Review of Current and Planned Adaptation Action: North Africa

Algeria, Egypt, Libya, Morocco, Sudan, Tunisia and Yemen

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Contributing Authors:

Karla Zubrycki, Alec Crawford, Hilary Hove, Jo-Ellen Parry

International Institute for Sustainable Development

About the Adaptation Partnership

The Adaptation Partnership was formed in May 2010 in response to a recognized need for development practitioners to share information and lessons on adaptation efforts. Chaired by Costa Rica, Spain and the United States, the goal of the partnership is to encourage effective adaptation by serving as an interim platform to catalyze action and foster communication among the various institutions and actors engaged in the effort to scale up adaptation and resilience around the world, particularly in the context of fast start finance. The Partnership is synthesizes lessons learned and good practices, highlighting needs and priorities, and identifying opportunities for cooperation and alignment of support to build resilience to the adverse effects of climate change. It is also enhancing communities of practice engaged in the adaptation effort.

Adaptation Partnership
Website: http://www.adaptationpartnership.org/

iisd International Institute for Sustainable Development / Institut international du développement durable

Foreword

In response to a growing awareness of the potential adverse effects of climate change and the particular vulnerability of developing countries to this process, a significant increase in adaptation action has been witnessed in recent years in Africa, Asia-Pacific, and Latin America and the Caribbean. These actions are providing opportunities to: increase understanding of the implications of climate change for the achievement of development objectives in the near and long terms; identify strategies and measures that can be taken to reduce climate vulnerability; communicate and build awareness of climate risks, opportunities and potential solutions; and begin implementing actions on the ground that build capacity to adapt to a changing climate.

Although the recent global upsurge in adaptation action is a welcome development, the emergence of a diverse array of efforts initiated by multiple actors within numerous jurisdictions has the potential to create confusion, lead to duplication of effort and limit the potential for sharing good practice guidance based on past efforts. Enhanced coordination among expanding networks of adaptation actors is needed to ensure resources are deployed quickly and effectively. To this end, the Adaptation Partnership was formed in 2010. Chaired by Costa Rica, Spain and the United States, the goal of the Adaptation Partnership is to encourage effective adaptation by serving as an interim platform to catalyze action and foster communication among the various institutions and actors engaged in the effort to scale up adaptation and resilience around the world.

Toward this goal, the Adaptation Partnership initiated a Review of Current and Planned Adaptation Action in the fall of 2010. Its purpose is to provide a baseline understanding of who is doing what on adaptation in three developing regions—Africa, Asia-Pacific, and Latin America and the Caribbean—and in priority adaptation sectors. Based on available resources, it seeks to provide a rapid assessment of: priority interests and adaptation needs; efforts by governments to support adaptation though policy and planning; the scope of international support for adaptation efforts in different countries and sectors; and potential gaps in adaptation efforts at the country and regional levels.

This document is one of 12 regional profiles completed as a contribution to the Review of Current and Planned Adaptation Action in Africa, Asia-Pacific and Latin America and the Caribbean. It presents a review of current and planned adaptation action in North Africa, covering the countries of Algeria, Egypt, Libya, Morocco, Sudan and Tunisia. As adaptation action in West Asia is not being examined within the review, the only least developed country in this region, Yemen, is also included in this regional profile. The review first provides an overview of adaptation action at a regional level, highlighting commonalities and differences between these seven countries. The appendices that follow discuss adaptation action taking place in each country.

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Abbreviations and Acronyms

AAP	Africa Adaptation Programme
AMDE	Algerian Ministry of Development and Environment
AMU	Arab Maghreb Union
ASLR	accelerated sea level rise
AU	African Union
AWC	Arab Water Council
BMZ	German Federal Ministry for Economic Cooperation and Development
CAMRE	Council of Arab Ministers Responsible for the Environment
CCAA	Climate Change Adaptation in Africa
DFID	Department for International Development (United Kingdom)
DEFRA	Department for Environment, Food and Rural Affairs (United Kingdom
EMSEA	Egyptian Ministry of State for Environmental Affairs
GDP	Gross Domestic Product
GEF	Global Environment Facility
GTZ	German Technical Cooperation
IDRC	International Development Research Centre
IISD	International Institute for Sustainable Development
IPCC	Intergovernmental Panel on Climate Change
LAS	League of Arab States
MDW	Moroccan Department of Water
MDWE	Moroccan Department of Water and Environment
MENA	Middle East and North Africa
NAPA	National Adaptation Programmes of Action
NBI	Nile Basin Initiative
NCAP	Netherland Climate Assistance Program
OECD	Organisation for Economic Co-operation and Development
SEI	Stockholm Environment Institute
SIDA	Swedish International Development Agency
SMEPD	Sudan Ministry of Environment and Physical Development
SSO	Sahara and Sahel Observatory
TMED	Tunisian Ministry of Environment and Development
TMELP	Tunisia Ministry of Environment and Land Planning
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UN-ESCWA	United Nations Economic and Social Commission for Western Asia
UNFCCC	United Nations Framework Convention on Climate Change
UNITAR	United Nations Institute for Training and Research
UNSD	United Nations Statistics Division
UN-WWAP	United Nations World Water Assessment Programme

USDS	United States Department of State
YEPA	Yemen Environmental Protection Agency

Executive Summary

Growing understanding of the need to adapt to the impacts of climate change has led to a significant rise in ongoing and planned adaptation action in the developing regions of the world. This upsurge in climate change adaptation action is a welcome occurrence, but enhanced coordination among expanding networks of adaptation actors is needed to ensure resources are deployed quickly and effectively. Responding to this concern, a review of current and planned adaptation action in North Africa was undertaken by the Adaptation Partnership[1] between October 2010 and April 2011. Covering the countries of Algeria, Egypt, Libya, Morocco, Sudan, Tunisia and Yemen, the rapid review examined: priority adaptation needs; efforts by governments to support adaptation though policy and planning; the scope of international support for adaptation efforts in different countries and sectors; and potential gaps in adaptation efforts at the country and regional level. This review of adaptation action in North Africa is one of 12 profiles covering regions of Africa, Asia-Pacific, and Latin America and the Caribbean completed by the Adaptation Partnership.

To assess the level of adaptation action in North Africa, a desk-based review of internet sources and relevant documentation was undertaken. The content of these sources was assessed in relation to a set of parameters established to focus the review's scope and ensure consistency across regions. Notably, it examines *discrete* adaptation actions, or *policies, programs and projects designed and implemented specifically to address the current and projected impacts of climate change*. The review therefore presents only a portion of the breadth of efforts underway to reduce the vulnerability of developing countries to the impacts of climate. In particular, it does not capture the broader array of development activities that are increasing the adaptive capacity of communities and countries. As well, within the review, adaptation actions have been deemed to be "current" if they are ongoing or completed in 2009 or later. As such, the review does not include projects completed prior to 2009 that may have contributed to building local and national adaptive capacity. The review only identifies those actions currently underway; it does not offer judgment of the effectiveness of actions taking place. In addition, reflecting the desk-based nature of the review, it is acknowledged that the content is biased toward identification of large-scale projects funded by international development assistance organizations, and those projects about which information is easily accessible. As such, small-scale projects that meet the review's definition of adaptation action, particularly those occurring at the community level, are not fully represented within the review.

Climate Vulnerability

Located between two climatic zones—temperate to the north and inter-tropical to the south—North Africa experiences a high degree of climate variability. There are signs that the region is experiencing a changing and even more unpredictable climate. This includes trends towards

[1] Formed in 2010, the Adaptation Partnership is chaired by Costa Rica, Spain and the United States. Its goal is to encourage effective adaptation by serving as an interim platform to catalyze action and foster communication among the various institutions and actors engaged in the effort to scale up adaptation and resilience around the world.

increases in temperature (Agoumi, 2003),[2] drier conditions over land between 1900 and 2002, an increase in the proportion of precipitation coming from heavy rainfall events, and more widespread drought (Trenberth et al., 2007, and references therein). Areas of the Sahelian region in Sudan, in particular, have witnessed a 25 per cent decrease in rainfall in the last quarter of the twentieth century (Hulme et al. 2001).

Climate change models indicate that these trends could continue during this century. Current models project that temperatures within the Mediterranean region could increase by 2.2 to 5.1°C by the period of 2080 to 2099. The region could potentially experience an annual mean decrease in precipitation—potentially a much as 20 per cent along the Mediterranean coast by 2080 to 2099 (Christiansen et al., 2007). Accelerated sea level rise (ASLR), globally projected to increase by 0.35 meters (+/- 0.12 meters) by the period of 2090 to 2099, also is a concern for the coastal areas of North Africa. However, large deviations in models make it difficult to determine regional distribution of sea level rise (Christiansen et al., 2007).

These projected changes in climatic conditions and sea levels are anticipated to affect the region's agricultural productivity, water quality and availability, and coastal zones, among other impacts. Future climate impacts may adversely affect socioeconomic sectors in North Africa in the following ways (Conway, 2005; De Villiers, 1999; Sowers & Weinthal, 2010; SSO, 2010):

- *Freshwater resources:* Existing water scarcity concerns in North Africa could be augmented by climate change, leading to concerns regarding access to water in urban centers; lowered agricultural production in rain-fed and irrigated areas; reduced river flow adversely affecting shipping; declining hydropower production; and constrained supply of water for use in tourism facilities.
- *Agriculture:* Agricultural yields are anticipated to decline due to factors such as reduced rainfall and declining water availability for irrigated agricultural production (a particular concern along the Nile River), higher temperatures and flooding of agricultural lands due to sea level rise.
- *Coastal zones:* Possible inundation of fertile agricultural lands and salinization of coastal aquifers; and risks to urban populations and infrastructure.
- *Tourism:* Sea level rise may cause damage to beaches, coastal islands and infrastructure, as well as potentially cause the bleaching and loss of coral reefs.
- *Human health:* Communicable diseases, water-borne and food-borne diseases, and non-communicable diseases may be exacerbated by climate change.

Identified Adaptation Needs and Priorities

In light of projected increases in temperature and decreases in rainfall, inundation of coastal areas and reduced water flow in the Nile River system, three common adaptation priorities have been identified in North Africa: freshwater resources, agriculture and coastal zones. These priorities have

[2] The average temperature increase in North Africa in the last century was 1°C (Agoumi, 2003).

been expressed by countries through National Communications to the United Nations Framework Convention on Climate Change and, in the least developed countries of Sudan and Yemen, National Adaptation Programmes of Action (NAPAs). Other priorities include: tourism, human health, infrastructure (roads, housing) and forestry. A wide range of priority adaptation actions have been identified by North African countries to respond to climate change within these areas, including the following (AMDE, 2001; EMSEA, 2010; MDWE, 2010; SMEPD, 2003):

- *Freshwater resources*: Improvements to irrigation efficiency; rainwater harvesting; the development of small and medium dams; wastewater and industrial water reuse; redesign of water storage and canals to reduce evaporation loss; public education on water efficiency; water desalination; and amendments to water resource laws.
- *Agriculture*: More efficient irrigation and the development of drought-resistant species; new livestock routes to improve the resilience of pastoralists; smallholder income diversification; development of oases; development of grazing enclosures; use of new technologies for weed control; and changes in cropping patterns.
- *Coastal zones*: Construction or improvement of sea walls and other barriers; creation of wetlands in vulnerable areas; protection and fixing of sand dunes (i.e. natural protection); integrated coastal zone management; the use of canal banks as protection; and monitoring of coastal subterranean waters.
- *Tourism*: expansion of marine protected areas; greater enforcement of regulations; adoption of integrated coastal zone management approaches; protection of vulnerable archeological and touristic sites; protection of marine areas (e.g., coral reefs); and the redirection of growth away from sensitive lands.
- *Health*: Improvements to public health infrastructure; improved access to quality health services; improvement of vaccination programs; development of early warning systems; enhanced control programs for infectious diseases; development of public awareness campaigns; pest control strategies; improved water treatment; and improved public hygiene.
- *Infrastructure*: In the buildings sector: building standards to reduce energy use; use of natural ventilation and lighting; and enhancing national institutional capacity. Road adaptation measures proposed include: re-orientation of flood routes away from road paths; storage of flood or rain water; bridge construction; and vulnerability assessments for new road projects—potentially leading to the re-routing of roads deemed too vulnerable to flood damage.
- *Forestry*: Increased reforestation; creation of greenbelts; creation of urban forests; protection of national park forests; encouragement of indigenous species usage; and the development of drought-resistant species.

Policy Level Actions

Adaptation action at the policy level is occurring to varying degrees throughout North Africa at the national level and through intergovernmental organizations that bring together countries within and outside the region. As members of the League of Arab States, all North African countries adopted the "Arab Ministerial Declaration on Climate Change" in 2007. The League of Arab States has also

committed to expanding its cooperation with the African Union in the area of climate change and recommended implementation of joint climate change observation, monitoring and early warning (AU & LAS, 2010). Algeria, Libya, Morocco and Tunisia, along with Mauritania, are also members of the Arab Maghreb Union, whose Committee on Food Security has addressed climate change (Global Mechanism, 2009). Moreover, Egypt and Sudan are part of the Nile Basin Initiative, whose member states are looking at the potential impacts of climate change on water quality and flow.

