on a particular sector or system. For example, the United Kingdom Department for International Development (DfID) supported a vulnerability mapping exercise, as part of a larger effort to identify the focus for its research programme on climate change and development in sub-Saharan Africa. Outputs from General Circulation Models (GCMs) were downscaled to provide climate scenarios, and possible changes in the length of the growing period were estimated for Africa to 2050 under different scenarios. The results of the assessments were presented on the basis of agricultural system types by country, using a systems classification as a proxy for the livelihood options available to natural resource users. From this, areas that appear to be particularly prone to climate change impacts were identified. These include arid and semi-arid

rangeland and drier mixed systems across broad swathes of the continent, particularly in southern Africa and the Sahel, as well as coastal systems in eastern Africa ([figure VI-17](#)).

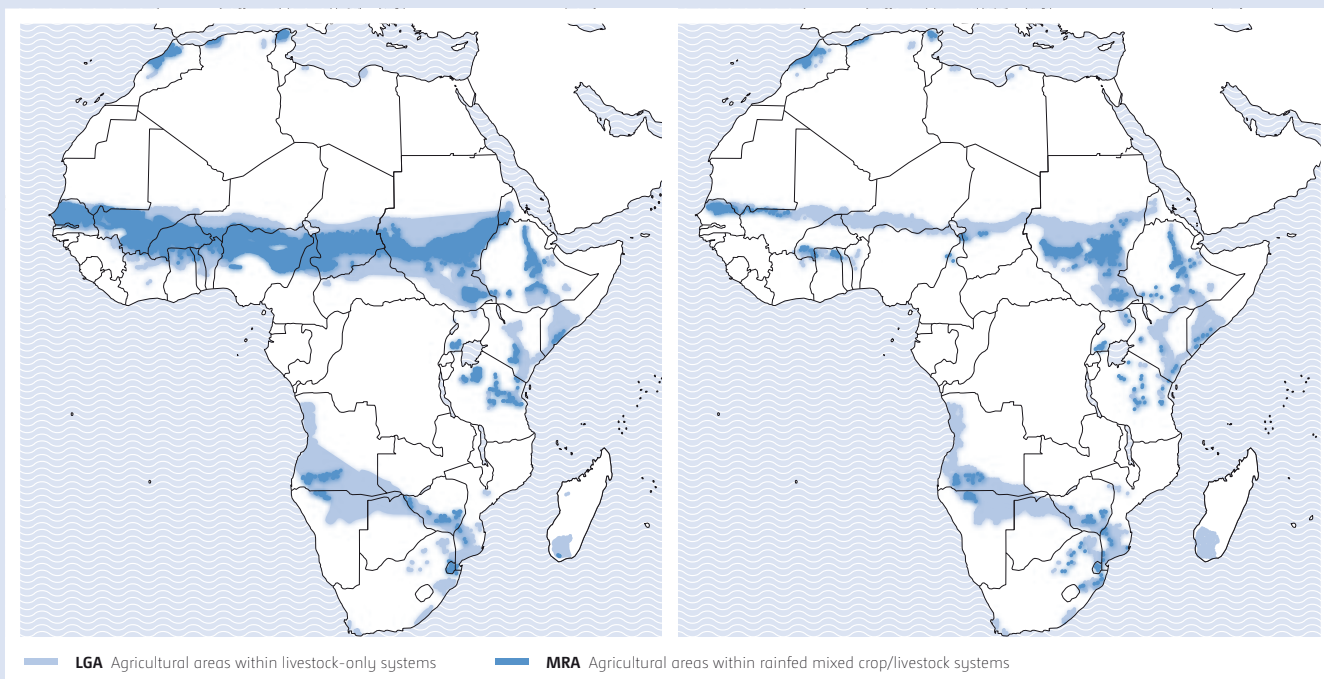
National assessments

In most countries, impact, vulnerability and adaptation assessments have been carried out within the context of national communications by Parties to the UNFCCC. These assessments are intended to inform the development and implementation of national adaptation strategies, policies and programmes. However, due to time, and resource and technical constraints, many developing countries have not been able to undertake comprehensive national assessments covering all key sectors or all of their country. Instead, most assessments are still limited to specific sectors and/or selected regions/areas (e.g. a particular agricultural zone, river basin or coastal area).

Subnational-level risk and vulnerability assessments

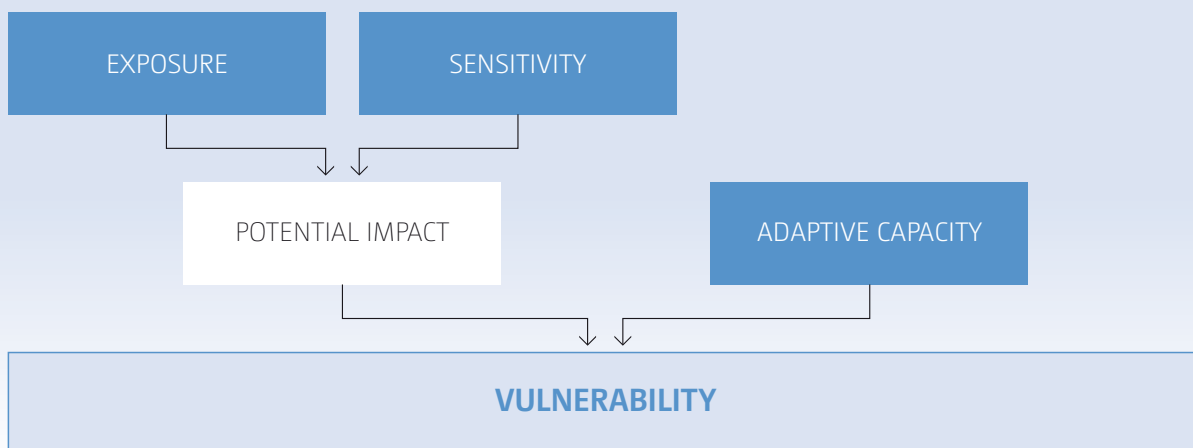
Following an analytical framework which defines vulnerability according to its exposure, sensitivity and adaptive capacity, a series of regional assessments were carried out in Australia to identify key impacts and vulnerability for each strategically important region. Stakeholder consultations then took place to discuss and validate these assessments and explore adaptive responses to reduce identified vulnerabilities within each region ([see figure VI-18](#)).

Figure VI-17. Agricultural areas within the livestock-only systems (LGA) in arid and semi-arid areas, and rainfed mixed crop/livestock systems (MRA) in semi-arid areas are projected by the HadCM3 GCM to undergo a >20 per cent reduction in the length of the growing period to 2050 (SRES scenario A1 (left) and B1 (right))



Source: adapted from Thornton et al. (2006).⁴¹

Figure VI-18. A synthesis of the vulnerability assessment for the Cairns – Great Barrier Reef Region, Australia



Vulnerability criterion	Findings
Exposure	Increased sea and land surface temperatures and an increase in the number and severity of storms and cyclones are likely.
Sensitivity	Both the Great Barrier Reef and the Wet Tropics are very sensitive to changes in temperature; an increase of as little as 2°C could have devastating effects. Increased storm surges and cyclone intensity could cause serious damage to Cairns, with potential for property damage and loss of life.
Adaptive capacity	Autonomous adaptive capacity of natural biological system is low.
Adverse implications	The Great Barrier Reef and the Wet Tropics are high profile and popular tourist attractions and World Heritage Areas. Tourism accounts for 16.3% of employment in Tropical North Queensland.
Potential to benefit	There is considerable scope to increase the resilience of natural systems by reducing other stresses. Settlements could benefit from attention to urban and natural disaster management planning.

Source: adapted from the Department of the Environment and Heritage, Australian Greenhouse Office, Australian Government. 2005. Available at <<http://catalogue.nla.gov.au/Record/3586527>>.

⁴⁰ See the approved IPCC AR5 WGII chapter outlines at <<http://www.ipcc.ch/pdf/ar5/ar5-outline-compilation.pdf>>.

⁴¹ See <<http://www.icrisat.org/journal/SpecialProject/sp7.pdf>>.

CASE STUDY 13. Integrated assessment focusing on a geographic area/particular communities

Based on studies carried out under the START-UNEP global project, Assessment of Impacts and Adaptation to Climate Change (AIACC), an integrated assessment was carried out to investigate the impacts on and vulnerability of the Pantabangan-Carranglan Watershed (one of the most important watersheds in the Philippines) and the community living within the watershed. The biophysical impacts on the different

aspects of the watershed, as well as the socio-economic implications under future climatic and livelihood conditions, were assessed using a combination of quantitative and qualitative methods. The vulnerability of different social groups within the watershed was then assessed (table VI-11) and adaptation options were identified.

