

Report on the status of  
**Disaster Risk Reduction  
in Sub-Saharan Africa**

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## Acknowledgments

This report on the Status of Disaster Risk Reduction in the Sub-Saharan Africa Region was prepared to increase awareness of the importance of disaster risk reduction as an integral part of sustainable development and showcase the contributions of the World Bank's Africa Disaster Risk Management Team, governments, and development partners in this field. This report, as many of the here showcased projects, was technically and financially supported by the Global Facility for Disaster Reduction and Recovery (GFDRR). The main authors of the report are Carl C Dingel and Asmita Tiwari, with guidance and comments by Ashok Subramanian (Sector Manager, Africa Region Water Resources Management), Kremena Ionkova (Regional Coordinator for Disaster Risk Management) and Paolo Caputo (Senior Disaster Risk Management Specialist). Editing was guided by comments and input from Anne Speca and Karen McLaughlin.

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## Foreword

**The number of disasters reported in Africa has increased significantly since the 1970s. Over the last four decades, Sub-Saharan Africa has experienced more than one thousand disasters. Disasters are a major threat to development, putting at risk many recent development gains. Africa's disaster profile is characterized by extreme hydro-meteorological events, which will likely increase in frequency and magnitude due to climate change. Sub-Saharan Africa's disaster profile is closely linked to the vulnerability of its population and economy and their often-low capacities to cope with natural hazards.**

Disaster risk reduction (DRR) is an important pillar for sustainable development and an integral part of the World Bank's activities in Sub-Saharan Africa. The Hyogo Framework for Action (HFA) is the primary global framework for disaster risk reduction. Together with UNISDR, the African Union and other development partners, the World Bank and the Global Facility for Disaster Reduction and Recovery (GFDRR) are key partners to support its implementation. The World Bank Africa DRM Team coordinates the disaster risk management (DRM) activities in Sub-Saharan Africa.

This report provides an update on the status of DRR activities in the Sub-Saharan Africa region of the World Bank. The report reviews recent activities and achievements covering the period from January, 2008 to the first half of 2010 in four chapters:

1. Africa's disaster profile
2. Global, regional, and national frameworks for disaster risk reduction
3. Disaster Risk Management in Sub Saharan Africa
4. Towards a comprehensive approach to disaster risk reduction

The report also highlights the continued dialogue with governments leading to strategic investments in DRR-including opportunities for regional cooperation and new risk financing instruments.

Throughout all chapters this status report provides an overview of projects and activities linking DRR to major sectors from agriculture to urban development. Success stories and background information in the supporting boxes provide additional insights on DRR across the continent. This review sets the stage for a scaled-up program in Sub-Saharan Africa, which will respond to the many challenges faced by countries and initiatives undertaken in Sub-Saharan Africa.

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## Executive Summary

**The number of reported disasters in Africa has significantly increased in recent decades, putting at risk its recent development gains. Disaster risk reduction (DRR) is therefore an important pillar for sustainable development and an integral part of the World Bank's activities in Sub-Saharan Africa. The Hyogo Framework for Action (HFA) is the primary global framework for DRR. Together with the United Nations International Strategy for Disaster Reduction (UNISDR), the African Union (AU) and other development partners, the World Bank and the Global Facility for Disaster Reduction and Recovery (GFDRR) are key partners to support its implementation. The World Bank's disaster risk management (DRM) activities in Sub-Saharan Africa are coordinated by the Africa DRM Team. This *Report on the Status of Disaster Risk Reduction in the Sub-Saharan Africa Region* looks back at its activities since 2008 and describes a more comprehensive approach to DRR in Africa.**

The majority of disasters in Africa are hydro-meteorological in nature, with droughts still affecting the largest number of people on the continent and floods occurring frequently along the major river systems and in many urban areas. Cyclones mainly affect Madagascar, Mozambique, and some of the Indian Ocean islands. Geological hazards are less pronounced and predominately appear along the Rift Valley. Sea level rise, coastal erosion, and storm surges are a growing threat for low-lying coastal areas in Africa. With climate change, a higher magnitude and frequency of these extreme weather events is expected.

Sub-Saharan Africa's disaster profile is closely linked to the vulnerability of its population and economies and exacerbated by minimal coping capacities. Most African countries have limited resources to invest in disaster risk reduction and minimal fiscal space to fund relief and recovery efforts after a major disaster. Disasters can be a tremendous setback for economic growth and performance. Poor, small island states and land-locked countries are particularly vulnerable to the economic impact of disasters. The capacities of many national and local DRM authorities remain limited. In many areas, the economy is based on rain-fed agriculture, which is highly susceptible to climate variability. Critical infrastructure such as roads, telecommunication, and dams often lag behind rapidly growing needs or are not constructed according to risk prone standards. Large parts of Africa's economic assets are located in densely populated urban areas; most are close to river deltas or other bodies of water. A large number of urban residents live in informal settlements often located in areas such as floodplains or drainage basins that are highly vulnerable to disasters.

The World Bank Africa Region's DRM activities build upon the HFA and the 2004 ratified AU-regional strategy. It focuses on the following objectives:

1. Facilitates disaster risk and vulnerability assessments across sectors; strengthen early warning and monitoring systems
2. Foster awareness, and support policy and institutional building for DRM

3. Invest in risk mitigation and reduction of underlying risk factors
4. Support new preparedness, contingency and catastrophic risk financing instruments
5. Improve emergency response and preparedness; assist in post-disaster situations

The national governments, their national DRM organizations, and national platforms are key partners for its implementation. To put these objectives into practice the Africa DRM Team launched risk and vulnerability assessments as its first set of activities. They initially covered economic impacts, flooding in urban areas, water resources management, drought and food security, marine environments, as well as capacity building initiatives. The following examples provide a snapshot of the conducted risk and vulnerability assessments.

1. A pilot study assessed flood, coastal surge and sea level rise hazards in greater Dakar, Senegal. The study identified high population hotspots in high-risk areas and pinpointed a number of critical institutional aspects related to disaster risk management in a regional context.
2. Severe droughts and related food insecurity have led to major humanitarian crises in Ethiopia. Through a weather-based risk management framework (Livelihood, Early Assessment and Protection, LEAP), costs for interventions can be determined at a very early stage and livelihoods can be protected through contingency operations.
3. The World Bank supported the development of a macro-economic model that assessed the economic impacts of frequent droughts and floods in Malawi. The model assessed average annual losses and impacts on various economic sectors and poverty levels. The results indicated that average annual losses to GDP through droughts and floods could total up to 1.7 percent.

Following the 2008 cyclone season, the 2009 Malawi earthquake, and floods throughout Namibia and western and central Africa, the Africa DRM Team conducted Post Disaster Needs Assessments (PDNAs) upon request of the respective governments. PDNAs are a standardized instrument to assess the socio-economic impacts of disasters and provide a framework for recovery and reconstruction. Partners recognize PDNAs as objective, which allows them to unveil critical bottlenecks to reconstruction, such as urban drainage infrastructure or weak institutional arrangements.

The PDNAs estimated the damages and losses ranging from \$174 million and \$159 million after the 2008 cyclone season in Madagascar to \$6 million and \$2.5 million after the 2009 floods affecting Bangui, Central African Republic (CAR). 'Build-back-better strategies', addressing a forward-looking, risk reduction approach, were proposed in all assessments as a basis for further investments in risk reduction and mitigation efforts. Estimates range from \$436 million for capital investments to flood-proof parts of northern Namibia to \$36 million to mitigate the impact of reoccurring floods in Bangui.

The PDNAs have provided momentum for a long-term dialogue with governments on DRR and an entry point to assess further investments. The first implemented activities also highlighted a number of lessons to be addressed:

1. Institutional aspects often require a long-term dialogue with the involved governments
2. Risk and vulnerability assessments should be more targeted to the strategic needs of the countries
3. Focus on countries most vulnerable to natural hazards in the region
4. The synergy with the climate change adaptation agenda should be further strengthened.

To build upon first lessons learned, the Africa DRM Team initiated a more comprehensive and concerted approach -through DRM Country Plans. Nine focus countries were selected for an initial implementation: Burkina Faso, Ethiopia, Ghana, Madagascar, Malawi, Mali, Mozambique, Senegal, and Togo.

The DRM Country Plans are based on the five pillars of the HFA and build upon an assessment of hazards. They support a broad range of initiatives ranging from institutional strengthening to early warning systems. The plans also include support to educational programs, reduction of underlying risks, and improved response to disasters. Through a broad consultation with stakeholders from national ministries, development partners and NGOs, the DRM Country Plans established \$5 million to be implemented over a three to five year period. These plans allow creating a framework for long-term dialogue with governments on DRR and the continuation of assessments. In most focus countries DRM Country Plans have been initiated successfully and are moving towards implementation.

Close dialogue with partner governments followed the PDNAs, which often led to dedicated investments in risk reduction and mitigation. The Africa DRM Team supports countries to initiate investments in reconstruction and risk reduction. Regional activities, such as the AU and its Regional Economic Communities (RECs), are important instruments to address the regional dimension of risk reduction such as early warning networks and knowledge exchange. The Africa DRM Team continues to seek linkages with the work on climate change adaptation. In addition, the recent support of the EU-ACP (African Caribbean and Pacific Group of States) Natural Disaster Facility will help the team to scale up activities. New financing instruments and steps toward risk insurance and transfer schemes show the way towards more innovative financing instruments.

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## Acronyms and abbreviations

|                |   |
|----------------|---|
| <b>AAL</b>     | Average Annual Loss   |
| <b>ACMAD</b>   | African Centre of Meteorological Applications for Development |
| <b>ACP</b>     | African Caribbean and Pacific Group of States                 |
| <b>AfDB</b>    | African Development Bank                                      |
| <b>AU</b>      | African Union   |
| <b>CAR</b>     | Central African Republic                                      |
| <b>CAS</b>     | Country Assistance Strategy                                   |
| <b>CCRIF</b>   | Caribbean Catastrophe Risk Insurance Facility                 |
| <b>CLIMDEV</b> | Climate for Development in Africa                             |
| <b>CSO</b>     | Civil Society Organization                                    |
| <b>CSRP</b>    | Sub-Regional Fisheries Commission                             |
| <b>DaLa</b>    | Damage and Loss Assessment                                    |
| <b>DoDMA</b>   | National Disaster Risk Management Authority of Malawi         |
| <b>DRM</b>     | Disaster Risk Management                                      |
| <b>DRR</b>     | Disaster Risk Reduction                                       |
| <b>EC</b>      | European Commission   |
| <b>ECCAS</b>   | Economic Community of Central African States                  |
| <b>ECOWAS</b>  | Economic Community of West African States                     |
| <b>EM-DAT</b>  | Emergency Events Database                                     |
| <b>ENSO</b>    | El Niño-Southern Oscillation                                  |
| <b>ERL</b>     | Emergency Recovery Loan                                       |
| <b>ESW</b>     | Economics and Sector Works                                    |
| <b>EU</b>      | European Union  |
| <b>FAO</b>     | Food and Agriculture Organization                             |
| <b>GCM</b>     | General Climate Model   |
| <b>GCOS</b>    | Global Climate Observing System                               |
| <b>GDP</b>     | Gross Domestic Product  |
| <b>GEF</b>     | Global Environment Facility                                   |
| <b>GFDRR</b>   | Global Facility for Disaster Reduction and Recovery           |
| <b>GHG</b>     | Greenhouse Gas Emissions                                      |
| <b>GIS</b>     | Geographic Information System                                 |
| <b>GoE</b>     | Government of Ethiopia  |
| <b>HFA</b>     | Hyogo Framework for Action                                    |
| <b>HIPC</b>    | Heavily Indebted Poor Countries                               |
| <b>ICPAC</b>   | IGAD Climate Prediction and Applications Centre               |
| <b>IDA</b>     | International Development Association                         |
| <b>IEG</b>     | Independent Evaluation Group (World Bank)                     |
| <b>IGAD</b>    | Inter-Government Authority on Development                     |
| <b>IMF</b>     | International Monetary Fund                                   |
| <b>INGC</b>    | National Institute for Disaster Management of Mozambique      |
| <b>IOC</b>     | Indian Ocean Commission                                       |
| <b>IPCC</b>    | Inter-governmental Panel on Climate Change                    |

|                   |  |
|-------------------|--|
| <b>LEAP</b>       | Livelihoods, Early Assessment and Protection                           |
| <b>MASAF</b>      | Malawi Social Action Fund  |
| <b>MDG</b>        | Millennium Development Goals   |
| <b>MRI</b>        | Maize Rainfall Index   |
| <b>NADMO</b>      | National Disaster Management Organization of Ghana                     |
| <b>NAPA</b>       | National Adaptation Programs of Action                                 |
| <b>NASFAM</b>     | National Smallholder Farmers' Association of Malawi                    |
| <b>NBI</b>        | Nile Basin Initiative  |
| <b>NDMO</b>       | National Disaster Management Organization                              |
| <b>NEPAD</b>      | New Partnership for Africa's Development                               |
| <b>NGO</b>        | Non Governmental Organization  |
| <b>NHMS</b>       | National Hydro-Meteorological Services                                 |
| <b>NOAA</b>       | National Oceanic and Atmospheric Administration                        |
| <b>NPC</b>        | National Planning Commission of Namibia                                |
| <b>OCHA</b>       | Organization for the Coordination of Humanitarian Affairs              |
| <b>OMVS</b>       | Senegal River Basin Development Authority                              |
| <b>PDNA</b>       | Post Disaster Needs Assessment   |
| <b>Plan ORSEC</b> | Emergency Plan of Senegal  |
| <b>PPCR</b>       | Pilot Program for Climate Resilience                                   |
| <b>PRSP</b>       | Poverty Reduction Strategy Paper                                       |
| <b>PSNP</b>       | Productive Safety Net Program  |
| <b>REC</b>        | Regional Economic Communities  |
| <b>RP</b>         | Return Period  |
| <b>RSPN</b>       | Regional Basic Synoptic Network Stations                               |
| <b>SADC</b>       | Southern African Development Community                                 |
| <b>SADC DMC</b>   | SADC Drought Monitoring Centre   |
| <b>UN</b>         | United Nations   |
| <b>UNDAF</b>      | United Nations Development Assistance Framework                        |
| <b>UNDG</b>       | United Nations Development Group                                       |
| <b>UNDP</b>       | United Nations Development Programme                                   |
| <b>UNECLAC</b>    | United Nations Economic Commission for Latin America and the Caribbean |
| <b>UNEP</b>       | United Nations Environment Programme                                   |
| <b>UNFCCC</b>     | United Nations Framework Convention on Climate Change                  |
| <b>UN-HABITAT</b> | United Nations Human Settlements Programme                             |
| <b>UNISDR</b>     | United Nations International Strategy for Disaster Reduction           |
| <b>USAID</b>      | United States Agency for International Development                     |
| <b>WCRP</b>       | World Climate Research Organization                                    |
| <b>WFP</b>        | World Food Programme   |
| <b>WHO</b>        | World Health Organization  |
| <b>WMO</b>        | World Meteorological Organization                                      |

*All dollar amounts are U.S. dollars unless otherwise indicated.*



## A. Coping with disasters in Africa

Disaster risk is widely understood as a function of hazards and vulnerability of livelihoods and economies (UNISDR, 2009b). Other notations often also distinguish exposure to hazards, which particularly refers to physical aspects of vulnerability. This chapter examines these components and how they shape Africa's disaster profile. Attention is given to the possible impacts of climate change on the frequency and magnitude of disasters, as well as the impact of major disasters on economic development.

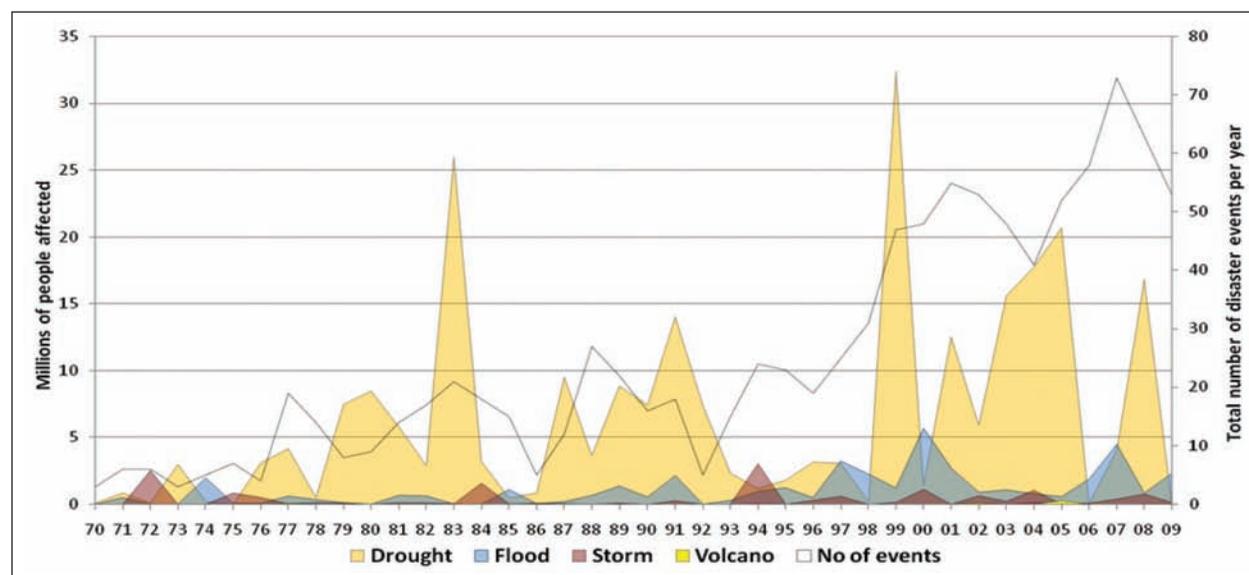
### 1. Sub-Saharan Africa's disaster profile

The number of disasters reported in Africa has increased significantly since the 1970s (Figure 1)<sup>1</sup> (EMDAT, 2009). Over the last four decades, Sub-Saharan Africa has experienced more than 1000 disasters,

with 300 disasters in the last five years alone. Since then more than 330 million people were affected<sup>2</sup> by droughts, floods, cyclones, earthquakes and volcanoes in Africa (EMDAT, 2010).