At the national level, North African countries—with the exception of Libya—have undertaken assessments of their vulnerability to the impacts of climate change and identified adaptation priorities and actions through National Communications and NAPAs. Outside of these efforts, Algeria prepared a national adaptation strategy in 2003; no other country in the region has prepared a national climate change (adaptation) strategy or plan. The integration of adaptation needs and priorities into national policies appears to be limited as well. However, some countries are implementing policies that do not explicitly state adaptation objectives but which nonetheless should provide adaptation benefits.

Projects and Programs that Support Adaptation

In addition to these intergovernmental initiatives, North African countries are engaged in the implementation of the adaptation projects and programs. Across the region, water resources, agriculture and coastal zones appear to be receiving the greatest attention, and these are also identified as priority sectors in nearly all National Communications and NAPAs. Adaptive capacity is also being built in a range of other sectors, including disaster risk management, human health, ecosystem conservation and enhancing the ability of governments to respond to climate change.

With the exception of Libya, each country is implementing at least one national adaptation project. The majority of these projects respond to identified needs related to agriculture. Coastal zone management, freshwater resources and human health are also sectors of focus. Significantly more action, however, is taking place through projects being implemented simultaneously in multiple countries. This includes a small number of projects that involve just North African countries. These projects focus on a combination of issues, including coastal zone management, disaster risk management, freshwater resources, ecosystem conservation and adaptation in urban areas. In addition, North African countries are participating in projects that involve other African and West Asian countries. Algeria, Morocco, Tunisia and Yemen are further engaged in one initiative each that brings together countries from around the world. These projects also support adaptation action in a range of sectors, including freshwater resources, agriculture, forestry, governance, ecosystem conservation, and energy.

Regardless of sector or whether a project is being implemented in one or several countries, most provide support for capacity building, research, knowledge communication and policy formation and integration. Fewer projects include field implementation components; this is particularly true for projects being implemented at the regional and global levels.

Adaptation Communities of Practice

No evidence of regional networks active in the area of climate change adaptation was identified through this research.

Needs and gaps

North African countries contend with persistent concerns such as water scarcity, poverty, desertification, soil salinization, civil strife and high population growth rates. While progress has been made in recent years in addressing some of these concerns, climate change has the potential to undermine these efforts. Most governments in the region have recognized and articulated this risk through the completion of their National Communications and NAPAs. However, adaptation action as a whole appears to be limited within the region.

This review has identified a number of gaps and opportunities for enhanced activity around adaptation, including in the following areas:

- North African countries share a number of common vulnerabilities and concerns, and there appears to be considerable opportunity for mutual learning through greater engagement in joint planning for adaptation and in regional adaptation programming; a higher emphasis on adaptation within existing cooperative initiatives could be pursued as well.
- To reduce vulnerability to rising sea levels, greater attention could be given to integrated coastal zone management and the sharing of lessons drawn from previous experience with this process.
- While continuing to build understanding of the risks associated with climate change and the capacity of governments and communities to respond these risks, there is a need to ensure that adaptation initiatives move from research to implementation. In particular, joint action to address current problems and future vulnerabilities in the area of freshwater resources management in the Nile Basin may be warranted.
- Current adaptation programs addressing the dominant priority sectors of freshwater resources, agriculture and coastal zones could be enlarged, and greater attention could be given to those priorities that are presently receiving less attention, such as public health, urban issues, infrastructure and important economic sectors such as tourism.

Overall, greater attention to the issue of adaptation appears to be warranted in North Africa. Many of these countries' climate change related efforts are presently focused on reducing greenhouse gas emissions. While these efforts are important, these countries remain vulnerable to a diversity of climate change impacts. Particular concern may be expressed regarding the vulnerability of Yemen due to its current and forecast levels of water scarcity, and Egypt due to its high reliance on the Nile River and the concentration of its population within the Nile Delta.

Review of Existing and Planned Adaptation Action: North Africa

1.0 Introduction

The region of North Africa includes the Mediterranean countries of Algeria, Egypt, Libya, Morocco and Tunisia, along with Sudan[3] and Yemen[4] located on the Red Sea. Although sizable countries, vast stretches of desert in each has encouraged their populations to concentrate near coastal areas (with the exception of Sudan). Outside of Morocco, oil and gas development forms a significant portion of North African national economies (particularly Algeria and Libya). Many have diversified and grown their economies—which include tourism, light manufacturing, mining, textiles and financial services, as well as the traditional sectors such as agriculture, livestock herding and fisheries—and are currently among the most developed countries in Africa. The exceptions are Sudan and Yemen, both of which remain among the least developed countries in the world. The vast majority of people in these countries rely upon agriculture and pastoralism for their livelihoods (80 per cent and 75 per

Figure 1: Map of North Africa

Source: Modified from the Central Intelligence Agency (2010)

[3] Research in support of this review was primarily undertaken between October 2010 and April 2011. As such, this review does not reflect the formation of Southern Sudan as an independent state in July 2011.

[4] Within the United Nations classification system, Yemen is included in West Asia—a region of the world that is not covered by this review of current and planned adaptation action. However, given that Yemen is the only least developed country within West Asia and therefore considered to be vulnerable to the impacts of climate change, it has been incorporated into the review as part of North Africa. The inclusion of Yemen in North Africa (as opposed to a region in Asia) reflects its greater ecological, social and cultural similarities to other countries in this region.

cent respectively; YEPA, 2009; USDS, 2010). The varying levels of socio-economic development in North Africa influence the degree to which individual countries are vulnerable to the impacts of climate change.

To better understand efforts underway in North Africa to prepare for and respond to the potential impacts of climate, this report provides a rapid review of current and planned adaptation action within the region. Based on available resources, it examines: identified priority adaptation needs; efforts by governments to support adaptation though policy and planning; the scope of international support for adaptation efforts in different countries and sectors; and potential gaps in adaptation efforts at the country and regional level. The main body of the report provides an overview of adaptation action at the regional level, highlighting commonalities and differences between Algeria, Egypt, Libya, Morocco, Sudan, Tunisia and Yemen. In the appendices that follow, adaptation action taking place in each of these countries is discussed.

At present, nearly all of the countries in North Africa are experiencing significant political change, including the July 2011 secession of the Republic of South Sudan from Sudan and the regime changes in Egypt, Libya and Tunisia in 2011. The implication of these changes for the capacity of these countries to prepare for climate change and take adaptation action is uncertain.

2.0 Methodology

A rapid review of current and planned adaptation action in North Africa—one that gives attention to policies, programs and projects at the national and regional level—presents a considerable task given the breadth of actions that can and are being taken to reduce vulnerability to the short, medium and long-term impacts of climate change. Prior to undertaking this review, it therefore was necessary to clarify the terms that would be used within it and establish a set of parameters to limit its scope. This section provides an understanding of the research parameters established for this rapid review and the process by which the information it contains was gathered. These guidelines are presented to help clarify what the study does and does not aim to achieve.

Definition of "Adaptation Action"

Adaptation is generally defined as being an "adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities."[5] Given the breadth of actions that may be taken which are in keeping with this definition, a critical first step in initiating the rapid review was determining the definition of "adaptation action" to be used within it.

This process was influenced by the outcomes of a review of 135 "adaptation" activities undertaken by McGray et al (2007) that led to identification of three different models of adaptation activity:

[5] UNFCCC glossary of climate change acronyms: http://unfccc.int/essential_background/glossary/items/3666.php.

- *Serendipitous adaptation*—"activities undertaken to achieve development objectives [that] have outcomes that incidentally may also support adaptation" (McGray et al, 2007, p. 13). This type of adaptation reflects the widely acknowledged intimate linkage between sustainable development and building capacity to adapt to the impacts of climate change. Specifically, sustainable development can enhance adaptive capacity by strengthening institutions, promoting sound management of natural resources, improving health and education systems, promoting gender equity and fostering economic growth.
- *Climate-proofing of development efforts*—where activities are "added to an ongoing development initiative to ensure its success under a changing climate. In these cases, adaptation is seen as a means to a development end" (McGray et al, 2007, p. 13); and
- *Discrete adaptation*—where "adaptation to climate change is the primary objective of a project or initiative. From the beginning, implementers and funders of these efforts have climate change in mind" (McGray et al, 2007, p. 13).

While recognizing the critical role of serendipitous adaptation and climate-proofing of development efforts in fostering adaptation to climate change in developing countries, a review of all three types of adaptation activities would be unmanageable. This study therefore focuses on an examination of discrete adaptation activities. Therefore, adaptation action within the review is defined as *policies, programs and projects designed and implemented specifically to address the current and projected impacts of climate change*. As such, specific reference has been made to supporting adaptation to climate change, and/or climate risk reduction in the objectives and/or rationale of each policy, program or project included in the study.

Due to the selection of this definition, the review automatically presents a narrow snapshot of the wide breadth of activity (often funded though official development assistance[6]) that is helping developing countries build adaptive capacity and reduce their vulnerability to the impacts of climate change. Therefore, the review should not be viewed as fully representative of the entirety of adaptation action occurring in developing countries—nor of the degree to which vulnerability reduction is occurring in the countries and regions profiled. Rather, the review aims to contribute to understanding of the identified adaptation needs and priorities of different countries and regions and the degree to which discrete adaptation activities are contributing to meeting these needs.

Definition of "Current" Action

To further focus the study, adaptation action have been deemed to be "current" if they were ongoing or completed in 2009 or later. As such, the review does not include a range of projects completed prior to 2009 that may have significantly contributed to building local and national adaptive capacity. This observation is particularly true of adaptation action in the Caribbean and Pacific; reflecting the early interest and commitment of small island developing states (SIDS) to

[6] In 2010, official development assistance totaled US$128.7 billion (OECD, 2011)—a level of funding that significantly outstrips that which is currently provided in support of adaptation to climate change. See, for example, SEI and UNEP (2010).

understanding and reducing their vulnerability to the impacts of climate change, countries in these regions began to explore adaptation concerns as early as the late 1990s.

While the review's definition of "current" adaptation action limits the scope of the study, the volume of discrete adaptation initiatives has accelerated in recent years, as reflected in the following trends:

- Financing for approved projects through the Least Developed Countries Fund has risen from nearly US$24 million in 2008 to US$177 million as of mid-2011;[7]
- Adaptation financing through the Special Climate Change Fund has increased from 22 projects worth nearly US$90.73 million in 2009 (GEF, 2009) to 31 projects approved for financing in the amount of US$128 million as of mid-2011;[8] and
- Financing for adaptation by four Bilateral Financial Institutes increased by 31 per cent from US$3,029 million in 2008 to US$3,963 million in 2009 (SEI and UNEP, 2010).

Therefore, the review reflects the growing number of adaptation efforts initiated in recent years.

Identification of Projects and Programs

A wide range of climate adaptation related initiatives are underway throughout the world—covering the gamut from original scientific research that informs our understanding of current and future climate patterns, to capacity building and knowledge sharing, to the adoption of new planting practices by farmers, to the building of infrastructure that anticipates future climatic extremes. While acknowledging this diversity, to better achieve the specific objectives of the review, it has focused on time-bounded projects that support preparation for and/or implementation of practical adaptation action. As such, the review does not include projects and programs that focus on:

- conducting original scientific research that enhances knowledge of climate change impacts and development of the tools and techniques for reducing vulnerability;
- ongoing, long-term monitoring efforts (whether climatic or socio-economic) that are needed to inform decision-making;
- stand-alone capacity building and knowledge sharing workshops, conferences and training programs; and
- activities solely related to participation in the ongoing international climate change negotiations.

As well, the review only captures adaptation action financed through international development assistance; it does not capture adaptation efforts financed solely by national governments. This focus reflects the original impetus for conducting the review—the current scaling up of adaptation action and the potential for duplication of effort and limited sharing of good practice—and the challenge of rapidly identifying nationally funded adaptation projects. This parameter is particularly important

[7] GEF, Least Developed Countries Fund website: http://www.thegef.org/gef/ldcf (accessed September, 2011).
[8] GEF, Special Climate Change Fund website: http://www.thegef.org/gef/sccf (accessed September, 2011).

for countries such as Brazil and China, whose governments are engaged in self-driven and self-funded adaptation efforts that are not included within this review.

Data collection

Projects and programs were primarily identified through a desk-based review of the websites of UN agencies, bilateral development agencies, multilateral financial institutions, international research organizations and non-governmental organizations. Reflecting the desire for a rapid review, a comprehensive examination of all of these organizations was not undertaken; rather an emphasis was placed on capturing initiatives involving organizations generally recognized as being actively engaged in fostering climate change adaptation. Additional information regarding current and planned adaptation action was gathered through an examination of relevant reports.

The process by which data were gathered for inclusion in the review has biased its content. Notably, it is highly likely that a number of small-scale projects meeting the review's definition of adaptation action, particularly those occurring at the community level, have not been captured. As well, the accuracy of the data captured in the review significantly depends upon the accuracy and completeness of the internet resources used.