Table VI-11. Vulnerability of social groups within the watershed to future climate variability and extremes

Description	Socio-economic groups			
	Small farmers	Average farmers and fishermen	Employees/small entrepreneurs	Rich farmers
Food availability and crop production	Decline in crop production; starvation.	Decline in crop production and other livelihood resources.	Increase in prices of commodities, hence increase in expenditures.	Supply of food is not affected because they have money to buy food.
Livelihood	Worsening poverty condition; more debts incurred and longer time to repay.	The livelihood sources of some will decline, while others will improve, especially those who loan money to the poor farmers with collateral.	Decline in business activities of small entrepreneurs, and limited money to spend due to increase in prices of commodities. However, they are not much affected because some have alternative sources of livelihood, like livestock raising.	They become richer because they obtain the farms and other possessions (collateral) of the poor who loaned money and was not able to repay. The poor farmers also approach them for farm inputs which they return with interest. Rich farmers are also the buyers of "palay", hence they have control over crop prices.
Health	Their health will be affected by intense climate condition and malnutrition. Since they don't have money to consult a doctor or buy medicine, they will just resort to medicinal herbs or consult an "albularyo".	Their health will not be much affected.	Their health will not be much affected.	Their health will not be much affected.
Water supply	Shortage in water supply for farm and domestic uses. The assistance given by government including water pumps usually does not reach them.	Some will experience water shortage while others will not be much affected because they have money to buy water for domestic and drinking purposes, as well as water storage facilities.	Expenditures for water will increase, but their water supply will not be much affected because they have money to buy water for domestic and drinking purposes, as well as water storage facilities.	Water supply will not be much affected because aside from the capacity to make/find alternative sources of water, they also have money to buy water for domestic and drinking purposes, as well as water storage facilities.

Table VI-11. Vulnerability of social groups within the watershed to future climate variability and extremes (continued)

Description	Socio-economic groups			
	Small farmers	Average farmers and fishermen	Employees/small entrepreneurs	Rich farmers
Degree of negative impacts	High	Moderate	Moderate	Low
Examples of adaptation strategies	They work in other farms, engage in other jobs, work in nearby towns, or even apply for jobs abroad. They also plant crops that can adapt to the dry season, like onions and tomatoes. Others make "sawali" from cogon grasses that can be harvested in the mountain.	They plant fast growing crops and store food supplies. They also invest in other businesses or find other sources of income. They look for job in other places.	They decrease budget in some expenditures and store food supplies.	They will be selective of whom to lend money to. They plant crops in other areas where there is water. They store food supplies.
Effectiveness of adaptation strategy	Some effective, others not.	Some effective, others not.	Some effective, others not.	Some effective, others not.
Location of settlement/ properties relevant to vulnerable areas	They have no choice but to stay in their area because they don't have the capacity to transfer to safer locations. In times of extreme weather events like typhoons, they need to evacuate to safer areas like schools.	They have the capacity to select or transfer to safer locations. Also, most of them live in high and safe places and their homes are made of sturdy materials like concrete.	They have the capacity to select or transfer to safer locations. Also, many of them live in safer places and their houses are made of sturdy materials like concrete.	They have the capacity to select or transfer to safer locations. Their houses are located in safer places and are made of concrete. There are some who have houses in other places.
Degree of vulnerability	High	Moderate	Moderate	Low
Present distribution of farmers	75–85%	5–15%	5–10%	2–5%

Source: adapted from Table 4.17 of Lasco R et al. 2010.⁴²

⁴² Available at <<http://www.worldagroforestry.org/downloads/publications/PDFs/B16559.pdf>>.

CASE STUDY 14. Developing weather risk management tools through better alignment with incentives for disaster risk reduction

In partnership with in-country commercial insurers, the World Food Programme (WFP) and the International Fund for Agricultural Development (IFAD) have been developing and testing weather risk

transfer tools in order to diversify and enrich the agricultural risk management options available to protect the livelihoods of small-scale farmers in China vulnerable to drought and flood risks.⁴³

CASE STUDY 15. Offering user-friendly guidebooks and relevant resources as an effective way of disseminating methods and tools

The Community-based Adaptation (CBA) Toolkit was developed by CARE International to guide users through the process of developing and implementing CBA projects. It is organized around the simplified stages in the project cycle: analysis, design and implementation. It

also provides guidance on information and knowledge management, including monitoring and evaluation. For each of these stages, step-by-step guidance is provided, along with recommended tools and resources to support the process (see figure VI-19).⁴⁴

Figure VI-19. Step-by-step guidance and essential supporting resources offered with the CBA Toolkit

STEP-BY-STEP GUIDANCE	QUICK LINKS
Analysis	Tools
Design	Resources
Implementation	Checklists
Information and Knowledge Management	FAQs
	Toolkit Team

Source: based on information from CARE web page on the Toolkit <http://www.careclimatechange.org/tk/cba/en/step_by_step_guidance/Step_by_Step.html>. Community-Based Adaptation Toolkit © Cooperative for Assistance and Relief Everywhere, Inc. (CARE), June 2010. Used by permission.

CASE STUDY 16. Decision context and stakeholder inputs guiding the selection and application of methods and tools

Based on a broad Sustainable Livelihood (SL) framework, Christian Aid has been working directly with vulnerable communities to assess climate risks and identifying strategies to manage them. Their work in the United Republic of Tanzania, and similar efforts in eastern Kenya, have resulted in the production of climate risk maps that

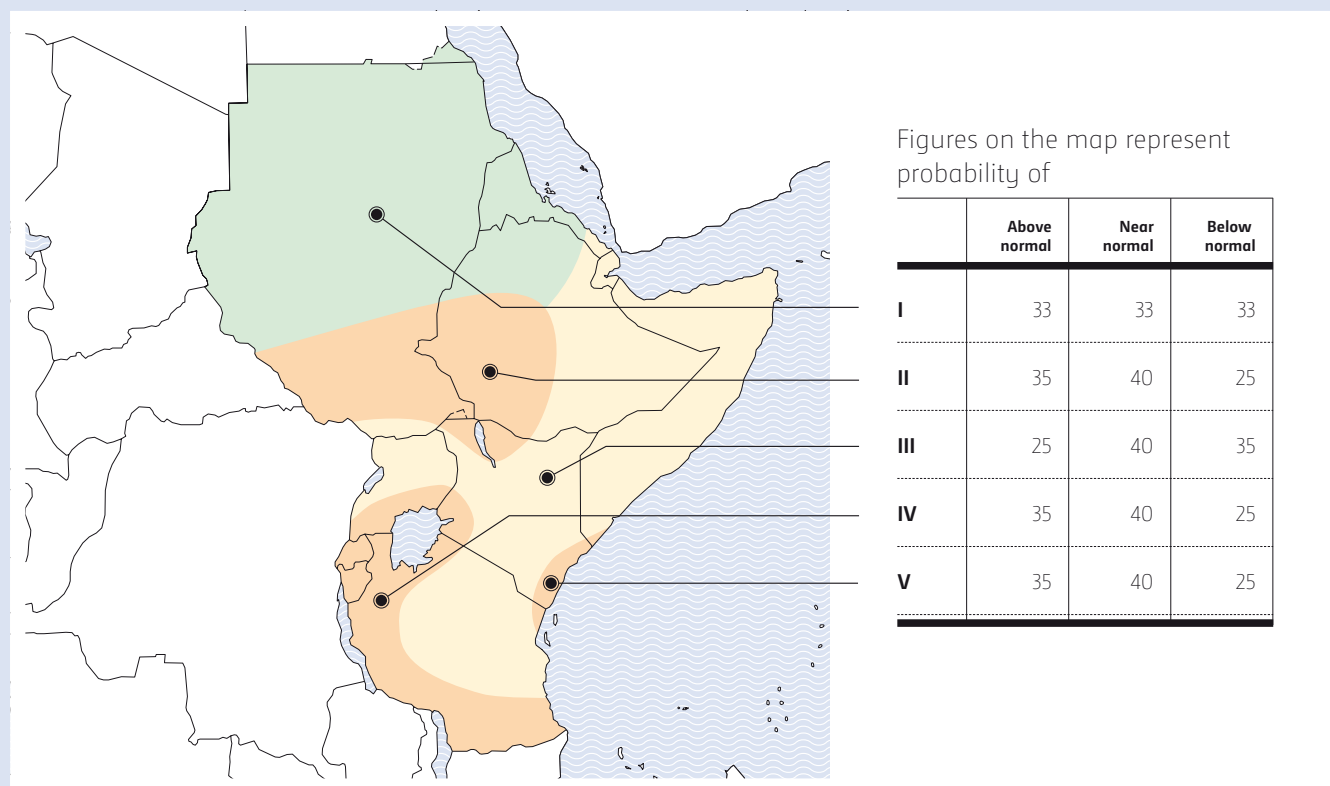
include the physical location and livelihood context of vulnerable communities, as well as a detailed assessment of community capabilities and needs for improving the management of current climate risks and adapting to future climate change.⁴⁵

CASE STUDY 17. The Greater Horn of Africa Climate Outlook Forum (GHACOF)

The Greater Horn of Africa (GHA) region comprises Burundi, Djibouti, Eritrea, Ethiopia, Kenya, Rwanda, Somalia, Sudan, Uganda and the United Republic of Tanzania. GHACOF is being coordinated by the Intergovernmental Authority on Development (IGAD) Climate Prediction and Applications Centre (ICPAC), Nairobi, Kenya. The forum is held periodically to formulate a consensus climate outlook for the GHA region. Users from sectors such as health, disaster risk management, agriculture and food security, water resources and the media, as well as non-governmental organizations and development partners, actively participate in the formulation of the potential impacts of the climate outlook on their respective sectors.