Disasters in Sub-Saharan Africa are predominately hydro-meteorological and climatological, and comprise cyclones and storms, floods, landslides, extreme temperatures, wild fires and droughts. Geological disasters, such as earthquakes and volcanoes, occur to a lesser extent. Droughts affect the most number of people on the continent, followed by floods and storms (Figure 1). Drought and floods together account for 80 percent of loss of life and 70 percent of economic losses linked to natural hazards in Sub-Saharan Africa (African Union et al., 2008).

**Figure 1:** Number of reported disasters, type, and number of people affected in Sub-Saharan Africa



Source: EMDAT, 2010<sup>3</sup>

<sup>1</sup> The EMDAT database classifies a "disaster" when one or more of the following criteria are met: 10 or more people reported killed through a disaster event; 100 or more people reported affected through a disaster event; declaration of state of emergency; and/or, call for international assistance.

<sup>2</sup> Total people affected: Sum of affected, homeless, injured.

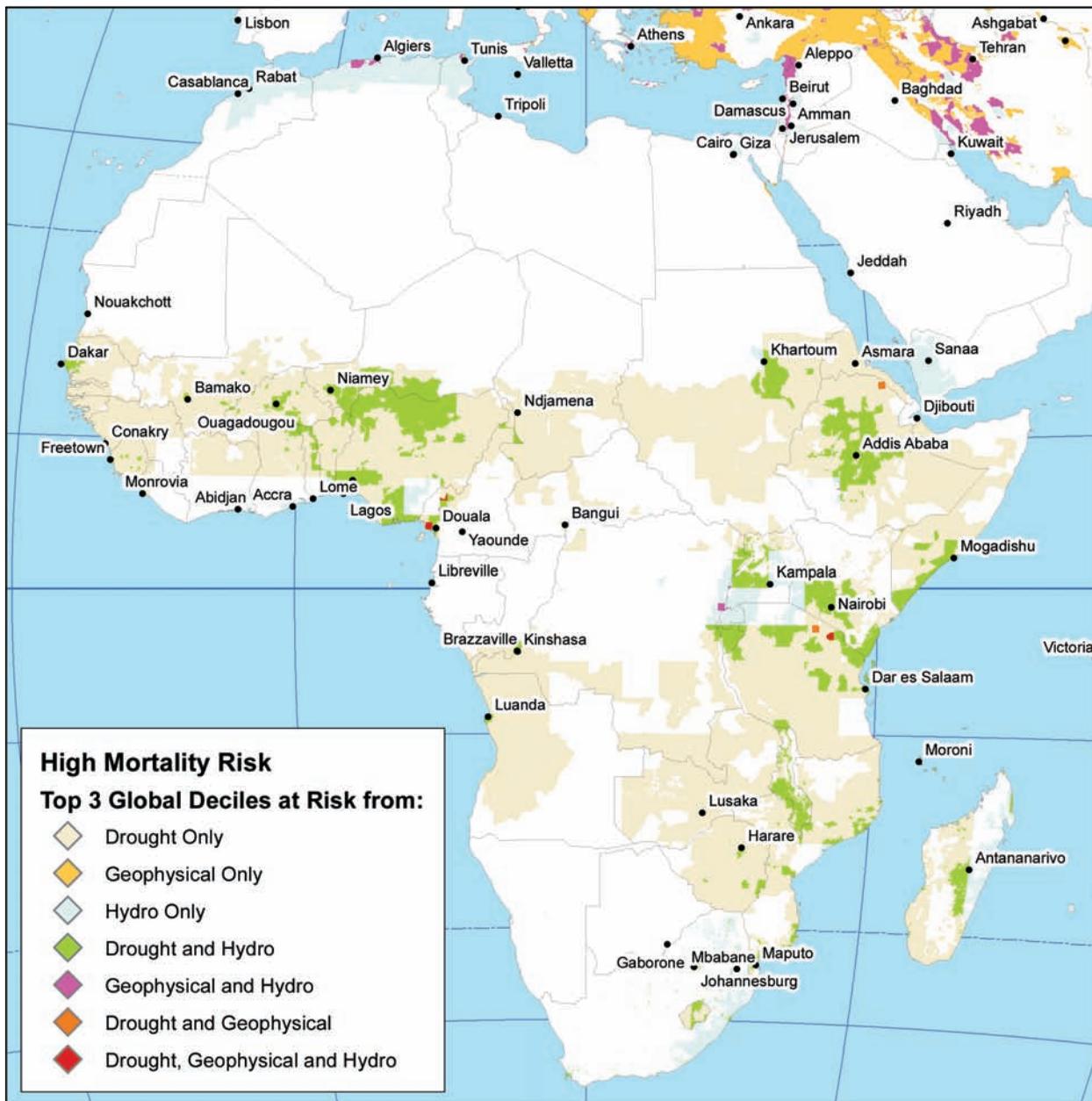
<sup>3</sup> EMDAT is the Emergency Events Database maintained by WHO Collaborating Centre for Research on the Epidemiology of Disasters (CRED) at the Universite Catholique Louvain, Belgium.

### 1.1 Hazards – Distribution and future trends

Almost all countries in Sub-Saharan Africa are exposed to one or multiple natural hazards (Figure 2). Floods usually affect large river basins such as the Congo, Niger, Nile, and Zambezi basins, but flash floods can impact any region after extreme rainfall.

Droughts occur predominately in semi-arid and sub-humid areas of the Sahelian countries, the Horn of Africa, and Southern Africa. The risk of landslide is high in countries with hilly terrain, high levels of rainfall, soil erosion and deforestation due to unsustainable land management. Cyclones and tropical storms affect countries on the southeastern coast of the Indian

**Figure 2:** Distribution of high mortality risk from different types of hazards in Sub-Saharan Africa



Source: Diley et al., 2005.

Ocean, primarily Madagascar, Mozambique, and the Indian Ocean islands. Storm events regularly cause severe damages and losses, particularly during the southwest Indian Ocean cyclone season (November to May). Many extreme hydro-meteorological events on the continent may be linked to the El Niño Southern Oscillation<sup>4</sup> (ENSO) phenomena. Climate change will likely exacerbate existing climate variability and increase the frequency and magnitude of extreme events (IPCC, 2007c) (see also chapter A.1.4).

Countries along the Rift Valley, stretching from Eritrea to Mozambique, are particularly vulnerable to earthquakes. Along the Rift Valley and on Indian Ocean islands, several volcanoes are known to be active, including Mount Nyiragongo in the Democratic Republic of Congo, and Mount Karthala on the Comoros. Sea level rise is increasingly a concern for many countries in the coastal regions, particularly those with low-lying urban centers, such as the densely populated Niger delta and low-lying areas along the coasts of West and East Africa and Madagascar. Recent studies show that low-lying countries along the coast of the Indian Ocean are susceptible to tsunamis (UNISDR, 2009c).

## 1.2 Vulnerability – Low coping capacity due to poverty, high reliance on rain-fed agriculture, and limited institutional capacities

The disproportionate impact of natural disasters on the poor has been well documented (UNISDR, 2009c). Natural disasters tend to have a greater impact on poor countries, thus countries with small and vulnerable economies, such as many small island states, land locked countries and many countries in Africa. Their ability to recover and reconstruct after

a major disaster is often limited, further diminishing their ability to increase resilience to disasters. This cycle is often referred to as the “disaster risk–poverty nexus”. The vulnerability of the African continent to disasters is linked to its poverty and structural issues and is caused and expressed by:

- a. Limited fiscal space and options to access financing to invest in risk reduction and recovery
- b. An economic foundation based on rain-fed agriculture
- c. Weak infrastructure to manage resources and recover from disasters
- d. Weak governance structures and institutional capacities
- e. A limited knowledge base to forecast and respond to natural disasters

This vulnerability is further fueled by environmental degradation and climate change, which will likely increase the frequency and magnitude of extreme weather events (see also chapter A.1.4).

**a. Limited fiscal resources and low resilience of economies**—Although the economic performance of many countries in Sub-Saharan Africa<sup>5</sup> has improved, their fiscal resources and scope to invest in DRR measures is limited. Public spending on ex-ante investments in DRR competes with other demands, such as health, infrastructure, defense, and debt service. Thirty-three countries in Africa have high debt overhang and fully or partly qualify for the Heavily Indebted Poor Countries Initiative (HIPC) (IDA and IMF, 2009).

Additionally, the fiscal resources of many governments cannot cover any relief and reconstruction efforts. They face shortages of funds, as emergen-

<sup>4</sup> El Niño Southern Oscillation is a quasi-periodic climate pattern that occurs across the tropical Pacific Ocean on average every five years. It is characterized by variations in the temperature warming or cooling known as *El Niño* and *La Niña* respectively. The ENSO weather phenomena is said to cause severe impact on the global climate (NOAA, 2010).

<sup>5</sup> Arbache, Jorge, et.al, 2008. GDP growth in Sub-Saharan Africa has accelerated to about six percent a year while inflation registered below two-digit levels.

cy funds are often not immediately available, and have difficulties accessing additional financing. Most countries in Africa depend fully or partly on external aid and relief operations following a major disaster event. The insurance penetration to cover damages on public and private property is very limited throughout the continent, with more than 40 percent of the direct losses from natural disasters are insured in developed countries, but only 5 percent are insured in low-income countries (Cummins and Mahul, 2008).

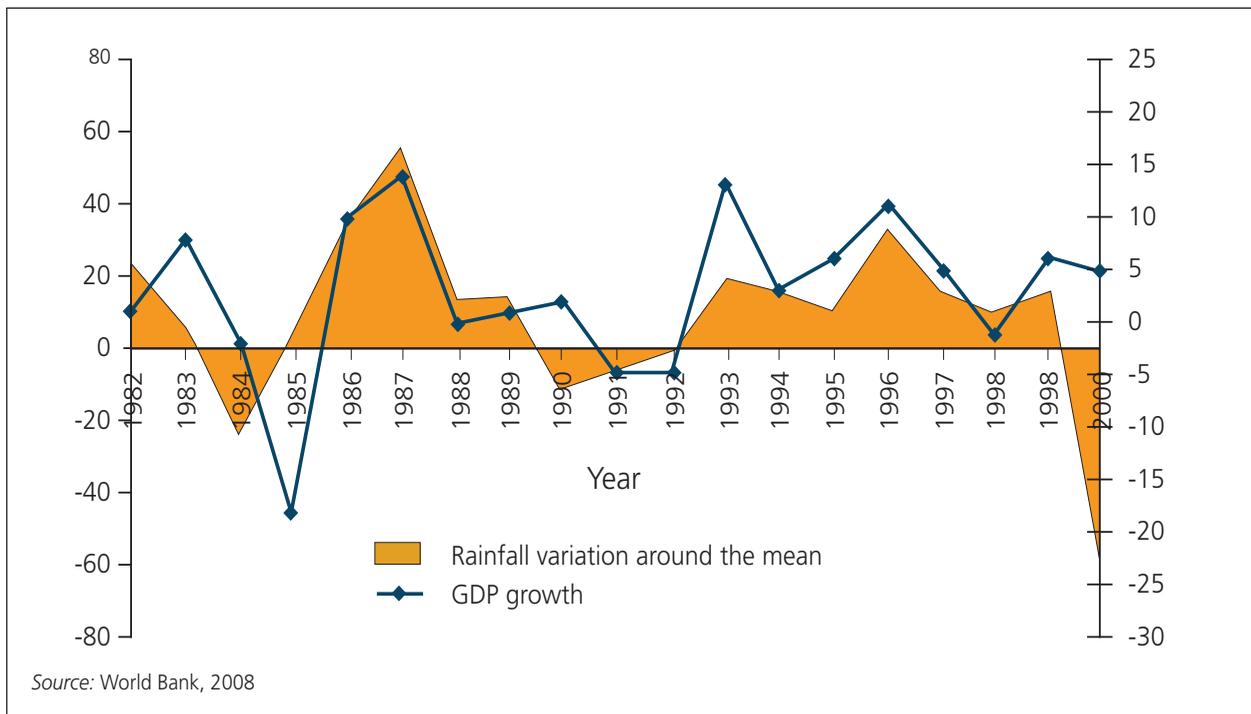
**b. Reliance on rain-fed agriculture**—The economies of many countries in Sub-Saharan Africa largely depend on rain-fed agriculture. This sector is particularly vulnerable to the high inter- and intra- annual climate variability and therefore, potentially to climate change. Figure 3 illustrates how GDP growth in Ethiopia largely followed rainfall variation in the past, being a typical example for many economies on the continent that largely depend on rainfall agriculture. Any drought can have severe impacts on livelihoods and economies at large.

**c. Limited infrastructure to buffer climatic variability and facilitate response and recovery**—

Africa’s infrastructure to buffer against hydro-meteorological events is fairly limited compared to other continents. Africa’s average water storage capacity reaches only some 200 m<sup>3</sup> per person/year. Countries like Ethiopia, for example, have a water storage capacity of some 43 m<sup>3</sup> per person/year, whereas North America has an average water storage capacity of 5,961 m<sup>3</sup> per person/year (World Bank, 2010g).

Safe roads, schools, and hospital infrastructure are important to deliver basic services to the population. In the immediate aftermath of disasters, they become critical infrastructure for relief and recovery operations. Therefore transport infrastructure, schools and hospitals need to be constructed and maintained according to minimum standards to resist certain earthquakes, cyclones, or flood events. Building codes and standards are often not enforced and may result in higher costs for construction (Box 9). A deteriorated infrastructure base will be more likely affected and

**Figure 3:** Variability of GDP with rainfall in Ethiopia



damaged by disasters. The costs for reconstruction of extensive infrastructure networks (for example, roads and bridges after floods) can be a major burden for these economies (Box 8).

d. Weak governance and institutional capacities – A number of countries in Sub-Saharan Africa face significant governance challenges, including an institutional and policy framework to effectively respond to disasters and manage risk reduction measures. This includes poor staffing and skills, weak analytical and implementation capacity, an unclear institutional landscape addressing DRM across various ministries and agencies, and weak partnerships with other agencies and academia, NGOs, and the private sector.

In most countries, DRM policy and legislation follow an ex-post responsive approach to disasters and are often not equipped with the right strategies and instruments for an ex-ante approach to risk reduction. Only a few countries in Africa have a legislative and institutional model in place that integrates DRR into broader development strategies addressing all pillars of the HFA. Even well equipped national DRM authorities often lack critical resources to invest in communications, early warning systems, or vehicles. Funding for DRM authorities at sub-national and local levels is particularly limited, where remote district offices depend on funding and information provided in the capitals.

e. Limited knowledge base – The capacities of a large number of DRM organizations in Africa are limited, due to lack of equipment, but more importantly through a lack of trained officials. Graduate courses for DRM specialists are rare on the continent and some universities for example, Bahir Dar University in Ethiopia have only recently started dedicated programs. The knowledge base for early warning systems, remote sensing, risk insurance, and hydro-meteorolog-

ical services is rare in most countries. Several recent initiatives to strengthen hydro-meteorological services across the continent report widespread deficiencies in the observing networks, telecommunications, and informatics system and low capacities in data management (Box 1) related to hydro-meteorological services (IRI, 2006). The knowledge base to assess other hazards (for example, geological equipment and experts to monitor earthquakes) is even more limited.

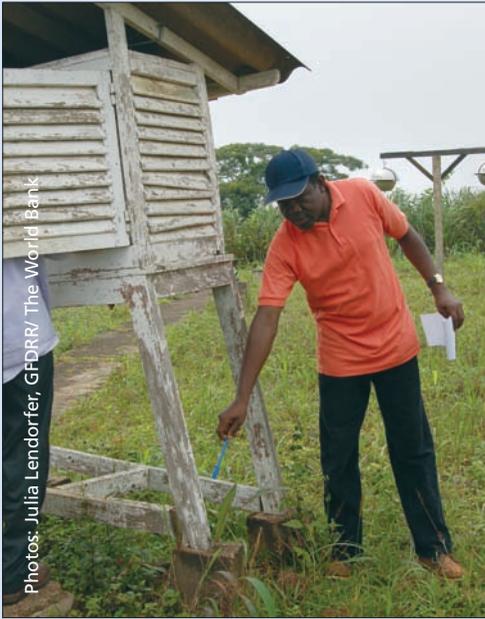
### 1.3 Exposure – Population growth in hazard-prone urban areas

Population growth and rapid urbanization are among the driving factors behind the increased exposure of Sub-Saharan Africa to natural hazards. Although Africa is still at an early stage of urban transition with 38percent of its population living in urban areas, Africa's urbanization rate is the highest in the world, which reached 3.3 percent annually between 2000 and 2005. Cities such as Nairobi, Niamey, Dar-es-Salaam, or Lomé have growth rates of more than 4percent annually (UN-Habitat, 2008). Urban areas are usually the engines of economic growth and centers of economic assets.