Classification of projects

To support analysis of the degree to which ongoing projects are addressing the priority adaptation needs of developing countries, identified initiatives have been classified in relation to two general characterizations—their sector or areas of focus and the types of activities being implemented. For the sectors or areas in which projects are supporting adaptation action, a classification system comprised of the following 14 macro project categories was developed: food, fiber and forests; ecosystems; freshwater resources; oceans and coastal areas; disaster risk management; migration and security; gender; business; infrastructure; human settlements; human health; climate information services; governance; and multi-sectoral. These macro project categories were then divided further to provide a more detailed picture of the types of projects identified through the review. For example, the macro project category of "food, fiber and forests" was sub-divided into agriculture, pastoralism, forestry and fire management. Current adaptation projects were then labeled in relation to one or more of these sub-categories.

For the types of projects being implemented, a shorter list of categories was developed. Current adaptation projects have been assessed in relation to the degree they support research, assessment, capacity building, knowledge communication, policy formation and integration, field implementation and community-based adaptation. A fuller discussion of the project classification system used during this review is provided at the beginning of the appendices.

Gender analysis

Within the review, assessments of the degree to which gender-sensitive adaptation action are underway in different countries and regions has focused solely upon the extent to which addressing

gender inequalities is a specified objective of projects and programs. The review did not assess the degree to which individual projects and programs may or may not have integrated gender issues into their detailed design.[9] Therefore, the gender analysis provided in the review should not be viewed as fully representative of the degree to which current adaptation action is gender-sensitive.

Assessment of the effectiveness of adaptation action

It should also be noted that this rapid review does not assess the quality or effectiveness of the project and programs it includes. Therefore, the review does not provide a basis upon which to judge the degree to which completed and ongoing projects have either achieved their stated objectives and/or made a positive contribution to increasing the ability of a country or region to adapt to the impacts of climate change. It only provides an indication of the intended outcomes of the identified initiatives, the type of action being taken (e.g., capacity building, policy integration and implementation of practical actions) and their area of focus (e.g., agriculture, water and health).

Scientific Information

Synopsis of projected changes in climate in different countries and regions included in the review are based primarily on the content of the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) and national assessment reports (e.g., National Communications). New scientific analysis published since the completion of these reports may have both refined and presented revised understandings of the projected consequences of climate change in different regions of the world. Therefore, the climate projection sections of the review should be viewed as indicative of anticipated trends in climatic change at the time of publication of the cited reports.

Qualification of Degree of Adaptation Action

To evaluate and consistently describe the relative level of adaptation activity occurring by country in each region, a simple benchmarking process has been applied across the review. Using a scale from zero to "X", where "X" is equivalent to the number of current adaptation projects underway in the country in a particular region with the largest number of current projects,[10] the scale was divided into five equivalent quintiles. Each quintile was then assigned a descriptor as follows:

- "Very Low" level of adaptation action = 0 to 20 per cent of "X;"
- "Low" level of adaptation action = 21 to 40 per cent of "X;"
- "Moderate" level of adaptation action = 41 to 60 per cent of "X;"
- "High" level of adaptation action = 61 to 80 per cent of "X;" and
- "Very High" level of adaptation action = 81 to 100 per cent of "X".

[9] For example, a project may have as its objective building resilience in the agriculture sector and target farmers in general. As no reference to gender is made in the project's objectives, it would not be considered a gender-focused adaptation action within the review. This finding would stand even if the detailed design of the project includes having set targets to ensure the involvement of female farmers.

[10] In other words, the country in the region with the highest total number of current adaptation projects was identified and used as a benchmark against which to assess performance in all other countries.

All countries in the region were allocated to one of these quintiles based on the total number of current adaptation projects and programs identified through the review.

This benchmark approach enabled a standard methodology to be applied across all 12 regions examined in the Review of Current and Planned Adaptation Action while also recognizing their individual differences. (For example, the smaller geographies and populations of SIDS suggest that hosting, for instance, 15 projects might reflect a higher level of activity than what might be possible for larger and more populated countries.) However, this methodology does not assess the financial size of individual projects; small projects are given equal weight in comparison to large projects. This approach also does not account for a country's comparative geographic size, population, level of development and other factors that may affect its level of adaptation activity. Therefore, these contextual influences are discussed within individual country profiles and regional comparisons.

Countries and Regions Incorporated in the Review

The following criteria were considered to identify countries to be included in the Review of Current and Planned Adaptation Action in Africa, Asia-Pacific and Latin America and the Caribbean, and determine their regional allocations:

- Inclusion only of non-Annex I Parties to UNFCCC;
- Allocation by region in accordance with the classification system used by the United Nations Statistics Division (UNSD, 2010); and
- The Organisation for Economic Co-operation and Development (OECD) Development Assistance Committee's list of countries eligible to receive official development assistance in 2009 and 2010 (OECD, 2009).

Definition of "Communities of Practice"

Communities of practice traditionally have been defined as "groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly" (Wenger, 2006). These groups are usually defined by a shared domain of interest and relationships than enable mutual learning. Broadly speaking, two different types of communities of practice with an interest in adaptation to climate change may be identified as:

- Established communities of practice, usually defined by a sector or issue, which have begun to integrate consideration of adaptation needs and priorities into their existing knowledge sharing efforts (e.g., a community of foresters discussing methods of integrating projected climate risk into their management planning); and
- New communities of practice established specifically due to a shared interest in adaptation to climate change (e.g., community-based adaptation experts).

Of these two broad groupings, the review gives attention only to communities of practice, which originated due to their shared interest in adaptation to climate change. This includes networks of non-governmental organizations actively engaged in sharing information regarding climate change.

This focus reflects the greater challenge of identifying and assessing the degree to which the vast array of traditional associations and networks have begun to integrate adaptation concerns into their discussions.

Anticipated Reader

Finally, it should be noted that the review has been written in a manner that assumes that its readers will have a basic understanding of adaptation to climate change. As such it does not provide definitions of terms such as "National Communication" or "National Adaptation Programmes of Action." Nor are explanations of key concepts included, such as "adaptive capacity," "mainstreaming," the relationship between climate change and development, or the challenges associated with the implementation of adaptation actions at the policy and program levels.

3.0 Climate Projections

Located between two climatic zones—temperate to the north and inter-tropical to the south—North Africa experiences a high degree of climate variability. Temperate climatic conditions in coastal areas—characterized by hot, dry summers and mild, humid winters—give way to more extreme climates in the interior of most countries (high temperatures and very low rainfall). In contrast, the climate of southern Sudan is tropical.

The region is experiencing signs of a changing and even more unpredictable climate. This includes trends towards increases in temperature (Agoumi, 2003),[11] drier conditions over land between 1900 and 2002, an increase in the proportion of precipitation coming from heavy rainfall events, and more widespread drought (Trenberth et al., 2007, and references therein). Areas of the Sahelian region in Sudan, in particular, have witnessed a 25 per cent decrease in rainfall in the last quarter of the twentieth century (Hulme et al. 2001).

Climate change models indicate that these trends will continue during this century. Model projections suggest that temperatures within the Mediterranean region will increase by 2.2° to 5.1°C by the period of 2080 to 2099, with the largest increases occurring in the summer months of June to August (Christensen et al., 2007).[12] In addition, North Africa will likely experience an annual mean decrease in precipitation (Christiansen et al., 2007); by 2080 to 2099, declines in mean annual rainfall along the Mediterranean coast could reach 20 per cent, with the largest decreases occurring in

[11] The average temperature increase in North Africa in the last century was 1°C (Agoumi, 2003).

[12] From Table 11.1 of Christensen et al. (2007) in which the Mediterranean region is defined as covering the area of 30° North, 10° West to 48° North, 40°East, and therefore includes the populated regions of Morocco, Algeria, Libya, Egypt and all of Tunisia. This geographical space does not include Sudan and Yemen. Regional average projections based on a set of 21 global models in the multi-model data set for the A1B scenario and assessed in comparison to a base time period of 1980 to 1999. The rate of warming is greater than the global average projection of 1.7°C to 4.4°C forecast by the A1B scenario. Greater warming has been projected using the A1F1 emissions scenario, which anticipates warming of up to 9°C from June to August for the Mediterranean coast of North Africa in the period of 2070 to 2099 (Boko et al., 2007).

summer and extend into the northern Sahara (Boko et al., 2007; Christiansen et al., 2007).[13] Accelerated sea level rise (ASLR), globally projected to increase by 0.35 meters (+/- 0.12 meters) by the period of 2090–2099,[14] is also a concern for the coastal areas of North Africa. However, large deviations in models make it difficult to determine regional distribution of sea level rise (Christiansen et al., 2007).

With projections of rising temperatures, increases in evapotranspiration, decreases in precipitation and ASLR, the effects of climate change on water resources are a topmost concern of most North African countries. Six of the seven countries in the region already experience conditions of water scarcity[15] (UN-WWAP, 2006). Boko et al. (2007:435) write that "Even without climate change, several countries in Africa, particularly in northern Africa, will exceed the limits of their economically usable land-based water resources before 2025." The situation is particularly acute in Yemen; with no perennial surface water resources, it has been estimated that all of the country's groundwater aquifers are being overexploited and falling at a rate of up to six meters per year (GTZ, 2007). Increases in temperature of between 1° to 3°C might place approximately 30 to 140 million people under water stress in the region (Arnell, 2006, cited in Boko et al. 2007).[16]

In Egypt and Sudan, changes in Nile River flow also are a concern. Projections about Nile River water quantity in the 21st century vary, though most studies anticipate a decrease in flow (Beyen, Lettenmaier & Kabat, 2010; Boko et al. 2007; Conway & Hulme, 1996; Kiros, Kabat & Lettenmaier, 2006; Strzepek & Yates 1996; Strzepek et al., 2001; Yates & Strzepek, 1998). A 2010 assessment based on the 2007 scenarios of the Intergovernmental Panel on Climate Change (IPCC) predicted an increase in flow until 2039, followed by a decrease of up to 84 per cent by the end of the century due to reduced precipitation and increased evapotranspiration in the Basin (Beyen, Lettenmaier & Kabat, 2010).

4.0 Needs and Priorities within North Africa

Many North African countries have made considerable strides in recent decades to improve their economies and the social conditions of citizens. However, these improvements may be threatened by climate change.[17] In light of projected increases in temperature and decreases in rainfall,

[13] Projection based on use of the A1B emissions scenario defined in the Intergovernmental Panel on Climate Change's Special Report on Emission Scenarios published in 2000 (Boko et al., 2007), and in comparison to a base period of 1980 to 1999.

[14] Project based on the A1B emission scenario and in comparison to average annual sea levels between 1980 and 1999 (Christensen et al., 2007).

[15] "Water scarcity" is defined as the availability of 1000 m^3 or less of total actual renewable water resources per capita (UN-WWAP, 2006). Sudan is the only country to have more than this amount; with 1880 m^3 per capita, it is characterized as experiencing "water vulnerability" (UN-WWAP, 2006).

[16] Based on content of Figure 9.3 in Boko et al. (2007) in which population that will experience increased water stress is projected using the A1/B1, A2 and B2 emission scenarios, and each scenario is derived from HadCM3.

[17] For example, the World Bank (undated) writes of the Middle East and North Africa: "Income and employment may be lost as a result of more frequent droughts in rural areas, and to floods and sea surges in urban and coastal areas…The

Table 1: Identified sectors of concern in North African countries

	Coastal Zones	Freshwater Resources	Agriculture	Health	Infrastructure	Tourism	Forestry
Algeria	✓	✓	✓				✓
Egypt	✓	✓	✓	✓	✓	✓	
Libya	✓	✓	✓				
Morocco	✓	✓	✓	✓			✓
Sudan		✓	✓	✓			
Tunisia	✓	✓	✓			✓	
Yemen	✓	✓	✓	✓	✓	✓	

Sources: AMDE (2001); EMSEA (2010); MDWE (2010); SMEPD (2003); SSO (2010); TMELP (2001); UNDP (undated); YEPA (2009).

inundation of coastal areas due to ASLR, and reduced flow through the Nile River system, three common adaptation priorities have been identified in North Africa: freshwater resources, agriculture and coastal zones (see Table 1). These priorities have been expressed by countries through National Communications and National Adaptation Programmes of Action (NAPAs). Other priorities include: tourism, health, infrastructure (roads, housing) and forestry. It should be noted that Libya has not published a National Communication and, therefore, priorities for this country were identified through inference from other reports and studies (e.g., SSO, 2010; UNDP, undated).

Freshwater Resources

As a resource already under stress, water ranks high as an adaptation priority for all North African countries. Water resource scarcity has implications for a number of different users and sectors, including: availability of drinking water in urban centers;[18] agricultural production that is rain-fed and irrigated (the latter occurring particularly in Egypt); river flow for shipping; hydropower production; and the supply of water for use in tourism facilities. For Sudan and Egypt, which share the Nile Basin with seven other countries, regional water resource planning is given added urgency due to existing tensions over trans-boundary resources and a desire to avoid future conflicts due to decreased water flows (Conway, 2005; De Villiers, 1999; Link et al. 2010).

Identified adaptation actions within the region include: improvements to irrigation efficiency; rainwater harvesting; the development of small- and medium-sized dams; wastewater and industrial water reuse; redesign of water storage and canals to reduce evaporation loss; public education on water efficiency; water desalination; and amendments to water resource laws (AMDE, 2001; EMSEA, 2010; MDWE, 2010; SMEPD, 2003).

combination of such impacts is likely to slow down the reform process and ultimately offset the growth benefits generated by high oil prices."