The latest forum was held in February 2011 to formulate a consensus climate outlook for the March – May 2011 rainfall season. The forum reviewed the state of the global climate system and its implications for the GHA, including the influence of sea-surface temperature anomalies over the tropical Pacific, Atlantic and Indian Oceans on the evolution of rainfall in the GHA region. Guidance products from the WMO Global Producing Centres and other seasonal climate prediction centres were also assessed. These inputs were combined using expert analysis and interpretation to obtain forecast probabilities for the evolution of regional rainfall during the period March – May 2011 (see figure VI-20).

Figure VI-20. The Greater Horn of Africa consensus rainfall outlook for March–May 2011 for different climate zones



Source: based on information from the statement from the 27th Greater Horn of Africa Climate Outlook Forum (<http://www.geologicalsocietyofafrica.org/file/News_4ddde8c2d55814.65009119.pdf>).

⁴³ Details of the tools and their pilots are available at <<http://www.ifad.org/ruralfinance/pub/weather.pdf>>.
⁴⁴ See <http://www.careclimatechange.org/tk/cba/en/about_the_toolkit/about_the_toolkit.html> for details of the CBA Toolkit and associated supporting resources.
⁴⁵ See <<http://www.christianaid.org.uk/whatwedo/africa/index.aspx>> for details of Christian Aid's work on climate change adaptation in Africa. See also <http://unfccc.int/files/adaptation/application/pdf/christianaid_ap_update_sep_09_case_study_1sp.pdf> for details of the case study.

6.2. PLANNING FOR ADAPTATION

CASE STUDY 18. Integration of approaches to adaptation across levels, sectors and hazards

This case study highlights three examples of how Parties are integrating approaches to adaptation planning across levels of government, economic sectors and climate hazards. Examples are adapted from presentations made at the Technical workshop on advancing the integration of approaches to adaptation planning held in Bangkok, Thailand from 12–14 October 2009. The original presentations, other presentations and a report of the workshop are available at <http://unfccc.int/4915.php>.

Integration across levels of government (COLOMBIA)

An Integrated National Adaptation Plan (INAP) is implemented in Colombia. It involves making information on climate variability and climate change available to facilitate the adoption of adaptation measures and policies across different administrative levels, as well as focusing on reducing vulnerability in specific vulnerable areas (high mountain ecosystems, Caribbean insular areas, tropical vector borne diseases).

Current strategies for adaptation planning in Colombia include:

- Formulation of a National Climate Change Policy which provides a regional approach for adaptation (aimed at the adoption of legal instruments to enable local decision makers to integrate climate change in the developing planning process);
- Methodological guidance for decision making, facilitating the integration of climate change in territorial and land use planning instruments;
- A national strategy of education, training and public awareness on climate change; and
- An adaptation portfolio which involves stakeholders and enhances public participation in adaptation measures.

Lessons learned and good practices from the implementation of the INAP:

- Outputs of the study set demonstrative pilot actions preparing the country for the establishment of a National Climate Change Adaptation National Policy;
- Capacity building through research, institutional training strategies and public awareness are effective mechanisms to improve the adaptability of coastal areas;
- International cooperation, as well as sharing of experience with other countries, has also been key components of the success of the scheme.

Integration across sectors (INDONESIA)

The government of Indonesia mainstreamed a climate programme into small island development in Lombok, West Nusa Tenggara to

build institutional capacity for adaptation and mitigation. The project aims to build government capacity and mobilize relevant and influential stakeholder groups to adapt to the impacts of climate change, specifically decreased water availability and catastrophic flooding.

Activities included:

- Institutional capacity building at the local level for adaptation and mitigation in the Province of West Nusa Tenggara;
- Provision of assistance to the local government in bringing together local stakeholders to assure that the issue of climate change is highlighted and incorporated into the development paradigm at the local level;
- Dissemination of information, documents and data related to climate change to create understanding in local stakeholders of its importance.

Some outcomes of the process include:

- The identification of constraints to mainstreaming climate change adaptation, e.g. the lack of political support, the lack of relevant policies, and a low level of public awareness;
- Eight elements of adaptation strategy elaborated under adaptation and mitigation programmes: responsibility, planning, legislation, links with other planning, education, wide engagement, scientific basis, and resources;
- Integration of risk reduction strategies into specific sectors;
- A taskforce established under Gubernatorial Decree (SK Gubernur) with clear goals, role division, membership, modalities, activities and required facilities.

Integration across hazards (CUBA)

Cuba is a tropical island state with low-lying coastal areas and fragile ecosystems. Its location makes it prone to extreme meteorological events such as hurricanes, pluvial flooding, sea water invasion, strong winds, landslides, wildfires and drought. Over time, a national framework has been developed to manage multiple hazards. The Cuban model for Disaster Risk Reduction (DRR) features:

- A legal and institutional framework that ensures compliance of DRR practices;
- A highly integrated disaster response system involving all relevant stakeholders;
- Use of the latest technologies, procedures and methodologies, as well as expert inputs on climate projection;
- Active involvement of the mass media; and
- Initiatives on education and awareness-raising on disasters.

Lessons learned and good practices include:

- Measures and actions responding to climate variability can be used as the basis for planning for adaptation to climate change;
- Knowledge dissemination, capacity building and training are good starting points for adaptation planning;
- Approaches to systems, measures, options for adaptation cut across different administrative levels, sectors and hazards;
- Everybody needs to adapt but adapts in different ways.

CASE STUDY 19. Increasing the portfolio of adaptation projects, especially trans-frontier projects, trans-sectoral projects and/or pan-sectoral projects

**Ibero-American Network of Climate Change Offices (RIOCC)
Programme on Adaptation to Climate Change (PIACC)**

Within its general objective of strengthening the development and implementation of adaptation strategies to climate change in the region, PIACC promotes a permanent exchange of experiences and information on national adaptation frameworks among all the RIOCC members through its inclusion as an ordinary item of the agenda of its annual meetings. These regular meetings provide the guarantee and stability for the continuity of PIACC.

PIACC has engaged several regional organizations active in climate change adaptation, with the aim of increasing synergies and working together with the countries involved, to develop projects and the exchange of knowledge and know-how. Among them are regional organizations, such as the Water Centre for the Humid Tropics of Latin America and the Caribbean (CATHALAC), the Tropical Agricultural Research and Higher

Education Centre (CATIE) and the United Nations International Strategy for Disaster Reduction (UNISDR)-Americas, which, as part of RIOCC, are included in the list of organizations that have expressed an interest in participating in the implementation of the Nairobi work programme.

PIACC also has the specific objective of promoting communication, education and public awareness (CEPA activities) in the region, and some outreach material has been produced to disseminate and communicate the initiatives and their activities. Another basic pillar of PIACC is to support the composition of a portfolio of adaptation actions. The results and outcomes of these projects feed the knowledge base and practices in the region. Furthermore, within the thematic programme entitled "Environment and Climate Change" of the Spanish Millennium Development Goal Fund, seven national projects from the Ibero-America region (Brazil, Colombia, Ecuador, Guatemala, Nicaragua, Panama and Peru) have been selected and most of the projects contain specific actions concerning the mainstreaming of adaptation into national policies.⁴⁶

CASE STUDY 20. START (global change SysTem for Analysis, Research and Training) activities on adaptation planning

Adaptation planning is the main focus of the ACCCA (Advancing Capacity to Support Climate Change Adaptation) project. Stakeholders and scientists are working together to evaluate and prioritize climate risks, assess adaptation options, communicate information about risks and options to at-risk populations and decision makers, and identify preferred options to be promoted.