One-third of Africa's urban population is already concentrated in the region's 36 cities with more than one million inhabitants. Most of the remaining two-thirds are spread across 232 intermediate cities<sup>6</sup> and peri-urban areas. Urban areas are often located in low-lying river deltas or coastal areas directly exposed to sea-level rise, coastal surge, and inundation. Urban floods affect many cities throughout Africa (see also PDNAs in Dakar, Ouagadougou, and Bangui). Limited infrastructure and weak urban governance resulting in a lack of urban planning and enforced standards for construction make large parts of the urban population vulnerable to natural hazards. This is particularly true for the rapidly growing informal settlements. According to UN-Habitat's *State of the World Cities 2008/09 Report*, nearly two thirds (62 percent) of the

<sup>6</sup> Cities between 100,000 and one million inhabitants.

**Box 1: Importance of National Hydro-Meteorological Services (NHMS) for DRR**



Photos: Julia Lendorfer, GFDRR/ The World Bank



**Left: Nelson Akibole of the National DRR Platform in Togo points out feeble state of a national weather observation station.**  
**Above: Seismograph at a weather observation station in Togo.**

Hydro-meteorological services play an important role in disaster risk reduction and managing climate change adaptation. Without weather observation networks, early warning for hydro-meteorological events such as floods and cyclones would be impossible. Long-time series and accurate data are crucial for planning and design of interventions such as dikes and inundation zones. Assessments of the inter-annual and intra-annual variability of climate are important for forward-looking interventions and assessments of climate change.

While many NHMS in Africa have the potential to provide information and services to decision makers, users, and the general public, communication with these targeted groups is insufficient and some products they provide are not easily understood and acted upon. A survey of the World Meteorological Organization (WMO) indicated that there are large differences in the capacities of the NHMS in Africa, often with widespread deficiencies in the observation network, telecommunications, and information systems. Synoptic stations, which permanently record a broad variety of weather information, are available in every country, mostly to allow airport operation. The synoptic stations are part of the WMO Basic Regional Synoptic Network. Many of the upper air stations are not functioning and less than 30percent reported through the WMO communication system in 2008. Similar difficulties occur with global models and satellite data interpretation. NHMS need a number of well-trained staff for numerical weather prediction and issues forecasts and early warnings. This requires a large number of trained meteorologists, equipment, and basic infrastructure such as internet and electricity.

Improved hydro-meteorological services can contribute directly to more accurate early warning systems. As an example the installation of doppler weather radars increased the lead-time for flash flood early warnings in the United States from ten minutes in the 1980s to more than forty-five minutes in the 1990s. National governments, the WMO, the African Development Bank (AfDB), and various bi- and multi-lateral development partners recognize the need to invest in strengthening hydro-meteorological services.

city dwellers in Sub-Saharan Africa live in slums. It is disproportionately high in Ethiopia, Angola, Central African Republic, Chad, Guinea-Bissau, Madagascar, Mozambique, Niger, Sierra Leone, and Sudan (UN-Habitat, 2008). Informal settlements are often arising in areas at risk, such as inundation zones and drainage channels or hill-slopes prone to landslides.

**1.4 Climate change – Possible impacts**

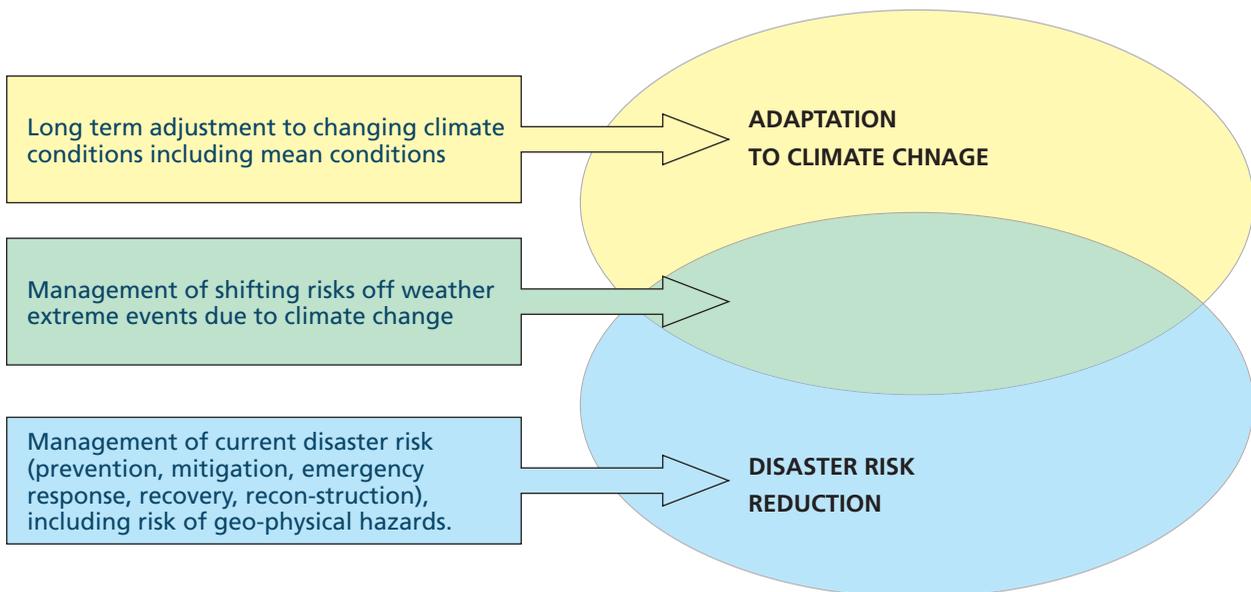
Climate change refers to the expected substantial changes in our climate that could directly be related to a human-induced increase in greenhouse gas emissions (GHG). Several climate projection scenarios were presented in the *Fourth Assessment Report of the Inter-governmental Panel on Climate Change* (IPCC, 2007a), indicating likely rises in temperature and changes in precipitation pattern, sea-level rise, and cyclone activity (Dasgupta, Susmita. et. al., 2009). These climate projections are based upon the estimations of various General Climate Models (GCM). All scenarios and model outcomes predict a temperature increase in the range of 1.5°C to 4°C in this century according to IPCC (2007a). Projected sea level rise<sup>7</sup>

would affect low-lying coastal areas, additionally making storm surges more severe, cause salinisation of coastal areas, and impact delta environments by the end of the twenty-first century.

GCMs indicate changes in the precipitation patterns, but there are large model discrepancies in the trends, magnitude, and affected areas. Even more difficult are projections of the accompanied run-off, river flow, or groundwater recharge. The so-called down-scaling of GCMs to a regional or country-wide level remains very limited but would be useful to address the likely impacts for planning purposes.

Based on model outcomes, climate change will likely cause more extreme (in frequency and magnitude) hydro-meteorological events. IPCC suggests that the geographic distribution, frequency and intensity of hazards have already been altered significantly by climate change (IPCC, 2007b). The six warmest years on record in Africa have occurred within the last twenty years and the average temperature rose approximately 0.5°C during the twentieth century.

**Figure 4:** Conceptual approach to the overlapping agendas of climate change adaptation and DRR



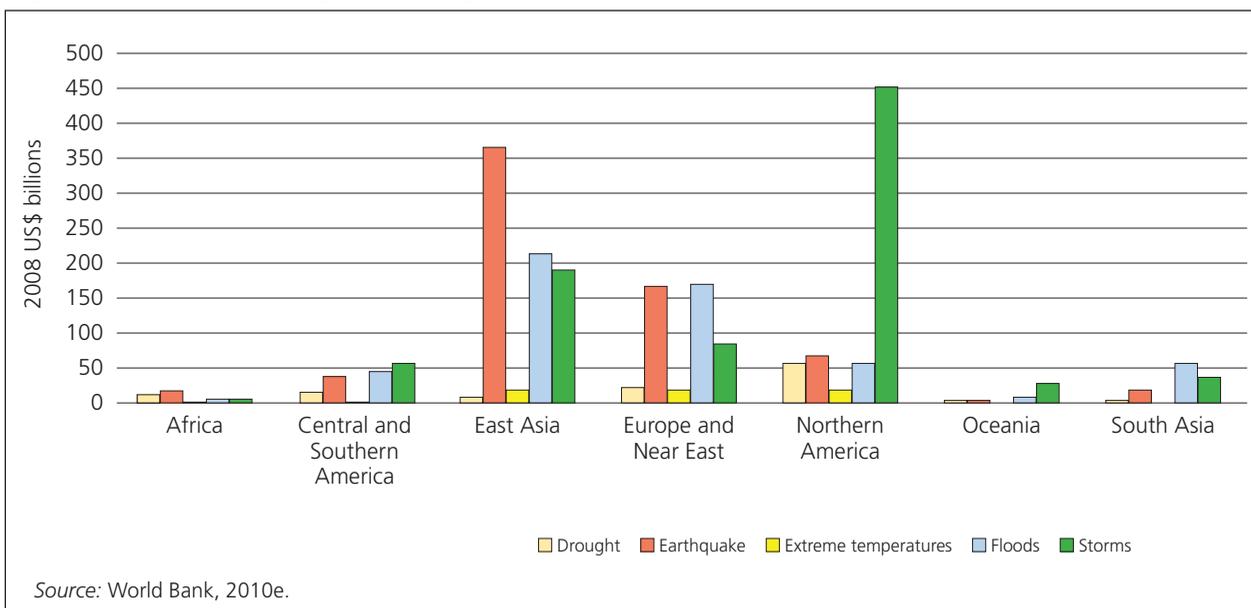
<sup>7</sup> Sea level rise may have several causes, including oceanic currents and tectonic movements.

Climate change adaptation and disaster risk reduction are closely linked. Adapting to climate change requires both preparing for long-term changes in average climatic conditions and addressing short- to medium-term impacts of climate variability and extreme events. Sustainable land-, water-, and forest management, coastal and urban development, watershed management, and increased agricultural productivity contribute towards long-term adaptation and reduce underlying risk to disasters at the same time. Reducing disaster risk under the current climate is understood as a “no-regrets” adaptation strategy that would be justified under all plausible future scenarios. Figure 4 provides the conceptual framework, highlighting the overlapping agenda. Climate change adaptation and disaster risk reduction are not only often addressed by the same ministries and agencies; they also rely on the same source of baseline information, such as hydro-meteorological data to be used in early warning systems and for long-term climate predictions.

## 2. Economic and social impacts of disasters

Disasters often have major economic and social impacts, causing direct damages to public and private property, resulting in short- and long-term economic losses, requiring large fiscal outlays for reconstruction and recovery, and further fueling the disaster risk and poverty nexus. Between 1975 and 2008, 8,866 disaster events (excluding epidemics) killed 2.28 million people and caused \$1,527.7 billion in economic losses worldwide (UNISDR, 2008). During this period high-income countries (North America, Europe and parts of Asia) incurred the majority of the absolute costs, although Africa reported the highest number of casualties. Figure 5 illustrates the total damages caused by various types of disasters worldwide in 2008. However, when economic impacts are compared in relation to the countries’ Gross Domestic Product (GDP), it becomes clear that the burden for high-income countries is far lower than for middle and low-income countries. Natural disasters tend to have a greater impact on small and vulnerable economies, such as many small island states and land locked countries, than large economies and those

**Figure 5:** Worldwide damages caused by disasters in 2008



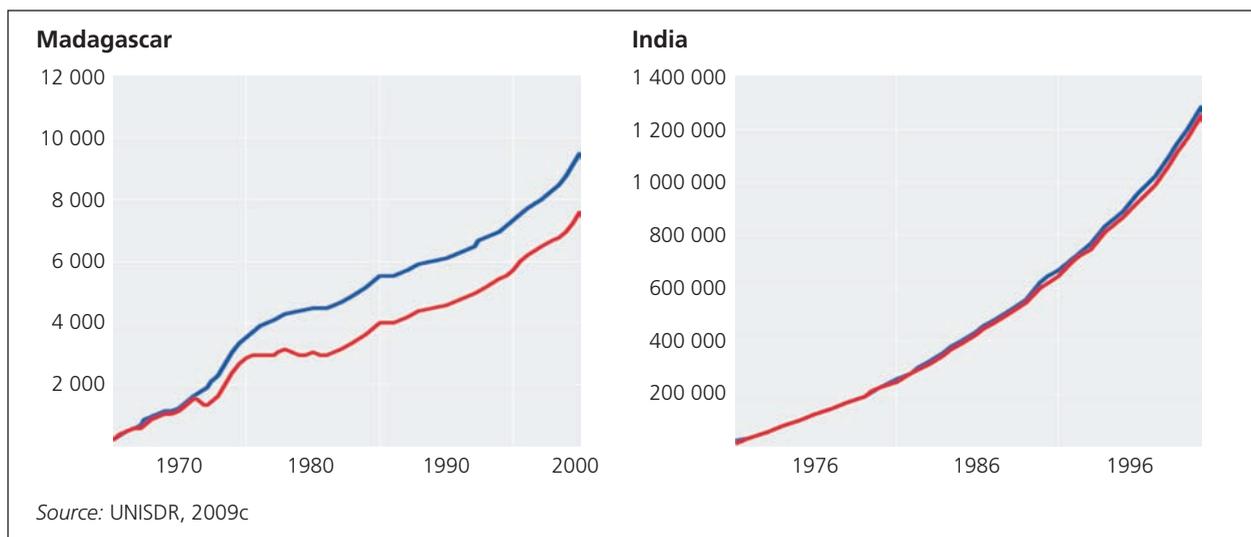
that can benefit from international trade (UNISDR, 2009c) (Figure 6). Various authors have reported severe economic impacts of disasters in the short term (Benson et al., 1997). In the medium-term<sup>8</sup> the effect on growth was still significant. Over time the detected impact on economic growth subsides. Higher aid rates as well as higher remittances lessen the adverse negative macroeconomic consequences.

Disasters can affect any sector, such as the *productive sector* (agriculture, tourism, commerce and industry), *infrastructure sector* (housing, transportation, power, communication, sanitation and water supply), *social sector* (education, health, governance), and *cross cutting sector* such as environment, livelihoods, religion and culture. Economic losses that impact GDP are mainly caused by impacts on the productive sectors, particularly agriculture, industry, and services. Impacts can manifold for example, through destroyed irrigation infrastructure, fewer consumer goods produced, shortages in supply, damaged transport facilities, or decreased tourism. Through additional imports or reduced exports of produced goods, the balance of payments of a country is often reduced (UNECLAC, 2003).

Disasters severely impact households and livelihoods, resulting in additional people falling into poverty. Poor people often settle in high risk areas (for example, inundation zones), rely on agricultural labor, reside in houses that cannot resist any disaster impact, and lose income opportunities, and are therefore particularly vulnerable to disasters. Following a disaster, the poor and vulnerable population often has only limited options to reconstruct according to disaster-resistant standards.

However, estimations like these are based on impacts of a single major disaster event. Macroeconomic impact studies tend to underestimate the true effects of disasters, since most countries suffer from smaller and moderate, but frequently reoccurring disasters, particularly droughts and floods. The World Bank and the Global Facility for Disaster Reduction and Recovery (GFDRR) estimated the impact of reoccurring droughts and floods on the national economy, various sectors, and regions in Malawi using a macroeconomic model (Box 6). Chapters C and D provide further insights into these economic assessments conducted for various projects and PDNAs.

**Figure 6:** Cumulative net capital formations from 1970 to 2000 in Madagascar and India in millions of dollars, with (red lines) and without (blue line) the effect of economic losses in disasters



<sup>8</sup> "Medium-term" refers to a comparison of the two years following a disaster with the two years before the disaster occurred.

## B. Global, regional, and national frameworks for DRR

Global and regional organizations in Africa, such as the United Nations (UN) system, African Union (AU), and others, play an important role in advocacy for disaster risk reduction and fostering cooperation for sustainable relief and recovery. Nonetheless, the national governments and disaster risk management authorities ultimately need to implement disaster risk reduction measures and organize recovery and reconstruction efforts. This chapter highlights the institutional landscape for DRR and strategies at global, regional, and national levels.

### 1. Global frameworks

The HFA, adopted in 2005 in Japan, provides a global strategic roadmap to disaster risk reduction. The HFA is a global blueprint for disaster risk reduction with the goal to substantially reduce disaster losses in lives, and in the social, economic, and environmental assets of communities and countries by 2015. The framework offers guiding principles, priorities for action, and practical means for achieving disaster resilience for vulnerable communities. It clearly emphasizes that concerted international cooperation is required to provide the knowledge, capacities and incentives for DRR (UNISDR, 2007) (Box 2).

The GFDRR is a partnership of the World Bank, United Nations International Strategy for Disaster Reduction (UNISDR), and international donors to support the implementation of the HFA. The World Bank on behalf of the participating donors and other partnering stakeholders manages GFDRR. It provides technical and financial assistance to high-risk, low- and middle-income countries to mainstream disaster reduction in national development strategies. It offers technical assistance in disaster response, recovery, and reconstruction. GFDRR fur-

ther anchors a broad knowledge source and provides technical expertise and specialists to various topics from risk financing to PDNAs and facilitates South–South cooperation initiatives. In Sub-Saharan Africa, GFDRR has funded various initiatives under its three financing tracks:

1. Track I supports UNISDR regional processes to leverage resources to implement the HFA.
2. Track II supports the mainstreaming of disaster risk reduction into national policy and strategy development, including pilot national and sub-national initiatives.
3. Track III supports damage and loss assessment as well as recovery from disasters.