[18] The situation in the Yemen capital of Sana'a is particularly acute, with water currently being extracted at a rate four times greater than it is being replenished. With the city's population growing at a rate of 7 percent per year, concern has been expressed that Sana'a could become the first capital city in the world to run out of water (New Agriculturist, 2010).

Agriculture

In several North African countries, agriculture remains the principle livelihood of a large number of citizens, many of whom experience poverty and lack income diversity.[19] With climate change, agricultural yields are expected to fall in the long term across the region (Sowers & Weinthal, 2010), with losses of 0.4 to 1.3 per cent of Gross Domestic Product (GDP) projected by 2100 (Mendelsohn et al., 2000b, cited in Boko et al., 2007). Most of the agriculture in the region is rain-fed, which leaves it highly vulnerable to changes in precipitation patterns. Although 95 per cent of Egypt's agriculture is irrigation-based, its reliance on obtaining water from the Nile River also leaves it vulnerable (EMSEA, 2010). Agriculture along the coastal zones of all countries is at risk as well from ASLR and salinization of the soil (see below).

Priority agricultural adaptation actions identified by North Africa countries are often tied to water use and include more efficient irrigation and the development of drought-resistant species. Other agricultural adaptation measures proposed in the region include: new livestock routes to improve the resilience of pastoralists; smallholder income diversification; development of oases; development of grazing enclosures; use of new technologies for weed control; and changes in cropping patterns (AMDE, 2001; EMSEA, 2010; SMEPD, 2003; MDWE, 2010).

Coastal Zones

Risks to coastal zones are closely related to many water and agricultural concerns, including inundation of fertile agricultural lands and salinization of coastal aquifers (Sowers & Weinthal, 2010). Risks to urban populations and infrastructure are also substantial. It is estimated that Egypt, Tunisia and Libya rank among the top 10 countries in the world whose urban populations are expected be highly affected by ASLR (SSO, 2010). The World Bank (undated) reports that 19 port cities in the region could be affected by ASLR and storm surges. All of these risks are demonstrated in Egypt, where it has been estimated that up to 1,800 square kilometers of the country's agricultural land area could be submerged, over two million people displaced and US$35 billion in land, property and infrastructure damage incurred if sea levels rise by 50 centimeters (SSO, 2010). A 2011 World Bank report highlights a number of cost effective measures that coastal cities may implement to mitigate these risks, such as urban planning and strengthening institutional preparedness (World Bank, 2011).

Other identified actions for coastal zone adaptation in North Africa include: the construction or improvement of sea walls and other barriers; the creation of wetlands in vulnerable areas; protection and fixing of sand dunes (i.e., natural protection); integrated coastal zone management; reinforcement of the international road along the Mediterranean coast to act as a line of defense; the use of canal banks as protection; and monitoring of coastal subterranean waters (AMED, 2001; EMSEA, 2010; MDWE, 2010; TMED, 2000).

[19] In Sudan, for instance, 80 per cent of the population supports its livelihood through traditional subsistence agriculture (SMEPD, 2003). In southern Sudan, a 20 per cent reduction in the length of the growing period is projected by 2050, a change that would threaten the already impoverished rural farming population (Sowers & Weinthal, 2010).

Tourism

The tourism sector forms a significant portion of many North Africa economies. For instance, it accounts for 5.5 per cent of the GDP of Tunisia (USDS, 2010), where 90 per cent of tourism occurs on the coast (Agoumi, 2003). As such, tourism is identified as a priority sector for adaptation by Egypt, Tunisia and Yemen; other countries also note it as a concern, particularly Morocco. The greatest concerns are linked to ASLR and the damage it could to do such amenities as beaches, coastal islands and infrastructure, as well as the potential for climate change to cause the bleaching and loss of coral reefs.

Countries concerned about tourism have proposed adaptation actions such as: the expansion of marine protected areas; protection of marine areas (e.g., coral reefs); enhanced regulation enforcement; adoption of integrated coastal zone management approaches; protection of vulnerable archeological and touristic sites; and the redirection of growth away from sensitive lands (EMSEA, 2010; MDWE, 2010).

Human health

Climate change related health concerns include those related to communicable diseases (malaria, schistosomiasis, lymphatic filariasis, rift valley fever etc.), water-borne and food-borne diseases (e.g., diarrhea) and non-communicable diseases that could be exacerbated by climate change (e.g., cardiovascular diseases, respiratory diseases, malnutrition). Although health impacts associated with increases in temperature and decreases in water availability will affect all North African countries, Egypt, Morocco and Sudan focus on health as a priority in their formal documents (EMSEA, 2010; SMEPD, 2003).

Proposed adaptation actions in the health sector include: the reduction of socioeconomic vulnerability (e.g., income diversification); improvements to public health infrastructure; improved access to quality health services; improvement of vaccination programs; development of early warning systems and control programs for infectious diseases; development of public awareness campaigns; other measures to reduce vulnerability to malaria transmission, meningitis outbreaks and Leishmaniasis disease; improvements to public transportation in order to improve air quality; use of catalytic convertors; pest control strategies; improved water treatment; and improved public hygiene (EMSEA, 2010; MDWE, 2010; SMEPD, 2003).

Infrastructure

While numerous North African National Communications make reference to infrastructure concerns, only Egypt lists infrastructure as a priority area for adaptation. Housing concerns include the heat island effect and its subsequent impacts on health. Deformation and damage of roads due to greater heat and excessive rains (e.g., flash floods, landslides) are additional concerns highlighted (EMSEA, 2010).

In response, Egypt has proposed adaptation measures in its housing sector that include: orientation of houses to minimize warming; building standards to reduce energy use; use of natural ventilation; the use of natural lighting; and the building of national institutional capacity (e.g., "green" architecture integration into relevant university curricula). Adaptation measures proposed in the transportation (roads) sector include: the use of bituminous materials; the re-orientation of flood routes away from road paths; the encouragement of alternative modes of transportation; upgrades to public transportation; the storage of flood or rain water (to prevent it from damaging roads and to provide a water source); bridge construction; and vulnerability assessments for new road projects which could lead to re-routing of roads deemed too vulnerable to flood damage (EMSEA, 2010). Similar measures could be applied in other North African countries.

Forestry

Documents from several countries discuss forestry or agroforestry as a priority area of adaptation, though only Algeria and Morocco do so in their National Communications. When forestry is discussed, links are often made to energy (e.g., the encouragement of alternative energy sources in order to reduce demand for wood fuel and thereby preserve forests).

Proposed adaptation actions include: increased reforestation; creation of greenbelts; creation of urban forests; protection of national park forests; encouragement of indigenous species usage; and the development of drought-resistant species (AMDE, 2001; MDWE, 2010).

5.0 Assessment of Adaptation Action within North Africa

Adaptation action at the policy and project levels is occurring throughout North Africa but varies considerably between countries. Shared policy initiatives and projects at the regional level are enabling governments to address common concerns, particularly in relation to freshwater management in a changing climate. In the majority of countries, these regional levels are the primary manner through which adaptation action is being taken; initiatives designed exclusively to address country-specific concerns are less abundant.

5.1 Regional Level Action

Regional level adaptation action in North Africa is taking place through intergovernmental organizations and projects that bring together countries within and outside of the region.

Regional Policy Action

At the intergovernmental level, as members of the League of Arab States, all of the North African governments supported the Arab Ministerial Declaration on Climate Change adopted in 2007 by the Council of Arab Ministers Responsible for the Environment. Adaptation related commitments in the Declaration include:

- Inclusion of climate change issues in all national and regional sectorial policies for sustainable development "in a manner that harmonizes with sustained economic growth and efforts to eradicate poverty;"
- Adoption of national and regional climate change action plans in which governments will have a major role in ensuring coordination and cooperation between all parties concerned;
- Ensure that adaptation measures are fully consistent with economic and social development; and
- A particular focus on providing the infrastructure necessary to reduce potential risks, including risk insurance, improved management of natural resources, early warning systems, improved exchange of information (including weather information) and public awareness (CAMRE, 2007).

Arab governments have begun to act upon the commitments contained in the Declaration. For instance, in 2008, the Secretariat of the Economic and Social Commission for Western Asia was asked at the Commission's 25th Ministerial Session to develop the Arab Framework Action Plan on Climate Change in partnership with the League of Arab States, United Nations Environment Programme and other relevant regional organizations. The Secretariat was also asked to work with governments of member countries to undertake a "reassessment of the impacts of climate change on economic and social development in the region, with emphasis on freshwater resources" and raise awareness of measures for adaptation to climate change (UN-ESCWA, 2010b). The framework for a project to assess the impact of climate change on water resources was elaborated through subsequent meetings and approved in July 2010 by the Arab Ministerial Water Council. Four pillars of the agreed project framework are: the collection and review of baseline information; climate change impact analysis and vulnerability assessment; awareness raising and information dissemination; and capacity building and institutional strengthening (UN-ESCWA, 2010a). Early in 2011, the League of Arab States, in partnership with the World Bank, initiated development of an Adaptation Report that will be used to inform the 5th IPCC Assessment Report (IISD, 2011). The League of Arab States has also committed to expanding its cooperation with the African Union in the area of climate change and recommended implementation of joint climate change observation, monitoring and early warning (AU & LAS, 2010).

Algeria, Libya, Morocco and Tunisia, along with Mauritania, are also members of the Arab Maghreb Union (AMU). Building on its existing efforts related to desertification, the AMU's Ministerial Committee on Food Security recommended in 2009 that climate change related issues be integrated into the mandate and activities of the Maghrebian Permanent Committee on Desertification and Sustainable Development (Global Mechanism, 2009). More recently, the AMU has agreed to conduct an assessment of meteorological institutions in the Union in order to strengthen their capacity to accurately forecast immediate weather events, particularly those related to extreme climatic events (Tunisia News Online, 2010).

Egypt and Sudan, as countries through which the Nile River flows, also are members of the Nile Basin Initiative (NBI). As part of the NBI's objective of achieving sustainable socioeconomic development through equitable sharing of the Nile Basin's water resources, its member states[20] have begun to look at climate change. In 2008, the Nile Basin Council of Ministers endorsed a concept note "for the development of a project to address climate change impacts and adaptation in the Nile basin," with expectations that the project would be at a basin-wide scale and developed in a participatory manner (NBI, 2008; Ndombe, 2009). In March 2010, the project "Adapting to Climate Change Induced Water Stress in the Nile River Basin" was launched by the NBI in partnership with UNEP and with funding from the Swedish International Development Agency (SIDA). The project aims to minimize the projected stress of too little and too much water on conflict prevention and disaster reduction through knowledge-based policy intervention, technology transfer and investment in key infrastructure in selected "hotspots"[21] (Mumba and Muragori, 2010).

Regional Projects and Programs

In addition to these intergovernmental initiatives, a small number of projects that exclusively involve North African countries are underway. Examples include:

- "Regional Coordination on Natural Resources Management and Capacity Building," a project financed in part by the Global Environment Facility that is helping Arab resource managers better understand and make decisions regarding regional natural resources in the context of climate change.[22]
- "Natural Disaster Preparedness for Coastal Cities of North Africa," through which the Global Facility for Disaster Risk Reduction and Recovery is supporting the cities of Alexandria, Tunis and Casablanca to prepare for the potential impacts of ASLR.[23]

North African countries are involved in a greater number of projects with their African and West Asian neighbors. These projects address a variety of sectors, including freshwater resources, agriculture, forestry, governance capacity, energy and ecosystem conservation. As described in Table 2, these projects include:

- "Support to Policy Consultation and Actions to boost Sustainable Use of Water and Energy Resources for Agricultural Production and Livelihood Improvement in the Near East and North Africa Region in the context of Climate Change," which involves all North African countries.[24]

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[20] The member states of the Nile Basin Initiative are Burundi, the DRC, Egypt, Ethiopia, Kenya, Rwanda, Sudan, Tanzania and Uganda.
[21] UNEP, http://www.unep.org/climatechange/adaptation/EcosystemBasedAdaptation/NileRiverBasin/tabid/29584/Default.aspx
[22] IW-LEARN: http://iwlearn.net/iw-projects/iwproject.2009-08-05.7974636515
[23] GFDRR, http://www.preventionweb.net/files/12693_GFDRRAnnualReport20091.pdf and http://gfdrr.org/docs/GFDRR2009.Annual_Report.REVISED.Nov20.2009.pdf
[24] FAO, https://extranet.fao.org/fpmis/FPMISReportServlet.jsp?div=&type=countryprofileopen&language=EN&countryId=SD and SESRIC, http://www.sesric.org/activities-oicfao.php

- "Adapting the Framework of Forestry Policy to Meet the Needs of Climate Change in the MENA [Middle East and North Africa] Region," involving the North Africa countries of Algeria, Morocco and Tunisia.[25]
- Participation by Morocco and Tunisia in the Africa Adaptation Programme (AAP).[26]
- Participation by Sudan in the projects: "Managing Risk, Reducing Vulnerability and Enhancing Productivity under a Changing Climate,"[27] "Security in Mobility: Advocating for safe movement as a climate change adaptation strategy for pastoralists in the Horn and East Africa,"[28] and "Managing Uncertainty: Innovation systems for coping with climate variability and change."[29]

Some North African countries participate as well in adaptation projects and programs that bring together countries from regions of Asia-Pacific, Africa and Latin America and the Caribbean, including (see Table 2):

- *Algeria* is participating in the projects "Capacity Development for Policy Makers: Addressing climate change in key sectors"[30] implemented by the United Nations Development Program (UNDP)
- *Morocco* is engaged in the "Community-based Adaptation Programme"[31] led by UNDP.
- *Tunisia* participated in the project "Advancing Capacity for Climate Change Adaptation" (ACCCA)[32] that brought together 19 countries from Asia and Africa.
- *Yemen* is a part of the "Pilot Program for Climate Resilience" (PPCR)."[33]

Funders of regional, inter-regional and global projects currently underway in North Africa include the Food and Agriculture Organization (FAO), the Global Environment Facility (GEF), the Global Fund for Disaster Risk Reduction, and the governments of Germany and Japan.