Examples of decision contexts in which pilot adaptation actions are being implemented include:

- Community-led adaptation for sustainable livelihoods in south-western Nigeria;
- Water management in Mali;
- Subsistence farming in Malawi;
- Fisheries management in Lake Victoria;
- Reducing risks from weather-related disasters in Nepal;
- Rangeland management and institutions in Mongolia;
- The integration of development and adaptation policies in India.

Adaptation was also 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 (available at http://www.aiaccproject.org/working_papers/working_papers.html).⁴⁷

⁴⁶ For more information see RIOCC's Action Pledge to the NWP, available at http://unfccc.int/adaptation/nairobi_work_programme/partners_and_action_pledges/items/5005.php?detail=j&id=134&nwp=act&dir=DESC&seite=2&anf=25&id_org=&work_area=5®ion=§or=&del_activity=, as well as the web pages of RIOCC, available at http://www.mma.es/portal/secciones/cambio_climatico/areas_tematicas/cooperacion_cc/menu_coop_iber.htm and the web pages of PIACC, available at http://www.lariocc.net/riocc_principal/es/programa_trabajo/adaptacion_cc.htm.

⁴⁷ For more information, see the START Action Pledge to the NWP, available at http://unfccc.int/adaptation/nairobi_work_programme/partners_and_action_pledges/items/5005.php?detail=j&id=113&nwp=act&dir=DESC&seite=2&anf=25&id_org=&work_area=5®ion=§or=&del_activity= and the START web page <http://start.org/>.

CASE STUDY 21. Three common approaches to appraising adaptation options

Cost-benefit analyses of adaptation options undertaken by Parties

The Government of the United Kingdom uses cost-benefit analysis to appraise and evaluate adaptation options. Additional guidance is provided, in addition to standard Treasury guidelines, on when and how to take climate change impacts into account. A “Real Options” approach is suggested when an activity has uncertainty, flexibility and learning potential. Valuing flexibility and the potential for learning from new information can give a different outcome. This approach has been applied to assess the net benefits of action to address flooding and to create a strategy for the management of coastal flooding with climate change in the Thames Estuary. The guidance can be downloaded from <http://archive.defra.gov.uk/environment/climate/documents/adaptation-guidance.pdf>.

Sectoral cost-benefit analyses are common among Parties. They have been carried out to assist decision making on flood risk by the Netherlands, and to identify adaptation options for irrigation systems in the face of climate change in Turkmenistan. Costa Rica carried out a cost-benefit analysis of options for adaptation in various aspects of water resources (hydropower, human consumption, agricultural production, flood control). Cost-benefit analysis in Kenya has shown that adaptation in the coastal zone could reduce the number of people flooded by one or two orders of magnitude for a cost of USD 28–56/year in 2030, depending on the sea-level rise scenario.

Cost-effectiveness analysis to address water scarcity in Pacific communities

A cost-effectiveness analysis (CEA) to project appraisal has been tested in Pacific Island communities through the PACC (Pacific Adaptation to Climate Change) project of the South Pacific Regional Environment Programme (SPREP).

A cost-effectiveness analysis was suitable in this setting because:

- It allowed evaluations to be carried out on projects that involved subsistence-based populations dependent on the land and the sea for sustenance and some semi-economic activities;
- It can be used in non-infrastructure type projects, for example those addressing food security, where the costs and benefits are less straightforward;
- The benefits can be measured in non-monetary values.

In Palau (Ngatpang State), CEA has been used to address the threat of salt-water intrusion on food security through the accompanying decline in the production of taro. CEA has allowed an appraisal of three options:

- The use of protection measures to stop salt-water intrusion into taro lands;
- The use of taro varieties that are salt-water tolerant;
- The implementation of upper catchment water management (traditional/contemporary) to regulate water flow into the affected area.

See http://www.sprep.org/climate_change/pacc/ for outputs of this programme.

Multicriteria analysis for national vulnerability assessments

The aim of the National Adaptation Programme of Action (NAPA) process is to direct and coordinate the prioritization and implementation of urgent and immediate adaptation activities. Mali prioritized activities using a multicriteria analysis (MCA).

The MCA followed a participatory approach which took into account local and national priorities. To account for the difference in importance of the criteria, relative weights were assigned and each criterion was standardized on a scale of 0–1.

Following the MCA and sensitivity tests, a list of 18 priority options were identified, the highest priority action being the adoption of climate-resilient crop varieties and animal species.

In Mali, as well as other least developed countries, an MCA approach was seen as beneficial to the NAPA process because it allowed:

- The involvement of vulnerable groups in the ranking of alternative adaptation options;
- The evaluation of options using a number of criteria;
- The evaluation of options where quantification and valuation in monetary terms was not possible.

The NAPA of Mali and other least developed countries can be found at: <http://unfccc.int/4585.php>.

6.3. IMPLEMENTING TARGETED ADAPTATION ACTIONS

CASE STUDY 22. Economic diversification as an adaptation strategy in the Caribbean Region⁴⁸

In response to adverse impacts from climate change on their main economic sectors, several Caribbean countries have sought to diversify their economies towards services, anchored around tourism and financial services. Tourism now accounts for between 25 and 35 percent of the total GDP of the region. It is also the major foreign exchange earner in the region, accounting for one-quarter of foreign exchange earnings, and one-fifth of all jobs.

Fisheries resources are coming under increasing pressures across the Caribbean because of, among others, increased sediment load as a result of flooding. Fishermen have been encouraged to shift from fishing to tourism as tour guides and guides for sport fishing.

On the mainland, subsistence farmers are also encouraged to move towards the tourism sector as tour guides, beekeeping and sustainable and selective forestry instead of clearing new land for agriculture.

CASE STUDY 23. Developing regional adaptation strategies through dialogues among stakeholders

The Ecologic Institute for International and European Environmental Policy coordinates the five-year RADOST project (Regional Adaptation Strategies for the German Baltic Sea Coast). The aim of the RADOST project is to develop regional adaptation strategies in a dialogue between research institutions, business, public administration and civil society. The essential idea of the project is to establish a close linkage of research and practice. In addition to a core consortium of 17 partners, RADOST involves a multitude of network partners from research organizations, businesses, public authorities and non-governmental organizations, part of which contribute to the research activities as subcontractors. At the time of proposal submission, this network included around 60 partners. It will be continuously expanded in the course of the project. The regional dialogue is complemented by a national and international information exchange involving partner regions in Europe, North America and North Africa.

Today, millions of euros per year are already invested in coastal protection in the region. The efficient use of these funds requires predictions about the coastline's future development to be as precise as possible. However, the specific impacts of climate change – caused by the rising sea level, modified currents or an increase of surges – are still very uncertain. Another challenge is posed by water quality alterations in a warmer climate with modified river discharge patterns.

In order to more accurately assess the dynamics of future environmental conditions, RADOST will use combinations of existing models to illustrate changes in more detail than before. RADOST

activities in the field of natural science will include investigations into hydrodynamics, sediment transport, water quality and ecosystems. In addition, the socio-economic consequences of climate change and adaptation options in the region will be assessed. Research and strategy development activities focus on the issues of:

- (1) coastal protection;
- (2) tourism and beach management;
- (3) water management and agriculture;
- (4) ports and maritime economy,
- (5) nature conservation and use; and
- (6) renewable energies.

Implementation projects with local partners will illustrate the economic opportunities of innovative responses to climate change. The envisaged practical applications include combining coastal protection constructions with diving tourism activities or geothermal energy generation; concepts for the aquaculture industry; design optimization of ships for use on routes through the Baltic Sea; and new marketing strategies for beach tourism.

Further information about the RADOST project may be found at <http://www.klimzug-radost.de/en>.

The Ecologic Institute's Action Pledge on RADOST can be found at http://unfccc.int/adaptation/nairobi_work_programme/partners_and_action_pledges/items/5005.php?nwp=act&turn=n&detail=j&id=165.

⁴⁸ Source: Submission by the Caribbean Community Climate Change Centre <<http://unfccc.int/resource/docs/2009/sbsta/eng/misc06.pdf>>.

CASE STUDY 24. Regional frameworks for adaptation of agriculture to climate change

WMO's Action Pledge to the Nairobi work programme on Regional Frameworks for Adaptation of Agriculture to Climate Change provides an example of the implementation of targeted adaptation solutions. This Action Pledge brings 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.