UNISDR is the UN agency facilitating the implementation of the HFA and fostering policy dialogues on DRR and recovery. UNISDR aims to build disaster resilient communities by promoting increased awareness of the importance of disaster reduction as an integral component of sustainable development, with the goal of reducing human, social, economic, and environmental losses due to natural hazards and related technological and environmental disasters. It fosters international cooperation and programs DRR and has launched several global campaigns such as the *Making Cities Resilient* program<sup>9</sup>. UNISDR has a regional program for Africa that coordinates disaster risk reduction activities across the continent. It strengthens policy dialogues with national governments, the AU, and other regional institutions.

### 2. Regional initiatives and cooperation

The AU is the intergovernmental organization that represents all African countries.<sup>10</sup> The AU's *New Partnership for Africa's Development (NEPAD)*, an

<sup>9</sup> UNISDR Making Cities Resilient program - <http://www.unisdr.org/english/campaigns/campaign2010-2011>.

<sup>10</sup> Except Morocco.

### Box 2: HFA: Strategic goals and priorities for action



Photo: Denis Jordy, The World Bank

Assessing needs for recovery and reconstruction after the 2009 floods in Dakar, Senegal.

In 2005 the United Nations convened in Kobe, Japan for the Second World Conference on Disaster Reduction. During this conference the HFA was agreed as the primary international agreement and instrument for implementing disaster risk reduction. Its overarching goal is to build resilience of nations and communities to disasters, by achieving substantive reduction of disaster losses by 2015 – in lives, and in the social, economic, and environmental assets of communities and countries. The HFA highlights five priorities for action, guiding principles and practical means for achieving disaster resilience for vulnerable communities in the context of sustainable development (UNISDR, 2007).

Since the adoption of the HFA, many global, regional, national, and local efforts have addressed disaster risk reduction more systematically; however much remains to be done. The UN General Assembly has called for the implementation of HFA, reconfirmed the multi-stakeholder UNISDR System and the Global Platform for Disaster Risk Reduction to support and promote it.

#### Three strategic goals of HFA:

1. More effective integration of disaster risk consideration into sustainable development policies, planning and programming at all levels, with a special emphasis on disaster prevention, mitigation, preparedness and vulnerability reduction
2. Development and strengthening of institutions, mechanisms and capacities at all levels, in particular at the community level, to methodically contribute to building resilience to hazards
3. Systematic incorporation of risk reduction approaches into the design and implementation of emergency preparedness, response and recovery programs in the reconstruction of affected communities

#### Five priorities for action:

- HFA 1: Ensure that DRR is a national and local priority with a strong institutional basis for implementation
- HFA 2: Identify, assess and monitor disaster risks and enhance early warning
- HFA 3: Use knowledge, innovation and education to build a culture of safety and resilience at all levels
- HFA 4: Reduce the underlying risk factors
- HFA 5: Strengthen disaster preparedness for effective response at all levels

economic development program adopted in 2001, recognizes that natural and human induced disasters put development at large at risk. The AU has recognized that institutional frameworks, risk identification, knowledge management, governance, and emergency response are critical to the DRR agenda (African Union, 2004). The AU established an overarching *Africa Regional Strategy for Disaster Risk Reduction* to address these issues. The objectives of the strategy are guided towards facilitating dialogues and fostering political commitment to DRR. The strategy has the following core objectives for DRR:

1. Increase political commitment to DRR
2. Improve identification and assessment of disaster risks
3. Enhance knowledge management
4. Increase public awareness
5. Improve governance of DRR institutions
6. Integrate DRR into emergency response management.

The strategy recognizes that interventions can best be conducted at national level. It therefore predominantly facilitates initiatives at the country and regional level and provides strategic options for countries to select based on their national context.

The RECs<sup>11</sup> play an important role in interpreting the strategy for their regions and facilitating their implementation at the national level. The strategy encourages the RECs to establish sub-regional risk reduction platforms and focal points, and calls on national governments to lead the process of developing risk reduction capacities and integration of DRR into sustainable development.

Moving forward with this strategy, a *Programme of Action for the Implementation of the Africa Regional Strategy for DRR* was launched at the first and second regional platform meetings. The AU and UNISDR

twice organized these regional platform consultations on DRR in preparation for the *Global Platform on Disaster Risk Reduction* in 2007 and 2009. The Programme of Action provides a matrix of action for national governments, RECs, and the AU, as well as specialized agencies and civil society organizations. It was agreed to provide bi-annual reports to measure the progress made with respect to the strategy and HFA (African Union and UNISDR, 2009).

In April, 2010, the *Second Ministerial Conference on Disaster Risk Reduction in Africa* endorsed this Programme of Action and highlighted the need to continue working on DRR. The declaration addressed the need for strengthening regional institutions and capacity development and increasing investments in DRR (UNISDR, 2010a). The conference was closely linked to the *First Conference of Ministers Responsible for Meteorology in Africa*, stressing the need for improved hydro-meteorological services across the continent.

Africa's RECs are key partners for the implementation of the strategy. The following examples demonstrate some of their recent commitments to DRR (AU et al., 2008):

- **Economic Community of Central African States (ECCAS)** – Coordinating Bureau for the Environment and Natural Resources, with technical support from UNISDR, drafted a DRR policy and outlined a process to develop and validate this policy among a broad range of regional stakeholders in 2009.
- **Economic Community of West African States (ECOWAS)** – Technical Committee on Disaster Management recommends ways to operationalize a DRR strategy in the region.

<sup>11</sup> The AU recognizes the following RECs: Arab Maghreb Union, Common Market for Eastern and Southern Africa, Community of Sahel-Saharan States, East African Community, Economic Community of Central African States, Economic Community of West African States, Indian Ocean Commission, Inter-Governmental Authority on Development, Southern Africa Development Community.

- **Indian Ocean Commission (IOC)** works toward objectives such as institutional reinforcement, knowledge improvement, capacity building, rebuilding and rehabilitating solutions.
- **Southern Africa Development Community (SADC)** – Disaster Risk Reduction Strategic Plan (2006-10) sets out the strategic direction to achieve the long-term goal of building the resilience of SADC nations and their communities to the impact of disasters.
- **Inter-Governmental Authority on Development (IGAD)** – has developed a regional strategy to strengthen sub-regional disaster preparedness and response capabilities that incorporate a regional program for DRM. The program aims at disaster mitigation through capacity development and enhancement.

Specialized regional agencies also dedicate part of their work to DRR. IGAD Climate Prediction and Applications Centre in Nairobi (ICPAC), SADC Drought Monitoring Centre in Gaborone (SADC DMC), AGRHYMET Regional Centre in Niamey (ARC), and African Centre of Meteorological Applications for Development in Niamey (ACMAD) have in recent years closely linked their climate research programs to DRR. GFDRR and the World Bank have supported several projects on regional cooperation in climate predictions and DRR.

Regional cooperation in river basin management, drought, floods and locust infestation has a long history in Sub-Saharan Africa cooperation is vital to strengthening institutional capacities in these areas. Some organizations involved in river basin management include the Senegal River Basin Development Authority, Niger Basin Authority, Nile Basin Initiative, *Gambia River Basin Development Organization*, or *Lake Victoria Basin Commission* as examples.

### 3. National initiatives and platforms

National governments and national disaster risk management authorities are central to implementing DRR in the broader development agenda. In recent years a number of countries have strengthened their national DRM authorities and formulated national policies, strategies and action plans. The institutional arrangements of DRR agencies are very diverse across the Sub-Saharan Africa region. National authorities are typically established under various ministries, including the ministries of the interior, defense, agriculture, and local government. DRM policies and frameworks are increasingly being revised to shift from an ex-post paradigm to an ex-ante approach to DRR. The institutional framework of the DRM agencies can often determine how strong national authorities are in coordinating between national ministries, UN organizations, international development partners, and NGOs.

Multi-stakeholder platforms of several ministries, UN agencies, and NGOs to enhance cooperation in DRR had already been established in several countries before the launch of *National Platforms for Disaster Risk Reduction*. Since 2007, several more have been initiated with the support of UNISDR. National platforms are a useful instrument to foster cooperation among ministries, agencies, donors, NGOs, and civil society organizations. A National Platform for DRR should be the coordination mechanism for mainstreaming DRR into development policies, planning and programs in line with the implementation of the HFA (UNISDR, 2007b). In some countries national platforms have not yet been established due to lack of resources, limited capacities, institutional structures or legal foundation. An overview of the activities of GFDRR, the World Bank, and others to support the work of the National Platforms is given in the following chapters.

## C. Disaster risk management activities in Sub-Saharan Africa

DRR and recovery are an integral part of the World Bank's commitment to Sub-Saharan Africa and crucial for sustainable development and poverty reduction. This chapter highlights the framework for DRR in Sub-Saharan Africa and outlines the activities of the Africa Disaster Risk Management Team (Africa DRM Team) on risk and vulnerability assessments and response to disasters.

### Framework for DRR in Sub-Saharan Africa

Guided by the 2005 HFA and the Africa Regional Strategy for Disaster Risk Reduction adopted by the AU in 2004 (see chapter B.1), the World Bank's activities in DRR in Sub-Saharan Africa focus on the following areas:

1. Facilitate disaster risk and vulnerability assessments across sectors; strengthen early warning and monitoring systems
2. Foster awareness, and support policy, and institutional building for DRM
3. Invest in risk mitigation and reduction of underlying risk factors
4. Support new preparedness, contingency, and catastrophic risk financing instruments
5. Improve emergency response and preparedness; assist in post-disaster situations

The first four areas are implemented largely through ex-ante activities addressing DRR through technical assistance, sector activities, advisory services, advocacy, and leveraging investments in this field. In the aftermath of disasters, ex-post assistance is provided to reduce the negative impacts of disaster events, including technical assistance such as PDNAs. Knowledge management and capacity building are crucial to achieve these long-term objectives.

The Africa DRM Team puts the implementation of this framework into practice in a concerted approach, starting with ex-ante activities to facilitate disaster

risk and vulnerability assessments. These activities include economic assessments, urban development planning, water resources management, drought and food security, adaptation coastal surges, and changing marine environments (see chapter C.1). In the aftermath of major disaster events and upon request of governments, ex-post activities to assist partner countries in response to disaster situations through PDNAs were conducted. In 2008 and 2009 this was the case for floods in West and Southern Africa, cyclones in Madagascar, and an earthquake in Malawi (see chapter C.2).

With more and more activities being implemented, the dialogue with governments can be further advanced towards a comprehensive approach to DRR at the national level. The focus can then be broadened to facilitating policy dialogues and institutional strengthening, working towards larger investments, and supporting new preparedness and risk financing instruments. This comprehensive and concerted approach is discussed in more detail in chapter D.

### 1. Disaster risk and vulnerability assessments

Ex-ante activities to facilitate disaster risk and vulnerability assessments across sectors are an entry point for a broader dialogue with governments on DRR. The World Bank and GFDRR have initiated a number of pilot activities in this field. They focus either on economic vulnerability assessment, floods, coastal hazards in urban areas, water management, drought and food security, adaptation to coastal surges and changing marine environments or capacity building. While the projects have a clear focus, their activities also touch further areas. Table 1 shows the primary and secondary focus of these activities. A detailed overview of all projects is provided in the annex.

**Table 1:** Overview of projects and their primary focus (p) and secondary focus (s) of activity

|                                       | Economic vulnerability to disasters | Floods, coastal hazards in urban areas | Water resources management | Drought and food security | Adaptation to coastal surges, marine environments | Capacity building |
|--|-------------------------------------|--|----------------------------|---------------------------|---|-------------------|
| Malawi: Mainstreaming disaster reduction for sustainable poverty reduction   | p                                   | s                                      | s                          |                           |   | s                 |
| Senegal: Preparing to manage natural hazards and climate change risks in Dakar   |                                     | p                                      |                            |                           |   | s                 |
| Mozambique: Mainstreaming DRR for sustainable poverty reduction  | s                                   | p                                      | s                          |                           |   | s                 |
| CAR: Flood recovery and resiliency program   |                                     | p                                      | s                          |                           |   | s                 |
| Ethiopia: Facilitating provision of baseline vulnerability information on flood exposed communities                    |                                     |  | p                          | s                         |   | s                 |
| Ghana: Sustainable development, disaster prevention, and water resources management                                    |                                     |  | p                          |                           |   | s                 |
| Ethiopia: Coping with adverse shocks of nutrition and health   |                                     |  |                            | p                         |   | s                 |
| Ethiopia: Weather risk management framework using weather based indices  | s                                   |  | s                          | p                         |   | s                 |
| Burkina Faso: Integrated weather risk management for sustained growth  | s                                   |  |                            | p                         |   | s                 |
| Madagascar: Mainstreaming climate and disaster risk management into economic development                               | s                                   |  |                            | s                         | p   | s                 |
| Seychelles: National disaster preparedness and response project  | s                                   |  | s                          |                           | p   | s                 |
| West Africa: Community co-management for disaster risk management of marine resources (regional)                       |                                     |  |                            |                           | p   | s                 |
| Swaziland: Capacity needs assessment for disaster risk management  |                                     |  | s                          | s                         |   | p                 |
| World Bank: Building capacity in DRR for World Bank task team leaders in agriculture and rural development             |                                     |  |                            |                           |   | p                 |
| East Africa: Climate observations and regional modeling in support of climate risk management, sustainable development |                                     |  | s                          | s                         |   | p                 |

### **Economic vulnerability to disasters**

Hazard analyses are often conducted for specific areas and hazards, but often fail to estimate the potential impact on the economy and livelihoods of the areas. Addressed as a planning instrument for the government and development partners, this World Bank study assessed the economic vulnerability to droughts and floods in Malawi. An analysis of historic flood and drought events resulted in a drought and flood risk atlas, which was then combined with a country-wide macro-economic model. The study modeled the potential impact on key indicators such as reduction to GDP and potential number of people falling into poverty. The study provided figures such as a modeled average annual reduction of GDP by 1.7 percent through droughts and floods in the country, particularly affected sectors and people affected in urban and rural areas (Box 3).

### **Floods and coastal hazards in urban areas**

Africa's cities are often in areas exposed to risk and with only limited spatial and urban planning. In Dakar, Senegal, for example, new and informal settlements in the city's outskirts are regularly affected by flooding. A study assessed hazards of floods, coastal surge, and sea level rise in the city and its surroundings. Applying the Climate Change Cities Primer framework, this study assessed the relative flooding potential, coastal inundation, and coastal erosion in a spatial assessment, and identified hotspots of high population increase in high-risk areas (Box 4). The PDNA took the results and recommendations of the study in autumn 2009 and prepared further DRM project activities.

The coastal twin cities of Inhambane and Maxixe, Mozambique, face a similar problem. The *Analysis of the Urban Vulnerability to Climate Risks in the Cities of Inhambane and Maxixe* has identified flood and coastal surge hazards and highlighted possible strategies to be addressed in urban development. Special attention was given to the role of urban (spatial) planning and the active participation of its inhabitants.

### **Water resources management**

Flood hazard assessments and the development of effective interventions, early warning systems and capacity building is an essential pillar for DRR in many flood prone areas across the continent. Following the 2007 floods in the three northern provinces of Ghana, a project was established to assist the country with building knowledge and capacity for flood prevention and water resources management. In Ethiopia flood exposed woredas (districts) are supported with a risk and vulnerability assessment. Meanwhile, this assessment has been further extended to provide a common framework for risk and vulnerability assessment for all areas of the country.

### **Drought and food security**

Innovative concepts have been developed in Ethiopia, where severe droughts and related food insecurity have led to major humanitarian crises in the past. To assist interventions at a very early stage the LEAP (Livelihood, Early Assessment and Protection) indicator and software was developed by the Government of Ethiopia (GoE) and the World Food Programme (WFP). It linked objective climate and water balance data with historic food security interventions and their estimated costs. Through this weather-based risk management framework, costs for intervention can be determined at a very early stage and livelihoods can be protected through food for work or other contingency operations. This project supported the development of the software, field-testing, and training of government officials through the World Bank between 2008 and 2010 (Box 5).

Another project in Ethiopia integrated nutrition and food security aspects in a broader humanitarian response addressing Ethiopia's chronic droughts. It established a nutrition surveillance and malnutrition early warning system. Facilities were also created by the project to produce high nutrition cookies with local resources for malnourished people.

### Box 3: Economic vulnerability and disaster risk assessment: Measuring economic risks of droughts and floods

Malawi has highly variable rainfall patterns and is frequently affected by floods and droughts. Malawi suffered twelve ‘water shocks’ between 1987 and 2007. Malawi has a GDP of \$3.6 billion, growing at a rate of 3.6 percent in 2008. Agriculture contributes to 34 percent of GDP. In 2008, the World Bank conducted a systematic study to assess the long-term economic impacts of droughts and floods.

The study applied a probabilistic risk analysis to evaluate the impacts of natural hazards. Risk is expressed in terms of the probability of exceeding specific levels of direct losses (in physical and monetary terms). Figure 7 shows flood and drought hazard maps for events that return on average every 10 to 100 years in Malawi. The results of the probabilistic risk analysis were combined with a macro-economic model to determine the potential impact on the entire economy. The model results indicated the following:

- 1.7 percent of GDP (\$22 million) is lost on average each year due to droughts and floods, and about 265,000 more people fall into poverty (Table 2). This is equivalent to \$12.5 million per annum (fiscal 2004/5 prices).
- Economic losses are much higher during extreme droughts; for example, during a one-in-twenty-five year drought (RP25), such as the drought of 1991-92, GDP contracts by as much as 10.4 percent.