[25] GTZ, http://www.gtz.de/en/weltweit/maghreb-naher-osten/tunesien/32875.htm
[26] UNDP, http://www.undp-adaptation.org/portfolio/projectR.php?id=110
[27] IDRC, http://web.idrc.ca/en/ev-118881-201_104146-1-IDRC_ADM_INFO.html
[28] Relief web, http://reliefweb.int/node/360082
[29] CGIAR, http://ongoing-research.cgiar.org/factsheets/managing-uncertainty-innovation-systems-for-coping-with-climate-variability-and-change/ and ICRISAT, http://www.icrisat.org/what-we-do/agro-ecosystems/aes-adaption-table.htm
[30] UNDP, http://www.undp.org/climatechange/capacity-development.html
[31] GEF, http://www.gefonline.org/projectDetailsSQL.cfm?projID=2774 and UNDP, http://www.undp-adaptation.org/projects/websites/index.php?option=com_content&task=view&id=203
[32] ACCCA, http://www.acccaproject.org/accca/
[33] CIF, http://www.climatefundsupdate.org/listing/pilot-program-for-climate-resilience

Table 2. Current regional, interregional and global adaptation programs in which North African countries are participating

Name		Objectives	Participating Countries	Project Details	
North African Regional Programs					
1.	Natural Disaster Preparedness for Coastal Cities of North Africa[34]	The objectives are to: assist the national and local governments of Egypt, Tunisia and Morocco in assessing and valuing the vulnerability of the coastal cities Alexandria, Tunis and Casablanca respectively to natural disasters while addressing their underlying the synergies with climate change vulnerability; and develop prioritized preparedness comprehensive action plans that will address urban coastal vulnerability and infrastructure for the three cities.	Egypt, Morocco, Tunisia	**Funder(s)**	Global Facility for Disaster Reduction and Recovery
				Total Budget	US$250,000
				Implementing Agency(s)	
				Duration	2009–2011
				Project Type	Assessment; Policy formation and integration
				Focus Area(s)	Disaster risk management; Urban areas; Coastal zone management
2.	Regional Coordination on Natural Resources Management and Capacity Building[35]	To help resource managers in the Arab region better understand the status of regional natural resources and make learned decisions on their use and management, including water/ international water, land and vegetation, especially in the context of climate change impacts. Such decisions will in the end help resources managers to optimize resource utilization and reduce environmental degradation, including desertification and land degradation, and also help the society to adapt to impacts of climate change and variability.	Algeria Egypt Libya Morocco Tunisia *Plus:* Lebanon Mauritania	**Funder(s)**	GEF Trust Fund, national government, bilateral aid
				Total Budget	US$87,679,545
				Implementing Agency(s)	Arab Water Council (AWC), Arab Water Academy, and relevant agencies of AWC member countries
				Duration	2009–2014
				Project Type	Capacity building; Research; Assessment; Knowledge communication
				Focus Area(s)	Ecosystem conservation; Freshwater supply
Collaboration with African and West Asia countries					
3.	Managing Uncertainty: Innovation systems for	Coping with risks and realizing opportunities associated with	Kenya, Rwanda, **Sudan**, Uganda	**Funder(s)**	AfDB
				Total Budget	

[34] GFDRR, http://www.preventionweb.net/files/12693_GFDRRAnnualReport20091.pdf and http://gfdrr.org/docs/GFDRR2009.Annual_Report.REVISED.Nov20.2009.pdf
[35] IW-LEARN: http://iwlearn.net/iw-projects/iwproject.2009-08-05.7974636515

Name		Objectives	Participating Countries	Project Details	
	coping with climate variability and change[36]	climate variability and change enhanced through appropriate strategies and institutional innovation. The project will: synthesize and disseminate knowledge to researchers and planners to support decision making in the agriculture sector; formation of learning alliances and knowledge exchange systems between meteorological and agricultural research and extension systems; and test strategies and tools and promote "proof of concept" projects.		**Implementing Agency(s)**	International Crops Research Institute for the Semi-Arid Tropics
				Duration	2007–2010
				Project Type	Research
				Focus Area(s)	Agriculture
4.	Managing Risk, Reducing Vulnerability and Enhancing Productivity under a Changing Climate[37]	Using case studies from Ethiopia, Kenya, Sudan and Tanzania, this action-research project seeks to contribute to the development of adaptive strategies by gathering knowledge on vulnerability to drought within different social, political and economic contexts, and designing decision-making tools to reduce vulnerability. The impacts of climate induced crises will be mitigated and resilience improved through the adoption, by small-scale farmers, of innovative strategies that reduce climate risk and manage vulnerability.	Eritrea, Ethiopia, Kenya, **Sudan**, Tanzania	**Funder(s)**	DFID and IDRC through the CCAA program
				Total Budget	CND 1,626,100
				Implementing Agency(s)	Sokoine University of Agriculture (Tanzania)
				Duration	2007–2011
				Project Type	Capacity building; Field implementation
				Focus Area(s)	Agriculture
5.	Security in Mobility: Advocating for safe movement as a climate change adaptation strategy for pastoralists in the Horn and East Africa[38]	The focus of the project was to: "1. Promote pastoralists internal and cross-border mobility needs as a climate change adaptation strategy; 2. Advocate for regional cross-border security needs to be reconciled with pastoralists' livelihood needs, including cross-	Ethiopia, Kenya, Somalia, **Sudan**, Uganda	**Funder(s)**	Swiss Agency for Development Cooperation
				Total Budget	
				Implementing Agency(s)	UN Office for Coordination of Humanitarian Affairs; UNEP; International Organization for

[36] CGIAR, http://ongoing-research.cgiar.org/factsheets/managing-uncertainty-innovation-systems-for-coping-with-climate-variability-and-change/ and ICRISAT, http://www.icrisat.org/what-we-do/agro-ecosystems/aes-adaption-table.htm

[37] IDRC, http://web.idrc.ca/en/ev-118881-201_104146-1-IDRC_ADM_INFO.html

[38] Relief web, http://reliefweb.int/node/360082

Name		Objectives	Participating Countries	Project Details	
		border mobility for access to water and pasture; 3. Support regional governments to develop regional normative framework on migration and mobility for pastoralists to enhance cross border security."[39]			Migration; Institute for Security Studies
				Duration	2009–2010 (closed)
				Project Type	Research; Knowledge communication; Policy formation and integration
				Focus Area(s)	Pastoralism
6.	Support to Policy Consultation and Actions to boost Sustainable Use of Water and Energy Resources for Agricultural Production and Livelihood Improvement in the Near East and North Africa Region in the context of Climate Change[40]	The project will assist in building the capacity of governments and civil society to prepare national reviews, analyze the current national policies for water development, examine cooperation on transboundary water management, and identify the investment needs and investment strategies for food, water and energy security to be adopted on a national and regional basis in the context of climate change. Capacity building of governments and civil societies for optimal natural resource management.	30 countries including: Afghanistan, **Algeria**, Djibouti, **Egypt**, Kazakhstan, Kyrgyzstan, **Libya**, Mauritania, **Morocco**, Pakistan, Somalia, **Sudan**, Tajikistan, **Tunisia**, Turkmenistan, Uzbekistan, and **Yemen**	**Funder(s)**	FAO
				Total Budget	US$436,000
				Implementing Agency(s)	FAO, Organisation of the Islamic Conference
				Duration	2010–2011
				Project Type	Capacity building; Policy formation and integration; Research
				Focus Area(s)	Freshwater supply; Energy; Agriculture
7.	Supporting Integrated and Comprehensive Approaches to Climate Change Adaptation in Africa (or Africa Adaptation Program – AAP)[41]	Under this program, UNDP is assisting 20 African countries in implementing integrated and comprehensive adaptation actions and resilience plans. The projects will ensure that national development processes incorporate climate change risks and opportunities to secure development gains under a changing climate. UNDP will help countries establish an enabling environment and develop the	*African:* 20 African countries[42] including: **Morocco**, **Tunisia**	**Funder(s)**	Japan International Cooperation Agency
				Total Budget	US$92.1 million
				Implementing Agency(s)	UNDP
				Duration	2008–2011
				Project Type	Capacity building; Policy formation and integration; Knowledge communication
				Focus Area(s)	Government

[39] Relief web: http://reliefweb.int/sites/reliefweb.int/files/resources/8E4A32AF1BCEE2544925775800065831-Full_Report.pdf

[40] ALM, http://www.adaptationlearning.net/program/support-policy-consultation-and-actions-boost-sustainable-use-water-and-energy-resources-agr and SESRIC, http://www.sesric.org/activities-oicfao.php

[41] ALM, http://www.adaptationlearning.net/program/africa-adaptation-programme and UNDP-APP, http://www.undp-aap.org/

[42] These countries are: Burkina Faso, Cameroon, Congo, Ethiopia, Gabon, Ghana, Kenya, Lesotho, Malawi, Mauritius, Morocco, Mozambique, Namibia, Niger, Nigeria, Rwanda, Sao Tome et Principe, Senegal, Tanzania and Tunisia.

Name		Objectives	Participating Countries	Project Details	
		capacity required to design, finance, implement, and monitor long-term and cost-effective adaptation policies and plans.			
8.	Community-Based Adaptation to Climate Change in Africa[43]	The project is identifying ways of communicating climate information to poor and vulnerable communities, and from communities to other stakeholders. Capacity building and support is being given to NGOs and communities through training to facilitate integration of climate change into their plans and activities. The project will generate information on community-based climate change adaptation; disseminate these to inform other stakeholders including researchers, NGOs, national and international policy and decision makers etc.	Kenya, Malawi, South Africa, **Sudan**, Tanzania, Uganda, Zambia, Zimbabwe	**Funder(s)**	IDRC and DFID, CCAA program
				Total Budget	CND 1,398,500
				Implementing Agency(s)	African Centre for Technology Studies
				Duration	2008–2011
				Project Type	Field implementation; Community-based adaptation; Research; Capacity building
				Focus Area(s)	Multi-sectoral
9.	Adapting the Framework of Forestry Policy to meet the needs of climate change in the MENA region[44]	The objective of the project is that conditions improve for the sustainable management of forest ecosystems and for the maintenance of their environmental services in the face of climate change in the Middle East and North Africa (MENA) region.	**Algeria**, **Morocco** and **Tunisia** *Plus:* Lebanon, Syria, Turkey	**Funder(s)**	BMZ; implemented under the Collaborative Partnership on Mediterranean Forests[45]
				Total Budget	
				Implementing Agency(s)	High Commission for Waters, Forests and Combating Desertification, Morocco
				Duration	2010–2014
				Project Type	Policy formation and integration; Research; Knowledge communication
				Focus Area(s)	Forestry; Ecosystem conservation

[43] IIED, http://www.iied.org/climate-change/key-issues/community-based-adaptation/community-based-adaptation-africa-cbaa, ACTS, http://www.acts.or.ke/index.php?option=com_content&view=article&id=60&Itemid=53 and IDRC, http://www.idrc.ca/cp/ev-83067-201_104898-1-IDRC_ADM_INFO.html

[44] GTZ, http://www.gtz.de/en/weltweit/maghreb-naher-osten/tunesien/32875.htm

[45] FAO, http://www.fao.org/forestry/65365/en/

Name		Objectives	Participating Countries	Project Details	
Participation in Projects involving countries from Africa, Asia, the Pacific and/or Latin America and the Caribbean					
10.	Advancing Capacity for Climate Change Adaptation (ACCCA)[46]	The rational for this project is that countries lack scientific knowledge and understanding of climate risks, and that this is an impediment to addressing climate variability. Activities include the following: identify and prioritize climate risks; assess available knowledge about risks and adaptation opportunities; develop, test, and disseminate risk communication materials that are designed to assist adaptation decisions; and identify critical knowledge gaps that impede effective adaptation decisions.	17 countries in Asia and Africa[47] including **Tunisia**	**Funder(s)**	IDRC; DEFRA; Swiss Federal Office for the Environment; NCAP; European Commission
				Total Budget	
				Implementing Agency(s)	UNITAR
				Duration	2007–2010
				Project Type	Assessment; Capacity building; Policy formation and integration
				Focus Area(s)	Multi-sectoral
11.	Capacity Development for Policy Makers: Addressing climate change in key sectors[48]	The project is a targeted capacity development initiative that supports two goals: 1. To increase national capacity to co-ordinate Ministerial views for more effective participation in the UNFCCC process; and 2. To assess investment and financial flows to address climate change for selected key sectors. As a result of this project, both the technical understanding of key climate change issues and their economic and policy implications within the context of the Convention will be enhanced.	19 countries,[49] including **Algeria**	**Funder(s)**	United Nations Foundation; Switzerland; Finland; Spain; and Norway
				Total Budget	US$6,953,413
				Implementing Agency(s)	UNDP
				Duration	2008–2010
				Project Type	Capacity building; Policy formation and integration; Knowledge communication
				Focus Area(s)	Government
12.	Pilot Program for Climate Resilience (PPCR)[50]	PPCR aims to pilot and demonstrate ways in which climate risk and resilience may be integrated into core development planning and implementation in a way that is consistent with	Bangladesh, Bolivia, Cambodia, Mozambique, Nepal, Niger, Tajikistan,	**Funder(s)**	World Bank's Strategic Climate Fund
				Total Budget	US$971.75 million pledged as of February 2011
				Implementing	World Bank

[46] ACCCA, http://www.acccaproject.org/accca/

[47] *African countries include*: Burkina Faso, Cameroon, Ethiopia, Ghana, Kenya, Malawi, Mali, Niger, Nigeria, Tanzania, Tunisia and South Africa. *Asian countries include*: Bangladesh, India, Mongolia, Nepal and the Philippines.