WMO aims to contribute to enhancing capacity to identify/understand impacts, vulnerability and adaptation, select and implement adaptation actions, enhance cooperation amongst South Asian and West African countries to better manage climate risks, as well as enhancing integration of climate change adaptation with sustainable agricultural development in South Asia and West Africa through various activities (some of which have already been undertaken) including:

- A Regional Symposium on Climate Change, Food Security, Sea Level Rise and Environment in South Asia in Dhaka, Bangladesh (25–29 August 2008);

- An International Workshop on Adaptation to Climate Change in West African Agriculture in Ouagadougou, Burkina Faso (15–19 September 2008);
- Providing a central forum to develop an improved understanding and assessment of climate change impacts on agriculture and the associated vulnerability in South Asia and West Africa;
- Discussing and developing informed decisions on practical adaptation strategies for the agriculture sector in different agroecosystems in South Asia and West Africa;
- Discussing and proposing Regional Frameworks for Adaptation of Agriculture to Climate Change in South Asia and West Africa;
- Discussing and recommending policy and financial innovations to enable smooth implementation of the regional frameworks and their integration into the sustainable development planning in different countries in South Asia and West Africa; and
- Discussing appropriate actions for strengthening information exchange on climate change impacts and adaptation amongst different countries in South Asia and West Africa.

For more information see <http://unfccc.int/adaptation/nairobi_work_programme/partners_and_action_pledges/items/5005.php?detail=j&id=16&nwp=act&dirc=DESC&seite=1&anf=0&id_org=&work_area=7®ion=§or=&del_activity>.

CASE STUDY 25. **Adaptation planning and implementation through stakeholder engagement and the application of technologies**

A continuous participatory process involving multiple stakeholders and allowing for shared learning, understanding, and assessment of the viability, costs and benefits of interventions is recognized as an essential basis for community-based adaptation approaches. 'Shared Learning Dialogues' (SLDs) – iterative small group discussions between multiple stakeholders – are an innovative approach for shared learning and engagement between climate scientists, governments, and local communities. Information on vulnerability of populations and sectors, and cost-benefit analyses of potential interventions that draw out 'who wins' and 'who pays' are part of this iterative process of learning.

The Institute for Social and Environmental Transition (ISET) promoted the use of SLDs to discuss the relative costs and benefits of embankments versus more people-centred community based adaptation options such as raising the plinth level of houses, storage of seed grains, and forest buffer zones along river banks in Nepal. The joint assessments highlighted the social and economic viability of people-centred approaches.

In another ISET project in Tamil Nadu, India, supported by the international development research centre (IDRC) and the National Oceanic and Atmospheric Administration (NOAA), SLDs initially rejected conventional approaches such as the construction of sluice gates or tidal regulators

across rivers to prevent the intrusion of saline ocean water. The viability of these measures, however, was called to question when communities took into account the implications of future climate change-related projections. With rising sea levels and/or increased storm intensity, tidal regulators would do little to limit the intrusion of saline water into agricultural areas. In fact, across most deltaic coastal areas where the gradient of the land does not increase rapidly away from the shore, it was recognized that strategies for "living with" increasing salinity would be essential. Instead of constructing large-scale physical barriers, communities opted for strategies to diversify livelihoods away from climate-vulnerable activities, develop new livelihood sources consistent with anticipated changes, and protect assets, health and lives in ways that should enable communities to live with future climate change.

For instance, an SMS early warning system using mobile phones was developed to deliver weather alerts, capitalizing on the high rate of mobile phone use. Computer training centres were established in some places targeting women and young people to provide them with employment opportunities independent of climate.

For more information, see http://www.i-s-e t.org/index.php?option=com_content&view=article&id=37&Itemid=48.

CASE STUDY 26. **Engaging stakeholders in adaptation planning and implementation**

Activities by the World Food Programme (WFP) provide examples of where stakeholders have been engaged in adaptation planning and implementation. WFP's Managing Environmental Resources to Enable Transitions to more Sustainable Livelihoods (MERET) project in Ethiopia is an example of where communities have been empowered through sustainable natural resource management. WFP has partnered with the government of Ethiopia in the areas of reforestation and soil and water conservation for over 30 years through the MERET project. MERET currently operates in 600 communities and benefits more than a million people each year. MERET's participatory approach clearly enhanced capacity to plan and manage development and adaptation activities. A key institutional arrangement in MERET is the community-based elected planning team, which develops five-year conservation plans subject to ratification and evaluation by the whole community. This process allows for accountability and the community voice to be heard.

In Bangladesh, WFP's Enhancing Resilience (ER) scheme provides an innovative link between relief, recovery and development activities enhancing household and community resilience in vulnerable, disaster prone areas. WFP's interventions are specifically aimed at supporting the livelihoods of disadvantaged groups, particularly 'ultra poor' women in highly food insecure and disaster-prone areas, through resilience-building tools including capacity building and trainings, as well as savings and micro credit for income generating activities. For the government, NGOs and other stakeholders, ER is an important means to meet the needs of disadvantaged and marginalized groups. At the national level, WFP is supporting the Bangladesh government's Climate Change Strategy and Action Plan, by building synergies between the food security, disaster management and assets and infrastructure elements of the Strategy.

For more information, see <http://www.wfp.org>.

6.4. MONITORING AND EVALUATING ADAPTATION INTERVENTIONS

CASE STUDY 27. Costa Rica's monitoring and evaluation indicators

In January 2007, Costa Rica's National Development Plan established a Climate Change Plan and National Climate Change Strategy, including multiple sectors. In developing its National Climate Change Strategy, Costa Rica identified additional criteria for selecting indicators, including whether the indicator is easily measurable, whether the indicator is applicable to a range of adaptation outcomes at different spatial and temporal scales and whether the costs of obtaining data are justified.

Metrics were included relating to vulnerability and adaptation, capacity building and technology transfer, and awareness raising and education, with the aim of meeting and supporting the decision making process to address climate change in different areas of national and international role.

For more information see <<http://www.encc.go.cr/metricas/>>.

CASE STUDY 28. The Inter American Development Bank's indicators for disaster risk reduction

The Inter American Development Bank has developed a system of risk indicators representing the current vulnerability and risk management situation in each country. The indicators proposed are designed to be transparent, relatively easy to update periodically, and easily understood by public policymakers. Four components or composite indicators have represented the main elements of vulnerability and show each country's progress in managing risk. The four indicators are the Disaster Deficit Index (DDI), the Local Disaster Index (LDI), the Prevalent Vulnerability Index (PVI), and the Risk Management Index (RMI).

- The Disaster Deficit Index measures country risk from a macroeconomic and financial perspective according to possible catastrophic events. It requires the estimation of critical impacts during a given period of exposure, as well as the country's financial ability to cope with the situation.
- The Local Disaster Index identifies the social and environmental risks resulting from more recurrent lower level events (which are often chronic at the local and subnational levels). These events have a disproportionate impact on more socially and economically vulnerable populations, and have highly damaging impacts on national development.

- The Prevalent Vulnerability Index is made up of a series of indicators that characterize prevalent vulnerability conditions reflected in exposure in prone areas, socio-economic weaknesses and lack of social resilience in general.
- The Risk Management Index brings together a group of indicators that measure a country's risk management performance. These indicators reflect the organizational, development, capacity and institutional actions taken to reduce vulnerability and losses, to prepare for crisis and to recover efficiently from disasters.

The system of indicators covers different areas of the risk problem, taking into account issues such as: potential damages and losses resulting from extreme events; recurrent disasters or losses; social and environmental conditions that make particular countries or regions more disaster prone; the capacity of the economy to recover; the operation of key services; institutional capacity and the effectiveness of basic risk management instruments (such as risk identification, prevention and mitigation measures, financial mechanisms and risk transfer); emergency response levels; and preparedness and recovery capacity.

For more information see <<http://www.iadb.org/exr/disaster/index.cfm?language=EN&parid=1>>.

CASE STUDY 29. Monitoring and evaluation under the UNDP community-based adaptation (CBA) Programme

Monitoring and evaluation for Community-Based Adaptation (CBA) is a new field, and the CBA Programme is piloting innovative approaches to evaluating the success of locally-driven adaptation projects, and generating lessons to inform ongoing practice.

Key considerations in monitoring and evaluation (M&E) for CBA include:

- Grounding M&E in the local context: M&E for CBA should avoid overly rigid frameworks, recognizing community heterogeneity and maintaining local relevance;
- Capturing global lessons from local projects: CBA projects are highly contextualized, but lessons generated should be relevant to stakeholders globally; and
- Incorporation of both quantitative and qualitative indicators: to ground projects in tangible changes that can be objectively evaluated, and to capture lessons and case studies for global dissemination.

To these ends, the CBA Programme uses three indicator systems: the Vulnerability Reduction Assessment, the Small Grants Programme (SGP) Impact Assessment System, and the UNDP Climate Change Adaptation Indicator Framework.