**Table 2:** Impacts of droughts and floods on the national economy in Malawi (in percent of GDP)

| <b>Droughts</b> | <b>RP5 (% of GDP)</b> | <b>RP10 (% of GDP)</b> | <b>RP15 (% of GDP)</b> | <b>RP25 (% of GDP)</b> | <b>AAL (% of GDP)</b> |
|-----------------|-----------------------|------------------------|------------------------|------------------------|-----------------------|
| Total GDP       | -0.5                  | -3.5                   | -7.2                   | -10.4                  | -1.0                  |
| Agriculture     | -1.1                  | -7.3                   | -14.9                  | -21.5                  | -2.0                  |
| Industry        | 0.0                   | 0.0                    | 0.3                    | 0.7                    | 0.0                   |
| <b>Floods</b>   | <b>RP5 (% of GDP)</b> | <b>RP10 (% of GDP)</b> | <b>RP20 (% of GDP)</b> | <b>RP50 (% of GDP)</b> | <b>AAL (% of GDP)</b> |
| Total GDP       | -1.7                  | -2.5                   | -3.2                   | -4.0                   | -0.7                  |
| Agriculture     | -3.5                  | -5.1                   | -6.5                   | -8.2                   | -1.4                  |
| Industry        | -0.6                  | -0.9                   | -1.2                   | -1.6                   | -0.2                  |

RP = return period, AAL = Average Annual Losses

Source: World Bank 2010i

Droughts also exacerbate Malawi’s already high levels of poverty. On average, droughts cause a 1.3 percent increase in poverty, but this rises to almost 17 percent during a one-in-twenty-five year event. This is equivalent to an additional 2.1 million people falling below the poverty line. When droughts occur, their impacts vary considerably across regions and population groups, with smaller-scale farmers most vulnerable to drought-induced economic losses. Non-farm and urban households are also vulnerable, especially the poor who spend a large proportion of their income on food. The impact of floods is more severe in the southern Shire River Valley.

### **Adaptation to coastal surges, cyclones, and changing marine environments**

Adapting to changing marine environments has been a major challenge for many fishing communities along Africa's coastline. Cyclones regularly affect the southern Indian Ocean region, particularly Madagascar and Mozambique, demanding new concepts for risk assessment and adaptation. In the aftermath of the 2008 cyclone season in Madagascar, a project has been launched to strengthen the national capacity for climate risk management and institutionalize DRM in national economic planning. Most activities have been implemented in a concerted approach around climate risk management, including modeling cyclone wind risk, strengthening risk modeling expertise of government officials, developing cyclone proof norms and standards for key public infrastructure in high risk areas (such as schools and health centers), and the establishment a risk financing mechanism for cyclone risks.

A project on community co-management for disaster risk management in West Africa aimed to build capacities among vulnerable, poor, and rural coastal communities in Senegal, Ghana, Liberia, and Sierra Leone. As one of the main results a science tool kit to equip coastal communities with instruments to monitor a changing marine and coastal environment was launched. The project has been implemented

between 2008 and 2010, with the support of the Sub-Regional Fisheries Commission<sup>12</sup> and the World Bank's *Global Program on Sustainable Fisheries*. It has shown how communities can get involved in monitoring their own their immediate environment and help them to build community based adaptation strategies.

### **Capacity building**

Capacity building is integral in any risk and vulnerability assessment project. One example of capacity building for complex issues such as climate change has been a hands on training workshop for climate observations and regional modeling in the Greater Horn of Africa region. The WMO, in partnership with the Global Climate Observing System (GCOS), World Climate Research Program (WCRP), and IGAD ICPAC in Nairobi, Kenya have implemented the project. Participants from Burundi, Djibouti, Eritrea, Ethiopia, Kenya, Rwanda, Somalia, Sudan, Tanzania, and Uganda have learned to use extreme climate data and climate indices, apply and downscale climate change models, and address policy issues during three hands-on workshops. Practitioners in the various user communities (that is, DRM, agriculture, water resources management, and so forth) have jointly participated with their colleagues from the national hydrological and meteorological services.

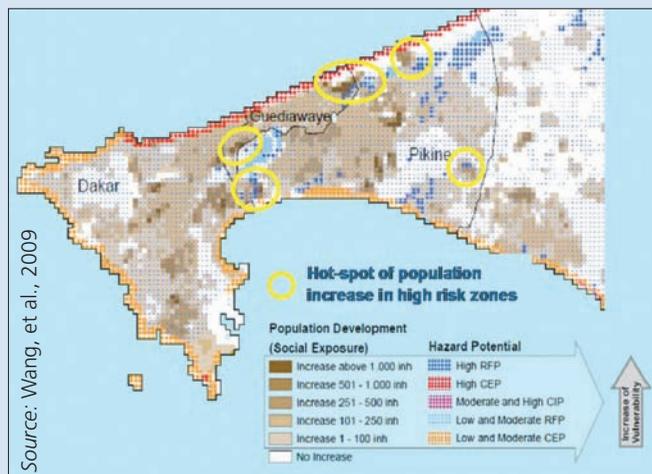
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<sup>12</sup> Commission Sous-Régionale des Pêches, CSRP.

#### Box 4: Managing natural hazards and climate change in Dakar, Senegal: A spatial and institutional approach

In June 2009, a pilot study on a spatial and institutional approach of disaster risk management was carried out through GFDRR funding. The study assessed flooding, sea-level rise, and coastal erosion in Dakar, Senegal. Its aim was to propose a new methodology for rapid assessment of natural hazard risks at a metropolitan-regional scale, using new spatial analysis tools based on geographic information system (GIS) data and a framework for a comprehensive institutional analysis based on the Climate Change City Primer<sup>13</sup>.

Much of the rapid population growth in the Dakar metropolitan areas has taken place in areas outside the city center, creating a sprawling peri-urban environment. Some of these areas are exposed to natural hazards, but face unclear administrative and governance arrangements. The study overlaid hazard analysis with population maps, land price data, and land cover information to determine exposure to flooding, sea-level rise, and coastal erosion at different locations. The spatial analysis highlighted three main areas:



- Potential hotspots and risk areas illustrating the type and degree of vulnerability (Figure 7)
- Built-up areas exposed to risk: general characterization of urban land use (that is, residential, industrial and commercial, and so forth) including type of vulnerability
- Non-built-up areas exposed to risk: general characterization of the land use, topography, and soil, including type of vulnerability

**Figure 7:** Hot spots of population increase in high risk zones in Dakar, Senegal

The analysis concluded that the peri-urban areas of Dakar encompass the largest community exposed to natural disasters within the metropolitan area. Up to 40 percent of newly settled areas in peri-urban areas face significant risk levels. This rate is twice as high as in the urban centre of Dakar and surrounding rural areas (19 percent and 23 percent, respectively). Land and property worth up to \$2 billion in the affected areas are located in highly hazard prone areas.

A survey based on the Climate Change City Primer reviewed general administrative information, governance structures related to disaster risks, urban planning and land use regulations, as well as political, economic, and social factors. The survey found that the local and municipal entities have only very limited scope to implement DRR strategies and influence policies. Land use planning instruments remain under the influence of national authorities. The study calls for a frank assessment of the institutional resources and capacities for DRR in the Dakar metropolitan area. Local agencies and communities should play a vital role in DRR and preparedness and demand for improved land use planning and disaster response.

<sup>13</sup> World Bank, 2009: *Climate Resilient Cities: A Primer on Reducing Vulnerabilities to Disasters*. By Neeraj Prasad, Federica Raghieri, Fatima Shah, Zoe Trohanis, Earl Kessler, Ravi Sinha. Washington.

### Box 5: Weather risk management in Ethiopia

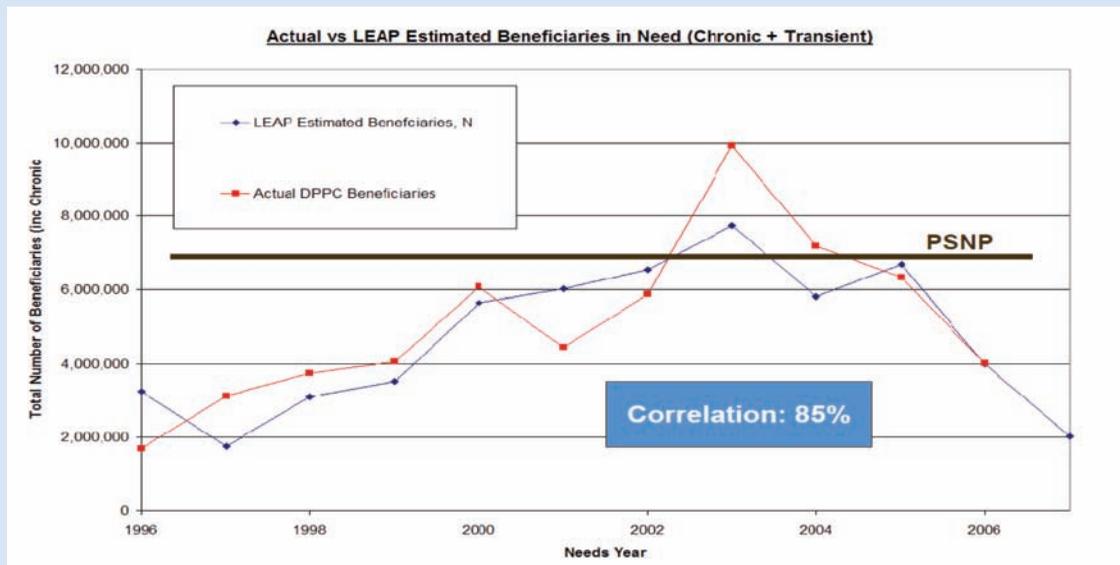
The economy of countries such as Ethiopia still depends largely on rain-fed agriculture. In rural areas, more than 80 percent of the population often relies on agriculture. Despite progress made in supporting rural livelihoods and improving agricultural technologies (for example, application of fertilizer, improved irrigation, and water harvesting), weather risks, particularly frequent droughts and flooding, continue to pose major threats to livelihoods and food security. Farmers and pastoralists in many drought-prone areas have become dependent on humanitarian relief and food aid.

To address these issues, WFP and the World Bank, in collaboration with GoE, have been investigating the possibilities of risk financing through weather insurance programs for farmers and pastoralists based on crop, pasture, and flood indices. The LEAP index is intended to harmonize key components of a risk management framework to translate early warning information into early response. Information provided through LEAP should ultimately trigger responses through an established social protection framework such as the multiple donor-sponsored Productive Safety Net Program (PSNP).

The LEAP software combines rainfall, crop growth, and water balance data. Earlier assessments suggested that rainfall data alone would be too crude to predict the risk of crop failure. Using a crop growth model for the major Ethiopian staples such as teff, the software estimates potential yield reduction. Linear regression is used to combine this regional drought index with a regional total beneficiaries index. The PSNP can use this information to estimate the number of people in need of contingency support. Figure 8 shows the correlation between actual and estimated number of beneficiaries in need of food assistance and relief operations with a correlation of 85 percent.

LEAP is intended to build an objective, accurate and timely estimation of livelihood protection and funding needs, which can be met through PSNP, contingency funds, public and private insurance schemes, or flash appeals. The LEAP components will be further developed for flood risks and made fully operational in the Ethiopian Ministry of Agriculture. For further information, including access to the LEAP software, visit <http://vam.wfp.org/LEAP>.

**Figure 8:** Total LEAP est. beneficiaries vs. actual beneficiaries of food security operations in Ethiopia



Source: Wiseman and Hess, 2008. Note: "blue line" - LEAP Estimated Beneficiaries; "red line" - Actual DPPC Beneficiaries, now DRM and Food Security Sector of the Ministry of Agriculture

## 2. Disaster response and recovery

Six countries in Sub-Saharan Africa called upon assistance from the World Bank and GFDRR in the aftermath of disasters in 2008 and 2009. PDNAs and similar ex-post activities were conducted to support recovery and reconstruction efforts after cyclones, floods and earthquakes.

### PDNAs

PDNAs refer to a standardized instrument for assistance in post-disaster situations, agreed to by the European Commission, the United Nations, and the World Bank in 2008<sup>14</sup>. Since then, PDNAs have been applied worldwide, such as in the aftermath of the 2010 earthquake in Haiti. They are designed to assess socio-economic impacts, identify recovery and reconstruction needs, and provide assistance to affected governments and for the donor community to identify and prioritize response and recovery options. PDNAs are led by the governments of the affected areas and are designed to coordinate efforts among UN agencies, the World Bank, the European Commission (EU), other bi- and multi-lateral donors, as well as NGOs. GFDRR has provided financial and technical support for these assessments.

A PDNA is ideally conducted after the immediate post-disaster humanitarian response phase. A PDNA team normally includes sector experts (agriculture, urban planning, infrastructure, and others) from the government and the various participating organizations. The assessment of socio-economic impacts has been adapted from the Damage and Loss Assessment (DaLa) methodology, which was initially developed in the 1970s by the United Nations Economic Commission for Latin America and

the Caribbean (UNECLAC) and revised since then. The DaLa methodology assesses damages to property, losses to the economy, and the general impact on the macro-economic situation of a country, and also looks at impacts on livelihoods, households and incomes (Box 6).

PDNAs sketch a recovery framework-addressing short-, medium-, and long-term recovery needs and prioritize interventions for recovery as part of a longer-term strategic development plan. PDNAs determine strategies for reconstruction that help to reduce vulnerability to disasters. This is often referred to as 'build-back-better-strategies'. Increasingly PDNAs are also becoming a strong basis for disaster and climate proofing infrastructure.

### Assessments in 2008 and 2009

In 2008 and 2009 the Africa region of the World Bank assisted with four PDNAs (in Namibia, Senegal, Burkina Faso and CAR), and a Joint Damage Loss and Needs Assessment in Madagascar. Malawi was assisted with rapid assessments after the earthquakes. The damages and losses of these disastrous events reached \$174 million and \$159 million respectively after the three 2008 cyclones in Madagascar (Box 7) (Government of Madagascar, 2008), while the floods in urban Bangui (CAR) on the other hand, caused only limited damages in the magnitude of \$6 million. Table 3 summarizes the estimated damages, losses and demand for reconstruction from these particular events in 2008 and 2009. The estimated impacts on the economy at large ranged from a 4 percent reduction in GDP after the cyclones in Madagascar to a fraction of a percent of GDP after the floods in Bangui.

<sup>14</sup> European Commission, UNDG and World Bank, 2008: *Joint Declaration on Post-Crisis Assessments and Recovery Planning signed on 25 September 2008* by the European Commissioner, the Administrator of UNDP on behalf of the UNDG, World Bank Vice President for Operations Policy and Country Services. Online available at: <http://oneresponse.info/GlobalClusters/Early%20Recovery/publicdocuments/UN%20and%20World%20Bank%20Joint%20Declaration.pdf>

### Box 6: Methodology for DaLa

PDNAs use the DaLa methodology to calculate damages and losses as well as the social, economic, and environmental impacts of the disaster. The UNECLAC developed the DaLa methodology in the 1970s, and it has been continuously revised and expanded since then for use in different areas of the world. The DaLa provides a close approximation of damages to property and losses to the economy and summarizes total macro-economic impacts. Impacts on the macro-economic performance of the country, such as impacts on GDP, economic growth, or balance of payments, are based on countrywide baseline information of the national accounts. DaLa also assesses impacts on poverty and individual households, looking at employment opportunities, income reduction, and the number of people below the poverty line. DaLa estimates:

1. Damage as the replacement value of totally or partially destroyed physical assets that must be included in the reconstruction program
2. Losses in the flows of the economy that arise from the temporary absence of the damaged assets
3. The resulting impact on post-disaster economic performance, with special reference to economic growth, the fiscal position and the balance of payments

The assessment involves all macroeconomic sectors:

1. Productive sector, including agriculture, tourism, commerce and industries
2. Infrastructure sector, including housing, transportation, power, communication, sanitation and water supply
3. Social sector, including public buildings, education, health
4. Crosscutting issues, such as environment, religious and cultural assets, gender, HIV/AIDS

**DaLa Training in Africa:** In order to build regional and national capacities for PDNA in Africa, a dedicated training program for government officials was initiated. Training workshops focusing on the DaLa methodology were conducted in Uganda and Togo. It is envisioned that this form of DaLa training will reach out to further countries.

**Table 3:** Overview of damages and losses estimated in PDNAs and similar post disaster assessments supported by World Bank / GFDRR in 2008 and 2009

| Event      | Country      | Date month/year | People affected Thousand | Damages \$ million | Losses \$ million | Recovery/ Reconstruction \$ million |
|------------|--------------|-----------------|--------------------------|--------------------|-------------------|-------------------------------------|
| Cyclone    | Madagascar   | 03/2008         | 350                      | 174                | 159               | 155                                 |
| Floods     | Namibia      | 03/2009         | 350                      | 136                | 78                | 622                                 |
| Floods     | Burkina Faso | 09/2009         | 150                      | 102                | 33                | 266                                 |
| Floods     | Senegal      | 08/2009         | 485                      | 56                 | 48                | 204                                 |
| Floods     | CAR          | 07/2009         | 15                       | 6                  | 2.5               | 36                                  |
| Earthquake | Malawi       | 12/2009         | 18                       | 5                  | 1                 |                                     |

Source: GFDRR-supported PDNAs in Africa in 2008-09<sup>15</sup>

<sup>15</sup> PDNAs and similar post disaster assessments in 2008 and 2009; Sources: Government of Madagascar, 2008; Government of Namibia 2010; Government of Burkina Faso, 2010; Government of Senegal, 2010.