[48] UNDP, http://www.undp.org/climatechange/capacity-development.html

[49] These countries are Algeria, Bangladesh, Colombia, Costa Rica, Dominican Republic, Ecuador, Gambia, Honduras, Liberia, Namibia, Nepal, Nicaragua, Niger, Paraguay, Peru, St. Lucia, Togo, Turkmenistan, and Uruguay.

[50] CIF, http://www.climatefundsupdate.org/listing/pilot-program-for-climate-resilience

Name		Objectives	Participating Countries	Project Details	
		poverty reduction and sustainable development goals. In this way, the PPCR provides incentives for scaled-up action and initiates transformational change. The pilot programs and projects implemented under the PPCR are country-led, build on NAPAs and other relevant country studies and strategies.	**Yemen**, Zambia *Regional Programs:* Caribbean and Pacific (includes Papua New Guinea, Samoa, Tonga)	**Agency(s)**	
				Duration	2008–ongoing
				Project Type	Policy formation and integration
				Focus Area(s)	Multi-sectoral
13.	Community-Based Adaptation Programme[51]	The objective of the program is to enhance the capacity of communities in the pilot countries to adapt to climate change including variability. Planned outcomes are: • Enhanced adaptive capacity allows communities to reduce their vulnerability to adverse impacts of future climate hazards; • National policies and programs include community-based adaptation priorities to promote replication, up-scaling and integration of best practices derived from community-based adaptation projects; and • Cooperation among member countries promotes global innovation in adaptation to climate change including variability.	Bangladesh, Bolivia, Guatemala, Jamaica, Kazakhstan, **Morocco**, Namibia, Niger, Samoa, Viet Nam	**Funder(s)**	GEF (Strategic Priority on Adaptation), co-financing
				Total Budget	US$6.7 million
				Implementing Agency(s)	UNDP
				Duration	2009–2011
				Project Type	Knowledge communication; Capacity Building; Community- based adaptation
				Focus Area(s)	Multi-sectoral

5.2 National Level Action

At the national level, North African countries are identifying adaptation priorities and actions through National Communications[52] and, in the case of Sudan and Yemen, their NAPAs; Libya has not yet completed its Initial National Communication. Some National Communications, such as Egypt's Second National Communication, suggest adaptation actions for all identified priority sectors. Other countries are more selective, proposing adaptation actions for a small set of priority

[51] GEF, http://www.gefonline.org/projectDetailsSQL.cfm?projID=2774 and UNDP, http://www.undp-adaptation.org/projects/websites/index.php?option=com_content&task=view&id=203

[52] Only Egypt and Morocco had completed their Second National Communications as of October 2011.

Table 3: Comparison of adaptation action at the policy and program level in North Africa (as of May 2011)

	Policy Action				Participation in Projects/Programs		
	1st National Communication	2nd National Communication	NAPA	National Adaptation Policies	Country-Specific/ National	Multi-country	Total
Algeria	2001	2010	Non-LDC	2003	1	4	5
Egypt	1999	2010	Non-LDC		4	4	8
Libya			Non-LDC		0	2	2
Morocco	2001	2010	Non-LDC		7	6	13
Sudan	2003		2007		1	7	8
Tunisia	2001	In progress	Non-LDC		3	7	10
Yemen	2001	2009	2009		2	2	4

Note: Information contained in this table is based upon research completed as of May 2011. Additional project and programs, for example, may be underway in each country. Full information regarding adaptation action in each country as of May 2011 is available in the Appendix of this report.

sectors. The Tunisian government, for example, has thus far focused its attention on ASLR; it has given less attention to the areas of water and agriculture (TMED, 2001; TMED, 2000).

Outside of these efforts, only Algeria (in 2003) has developed an explicit national adaptation strategy. As well, the integration of adaptation needs and considerations into national policies appears to be limited. However, some countries, are implementing policies that may not explicitly state adaptation objectives but which nonetheless have adaptation benefits. For instance, the Moroccan Department of Water in the Ministry of the Environment is implementing strategies that include: continuation of a program to create small- and medium-sized dams; encouragement of drip irrigation; encouragement of rainwater collection; and introduction of new species resistant to water stress (MDW, 2009).

In terms of implementation, the highest level of adaptation action is occurring in Morocco. In addition to participating in several regional initiatives, the country is pursuing a greater number of projects that exclusively target its specific needs. A high number of adaptation focused projects are underway as well in Egypt, Sudan and Tunisia. Outside of these countries, relatively few projects (five or fewer) have been identified in each of Algeria, Libya and Yemen.

Across North Africa, projects designed for implementation exclusively in a North African country appear to mostly be focused on freshwater resources, agriculture and coastal zones—which is fitting given that these are priority sectors identified by nearly all countries through their National Communications and NAPAs. The review also suggests that the numerous human health concerns likely to arise with climate change (e.g., malaria, heat-related illnesses) are receiving less emphasis, although it was identified as a priority concern by four countries (Egypt, Morocco, Sudan and Yemen). Current projects are also responding to needs related to disaster risk management and internal capacity of governments.

The tourism sector does not appear to be a focused area of activity, and forestry is most commonly addressed through agriculture or energy-related projects. A further potential gap in adaptation action may be with respect to urban issues given the large urban populations in many North Africa countries. Presently, most urban actions appear to be centered on adaptation to ASLR, but other urban priorities, such as extreme events, may require greater attention. In addition, none of the projects identified through this review are focused on understanding the gender dimensions of climate change adaptation. Most projects remain focused on assessment and capacity building rather than implementation of field-level adaptation actions.

Funding is commonly through such major sources as the Climate Change Adaptation in Africa program (funded by the United Kingdom's Department for International Development and the International Development Research Centre), the Special Climate Change Fund, World Bank and the government of Germany. Sudan and Yemen have also both secured funding through the Least Developed Countries Fund.

5.3 Communities of Practice

Through communities of practice, individuals are able to share information, build knowledge and promote greater understanding of their areas of interest. Considerable benefit may be derived from participation in communities of practice focused on the adaptation to climate change given the recent emergence of this field and the importance of learning and knowledge exchange in facilitating adaptation. However, no evidence of communities of practice active in the area of climate change adaptation in North Africa was identified through this research.

6.0 Conclusions

North African countries contend with persistent concerns such as water scarcity, poverty, desertification, soil salinization, civil strife and high population growth rates. While progress has been made in recent years in addressing some of these concerns, climate change has the potential to undermine these efforts. Most governments in the region have recognized and articulated this risk through the completion of their National Communications and NAPAs. However, adaptation action as a whole appears to be limited within the region.

At the national level, policy planning seems confined to the completion of National Communications and NAPAs; countries have not yet developed explicit adaptation strategies and little integration of climate change into sectoral policies appears to be underway. The number of discrete adaptation projects and programs that exclusively address national concerns is also limited; in all countries except Morocco, only a handful of national projects appear to be currently underway. Moreover, most adaptation action in North Africa remains focused on assessment and research; relatively little "on-the-ground" work is taking place at present.

North African countries share a number of common vulnerabilities and concerns, and therefore opportunities for learning from one another exist. This potential has been recognized in part through the 2007 Arab Ministerial Declaration on Climate Change and subsequent initiation in 2010 of a joint project that will examine the potential impacts of climate change on water resources. However, there appears to be considerable room for greater regional level cooperation and joint planning, as well as a higher emphasis on adaptation within existing cooperative initiatives. For example, as highlighted by the Arab Maghreb Union, adaptation could be integrated more into ongoing work focused on desertification. In the agricultural sector, shared knowledge regarding effective practices (such as the introduction of drought-resistant species, water harvesting and other commonly identified adaptation actions) could help countries avoid duplication of efforts. Rising sea levels are also a concern shared by all North African countries. While a significant amount of required adaptation may involve the construction of physical infrastructure, integrated coastal zone management could significantly contribute to climate risk reduction strategies while addressing current needs related to population growth, rapid urbanization, expansion of the tourism sector and ecological degradation. Lessons from past and ongoing integrated coastal zone management efforts could efforts could be shared, along with emerging knowledge related to coastal adaptation to climate change.

Several existing regional adaptation projects address a variety of the region's shared priority adaptation concerns, including freshwater resources, agriculture, food security and coastal zone management. However, these initiatives appear to be focused on assessment, strategy formulation, and policy integration. Although these activities are important and lay the groundwork for more concrete action in the future, there is a need to ensure that adaptation initiatives move from research to implementation. This is particularly a concern in the area of freshwater resources management in the Nile Basin, where concrete joint action and implementation is required in order for progress to be achieved. Current efforts to address dominant priority sectors such as water, agriculture and coastal zones could be enlarged, and greater attention given to those priorities that presently are receiving less attention, such as health and urban issues.

In most North African countries, climate change related action has focused much more on reducing greenhouse gas emissions—reflecting the importance of oil and gas production in their economies. Yet these countries remain vulnerable to a diversity of climate change impacts. Particular concern may be expressed regarding the vulnerability of Yemen due to is current and forecasted levels of water scarcity, and to Egypt due to its high reliance on the Nile River and the concentration of its population within the Nile Delta. The more developed status of several North African countries, however, suggests that great economic and technical capacity may exist in the region to respond to these challenges.

Finally, it needs to be acknowledged that North Africa is presently experiencing profound political change, including the regime changes in Egypt, Libya and Tunisia, the civil unrest in Yemen, and the

formation of South Sudan. The implications of these changes—either positive or negative—for adaptation action and adaptive capacity remain to be seen.

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Appendices: Country Profiles

Within this review of current and planned adaptation action, North Africa is defined as including: Algeria, Egypt, Libya, Morocco, Sudan, Tunisia and Yemen. The West Asian country of Yemen is incorporated into this region due to its climatic, economic and cultural linkages with North Africa.

To assess the level of adaptation action occurring in each of these countries, a desk-based review of internet sources and relevant documentation was undertaken. The content of these sources was assessed in relation to a set of parameters established to focus the review's scope and ensure consistency across regions. Notably, it examines *discrete* adaptation actions, or *policies, programs and projects designed and implemented specifically to address the current and projected impacts of climate change*. Therefore, the review presents only a portion of the breadth of the efforts underway to reduce the vulnerability of developing countries to the impacts of climate change. In particular, it does not capture the broad array of development activities that are increasing the adaptive capacity of communities and countries. As well, within the review, adaptation efforts have been deemed to be "current" if they were ongoing or completed in 2009 or later. Therefore, the review does not include projects completed prior to 2009 that may have contributed to building local and national capacity to adapt. The review also only identifies those actions currently underway; it does not offer judgment of the effectiveness of actions taking place. In addition, reflecting the desk-based nature of the review, it is acknowledged that the content is biased toward identification of large-scale projects funded by international development assistance organizations and those projects about which information is available online. Therefore, small-scale projects that meet the review's definition of adaptation action, particularly those occurring at the community level, are not fully represented within the review. A fuller explanation of the methodology used to develop the country profiles that follow is provided in the methodology section of this report.

To facilitate analysis of the degree to which current adaptation projects and programs identified through the review are helping to meet the adaptation needs and priorities of developing countries, a common classification system was developed. This system examined identified projects and programs from two perspectives—their sector or areas of focus and the types of activities they are supporting. A fuller description of these two types of classifications is provided below.

Sector or Area of Focus

To support development of a general classification system for adaptation projects on the basis of their sector or area of focus, a review of the categories used by the Adaptation Learning Mechanism, Intergovernmental Panel on Climate Change (IPCC), United Nations

Environment Programme (UNEP) and the Nairobi Work Programme was completed and used to guide development of a series of categories for characterizing activities included in this review. Based on this review and expert judgment, a set of 14 macro project categories were identified: food, fiber and forests; ecosystems; freshwater resources; oceans and coastal areas; disaster risk management; migration and security; gender; business; infrastructure and transportation; human settlements; human health; climate information services; governance; and multi-sectoral. Where appropriate, these macro project categories were further refined through the identification of various sub-categories. These sub-categories were then used to label the discrete adaptation projects included in the review.