The Vulnerability Reduction Assessment (VRA)

The VRA follows UNDP’s Adaptation Policy Framework, and is measured in a series of meetings with local community stakeholders. In these meetings, locally-tailored questions based on standard VRA questions/indicators are posed (see the VRA structure in table VI-12 below), and the community assigns a numerical score on a 1–10 scale for each question. Progress is evaluated through changes in scores over the course of implementation, as well as through qualitative data collected in community discussions surrounding the exercise. UNDP has developed a [Users Guide to the VRA \(Espanol\) \(Francais\)](#) as a tool to assist practitioners to conceptualize and execute VRA measurements in the context of CBA projects.

The SGP Impact Assessment System (IAS)

The CBA, being a project funded under the Global Environment Facility (GEF) Strategic Priority on Adaptation, aims to increase the resilience of ecosystems and communities to the impacts of climate change. To this end, the CBA projects use the SGP impact assessment system for monitoring achievements in GEF focal areas (focusing primarily on biodiversity and sustainable land management).

UNDP Climate Change Adaptation Indicator Framework

CBA projects also track quantitative indicators from UNDP’s Adaptation Indicator Framework, corresponding to the thematic area on natural resources management.

Table VI-12. The Vulnerability Reduction Assessment (VRA) structure

Adaptation Policy Framework Step	VRA Indicator	VRA Question (In these examples, we consider the case of a community facing increasing drought risks)
Assessing current vulnerability	(1) Vulnerability of livelihood/welfare to existing climate change and/or climate variability.	Example: What happens when there is drought? How does this affect you and your community?
Assessing future climate risks	(2) Vulnerability of livelihood/welfare to developing climate change risks.	Example: What would happen if drought was twice as frequent? How would this affect you and your community?
Formulating an adaptation strategy	(3) Magnitude of barriers (institutional, policy, technological, financial, etc) barriers to adaptation.	Example: What stands in the way of adapting to increasing drought? What means do you or your community have to manage events occurring more frequently?
Continuing the adaptation process	(4) Ability and willingness of the community to sustain the project intervention	Example: Rate your confidence that the (project activity) will continue after the project period.

Source: based on information presented at <http://www.undp-adaptation.org/projects/websites/index.php?option=com_content&task=view&id=344>.



Assessing Climate Change Impacts and Vulnerability

PART THREE

ADDITIONAL RESOURCES

VII. ADDITIONAL RESOURCES

As discussed in [PART ONE](#) and illustrated in case studies included in [PART TWO](#), work on the various aspects of adaptation to climate change has been rapidly expanding. This part of the summary note intends to provide pointers to sources of literature, data and information which are relevant to work supporting the core components of the adaptation process. [TABLE VII-13](#) below provides an overview of the types of resources included in this note and details of these resources are presented in [TABLES VII-14](#) to [VII-17](#).

Table VII-13. Overview of additional resources to support the assessments of climate impacts and vulnerability, adaptation planning, implementation, and monitoring and evaluation

Category of resources	Relevant to key components of adaptation process			
	1	2	3	4
General methodologies and approaches to assessing impacts and vulnerability, and for adaptation planning (table VII-14)	●	●	● ⁴⁹	● ⁴⁹
Data and scenarios (table VII-15)	●	●		● ⁵⁰
Impacts, vulnerability and adaptation assessments (table VII-16)	●	●		
Adaptation practices (table VII-17)		●	●	●

Abbreviations: 1 = Assessing climate impacts and vulnerability; 2 = Planning for adaptation; 3 = Implementing targeted adaptation actions; 4 = Monitoring and evaluating adaptation interventions

⁴⁹ Although some of the methodological frameworks (e.g. the UKCIP Risk Decision Framework, UNDP APF) include the implementation, monitoring and evaluation of adaptation, much less detailed guidance is offered on monitoring and evaluating adaptation interventions.

⁵⁰ In most cases, socio-economic information is required for monitoring and evaluating adaptation interventions.

Table VII-14. Resources and reference material relating to methods and tools for assessing impacts and vulnerability, and for adaptation planning

Resource	Further information
General methodological frameworks and approaches	
UNDP Adaptation Policy Framework (APF)	<p>It provides a framework for considering adaptation to climate change within the context of development. It uses climate variability as the starting point for adaptation to future climate change, assesses adaptation measures in the context of development goals, and recognizes that adaptation occurs at all levels, and the equal importance of the adaptation strategy and process.</p> <p>Further details and the underlying technical report on the Framework are available at http://www.undp.org/climatechange/adapt/apf.html.</p>
Sectoral/thematic frameworks and approaches	
A Guide for Business and Government (Australian Department of Climate Change and Energy Efficiency Climate Change Impacts & Risk Management)	<p>The guide aims to help businesses and organizations to:</p> <ul style="list-style-type: none"> • Enumerate risks related to climate change impacts; • Prioritize risks that require further attention; and • Establish a process for ensuring that higher priority risks are managed effectively. <p>The Guide is available at http://www.climatechange.gov.au/what-you-can-do/community/local-government/risk-management.aspx.</p>
Guidance on integrating adaptation into development projects (USAID)	<p>It provides a 7-step framework to integrate adaptation to climate variability and change to development project cycle.</p> <p>The Guidance is available for download in English, French and Spanish.</p>
Adapting to Coastal Climate Change: A Guidebook for Development Planners (USAID)	<p>The Guidebook proposes an approach for assessing vulnerability to climate change and climate variability, developing and implementing adaptation options, and integrating options into programs, development plans, and projects at the national and local levels.</p> <p>It is available at http://pdf.usaid.gov/pdf_docs/PNADO614.pdf.</p>
Coping with a changing climate: considerations for adaptation and mitigation in agriculture (FAO)	<p>It offers perspectives for policy-makers, institutions, societies and individuals on improved ways of identifying most at-risk communities and “best practices” of coping with current climate variability and extreme climate events. It contributes approaches and considerations for adaptation and mitigation and improved ways of integrating present-day “best practices” with the longer-term strategies to cope with uncertain future climates.</p> <p>The report can be downloaded at http://www.fao.org/docrep/012/i1315e/i1315e.pdf.</p>
Making the invisible visible: The Role of Impact Assessments in Climate Change Adaptation Measures (Wetlands)	<p>It highlights the need to incorporate ecosystem-based adaptation approaches as vital components of adaptation strategies. It also calls for the establishment of mechanisms that help to avoid adverse environmental impacts resulting from well-intended adaptation projects, which in the long run might lead to maladaptation.</p> <p>The paper is available at http://www.wetlands.org/WatchRead/tabid/56/mod/1570/articleType/ArticleView/articleId/2719/Making-the-invisible-visible.aspx.</p>

Table VII-14. Resources and reference material relating to methods and tools for assessing impacts and vulnerability, and for adaptation planning (continued)

Resource	Further information
<p>Climate Change Connections: Gender, Population and Climate Change (UNFPA and WEDO)</p>	<p>It is a comprehensive resource kit from UNFPA and WEDO on gender, population and climate change. It helps the users to understand how gender equality can reduce vulnerability to climate change impacts and how women are uniquely positioned to help curb the harmful consequences of a changing climate.</p> <p>The Kit can be accessed from http://www.wedo.org/themes/sustainable-development-themes/climatechange/climate-change-connections.</p>
<p>Community-based adaptation tools and practices on Community-based adaptation Exchange (CBA-X) (Eldis)</p>	<p>These include useful tools, manuals and methodologies to help scope out, implement and assess practical grassroots interventions.</p> <p>Details are available at http://www.eldis.org/index.cfm?objectId=63774BF9-E029-895F-9CA082B430182BA9.</p>

Table VII-15. Resources and reference material relating to the provision of data and scenarios for assessing impacts and vulnerability, and for adaptation planning