The six assessments also estimated costs for reconstruction and DRR efforts (immediate recovery, medium term recovery and reconstruction as well as long term reconstruction), with costs ranging from \$36 million in CAR to \$622 million in Namibia. The following examples highlight the range of build-back-better strategies determined in the PDNAs:

- Build-back-better-strategies worth \$622 million for capital investment to flood proof parts of northern Namibia proposed to the government and the international donor community. Box 8 highlights the estimates of damages and resulting short- and long-term construction of the transport sector after the floods in Northern Namibia, as an example.
- Mitigation strategies requiring in total \$36 million of capital investment and \$2 million of recurrent expenses were estimated to prevent recurrent urban floods in Bangui, CAR. The PDNA proposed a medium-term flood mitigation program combining community education measures with infrastructure works and public management reforms.
- The PDNA done in the aftermath of the 2009 Senegal floods suggests sustainable ways of reducing the risk of recurrent floods, especially in urban areas of Dakar. For the immediate recovery \$40.7 million and for medium to long term risk reduction efforts \$163.9 million were estimated. This includes structural (drainage infrastructure) and non- structural components (better urban management, disaster preparedness, and institutional strengthening).

As fairly objective assessments, PDNAs help governments prioritize investments, coordinate recovery efforts among donors, and highlight the need for external financing. The World Bank has been one of the partners supporting governments with additional financing in the aftermath of disasters. Following a disaster, international attention from UN agencies,

development partners, the media, and civil society organizations in the country raise the profile of DRR, particularly in the political context. PDNAs provide a unique opportunity to emphasize large-scale implementation of DRR activities.

This can also include policy interventions or the establishment of norms and guidelines for safe construction of houses and infrastructure. After the 2008 cyclones in Madagascar, for example, construction norms for cyclone-resistant housing were established (Box 9). Norms for safer housing and schools were also initiated in Malawi following the earthquake in the Karonga province. Although total damages were modest, the impact on the educational sector in Karonga was severe. Some 3,000 community schools were significantly damaged, raising the risk that thousands of students would be out of school for at least one year. With support from GFDRR, a team of structural engineers assessed the damages on school buildings and collaborated with the Malawi Institute of Architects to develop basic principles and building guidelines for the construction of schools and houses in the country.

PDNAs are mainly applied to major events that impact most of the country's economy. However, the impacts of smaller but frequently reoccurring events, such as urban floods, on an economy are frequently underestimated. While the total damage of a single event might be limited, the recurring costs and impact on livelihoods can severely set back the development of the affected area. The urban floods in Bangui are an example of this, as recurring floods in the area result in average annual damages and losses of \$7 million. The PDNA following the floods proved to be a unique opportunity to estimate the demand for forward-looking investments in the urban drainage sector and establish a dialogue on risk reduction and invest in mitigation efforts. Chapter D.2 provides further details on investment programs that used the recommendations of PDNAs and shows how long-term dialogues with governments strengthen risk reduction efforts.

### Box 7: Impact of the 2008 cyclones on the economy in Madagascar

The assessment following three major cyclones in Madagascar during 2008 estimated the impact on sectors, public and private assets, GDP, and foreign earnings (Government of Madagascar, 2008). Total damages and losses were estimated at \$174 million and \$159 million respectively. Major damages for the housing sector were estimated at \$127.6 million. The agricultural sector accounted for the biggest losses with \$103 million. Table 4 highlights these damages and losses. Estimates show that GDP was reduced by 4 percent in 2008 and the growth rate of GDP slowed by 0.3 percent. The balance of payments reduced from -4.9 percent to -5.6 percent of GDP through losses in the tourism sector, reduced agricultural exports and higher imports. Madagascar's treasury lost \$182.2 million largely through higher investments and costs for transport, public administration, and damaged irrigation infrastructure. In total, 125,000 people (4.3 percent of the total population) were affected (see chapter C.2). Estimations after the cyclones in Madagascar (Government of Madagascar, 2008) indicated that households were additionally affected with loss of income opportunities (particularly agricultural labor) adding up to some estimated 6.2 million working days.

**Table 4:** Disaster effects (damages and losses), ownership per sector (public and private) and impact on fiscal sector, after the 2008 Madagascar cyclone season. In millions of Madagascar Ariary<sup>16</sup>

|                                   | Disaster Effects  |                   |                   | Ownership by Sector |                   | Effects on Fiscal Sector |
|-----------------------------------|-------------------|-------------------|-------------------|---------------------|-------------------|--------------------------|
|                                   | Damage            | Losses            | Total             | Public              | Private           |                          |
| <b>Social Sectors</b>             | <b>212,193.20</b> | <b>24,425.60</b>  | <b>236,618.80</b> | <b>48,280.98</b>    | <b>188,337.76</b> | <b>35,934.80</b>         |
| Education                         | 5,276.60          | 1,059.90          | 6,336.50          | 6,055.48            | 281.06            | 2,288.90                 |
| Health                            | 11,230.00         | 5,690.50          | 16,920.50         | 16,920.50           | 0.00              | 5,690.50                 |
| Nutrition                         | 1,314.30          | 1,575.70          | 2,890.00          | 2,890.00            | 0.00              | 5,000.00                 |
| Housing, Publ. admin. buildings   | 194,372.30        | 16,099.50         | 210,471.80        | 22,415.00           | 188,056.70        | 22,955.40                |
| <b>Productive Sectors</b>         | <b>13,974.80</b>  | <b>212,216.10</b> | <b>226,190.80</b> | <b>9,515.00</b>     | <b>216,676.20</b> | <b>12,489.90</b>         |
| Agriculture, livestock, fisheries | 10,461.10         | 159,564.30        | 170,025.40        | 9,314.50            | 160,711.30        | 10,407.00                |
| Industry and commerce             | 2,849.50          | 27,423.80         | 30,273.20         |                     | 30,273.20         | 64.70                    |
| Tourism                           | 664.2             | 25,228.00         | 25,892.20         | 200.50              | 25,691.70         | 2,018.20                 |
| <b>Infrastructure</b>             | <b>60,792.10</b>  | <b>24,954.90</b>  | <b>85,747.00</b>  | <b>63,681.80</b>    | <b>22,065.20</b>  | <b>69,970.40</b>         |
| Electricity                       | 3,502.40          | 2,957.60          | 6,460.00          | 6,460.00            |                   | 2,957.60                 |
| Water and Sanitation              | 616.8             | 1,729.00          | 2,345.80          | 1,155.00            | 1,190.80          | 3,000.00                 |
| Transport                         | 55,383.60         | 20,083.60         | 75,467.20         | 55,383.60           | 20,083.60         | 63,899.00                |
| Telecommunications                | 1,289.30          | 184.70            | 1,474.00          | 683.20              | 790.80            | 113.80                   |
| <b>Cross-Sectoral</b>             | <b>356.6</b>      | <b>475.80</b>     | <b>832.40</b>     |                     | <b>832.40</b>     |                          |
| Environment                       | 356.6             | 475.80            | 832.40            |                     | 832.40            |                          |
| <b>TOTAL</b>                      | <b>287,316.70</b> | <b>262,072.40</b> | <b>549,389.00</b> | <b>121,477.78</b>   | <b>427,911.56</b> | <b>118,395.10</b>        |

Source: Government of Madagascar, 2008.

<sup>16</sup> Reference exchange rate of 1 USD = 1650 Madagascar Ariary.

### Box 8: Damages, losses and reconstruction of the transport sector after the floods in Namibia



Photo: Denis Jordy, The World Bank

Urban transport affected during floods in Dakar, Senegal in 2009.

The 2009 floods in northern Namibia among others impacted the transport sector, with major impacts on bridges and secondary and tertiary roads. East-west roads were damaged by floodwaters from the Cuvelai basin, while north-south roads were particularly affected by standing water. The floods damaged many secondary roads, which were not built according to international standards. In total about 408 kilometers of roads were fully or partially damaged.

Transport services were limited to shuttling on short distances, which stayed free of water, for some thirty to forty-five days. When transport services resumed, costs were often higher due to longer routes, damages to vehicles, and higher fuel consumption. The Roads Authority spent approximately \$2.3 million for emergency repairs. Fully damaged roads had to be reconstructed, ideally not only to the pre-disaster conditions, but also in accordance with proper standards and storm water drains.

The PDNA estimated short-term road rehabilitation costs at \$27.4 million. Costs for emergency mitigation measures, especially the construction of culverts, drainage and bridges, would cost \$23.7 million. Long-term investments, such as flood resilient road networks in rural and urban areas, were estimated at \$293.3 million. Table 5 summarizes estimated costs for short and long-term reconstruction efforts in the transport sector (Government of Namibia, 2010).

**Table 5:** Estimated costs for reconstruction and improved standards of the transport infrastructure in northern Namibia

| Activity  | Value (USD million) |
|---|---------------------|
| <b>Urgent Reconstruction (short-term)</b>               |                     |
| Road rehabilitation                                     | 27.4                |
| Urgent construction of bridges and culverts             | 23.7                |
| <b>Improving standards (long-term)</b>                  |                     |
| Upgrading of critical roads                             | 193.3               |
| Access to critical services and villages                | 83.4                |
| Improve storm water management in Oshakati and Ondangwa | 16.7                |

Source: Government of Namibia, 2010

### Box 9: Improving building standards for cyclone-affected areas in Madagascar



Photos: Georges Lamoure, IMI



#### Improved building standards for cyclone resistant traditional houses in Madagascar

PDNAs often reveal that some damages and losses were avoidable and often caused by weak housing and construction standards. Without governmental support, planning, or enforced standards, poor and high-risk populations often have no other option following a disaster than to carry out sub-standard reconstruction and resettlement in high-risk areas. Without adequate funding, public assets such as hospitals, schools and government buildings tend to be reconstructed to pre-disaster standards and conditions. Critical improvements to avoid future disasters and work toward sustainable DRR are often lacking. Consequently, some communities and local governments try to rebuild using their own resources, means, and norms.

Building codes are therefore an important instrument to be developed by governments and the construction industry. Incentives, training, public awareness, and compliance mechanisms are key components to adopting and enforcing building codes. Cyclone-resistant building codes were drafted after the 2008 cyclones in Madagascar with the support of the World Bank and GFDRR, building on earlier experiences from Ile de la Réunion and Tonga. Codes were defined according to different risk zones. Buildings in Zone 1 (in the northern and northeastern tip of the island) have to resist wind speeds of up to 266 km/h. In this zone, estimates from field tests suggest that with the new building standards, only one out of one thousand buildings would be damaged. For zones in less frequently and less severely affected areas, construction codes can be less strict. Costs for construction according to these standards can be estimated to be only 14 percent higher than costs for comparable constructions not following these standards (for zones with storms around 126 km/h).

Madagascar's new construction codes are expected to become mandatory for public buildings, including schools and health centers. They will be recommended for traditional houses in high-risk areas. Shared experiences and guidelines for decision makers and engineers are compiled in the new *Safer Homes, Stronger Communities – A Handbook for Reconstructing after Natural Disasters* (World Bank, 2010f).

## D. Towards a comprehensive approach to DRR in Africa

Following a number of risk and vulnerability assessments and post-disaster assessments discussed in chapter C, this chapter highlights ways towards a more comprehensive approach to DRR. Starting with lessons learned from earlier activities, it describes the concept of focus countries and their country plans, including new approaches in post-disaster reconstruction, risk financing, regional cooperation, and new partnerships in Africa.

### Lessons learned from previous activities

The first implemented projects and activities have made significant strides towards DRR across the continent. They have been well appreciated by all partners and brought a number of innovative pilot activities forward. However, these experiences have also highlighted a number of gaps and challenges that should be addressed in future activities. Lessons learned were drawn from discussions with governments, development partners, feedback from GF-DRR's consultative groups, various recently published reports including the World Bank's Independent Evaluation Group's report on *Hazards of Nature* (World Bank, 2006). The lessons learned for the risk and vulnerability assessments can be summarized according to the following major points:

- The projects addressed often only one type of hazard or economic sector, such as urban floods in Senegal, or droughts in Ethiopia. Ideally projects would focus on all sectors and particularly on those with critical knowledge gaps in the country. Beyond risk assessments, the involved countries and communities expressed their interest in targeted investments in risk reduction and thereby address those hazards.
- The impact on institutional dialogues or the development of risk reduction strategies and policies corresponding to the HFA limited. To strengthen the national disaster risk manage-

ment institutions and policies, a long-term commitment and dialogue with governments is required that fosters awareness and supports policy and institution building for DRM.

- Projects were implemented in ten countries, and regional cooperation projects targeted participants from an additional twelve countries in western and eastern Africa. To be more effective the program should – focus on those countries – which are most affected by natural disasters in the region.
- Many of the projects were stand-alone activities with only limited follow up and coordination towards a programmatic approach. Ideally risk and vulnerability assessments would be mainstreamed in larger programs and activities. A successful example is the LEAP project (Box 5), which shall be integrated as part of a larger contingency planning instrument in the Productive Safety Nets Project (PSNP) in Ethiopia.
- In many countries PDNAs provided a unique momentum for risk reduction and future reconstruction. However, the conducted PDNAs showed the demand for long-term investments in risk reduction often exceeded the available funds from governments and donors for immediate investments.

### Towards a comprehensive dialogue and investments in DRR

The lessons learned – created a more comprehensive dialogue and commitment to those countries, which are most severely affected by natural hazards, thereby strengthening their capacities and increasing resilience to natural disasters. Disasters can provide a unique momentum to advance the risk reduction agenda and facilitate investments in risk reduction efforts. At the same time new opportunities and part-

bottlenecks in this field. Following PDNAs in Senegal, CAR, and Malawi, dedicated investments have been prepared or are currently under discussion. The Africa DRM Team supports countries' investments in build-back-better and mitigation strategies and facilitates a constructive dialogue with partner governments, development partners and civil society organizations (see chapter D.2). The dialogue of civil society organizations and parliamentarians in Senegal to advance these activities following the PDNA is highlighted as an interesting example in box 10;

- New analytical work and recently launched programs on climate change adaptation suggest a more coordinated approach to advancing both the DRR and climate change adaptation agendas. The first results of the World Bank case study on Economics of Adaptation to Climate Change are available (World Bank, 2010h). The Africa DRM Team seeks to use synergies with the newly established funds for climate change adaptation.

Regional cooperation with the AU, RECs, specialized agencies, or other regional organizations may facilitate risk assessments, for example, concerning floods in larger river basins. Often regional centers of excellence can efficiently organize capacity building and knowledge sharing. First steps in this direction have been set, but the Africa DRM Team wants to strengthen regional activities (see chapter D.3). New partnerships, for example, with the African Caribbean and Pacific Group of States (ACP), may enable the financing of activities in more countries across the continent (Box 11).

New funding mechanisms, such as risk insurance and risk transfer, can help mitigate some of the most severe impacts of natural hazards including the rising risks and uncertainties due to climate change. The Africa DRM Team is exploring options for risk sharing and risk financing which are suitable for Africa (see chapter D.4).

## 1. DRM country plans

To address the DRR framework more comprehensively and to engage in a long-term dialogue with key stakeholders, the Africa DRM Team initiated DRM country plans. This chapter provides an overview of the selected focus countries and the structure of the proposed activities. Building on the specific hazard and vulnerability profile of countries, nine focus countries were initially selected to test and implement the concept of country plans:

### **Burkina Faso, Ethiopia, Ghana, Madagascar, Mali, Malawi, Mozambique, Senegal, and Togo**

The goal of the DRM country plans was to implement a set of comprehensive activities encompassing all aspects of the HFA based on objectives specified by the focus countries. The process of drafting and implementing country plans, as such, is a unique opportunity to facilitate a dialogue with governments and stakeholders on risk reduction and climate change adaptation. This process began in 2009 through multi-stakeholder consultations involving national DRM authorities, national DRM platforms, sector ministries, UN agencies (UNDP, WFP, UNISDR, others), multi- and bilateral development partners, NGOs, and CSOs. The country plans consist of the following four main components:

- A thorough analysis of natural hazards in the country, livelihoods, economic vulnerabilities, institutional landscape, legislation, and policies;
- Ongoing activities and policies related to the five pillars of the HFA and detection of gaps;
- Identification of projects supported by other stakeholders;
- Plan of action with priorities for implementation as agreed with governments and discussed with stakeholders.

### Box 10: Parliamentarians' support for disaster risk reduction in Senegal

The Post Disaster Needs Assessment, following the torrential rain falls in August/ September 2009, indicated that not so much the magnitude of the event, but rather lacking drainage infrastructure, increasing groundwater levels, lack of timely interventions and response might have exaggerated the floods to a disaster. Media coverage (among others through national television and *Radio France International*), the involvement of civil society organizations, parliamentarians and international development partners put the issues of regular urban flooding high on the political agenda in Senegal.

Following the events civil society and parliamentarians closely followed the proposed strategy in flood protection and risk reduction. In May 2010 the parliamentary commission on spatial planning and development dedicated a special session to flooding and discussed the proposed intervention strategy. With the next winter rainy season ahead, the working group recommended emergency measures to improve the pumping and drainage of water, secure financing, install a high level coordination mechanism for efforts, and improve the capacities of the Civil Protection Directorate as well as other sector ministries (sanitation, urban development). They also invited to Government for a national debate on floods in the national assembly.