Definitions of the macro project categories used in the review along with descriptions of the types of projects included within their individual sub-categories are presented below.

1. **Food, Fiber and Forests** – Defined as the management and use of terrestrial natural resources to directly improve human well-being. Its sub-categories are:
   - *Agriculture* – Encompassing subsistence agriculture, commercial agriculture and the rearing of confined domestic animals.
   - *Pastoralism* – Encompassing the use of domestic animals as a primary means for obtaining resources from habitats (UNEP, 2007), particularly in nomadic and semi-nomadic communities.
   - *Forestry* – Encompassing afforestation, reforestation, agroforestry, commercial forestry, community-based forest management and woodland management.
   - *Fire management* – encompassing monitoring, planning and management to address the impact of fires on settlements and ecosystems, including forested and grassland ecosystems.

2. **Ecosystems** – Defined as a system of living organisms interacting together and with their physical environment, the boundaries of which may range from very small spatial scales to, ultimately, the entire Earth (IPCC, 2007). Its sub-categories are:
   - *Biodiversity* – Encompassing activities related to the maintenance of living organisms at various spatial scales, including the establishment and protection of parks and bio-reserves.
   - *Ecosystem conservation* – Encompassing efforts to *maintain* the health of particular ecosystems, such as wetlands, grasslands, forests, mangroves and coral reefs.
   - *Ecosystem restoration* – Encompassing efforts to *restore* the health of particular ecosystems, such as wetlands, grasslands, forests, mangroves and coral reefs.

3. **Freshwater Resources** – Defined as the management and use of freshwater contained in terrestrial ponds, lakes, rivers, watersheds, among others. Its sub-categories are:
   - *Freshwater fisheries* – Encompasses the catching, packing and selling of fish and shellfish derived from lakes, rivers and ponds, as well as through freshwater aquaculture.
   - *Watershed management* – Encompassing management of the basins that supply water to different streams, rivers, lakes and reservoirs, including integrated watershed management.
   - *Freshwater supply* – Encompassing efforts to access and preserve freshwater for human consumption and use including drinking water sources, groundwater resources, rainwater harvesting and water infrastructure such as wells, dams and dikes.

4. **Oceans and Coastal Areas** – Defined as the management and use of coastal areas and oceans. Its sub-categories are:
   - *Coastal zone management* – Encompassing the management of land and water resources in coastal areas, including through integrated coastal zone management and the establishment and maintenance of coastal infrastructure.
   - *Marine management* – Encompassing the management and use of off-shore ocean and sea resources.
   - *Marine fisheries* – Encompassing the catching, packing and selling of fish, shellfish and other aquatic resources found in the oceans and seas, including through marine and coastal aquaculture.

5. **Disaster Risk Management** – Defined as the "systematic process of using administrative directives, organizations, and operational skills and capacities to implement strategies, policies and improved coping capacities in order to lessen the adverse impacts of hazards and the possibility of disaster" (UNISDR, 2009, pp. 10). It includes emergency response measures, preparation for extreme events and early warning systems. No sub-categories were established in relation to this macro project category.

6. **Migration and Security** – Defined as efforts to support the movement of people and maintain their personal security in the face of incremental climate changes or climate shocks.
   - *Migration* – Encompassing preparations for and responses to the potential movement of people from one location to another due to climate change impacts.
   - *Security* – Relates to personal security and freedom from violence, crime and war due to natural and human-induced disasters (UNEP, 2007) and encompasses peace building, conflict reduction and conflict avoidance activities.

7. **Gender** – Defined as the social attributes and opportunities associated with being male and female and the relationships between women and men, and girls and boys, as well as the relations between women and those between men. These attributes, opportunities and relationships are socially constructed and are learned through socialization processes (UN Women, undated). It includes efforts to understand the vulnerability of women to the impacts of climate change, gender-sensitive adaptation strategies, and measures to improve the situation of women at the local and policy level, including through gender mainstreaming. No sub-categories were established in relation to this macro project category.

8. **Business** – Defined as the purchase and sale of goods and services with the objective of earning a profit. Its sub-categories are:
   - *Tourism* – Encompassing the adjustment and development of tourist facilities and operations to account for current and future vulnerabilities, including these actions in relation to ecotourism.
   - *Private sector* – Encompassing potential impact of climate change and potential adaptation strategies on the diverse activities underway in the portion of the economy in which goods and services are produced by individuals and companies including industry, mining and other economic sectors.
   - *Trade* – Encompassing the exchange of goods and services within and between countries.
   - *Insurance* – Encompassing the development, testing and adjusting of insurance and risk-management schemes, including weather-based index systems.

9. **Infrastructure** – Defined as the basic equipment, utilities, productive enterprises, installations, institutions and services essential for the development, operation and growth of an organization, city or nation (IPCC, 2001). Its sub-categories are:
   - *Energy* – Encompassing energy-related systems and infrastructure, including small-scale and large-scale energy generation through hydroelectric power generation, wind, solar and other forms of traditional and new energy sources, as well as transmission networks.
   - *Transportation* – Encompassing the components of the system required to move people and goods, including roads, bridges, railway lines, shipping corridors and ports.
   - *Waste management* – Encompassing sanitation, sewage systems, drainage systems and landfills.
   - *Buildings* – Encompassing actions related to built structures such as houses, schools and offices, including changes to building codes, building practices and green ways of construction.

10. **Human Settlements** – Defined as a place or area occupied by settlers (IPCC, 2001). Its sub-categories are:
    - *Peri-urban areas* – Encompassing the outskirts of urban centers, and the transition zone between rural and urban areas.
    - *Urban areas* – Encompassing municipalities, towns and cities, as well as areas in these centers (such as slums).
    - Rural areas – Encompassing villages and other small settlements, as well as rural landscapes and integrated rural development.

11. **Human Health** – Defined as a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity (WHO, undated). It includes efforts to assess vulnerabilities to and the impacts of climate change on human health directly and indirectly, and the development and implementation of appropriate adaptation strategies at the local, regional and national levels. No sub-categories were established in relation to this macro project category.

12. **Climate Information Services** – Defined as the production and delivery of authoritative, timely and usable information about climate change, climate variability, climate trends and impacts to different users at the local, sub-national, national, regional and global levels.[53] It includes efforts to develop, adjust and provide short- and long-term climate forecasts, including climate change projections, to different audiences. No sub-categories were established in relation to this macro project category.

13. **Governance** – Defined as the institutions (laws, property rights systems and forms of social organization) through which societies define and exercise control over resources.[54] Its sub-categories are:
    - *Government* – Encompassing efforts to build the capacity of government officials, either at the national or sub-national level, to prepare for and facilitate adaptation to climate change, including through the development of policies, plans, frameworks and strategies, as well as the establishment and operation of climate change trust funds.
    - *Civil society* – Encompassing efforts to build the capacity of the public including non-governmental organizations, to understand, prepare for and respond to climate change.

14. **Multi-sectoral** – Defined as actions that simultaneously address more than one sector in one and/or multiple locations. It includes efforts that address more than one sector, which are challenging to tease apart, and in the context of this review includes large, multi-country projects in which the specific sector of focus is nationally determined and, therefore, varies from country to country. No sub-categories were established in relation to this macro project category.

[53] Derived from: http://www.joss.ucar.edu/cscc/climate-service-definition-condensed.pdf
[54] Derived from UNEP, 2007.

Types of Activities

The following categories were used to organize the types of activities being completed as part of current adaptation projects and programs identified through the review:

- *Research* – Encompassing efforts to develop new knowledge and/or organize existing information so as to increase understanding of the links between climate change, human society and ecosystems and inform adaptation decision-making.
- *Assessment* – Encompassing risk, impact and vulnerability assessments, as well as monitoring of ecological and societal trends.
- *Capacity building* – Encompassing the provision of technical training, technical assistance, institutional strengthening and education.
- *Knowledge communication* – Encompassing efforts to share information, knowledge and practices related to climate change adaptation, including awareness raising and engagement of media.
- *Policy formation and integration* – Encompassing efforts to inform, develop and implement climate change adaptation plans, strategies, frameworks and policies at the local, sub-national, national and international levels.
- *Field implementation* – Encompassing physical measures to reduce vulnerability to the impacts of climate change, including the implementation of pilot projects, construction of infrastructure, development and modification of technologies and the management of physical resources.
- Community-based adaptation – Encompassing actions that directly engage community members in efforts to understand, plan for and respond to the impacts of climate change.

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1.0 Algeria

AWC	Arab Water Council
GEF	Global Environment Facility
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit
IDRC	International Development Research Centre
IFAD	International Fund for Agriculture and Development
UNDP	United Nations Development Programme

The second largest country in Africa, the People's Democratic Republic of Algeria covers an area of nearly 2.4-million square kilometers and has an estimated population of 36.3 million people (USDS, 2011). The country's topography and climate varies considerably from region to region and from season to season. The Tellian and Saharan Atlas mountain ranges, which run parallel to the country's Mediterranean coastline, divide Algeria into three distinct regions. Between the Tellian Atlas range and the coast is a narrow, fertile plain with a temperate, Mediterranean climate. The High Plateau between the Tellian and Saharan Atlas ranges is rugged and very dry with winter temperatures that can drop to near freezing. South of the Saharan Atlas range lies the Sahara Desert, which extends southward to the borders of Mali and Niger. The country frequently experiences dust and sandstorms between February and May (USDS, 2011).

Algeria's economy is highly reliant on oil and gas production, with 97 per cent of its export earnings coming from the sale of hydrocarbons. Agriculture is the source of eight per cent of the country's GDP; the country's main agricultural crops are wheat, barley, oats, grapes, olives, citrus and fruits. Herding sheep and cattle is also an important livelihood activity (USDS, 2011).

A. Adaptation Needs and Priorities

Algeria has experienced more frequent droughts, increased desertification and greater wind and water erosion in recent years. As well, decreased rainfall over the past 30 years has affected dams, groundwater tables, socio-economic activities and various environmental impacts (e.g. salinization due to aquifer over-exploitation and drought). These trends have highlighted the vulnerability of the country to the impacts of climate change.

Algeria has identified a number of areas of concern related to the projected impacts of climate change and actions that could be taken in response. These are summarized in Table 1. Further information about possible adaptation action in Algeria's water sector, as identified in its Second National Communication, are provided in Section D.

Table 1: Risks and adaptation activities and needs in key vulnerable sectors as identified by Algeria (AMATE, 2001)

Key vulnerable sectors	Risks due to climate change	Adaptation activities and needs
Freshwater Resources	• Projected decrease in precipitation • More groundwater salinization near coastal areas • Reduced dam storage (due to decreased rainfall) • Increased evaporation	• Increase water supply such as by using groundwater, building reservoirs, recycling industrial water and desalination • Develop and introduce flood and drought monitoring and control systems • Improve control dam operations to ensure that the volume of water supplied corresponds to real needs downstream, particularly for agriculture • Inject surface water into underground layers • Improve or stabilize watershed management, such as through re-vegetation and soil restoration • Modernize water distribution in urban centers; measure consumption and reduce losses (e.g. from leaks) • Carry out public education on water through media, schools, NGOs, information campaigns • Monitor water quality and increase use of water meters • Study dam sites, and plan new dam sites to adjust to projected climate conditions (assuming a lifespan of 50-100 years) • Use industrial processes with low water consumption • Implement a progressive water tax; implement financial incentives for water conservation by major water consumers (hotels, government offices, schools, local authorities etc.)
Coastal Zones and Marine Ecosystems	• Soil salinization	• Increase development planning/new investment requirements • Research/monitor the coastal ecosystem • Establish regulatory measures to protect coastal zones • Treat and purify wastewater before returning it to sea • Increase conservation of coastal sand dunes • Monitor groundwater aquifers and marine water intrusion
Agriculture/Food Security	• Erosion and degradation of soil (ongoing and could worsen with climate change)	• Improve and conserve soils • Enhance irrigation efficiency and/or expand irrigation

	• Reduced growing time for crops • Reduced crop yields	• Develop new crops • Choose forage species according to water availability (e.g. less water-intensive crops in sub-coastal and high plateau areas)[55] • Grow olives and fruit trees (almonds, pistachios) in arid and mountain areas • Grow citrus fruits by rejuvenating orchards and creating new plantations in the central and eastern areas where water availability will permit • Carry out viticulture, particularly in the western part of the country (Ain Témouchent, Mostaganem, Tlemcen, Sidi-Bel-Abbés, Mascara)
Forests	• Some species not going into hibernation • Increasing desertification of lands that are currently forested	• Increase reforestation efforts; reforest 20,000 to 40,000 hectares per year (in order to fight desertification, erosion, degradation of agricultural land, dam siltation, increase biodiversity protection, and create microclimates) • Update forest inventory (last updated in 1985) • Create urban green belts and other urban green spaces • Strengthen protection of nature reserves and national parks • Conduct and implement forest management studies

B. National Level Policies and Strategic Documents

Algeria has completed its first and second National Communications to the UNFCCC (in 2001 and 2010 respectively). The focus of these documents is on Algeria's greenhouse gas emissions and climate change mitigation efforts; little detail is provided with respect to the country's adaptation needs, priorities and actions. Within the Second National Communication, emphasis is placed on the vulnerability of the country's water sector to the impacts of climate change.