Resource	Further information
Climate observations and scenarios	
The IPCC Data Distribution Centre (DDC) (IPCC)	The DDC maintains and provides links to an extensive list of observational and climate model data products. A series of guidance documents are also available on accessing and applying these and other scenario products for climate change impacts, vulnerability and adaptation assessments. Details are available at < http://www.ipcc-data.org >.
UNDP Country-level Climate Profiles (UNDP)	These series provide country-level climate profiles, including both observed climate trends over the recent past as well as projections (based on IPCC AR4 assessed GCM outputs) for the future. Profiles are available both as reports and datasets at < http://country-profiles.geog.ox.ac.uk/ >.
World Bank Climate Data Portal (World Bank)	It provides site-specific historic climate as well as GCM-based climate projections. Details are available at < http://sdwebx.worldbank.org/climateportal/ >.
Downscaled climate scenarios (for African continent and part of Asia) portal (Climate Systems Analysis Group, University of Cape Town)	This portal provides access to downscaled global climate model projections of a number of climate variables. Both station data and gridded data is available depending on the area of interest. See < http://data.csag.uct.ac.za/ > for details.
Other environmental data	
The IPCC Data Distribution Centre (DDC) (IPCC)	The DDC provides a range of atmospheric environmental data and scenario products. Details are available at < http://www.ipcc-data.org/ddc_envdata.html >.
The U.S. Geological Survey Land Cover Institute land cover data	They include an extensive land cover data holdings from organizations that distribute land cover data and demonstrate the application of such data. A large variety of land use data is available at < http://landcover.usgs.gov/landcoverdata.php >.
Representative Concentration Pathway (RCP) database (IIASA)	The database includes harmonized and consolidated data for three of the four RCPs which are selected as a basis for the scenario development process for the Fifth Assessment Report of the IPCC. This comprises emissions pathways starting from identical base year (2000) for BC, OC, CH ₄ , Sulfur, NO _x , VOC, CO and NH ₃ . In addition, harmonized well-mixed GHG emissions of the RCPs have been added for the period 2005 to 2100. See < http://www.iiasa.ac.at/web-apps/tnt/RcpDb/dsd?Action=htmlpage&page=about > for details.
Socio-economic information	
The IPCC Data Distribution Centre (DDC) (IPCC)	It holds socio-economic information describing the present-day situation and information relating to two sets of emissions scenarios: the IS92 scenarios, prepared for the IPCC Second Assessment Report, and the SRES scenarios (Special Report on Emissions Scenarios) prepared for the Third Assessment Report. These have a projection period out to 2100. Details are available at < http://sedac.ciesin.columbia.edu/ddc/index.html >.

Table VII-16. Resources and reference material relating to impacts, vulnerability and adaptation assessments

Resource	Further information
<p>Contribution of the Working Group II to the Fourth Assessment Report (AR4) of the IPCC (IPCC)</p>	<p>This volume of the IPCC AR4 synthesizes information on the impacts of, vulnerability and adaptation to climate change in different regions and different sectors.</p> <p>Assessments are available from the IPCC website.</p> <p>Sectoral assessments:</p> <ul style="list-style-type: none"> • Fresh water resources and their management; • Ecosystems, their properties, goods and services; • Food, fibre, and forest products; • Coastal systems and low-lying areas; • Industry, settlement and society; and • Human health. <p>Regional assessments: Africa; Asia, Australia and New Zealand; Europe; Latin America; North America; Polar regions (Arctic and Antarctic); and Small islands.</p>
<p>National level vulnerability and adaptation assessments within the context of National Communications to the UNFCCC (national governments)</p>	<p>As part of the national reporting mechanism under the UNFCCC, national governments prepare and submit national reports on climate change impacts, vulnerability and adaptation. These are usually comprehensive assessments including multiple sectors and covering all regions of countries.</p> <p>National Communications submitted by Annex I Parties (developed countries) to the UNFCCC are available at http://www.unfccc.int/4903.php;</p> <p>National Communications submitted by non-Annex I Parties (developing countries) to the UNFCCC are available at http://www.unfccc.int/2979.php.</p>
<p>Assessment of urgent and immediate adaptation needs of Least Developed Countries (LDCs) (LDC national governments)</p>	<p>As a process to facilitate the identification of urgent and immediate needs for adapting to climate change, the LDCs were engaged in the preparation of the National Adaptation Programmes of Action (NAPAs).</p> <p>Submitted NAPA documents are available at http://www.unfccc.int/4585.</p>
<p>Assessments of Impacts and Adaptations to Climate Change in Multiple Regions and Sectors (AIACC) (START)</p>	<p>As a research-driven capacity building initiative, AIACC aims to fill these gaps by funding, training, and mentoring developing country scientists to undertake multi-sector, multi-country assessments in developing countries in Africa, Asia, Latin America and Oceania. These assessments address a range of questions about vulnerabilities to climate change and multiple other stresses, their implications for human development, and policy options for responding.</p> <p>Details on and results from the twenty-four regional assessments are available at http://www.aiaccproject.org.</p>

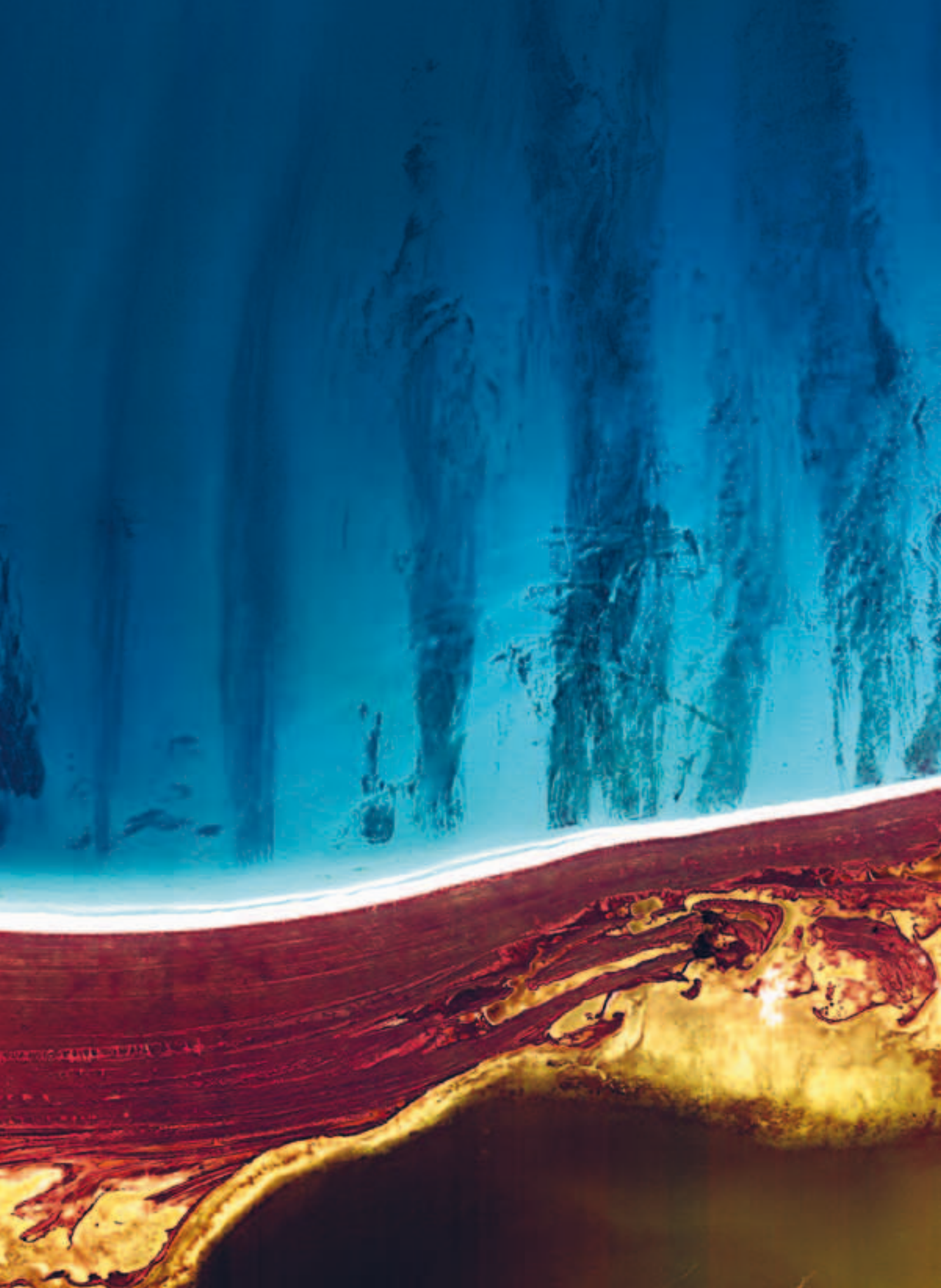
Table VII-16. Resources and reference material relating to impacts, vulnerability and adaptation assessments (continued)