In July an extra-ordinary session of the national assembly was called by the parliamentary commission to discuss re-occurring floods and identify practical solutions. Several high level ministers were present in this extra-ordinary session of the assembly. The government was called to act fast and implement mitigation measures before the rainy season would again cost severe damages and losses. The need for long term solutions was well underlined. In response the government expedited an action plan to mitigate the impacts of the following rainy season. The plan included a.o. emergency drainage infrastructure for the rapid evacuation of water to the sea, drainage of retention basins and strengthening and reorganization of the pumping system.

It was one of the first times that parliamentarians in Senegal demanded an extra-ordinary session of the national assembly on floods. The PDNA did not only highlight the damages and losses and required interventions for reconstruction, it also contributed to an open and transparent process, involving parliamentarians and civil society organizations, leading to interventions on disaster risk reduction. Further investments in to reduce urban flooding in Dakar and other cities of the country may in future be included in the countries development planning (SENEGO, 2010).

nerships have emerged, that place DRR on a larger foundation. The Africa DRM Team has put this in place through three main pillars:

- The Africa DRM Team concentrates its activities on nine focus countries that are most vulnerable to natural hazards in Sahel, the Horn of Africa, and southeastern Africa. In these areas, comprehensive disaster risk management country plans have been established. They enable a long-term dialogue over a period of three to five years and focus strategic investments along the five pillars of the HFA. DRM country plans provide

a platform for tailored activities to strengthen risk reduction, institutions, hazard assessments, capacity building and response and recovery efforts. This long-term commitment to these countries provides a response to the reoccurring nature of many disasters in Africa;

- PDNAs often result in a momentum for continued dialogue with partner governments, investments in mitigation measures, and build-back-better strategies. In many countries risk mitigation strategies like construction norm have been established and enforced after the PDNA unveiled

### Box 11: Embracing new partnerships with the EU – ACP Natural Disaster Facility



Photo: Rimma Dankova, The World Bank.

#### Community-based early warning exercises in Malawi

The ACP is a group of seventy-nine states (of which forty-eight are African states) cooperating for sustainable development through partnership in the European Union (EU). The ACP countries are some of the most risk prone countries in the world, and some belong to the least developed countries, small island states, and land locked group of countries. The EU and the ACP Group of States have set up a natural disaster facility called the - Cotonou's Partnership Agreement. The main objective of the natural disaster facility is to address the issue of vulnerability in ACP regions re-enforcing disaster management at regional and national levels. The ACP secretariat is one of the partners of GFDRR, providing a unique opportunity for a close cooperation between EU, ACP, GFDRR, and the World Bank. This cooperation will supplement the ongoing activities of the World Bank and GFDRR on disaster risk reduction in the region. It shall support activities fostering regional cooperation, mainstream DRM through technical advisory activities, and support recovery activities in the following ways:

- Regional and sub-regional cooperation to cope with trans-boundary risk reduction efforts, including risk mapping, regional early warning systems, regional flood risk management in flood risk management, knowledge exchange and capacity building with ECOWAS, SADC, ECCAS, and other regional Economic Commissions.
- Mainstreaming projects supporting ACP countries to implement need based DRR actions such as better hazard mapping, strengthening national policy, and establishing norms.
- Facilitate post disaster recovery and reconstruction activities through ex-ante capacity development, ex-post assistance that enable drawing up an rebuilding plan, advisory service to disaster stricken governments, and matching funds for the implementation of DRR components recommended by PDNAs.

### Structure and proposed activities

Its plan of action consists of grants for activities totaling approximately \$5 million to be implemented over a three to five year period. They will be implemented through the national agencies and through the World Bank country offices, often with the support of other national and international consultants. The Africa DRM Team drafted the majority of the DRM country plans for Africa in 2009 and 2010, and launched the country plans for Ethiopia, Ghana, Mali, Malawi, Mozambique, Senegal, and Togo. The country plans for Burkina Faso and Madagascar are currently being drafted and negotiated with the governments. A summary overview of the status of the DRM plans already underway is provided in the annex. The proposed activities are designed around the five pillars of the HFA:

#### **HFA 1: Strengthen national DRM strategies and institutions**

Local and national disaster management strategies and institutions need to be strengthened in their efforts to shift towards an ex-ante approach of disaster risk reduction. Proposed actions may include establishing national and regional disaster management units; developing DRM policy and legislation, assessing institutional capacity and providing training for disaster management officials, and promoting dialogue among stakeholders.

#### **HFA 2: Ensure risk and vulnerability assessments, early warning, contingency planning, financing**

Proposed actions support this HFA pillar through developing hazard risk maps and models that identify vulnerabilities to help governments prioritize physical interventions; supporting early warning systems to allow countries to better predict natural hazards, adoption of emergency response protocols, and more organized and efficient disaster responses; and supporting contingency planning and financing, including risk transfer strategies.

#### **HFA 3: Increase and sustain awareness creation, education and capacity building**

Under this pillar, capacity building and curriculum development activities range from awareness raising campaigns addressed at secondary and primary schools, to the support of university programs and dedicated research at national DRM institutions.

#### **HFA 4: Reduce underlying risks and vulnerabilities**

Most country plans showcase strategic innovative interventions to reduce underlying risks and vulnerabilities. These are often smaller pilot activities, with the potential to be expanded by governments and development partners, addressing innovative concepts related to flood or drought management, housing and construction norms.

#### **HFA 5: Improve emergency preparedness and response through capacity strengthening**

Activities include the implementation of rapid response and recovery protocols, capacity building in standardized damage and loss assessments, and community-based DRM pilot exercises.

## **2. Disasters as a momentum for mainstreaming and investments in risk reduction**

In Senegal and Burkina Faso, the 2009 floods overtook the preparation of the DRM country plans. Following these events, the World Bank conducted PDNAs (see chapter C.2), which provided momentum to invest in risk reduction and mitigation. This chapter describes these investments and provides an overview of the World Bank's instruments for financial and technical assistance.

Some PDNAs conducted by the World Bank in Sub-Saharan Africa have successfully supported national governments to leverage additional finance for investments in the aftermath of disasters. Together with other bi- and multi-lateral development partners, the World Bank supports investments in recovery and risk reduction.

- Additional financing to supplement the Emergency Urban Infrastructure Rehabilitation and Maintenance Project for the CAR has been mobilized in 2010. The project includes investments in water supply, flood reduction and mitigation, solid waste, and urban roads including technical assistance for institutional strengthening. In response to the 2009 floods, –\$5 million was made available from an exceptional natural disaster-related allocation;
- Additional financing is being provided for Malawi under the Malawi Social Action Fund (MASAF) to support fifteen disaster-affected districts through: (a) increasing the existing public works program and (b) reconstructing and retrofitting earthquake-damaged education infrastructure. For the reconstruction of damaged education infrastructure, \$4 million was added to the MASAF project;
- In preparation for the next rainy season, the Government of Senegal developed an action plan that includes immediate measures for the rehabilitation of strategic drainage channels, retention basins, and pumping equipment. These measures will largely be financed through government resources. The World Bank financed Local Authorities Development Project<sup>17</sup> (PRECOL) supports the acquisition of motor pumps, hoses, and other equipment. Preliminary discussions have begun for future investments in flood prevention and drainage to be financed by the World Bank and development partners. Based on findings of the PDNA it may include structural and non-structural measures such as drainage systems, urban restructuring, and institutional strengthening.

### **Instruments for mainstreaming DRR across sectors**

Through continued dialogue following post disaster assessments, country plans, or other pilot projects, DRR is often recognized as a priority in the countries' development agenda and investments. The Africa DRM Team supports mainstreaming of DRR and facilitates the integration of risk reduction efforts in major investments and programs.

Poverty Reduction Strategy Papers (PRSP) and Country Assistance Strategies (CAS) increasingly make risk reduction and climate change adaptation a priority. The World Bank provides technical assistance to help client countries integrate climate hazards, livelihood vulnerabilities, and infrastructure concerns into strategic planning documents. Technical assistance through Economics and Sector Works (ESW) can address hazards such as droughts and floods, and institutional and management issues for the preparation of larger investments. The systematic screening of investments for their climate risks will become increasingly important in the future.

The World Bank has supported a large number of projects supporting post-disaster reconstruction and recovery. With Emergency Recovery Loans (ERL) the World Bank has a dedicated instrument to assist with reconstruction investments. ERLs follow an expedited process of project appraisal and approval according to Operational Policy 8.00 Rapid Response to Crises and Emergencies.

Lending operations across various sectors integrate risk reduction efforts in the project design and implementation. For example, drought and food security are addressed through the Productive Safety Net Project in Ethiopia, while urban development projects often have a dedicated component for improving drainage facilities and urban spatial planning targeting informal settlements in flood plains. They often

<sup>17</sup> Programme de Renforcement et d'Équipement des Collectivités Locales (PRECOL).

build upon earlier experiences and results from post-disaster assessments or pilot activities. An evaluation of the World Bank's support following natural disasters indicates that from 1984 to 2006, more than nine percent of all World Bank commitments directly or indirectly addressed disaster risk reduction and recovery issues (World Bank, 2006).

### 3. Towards regional cooperation and partnerships with climate funds

A number of disaster risk reduction efforts gain further reach and strength once they are coordinated regionally. Regional cooperation through Regional Economic Communities (ECOWAS, IGAD, SADC and others), River Basin Organizations, other regional bodies, or among individual countries or communities are becoming increasingly important. Linkages with existing initiatives such as the Climate for Development in Africa Programme (CLIMDEV) on strengthening climate services or TerrAfrica, a partnership to improve sustainable land use management across the continent can be a good start. Using the synergy with the recently established climate change adaptation funds of World Bank, international finance institutions and other development partners may help to set DRR on a broader foundation. New partnerships with the EU ACP (African, Caribbean, Pacific Group of States) will help to initiate activities in even more countries across the continent (Box 11).

The Africa DRM Team wants to strengthen regional cooperation for capacity building and knowledge exchange and embraces projects with a regional focus. The following areas will particularly benefit from regional cooperation:

- Regional cooperation of hydro-meteorological services to strengthen early warning capacities and exchange data and information across borders (This is also relevant for the exchange of geo-hazard information for earthquake assessments.);

- AU, RECs, and other organizations (for example, river basin organizations) have a large convening and mobilizing power for their member states. A number of national DRM strategies have been aligned with the strategies of these regional organizations;
- Countries sharing a common river basin need to cooperate through river basin organizations for functioning cross-border flood protection systems;
- Research and development through the cooperation of universities and research institutions will help to create high-level capacities, for example, in the field of remote sensing and use of satellite technology for early warning systems, mapping of disaster impacts and others;
- Peer learning, exchange of information and knowledge between government officials, professionals, and citizens will become an important instrument;
- Regional risk transfer schemes among sovereign states have already been initiated in the Caribbean and other parts of the world. Pooling risk among sovereign countries could become a more important instrument (see chapter D.4).

Jointly with ECOWAS, a Regional Exchange and Cooperation on Transnational Flood Impacts and Preparedness Mechanisms in West Africa was facilitated. The activity aimed to (a) review primary transnational causes, effects, and impacts of floods in West-Africa; (b) understand climate change and variability in the region; (c) review the history of cooperation on flood and drought prevention, response and recovery at national and regional levels, and (d) identify strengths, weaknesses, and good practices. This study supported Ecowas and its West African member states to be better prepared to address natural disasters and enhance cooperation in DRR, relief and recovery efforts in the region. The World Bank and GFDRR have

supported many other regional cooperation activities in Africa recently, including hands on training on climate modeling.

#### **Funds for climate change adaptation**

In close cooperation with regional financial institutions such as the African Development Bank (AfDB) and the United Nations Development Programme (UNDP), the United Nations Environment Programme (UNEP) and the United Nations Framework Convention on Climate Change (UNFCCC), several new funds for climate change adaptation and disaster risk reduction have been established<sup>18</sup>. The Pilot Program for Climate Resilience (PPCR) is one of the main programs the recently created Climate Investment Funds of the World Bank.

The Climate Investment Funds also include PPCR that focuses on Zambia, Mozambique, and Niger. The World Bank, in cooperation with the regional development banks, has approved these countries to promote international cooperation on climate change and support progress on the climate regime. PPCR is already entering into its first phase of implementation and will support countries that make national development plans more climate resilient through significant investments. These pilot activities will build on National Adaptation Program of Action (NAPA) and other relevant country studies and strategies.

#### **4. Towards preparedness, contingency and catastrophic risk financing instruments**

The HFA highlights the importance of financial risk sharing mechanisms, especially insurance and re-insurance against disasters. The need for comprehensive risk financing strategies for disaster-prone countries is a priority, not only due to the increasing frequency of hazards, but also due to the growing concentration of valuable assets (particularly in urban areas) and limited resources ex post

reconstruction. While risk transfer schemes and insurances have long been established in developed countries, innovative risk financing mechanisms are particularly limited in middle- and low-income countries (Cummins & Mahul, 2008). However, a precondition for the large-scale establishment of an insurance scheme is a more mature market environment, and extensive information on hazard risks to determine the likelihood of particular events and subsequently insurance premiums.

In general, risk sharing and insurance initiatives can be distinguished between those at the macro level addressed to sovereign governments, and those at the micro level addressed to individuals and enterprises (for example, farmers). These instruments can provide immediate liquidity to governments for post-disaster relief and reconstruction of damaged government properties and infrastructure, and offer insurance to homeowners, businesses, and the agricultural community to mitigate the financial impact of disasters.

A few catastrophe risk insurance schemes addressed to sovereign governments have been initiated in developing countries. One example is the Caribbean Catastrophe Risk Insurance Facility (CCRIF) providing parametric risk insurance for high-risk, small island states in the Caribbean. Some countries in Africa have launched initiatives in this field, but these are at an incipient stage only. Through diversification effects across different weather zones in Africa, there could indeed be financial advantages to pooling risk across the continent. The Second Ministerial Conference on Disaster Risk Reduction in Africa<sup>19</sup> called upon the African Union member states, “to explore the feasibility of continental financial risk pooling in working towards the creation of an African-owned Pan-African disaster risk pool, building on existing and emerging tools and mechanisms for financing

<sup>18</sup> For example: Global Environment Facility (GEF) Trust Fund and its special priority on climate change, the Adaptation Fund under the Kyoto Protocol, and the Least Developed Countries Fund.

<sup>19</sup> Second African Ministerial Conference on Disaster Risk Reduction Nairobi, Kenya, 14-16 April 2010.

### Box 12: Parametric weather risk insurance: Experiences from Malawi



In weather index insurance, payout is determined by an objective parameter such as the combination of a series of weather-related metrics— for example, millimeters of rain, soil moisture, and so forth. The monitoring costs of weather insurance are less since farm-level loss adjustments are unnecessary and the insured and the insurer equally share the balance of information about the weather. Thus, weather insurance could be a preferred alternative to crop insurance. Below is a brief description of the steps involved in developing weather-based insurance (Hess and Syroka, 2005):

- Step 1: Defining the Drought Index: Establishing a Maize Rainfall Index (MRI) as an indicator of drought, based upon rainfall and crop growth data.
- Step 2: Quantifying Drought Risk: A strong correlation between MRI and yield, particularly for below average maize yield years. This point could be considered the “trigger level” at which insurance will kick in.
- Step 3: Structuring the Insurance Contract: At the micro level, a farmer could buy a stand-alone insurance product with an up-front premium to be paid before the protection period. The farmer can take insurance at a trigger level relative to the MRI for the location. The insurance will compensate the farmer if the maize rainfall index for the growing season is recorded to be less than the trigger level.
- Step 4: Pricing the Contract: Weather-indexed insurance contracts are priced using an actuarially fair assessment of the risk an insurance company selling the contract takes. This will depend on factors such as historical rainfall data, average loss per year, average payout, and risk preferences of the company.
- Step 5: Executing the Contract: A national insurance company or farmer aggregators such as National Smallholder Farmers’ Association of Malawi (NASFAM) could act as agents for the distribution of the insurance.

disaster risk reduction” (UNISDR, 2010b<sup>20</sup>). First steps to support this initiative have been conducted by the World Bank and WFP.

For individual farmers and vulnerable communities, crop insurance and weather index-based insurance schemes for small farmers can play an important role. The cumulative negative impact of recurring natural disasters and conflicts results in sharp declines in agricultural productivity and losses of stored crops, creating temporary food

shortages. Governments and donors typically react to these shocks rather than managing the risks of the events occurring. Weather index-based risk management is a new concept that involves creating functioning markets, increasing smallholder productivity, establishing effective social safety nets, and preparing for food emergencies through ex ante emergency risk management. An example of parametric risk insurance developed with World Bank support for groundnut farmers in Malawi is presented in box 12.

<sup>20</sup> Ministerial Declaration adopted at the Second African Ministerial Conference on Disaster Risk Reduction Nairobi, Kenya, 14-16 April 2010 - Point 9.

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## Appendix I: Risk and vulnerability assessments

### **Mainstreaming disaster reduction for sustainable poverty reduction in Malawi**

The objective of this project (implemented between 2007 and 2010) was to address DRM in strategic planning and sectoral development policies, develop institutional capacities, and enhance preparedness at national and district levels. The main counterpart of the project was the National Disaster Risk Management Authority of Malawi (DoDMA). Aimed as a planning instrument for the government, this project estimated the economic vulnerability of the country to droughts and floods. The project consisted of the following core components:

- Water resources assessment in the Lower Shire River Basin highlighting strategic areas for investment in structural and non-structural flood protection measures
- DRM situation analysis
- Study on economics of vulnerability to natural disasters
- Capacity building program for district and local officers
- DRM country program development; to be implemented over a three to five year period

### **Preparing to manage natural hazards and climate change risks in Dakar, Senegal**

This project (implemented between 2008 and 2009) assessed hazards due to floods, coastal surge, and sea level rise in urban and peri-urban areas of Dakar, Senegal. Large areas of Dakar, particularly new and informal settlements in the outskirts of Dakar, are regularly affected by flooding. This study assessed the relative flooding potential, coastal inundation, and coastal erosion in a spatial assessment, and identified hotspots of high population increase in high-risk areas. The PDNA utilized the results and recommendations of the study in autumn 2009 and in preparation of further DRM project activities.

### **Mainstreaming DRR for sustainable poverty reduction: Mozambique**

This project (implemented since 2008) has provided technical assistance to the Government of Mozambique to mainstream DRR in strategic planning, increase national capacities, and enhance preparedness at national and district levels. The activity has also supported two studies, *Economic Vulnerability and Disaster Risk Assessment* (jointly with a project in Malawi) and *Analysis of the Urban Vulnerability to Climate Risks in the Cities of Inhambane and Maxixe*. The latter study identified flood and coastal surge hazards in the twin cities and highlights possible strategies to be addressed in urban development. This involved the active participation of the urban population of Inhambane and Maxixe. A national DRM country plan was jointly developed with the government under this project.

### **CAR flood recovery and resiliency program**

Following the floods in 2009 in the centre of Bangui, GFDRR and the World Bank assisted with a PDNA. A plan for capacity building in the most flood affected areas of Bangui followed on the PDNA, along with a study of flood risk in the entire country and an analysis of the national disaster response mechanism. Community-based pilot activities were identified with the support of an international NGO.

### **Facilitating provision of baseline vulnerability information on flood exposed communities in Ethiopia**

Although this work initially focused on baseline data collection for flood protection activities, the scope has been extended to support the establishment of a countrywide disaster risk and vulnerability profiles for the more than 700 woredas (districts) in the country. The project (implemented since 2008) has focused on the development of the methodology for the national woreda risk profiling exercise, backstopping and training of field enumerators and capacity building,

and training of staff at regional and woreda levels. The methodology has been fine-tuned and the first woreda profiles were established in 2010. A report on flood-exposed woredas is under preparation.

### **Ghana North – Sustainable development, disaster prevention, and water resources management**

Following floods in 2007 in the three northern provinces of Ghana, this project was established to assist the country with developing initial steps in long-term economic recovery planning, strengthening the national strategy for disaster prevention, and building knowledge and capacity for flood prevention and water resources management. The assessment of flood risks and prevention measures may feed into a broader scope of water resources and flood assessments in Ghana.

### **Ethiopia: Coping with adverse shocks of nutrition and health**

The project (implemented between 2008 and 2010) established a nutrition surveillance system that also functioned as a malnutrition early warning system. The system integrated nutrition and food security aspects in a broader humanitarian response addressing Ethiopia's chronic droughts. Facilities were also created by the project to produce high nutrition cookies with local resources for malnourished people.

### **Ethiopia: Weather risk management framework using weather based indices**

Severe droughts and related food insecurity have led to major humanitarian crises in Ethiopia. To assist interventions at a very early stage the LEAP indicator and software was developed by GoE and WFP. It linked objective climate and water balance data with historic food security interventions and their estimated costs. Through this weather-based risk management framework, costs for intervention can be determined at a very early stage and livelihoods can be protected through food for work or other contingency operations. This project supported the development of the software, field-testing and training of government

officials through the World Bank between 2008 and 2010. This activity shall be integrated in the contingency operations of the larger Productive Safety Nets Project in Ethiopia and further developed by defining coefficients for livestock keeping communities and further and outreach.

### **Integrated weather risk management for sustained growth in Burkina Faso**

This activity (implemented between 2008 and 2009) supported between the establishment of crop insurance and weather-related early warning systems for cotton farmers in Burkina Faso by developing the outline for cotton-crop insurance scheme. Targeted audiences of the project were government officials responsible for budget management, cotton producers (through the AICB or Confederation of Peasant Farmers of Burkina Faso), ginning companies, domestic banks and international re-insurance companies.

### **Mainstreaming climate and disaster risk management into economic development: Madagascar**

This project has been developed in the aftermath of the 2008 cyclone season in the country and builds upon the joint PDNA. Its main objective has been to strengthen the national capacity for climate risk management and institutionalize disaster risk management in national economic planning. Most activities have been implemented in a concerted approach around climate risk management, including modeling cyclone wind risk, strengthening risk modeling expertise of government officials, developing cyclone proof norms and standards for key public infrastructure in high risk areas (such as schools and health centers) and the establishment a risk financing mechanism for cyclone risks. Despite the crisis that has affected Madagascar since 2009, a number of activities have been implemented since then.

### **National disaster preparedness and response project: Seychelles**

This project (implemented since 2008) has focused on risk and vulnerability and the development of disaster

scenarios (mainly for flood and coastal hazards), early warning and emergency planning, and improvement of the response of capacity of the government the Seychelles. Among others the project has aimed to improve early warning capacities through siren towers on the island to warn inhabitants of risk of storms and floods. The project has looked at concepts to integrate marine oil spillage into early warning and response.

### **Community co-management for disaster risk management of marine resources in West Africa**

This initiative aimed to build capacities among vulnerable, poor, and rural coastal communities in Senegal, Ghana, Liberia, and Sierra Leone to: (a) fully comprehend and engage with the national government's policies on coastal and marine resource management; (b) develop local-level policies and strategies to help communities assume management of coastal and marine resources; and, (c) develop community-specific strategies to respond to local risk factors related to climate change. As one of the main results a science tool kit to equip coastal communities with instruments to monitor a changing marine and coastal environment was launched. The project was implemented between 2008 and 2010 with the support of the Sub-Regional Fisheries Commission (Commission Sous-Régionale des Pêches, CSRP) the World Bank's *Global Program on Sustainable Fisheries*.

### **Capacity needs assessment for disaster risk management in the Kingdom of Swaziland**

This project, which was implemented between 2008 and 2010, helped the government to define its priorities in DRM. The project went along the establishment of the National Disaster Management Council and Secretariat and helped to improve its recognition and visibility among the general public. Consultations particularly involved stakeholders from the agricultural sector to assess linkages between risk reduction and commercial and smallholder agriculture on public and private land.

### **Building capacity in DRR for World Bank task team leaders in agriculture and rural development**

This project established the conceptual framework for a training curriculum on DRR for World Bank task team leaders responsible for the implementation of agriculture and rural development projects. The training curriculum was tested through an initial workshop in Burkina Faso conducted by Catholic Relief Services on agricultural seed systems in June, 2010.

### **Climate observations and regional modeling in support of climate risk management and sustainable development in Eastern Africa**

This project has been implemented since 2008 to support better understanding of extreme climate events and work with climate change models in the greater Horn of Africa. The WMO, in partnership with GCOS, WCRP, and ICPAC in Nairobi, Kenya, have implemented the project. Participants from Burundi, Djibouti, Eritrea, Ethiopia, Kenya, Rwanda, Somalia, Sudan, Tanzania, and Uganda have learned in three hands-on workshops to use extreme climate data and climate indices, apply and downscale climate change models, and address policy issues. Practitioners in the various user communities (DRM, agriculture, water resources management, and so forth) have jointly participated with their colleagues from the national hydrological and meteorological services. The first workshop was conducted in April, 2010 at ICPAC in Nairobi, and the remaining workshops will be conducted in October, 2010 and spring, 2011.

## Appendix II: PDNAs

### PDNA – Floods in northern Namibia

In March 2009, flooding affected six regions in northern Namibia. The floods affected sixty percent of the population in the area, destroyed critical infrastructure, washed away crops and livestock, damaged homes, and caused population displacements. Many of those affected by the floods had not recovered fully from heavy rainfall in 2008 that also caused destruction and displacement. Immediately following the relief efforts, the National Planning Commission (NPC) of Namibia requested the World Bank, through the GFDRR, to conduct a PDNA. In coordination with the UN, the European Commission (EC), the Government of Luxembourg, USAID, and other partners, the Government was assisted in developing a comprehensive approach to recovery and reconstruction efforts (Government of Namibia, 2010).

The assessment estimated physical damage of \$136.4 million, mainly in housing, transport and trade. Economic losses were estimated at \$78 million, mainly in agriculture, manufacture, and trade. A two-phased reconstruction strategy was developed. Phase I (\$136 million) would focus on early recovery and reconstruction of damaged assets to pre-disaster conditions. Phase II (\$436 million) describes “build-back-better” options to (a) disaster- and climate-proof infrastructure and relocate the population to safer areas, (b) make more efficient use of water for agriculture and flood management, and (c) invest in long-term disaster risk management. Box 8 highlights the estimated costs for reconstruction of the transport sector and suggested investments in the flood proofing of the road infrastructure.

### PDNA - Floods in urban centers in west and central Africa

#### Floods in Bangui, CAR

Bangui, the capital of CAR, grew rapidly in recent decades without any structured land use and ur-

ban planning. The city is situated in the natural Basin of the Oubangui River with its tributary Mpoko. Floods occur regularly in approximately fifteen percent of the urban area, particularly at the end of the rainy season. Floods are caused by high intensity rains, which cannot be rapidly evacuated and drained. In large parts of the city, drainage is inexistent or clogged due to solid waste or construction along drainage channels.

The 2009 flood events in the urban area of Bangui on June 14–15 and July 3–4 left at least 14,500 people homeless, mostly women and children. Damages were estimated at \$6 million, with economic losses of \$2.6 million. Macroeconomic estimates suggest that the impact of this single event on GDP was limited. The housing sector was most affected in term of damages and losses, followed by the commercial sector. The assessment in Bangui highlighted strategies to “build-back-better” and reduce the impacts of flooding in this urban area, particularly in drainage infrastructure. Together with the government, the assessment team identified a number of priority objectives and interventions:

1. Reduce the frequency, area, depth and duration of future floods:
  - construction and maintenance of new drainage works;
  - improved solid waste collection;
  - elevation of low-lying zones by compacted fill;
  - resettlement and declaration of flood prone areas uninhabitable.
2. Mitigate the impacts of future floods:
  - improved environmental health to reduce flood-related diseases;
  - flood-resilient housing construction methods and materials;
  - community-based disaster preparedness and response.

3. Build institutional capacity at various levels to mitigate and respond to floods:

- clarification of responsibilities;
- capacity building for urban development planning and flood risk management tools.

### **Floods in Ouagadougou, Burkina Faso**

On September 1, 2009, unexpectedly high rainfall of more than 260 mm (compared to average annual precipitation between 800 and 900 mm) affected eleven of thirteen provinces. Rainfall of this magnitude had not been recorded before in Burkina Faso. More than 150,000 people in Ouagadougou were affected. Upon the request of the Government of Burkina Faso, a joint team of international experts from the World Bank, UN agencies, the EU, and national experts conducted a PDNA in November, 2009.

Damages were estimated at approximately \$102 million and losses at \$33 million. The housing, urban infrastructure, and health sectors were most affected. Damages to buildings, particularly hospitals and schools, comprised the majority of damages in urban areas. In rural areas, small dams and irrigation infrastructure were damaged, causing relatively high losses in the agricultural sector. Reconstruction and DRR needs were estimated at \$266 million.

### **Floods in Dakar, Senegal**

In August, 2009, severe floods caused damages in Dakar, Senegal. Schools, houses, public infrastructure, roads, and water and sanitation infrastructure were damaged or destroyed. On August 27 the national emergency plan (Plan ORSEC) was triggered. According to Government estimates, about 360,000 people were directly affected in greater Dakar, especially in the districts of Pikine and Guédiawaye, with 125,000 people directly affected in the rest of the country. Upon the request of the Government of Senegal, a joint team of international experts from the World Bank, the EU, the UN, and national experts conducted a PDNA from October 23 to November 23.

The floods were mainly triggered by the lack of a functioning storm water drainage system in the metropolitan area. The heavy rainfall at the end of August was 173 percent above average, with 40 millimeters of rainfall in one day. Two months after the floods, more than 800 hectares were still under water.

The assessment team estimated total damages and losses of approximately \$104 million. Major damages (\$58 million) particularly affected the housing, health and infrastructure sectors. The overall impact on the economy, however, was relatively limited, affecting only 0.07 percent of GDP. The PDNA found that recovery, reconstruction and DRR efforts required more than \$232 million in total, especially for investments in the public infrastructure, water, sanitation and solid waste sectors. The assessment proposed a number of structural (investments in storm water drainage and implementation of the sanitation master plan) and non-structural measures (urban planning and improved response to disasters) to reduce flooding in Dakar and other urban areas over the long-term.

### **Cyclones in Madagascar**

In the first few months of 2008 cyclones Fame, Ivan and Jokwe hit Madagascar, affecting 17 of the 22 regions of the island. Heavy rains, especially in the north of the country, accompanied these category 3 and 4 storms. The storms caused severe damages to infrastructure, and affected 342,000 people, while more than 100,000 people lost their homes and one hundred people died. Various international partners, including the World Bank, UN, EU, and national government agencies, participated in a joint *Damage, Loss, and Needs Assessment* (similar to a PDNA) following cyclone season.

The assessment estimated damages and losses from cyclone season at \$333 million, with \$174 million in damages and \$159 million in losses. The most affected sectors included the social and infrastructure sectors, due to damages to houses and public infrastructure (\$118 million). Longer-term economic losses were concentrated in the productive sector. The as-

assessment estimated losses to agricultural production at \$97 million. In total, the assessment estimated the impact on the entire economy at four percent of total GDP, with a reduction in GDP growth by 0.3percent.

At the household level, impacts were also severe. Persons living in Analanjirofo, for example, suffered damages and losses averaging more than \$120 per capita, a substantial amount compared to GDP per capita of \$375 in 2007.

The assessment calculated financial requirements to address the most immediate as well as the longer-term recovery and reconstruction needs at \$154.8 million, with \$18.9 million required for immediate recovery activities, \$135.9 million for medium-to long-term recovery and reconstruction. This strategy considers primarily public sector investment needs. Private sector recovery and reconstruction needs are typically not included in estimates. Risk management measures and the costs of building back better are mainstreamed in this estimate in order to mitigate the effect of future cyclones.

### **Earthquake assessment in Malawi**

Between December 6 and 20, 2009, a series of earthquakes with magnitudes between 3.8 and 5.9 on the Richter scale affected the northern Karonga district of Malawi. The area is part of the greater East African Rift Valley System, an earthquake-prone area. The earthquakes caused damages to schools, government buildings, and houses. Twelve villages (approximately 3,000 people) were sheltered in temporary housing, and more than 18,000 people were affected. Upon request of the Government of Malawi, a small World Bank team conducted a PDNA in January, 2010. The assessment indicated that the vast majority of the damage was related to the housing sector (privately owned houses), schools and government buildings (public sector). The PDNA estimated total damage at \$5.2 million, with additional losses in the private housing sector at approximately \$1 million.

## Appendix III: Status of DRM country plans

**Burkina Faso:** The Africa DRM Team completed the hazard, vulnerability, and institutional analysis. Activities, priorities and implementation arrangements were discussed with the respective ministries and stakeholders. It is expected that the DRM country plan will be published in late 2010.

**Ethiopia:** The Africa DRM Team consulted with government and stakeholders to draft a DRM country plan. The plan focuses on improving hazard assessment and early warning capacity. It includes a broad range of activities from strengthening institutional capacities, including the connectivity of remote DRM woreda offices, vulnerability assessments, implementation of the LEAP software (see also Figure 9), contingency planning, support for University master programs and capacity strengthening in disaster response. The first activities of the country plan swiftly move towards implementation.

**Ghana:** The DRM country plan was developed and agreed upon with the National Disaster Management Organization (NADMO) in 2009. Activities will be implemented as soon as funds are available and a number of concerns on environmental and social management issues have been addressed.

**Madagascar:** Discussion with the government and stakeholders on the DRM country plan will start soon and build on the earlier *Mainstreaming Climate and Disaster Risk Management into Economic Development* project.

**Mali:** The Africa DRM Team consulted and agreed with stakeholders and government on the DRM country plan in late 2009. The main pillars of the country plan include strengthening of the early warning capacities for droughts and floods, capacity

building for the national DRM agencies, schools and universities. It is closely aligned with ongoing work in sustainable land and water management carried out under TerrAfrica activities.

**Malawi:** The country plan was finalized and agreed upon with the government in spring 2010. It proposes activities to strengthen institutional arrangements, addresses floods and early warning systems, strengthens hydro-meteorological systems, and pilots flood protection measures throughout the Shire River Basin.

**Mozambique:** The National Institute for Disaster Management (INGC) has a long history of support by international development partners. The country plan builds upon these activities and addresses support to institutions and agencies through capacity building, support for early warning systems, particularly through weather radar system upgrades, and the reduction of underlying risk.

**Senegal:** Following the study on vulnerability to disasters in urban and peri-urban areas in Dakar, the country plan was drafted in autumn 2009. The activities focus on institutional arrangements, strengthening and capacity building, early warning systems and contingency planning for flood-affected areas, capacity building for schools and the general public, and training in disaster recovery activities.

**Togo:** The country plan has been drafted in 2009. With a budget of \$7.5 million, the plan has a slightly larger scope than the other country plans. The plan is focused on community-based activities and improved early warning capacity and hydro-meteorological service. A large part of the work will focus on institutional arrangements and activities.