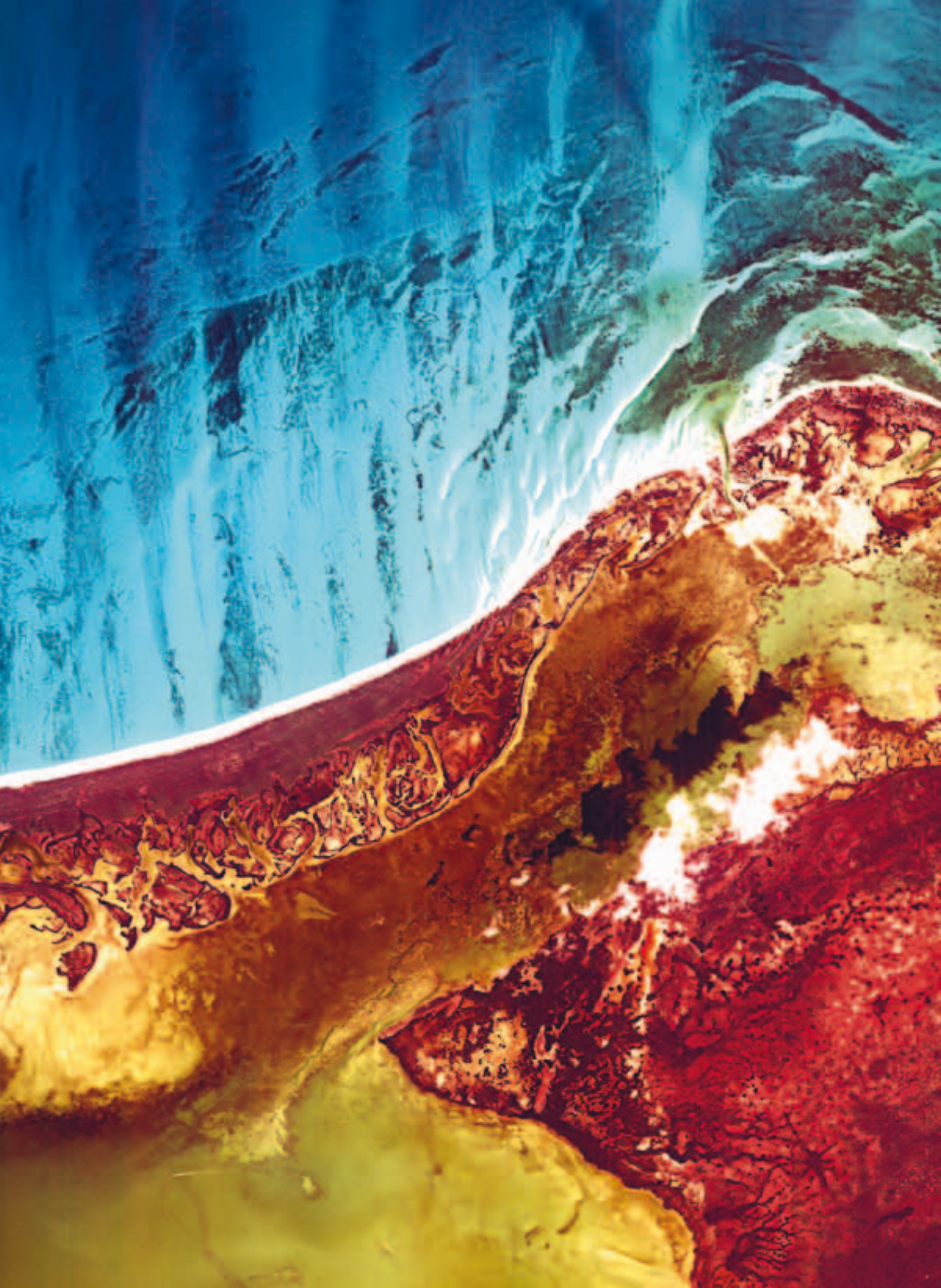
Resource	Further information
<p>Database of observed climate change impacts assessed in the IPCC AR4 (IPCC)</p>	<p>This database contains observed responses to climate change across a wide range of physical and biological systems as well as regions. In the database, responses in physical systems include shrinking glaciers in every continent, melting permafrost, shifts in spring peak river discharge associated with earlier snowmelt, lake and river warming (with effects on thermal stratification, chemistry, and freshwater organisms), and increases in coastal erosion. For terrestrial biological systems, changes documented in the database include shifts in spring events (e.g., earlier leaf unfolding, blooming date, migration, and timing of reproduction), species distributions, and community structure. Database observations also demonstrate changes in marine-ecosystem functioning and productivity, including shifts from cold-adapted to warm-adapted communities, phenological changes and alterations in species interactions. In each category, many of the data series are over 35 years in length.</p> <p>The database is accessible at <http://sedac.ciesin.columbia.edu/ddc/observed/data/IPCC_AR4_Observed_CC_Impacts_Database_v1.0.html>.</p>
<p>The Economics of Adaptation to Climate Change study (the World Bank)</p>	<p>This study aims to develop a global estimate of adaptation costs for informing the international community's efforts in the climate negotiations, and to help decision makers in developing countries assess the risks posed by climate change and design national strategies for adaptation. The study was conducted on two parallel tracks:</p> <ol style="list-style-type: none"> (1) a global track – a top-down approach, in which national databases were used to generate aggregate estimates at a global scale, drawing on a wide variety of sector studies; and (2) a country level track – a bottom-up approach, in which subnational data were aggregated to generate estimates at economy wide, sectoral, and local levels. <p>Details on the study, resulting reports and case studies are available at <http://climatechange.worldbank.org/content/economics-adaptation-climate-change-study-homepage>.</p>
<p>The Stern Review on the economics of climate change (UK Government)</p>	<p>The Stern Review is an independent, rigorous and comprehensive analysis of the economic aspects of climate change mitigation and adaptation.</p> <p>Final report of the Review is available at <http://webarchive.nationalarchives.gov.uk/ and <http://www.hm-treasury.gov.uk/stern_review_report.htm>.</p>

Table VII-17. Resources and reference material relating to adaptation practices (including implementation, monitoring and evaluation of adaptation)

Resource	Further information
<p>Nairobi work programme adaptation practices interface (UNFCCC secretariat)</p>	<p>It is a gateway to information on 130 adaptation practices worldwide. The Interface provides summaries of adaptation practices by a large range of organizations, agencies and businesses, along with descriptions and relevant links and publications.</p> <p>The Interface is accessible at http://unfccc.int/5135.php.</p>
<p>Local coping strategies database (UNFCCC secretariat)</p>	<p>This is a database of local, long-standing coping strategies/mechanisms, knowledge and experience from communities that have had to adapt to specific hazards or climatic conditions. It can be searched by climate hazard, impact or coping strategy, or a combination thereof, by selecting from the scroll-down menus. Please note that not all combinations of hazard/impact/strategy will lead to identification of a specific adaptation action. Following the submission of a query, you will be presented with a list of corresponding adaptation actions and associated case studies. Additional information on the case studies will also be provided, and includes a short summary on the coping practice, details on resource requirements, non-climate benefits and potential maladaptation, as well as contact information and links to relevant files and web sites.</p> <p>The database is accessible at http://maindb.unfccc.int/public/adaptation/.</p>
<p>List of projects supported by the Least Developed Countries Fund (LDCF) (UNFCCC secretariat)</p>	<p>This list provides an overview of the implementation status of projects supported by the LDCF.</p> <p>Details are available at http://www.unfccc.int/5632.php.</p>
<p>Online resources on adaptation programmes, projects and initiatives (ALM)</p>	<p>These contain a large number of adaptation practices, which can be searched by theme/sector, funding sources and leading organizations. Each entry provides a profile of the practice and information relevant to the adaptation practice.</p> <p>They can be accessed at http://www.adaptationlearning.net/explore.</p>
<p>Adaptation layer on weAdapt (IIED, CBA-x, CSAG, UNEP RRCAP, SENSEA, Oxfam GB, CIFOR, UNITAR, Google.org, ENDA and START)</p>	<p>Through Google Earth and with inputs from user community, it provides a geographically referenced overview of adaptation practices across the globe.</p> <p>The adaptation layer can be accessed at http://www.weadapt.org.</p>
<p>Community-based adaptation case studies on Community-based adaptation Exchange (CBA-X) (Eldis)</p>	<p>These include innovative approaches, good practice, learning and inspiration about how adaptation can be adopted in a local context.</p> <p>They can be accessed at http://www.eldis.org/index.cfm?objectId=6375FE8D-047C-510A-8232A1530000CC5A.</p>
<p>(Draft) Climate change adaptation monitoring and evaluation framework (UNDP)</p>	<p>The Framework is developed to monitor and evaluate adaptation actions at portfolio and project levels, focusing on seven thematic areas: agriculture/food security, water resources and quality, public health, disaster risk management, coastal zone development, natural resources management and infrastructure. It contains indicators that measure the coverage, impact, sustainability and replicability of adaptation actions.</p> <p>The draft framework is available at http://www.undp.org/climatechange/adapt/downloads/Adaptation_ME_DRAFT_July.pdf.</p>







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