Table 2: Key Government Policies and Reports reflecting Adaptation Needs, Priorities and Planned Actions

Name of Policy Action		Government Division Responsible	Status	Sector(s) of Focus	Summary description
1.	Initial National Communication to the UNFCCC (Communication Nationale Initiale)	Ministry of Development and the Environment	Released March 2001	Freshwater resources, agriculture, forestry, coastal	Vulnerability and adaptation discussion focused on water resources, agriculture, forests and coastal zones.

[55] Specific recommendations include: grow pulses in the following regions: Tiaret, Tissemsilt, Ain Témouchent, Tlemcen, Relizane, Mila, Skikda, Bouira; grow sugar beets in Haut Cheliff, Bounamoussa et Guelma; grow carthame as an oleaginous (oilseed) crop in the high plateau areas (Oum El Bouaghi, Tiaret, Sétif); and grow sunflower as an oleaginous crop in coastal and sub-coastal areas (El Tarf, Guelma, Ain-Defla, Chlef.) (AMDE, 2001).

Name of Policy Action		Government Division Responsible	Status	Sector(s) of Focus	Summary description
				zones	
2.	Plan National d'Action et d'Adaptation aux Changements Climatiques[56]	Ministère de l'Aménagement du Territoire, de l'Environnement et du Tourisme	Adopted in 2003	Multi-sectoral	Includes adaptation and mitigation measures. Particular actions noted include reforestation, measures to increase agricultural resilience (not specified), water recycling and water desalinization.
3.	Second National Communication to the UNFCCC[57]	Ministries of Development, Environment and Tourism (Ministère de l'Aménagement du Territoire, de l'Environnement et du Tourisme)	Released December 2010	Freshwater resources	Adaptation section focuses on water resources, linking to water needs of the population, industry, tourism and agriculture. Adaptation discussion focuses on the Cheliff Basin, which lies along the Mediterranean Coast. However, while the adaptation section of the Communication provides a detailed assessment of the Cheliff Basin, potential adaptation measures are not well-developed.
4.	National Reforestation Plan		Ongoing	Forestry	Created to combat desertification, but has climate change adaptation benefits. (Reforestation is recommended in the national communications, as climate change will exacerbate desertification).

C. Current Adaptation Action

Adaptation action in Algeria is currently low in comparison to other North Africa countries. Ongoing activities include a project focused on reducing vulnerability to vector-borne diseases using an eco-health approach; increased capacity to determine investment and financial flows related to the health and water sectors; sustainable use of water and energy resources for agricultural production and livelihood improvement; and improved management of forest resources. Adaptation action related to other vulnerable sectors, such as coastal zones, has not yet been identified.

It may be noted that several other initiatives (either completed or underway) will likely help increase Algeria's resilience to climate change although this is not specifically one of their planned objectives. These include a number of actions focused on reforestation and reducing desertification. Other examples include several projects led by the International Fund for Agricultural Development (IFAD), namely:

[56] Algeria, http://www.ambassade-algerie.ch/realisations_1999_2009/environnement.html
[57] UNFCCC, http://unfccc.int/essential_background/library/items/3599.php?such=j&symbol=DZA/COM/2%20E#beg

- "Rural Development Project for the Mountain Zones in the North of the Wilaya of M'Sila women," the goals of which are efficient water use, poverty reduction, improved agricultural management and economic diversity.[58]
- "Pilot Project for the Development of Mountain Agriculture in the Watershed basin of Oued Saf Saf," which aims to undertake rehabilitation of small-scale irrigation, land reclamation, soil and water conservation, agricultural improvements, and increased access to government programs.[59]
- "Pilot Project for Integrated Rural Development of the Mellegue Watershed," the activities of which include pasture improvement, water conservation, spring rehabilitation and creation of shallow wells.[60]
- "Cereal and Livestock Smallholder Development Project in the Wilaya of Tiaret" which includes the stocking of fodder for drought adaptation.[61]

Table 3: Current Adaptation Projects and Programs active in Algeria

Name		Objectives	Funder(s)	Implementing Agency(s)	Type of project	Duration	Priority Sector(s)	Geographic focus (if any)
National Action								
1.	Exploring Adaptation Scenarios: Cutaneous Leishmaniasis and climate change in Algeria[62]	Using cutaneous leishmaniasis—a particularly widespread vector disease of epidemic nature—as a case in point, this project will develop an eco-health methodology to disease control. The project will be based on an in-depth study of two departments, Saïda and Tizi Ouzou, representing two contrasting natural ecosystems: the semi-arid and sub-humid, respectively. The project will endeavor to strengthen the capacity of various actors—researchers, professionals and citizens—to reduce the vulnerability of the population to	IDRC Budget: US$358,350	Centre National de Recherche en Anthropologie Sociale et Culturelle	Research; Capacity building	2010–2012	Human health	Saïda and Tizi Ouzou departments (chosen for their contrasting climates)

[58] IFAD, http://operations.ifad.org/web/ifad/operations/country/project/tags/algeria/1257/project%20overview
[59] IFAD, http://operations.ifad.org/web/ifad/operations/country/project/tags/algeria/1176/project%20overview
[60] IFAD, http://operations.ifad.org/web/ifad/operations/country/project/tags/algeria/226/project%20overview
[61] IFAD, http://operations.ifad.org/web/ifad/operations/country/project/tags/algeria/197/project%20overview
[62] IDRC, http://www.idrc.ca/en/ev-83269-201_105738-1-IDRC_ADM_INFO.html

Name		Objectives	Funder(s)	Implementing Agency(s)	Type of project	Duration	Priority Sector(s)	Geographic focus (if any)
		environmental conditions, leading to better risk management. The final goal is to put in place a regional strategy for the management of cutaneous leishmaniasis and similar diseases in other areas at risk in the Middle East and North Africa.						
Participation in Regional and Global Actions								
2.	Capacity Development for Policy Makers: Addressing climate change in key sectors[63]	The project is a targeted capacity development initiative that supports two goals: 1. To increase national capacity to co-ordinate Ministerial views for more effective participation in the UNFCCC process; and 2. To assess investment and financial flows to address climate change for selected key sectors. As a result of this project, both the technical understanding of key climate change issues and their economic and policy implications within the context of the Convention will be enhanced.	United Nations Foundation; Switzerland; Finland; Spain; and Norway *Budget:* US$6,953,413	UNDP	Capacity building; Policy formation and integration; Knowledge communication	2008–2010	Government	*Global:* 19 countries,[64] including Algeria
			In Algeria: Algeria will focus on the key sectors of health (adaptation), water (adaptation), and forestry (mitigation), and is currently preparing a work plan for the assessment of investment & financial flows for these key sectors.[65]					
3.	Regional Coordination on Natural Resources Management and Capacity Building[66]	To help resource managers in the Arab region better understand the status of regional natural resources and make learned decisions on their use and management, including water/ international water, land and vegetation, especially in the context of climate change impacts. Such decisions will	GEF Trust Fund, national government, bilateral aid Budget:	Arab Water Council (AWC), Arab Water Academy, and relevant agencies of AWC member	Capacity building; Research; Assessment; Knowledge communication	2009–2014	Ecosystem conservation; Freshwater supply	*African:* Algeria, Egypt, Lebanon, Libya, Mauritania, Morocco, Tunisia

[63] UNDP, http://www.undp.org/climatechange/capacity-development.html
[64] These countries are Algeria, Bangladesh, Colombia, Costa Rica, Dominican Republic, Ecuador, Gambia, Honduras, Liberia, Namibia, Nepal, Nicaragua, Niger, Paraguay, Peru, St. Lucia, Togo, Turkmenistan, and Uruguay.
[65] UNDP-CC, http://ccmap.undp.org/content/global-project-capacity-development-policy-makers-addressing-climate-change-key-sectors
[66] IW-LEARN, http://iwlearn.net/iw-projects/iwproject.2009-08-05.7974636515

Name		Objectives	Funder(s)	Implementing Agency(s)	Type of project	Duration	Priority Sector(s)	Geographic focus (if any)
		in the end help resources managers to optimize resource utilization and reduce environmental degradation, including desertification and land degradation, and also help the society to adapt to impacts of climate change and variability.	US$87,679,545	countries				
			In Algeria: To be determined					
4.	Support to Policy Consultation and Actions to boost Sustainable Use of Water and Energy Resources for Agricultural Production and Livelihood Improvement in the Near East and North Africa Region in the context of Climate Change[67]	The project will assist in building the capacity of governments and civil society to prepare national reviews, analyze the current national policies for water development, examine cooperation on transboundary water management, and identify the investment needs and investment strategies for food, water and energy security to be adopted on a national and regional basis in the context of climate change. Its main objectives are: • Carry out studies and workshops to increase awareness of water-energy-food interrelation and their sustainable use. • Address food and energy security in the Near East and North Africa region through a convergent approach which integrates four critical resource factors - water, energy, technology, and knowledge under the stress of climate change. • Carry out studies on the use of water resources, on the management strategies and on the investment needs at national level. • Capacity building of governments and civil	FAO Budget: US$436,000	FAO; Organisation of the Islamic Conference	Capacity building; Policy formation and integration; Research	2010–2011	Freshwater supply; Energy; Agriculture	*Global:* 30 countries including: Afghanistan, Algeria, Djibouti, Egypt, Kazakhstan, Kyrgyzstan, Libya, Mauritania, Morocco, Pakistan, Somalia, Sudan, Tajikistan, Tunisia, Turkmenistan Uzbekistan, Yemen
			In Algeria: To be determined					

[67] ALM, http://www.adaptationlearning.net/program/support-policy-consultation-and-actions-boost-sustainable-use-water-and-energy-resources-agr and SESRIC, http://www.sesric.org/activities-oicfao.php

Name		Objectives	Funder(s)	Implementing Agency(s)	Type of project	Duration	Priority Sector(s)	Geographic focus (if any)
		societies for optimal natural resource management.						
5.	Adapting the Framework of Forestry Policy to Meet the Needs of Climate Change in the MENA region[68]	The objective of the project is to improve conditions for the sustainable management of forest ecosystems and for the maintenance of their environmental services in the face of climate change in the Middle East and North Africa (MENA) region.	BMZ implemented under the Collaborative Partnership on Mediterranean Forests[69]	High Commission for Waters, Forests and Combating Desertification, Morocco	Policy formation and integration; Research; Knowledge communication	2010–2014	Forestry; Ecosystem conservation	*Regional:* Algeria, Lebanon, Morocco, Syria, Tunisia, Turkey
			In Algeria: To be determined					

D. Proposed Adaptation Action

In its Second National Communication (AMATE, 2010), Algeria focused on the vulnerability of its water resources, particularly in the Cheliff Basin. It also identifies a number of broad adaptation measures that could be undertaken in different sectors, but does not define specific projects that could be implemented in the future. Potential adaptation measures for this sector are identified as being:

- Water efficiency measures to reduce water demands;
- Improve planning strategies and preparedness for droughts and severe floods;
- Reduce water contamination from industrial, wastewater and other human sources;
- Enhance monitoring and improved measurement of climate parameters, hydrology, hydrogeology and water quality;
- Improve procedures for equitable distribution of water resources;
- Control dam operations: the volume of water supplied must correspond to real needs downstream, particularly for agriculture;
- Inject surface water into groundwater;
- Ensure crops suit the type of soil and climate;
- Reforestation, land consolidation and development of an agricultural map;
- Develop wastewater reuse and using this water for agriculture and watering greenspaces;

[68] GTZ, http://www.gtz.de/en/weltweit/maghreb-naher-osten/tunesien/32875.htm
[69] FAO, http://www.fao.org/forestry/65365/en/

- Protect water resources from pollution;
- Widespread development of efficient irrigation techniques (e.g. drip irrigation);
- Improve existing irrigation infrastructure through improved maintenance and rehabilitation; and
- Improve yields of drinking water distribution networks.

E. Assessment

Although it initiated the development of national adaptation strategy in 2003, Algeria appears to be less engaged in climate change adaptation when compared to other North African countries, such as Morocco, Tunisia and Egypt. Little adaptation action in the area of policy development or the implementation of programs and projects currently appears to be underway. While greater adaptation action is required across all sectors, key gaps appear to be the absence for projects and programs focused specifically on coastal zone management and the limited attention to agriculture and food security related risks; as well, none of the project focus explicitly on the gender dimensions of climate change. Common concerns such as rising sea levels, drought and the risk of desertification suggest that multi-country cooperation may be beneficial. In particular, Algeria shares common concerns with Morocco and Tunisia, and might benefit for their experience to facilitating adaptation action.

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2.0 Egypt

CCAA	Climate Change Adaptation in Africa
EEAA	Egyptian Environmental Affairs Agency
GDP	Gross Domestic Product
GEF	Global Environment Facility
ICZM	Integrated Coastal Zone Management
MDG	Millennium Development Goals
SCCF	Special Climate Change Fund
UNDP	United Nations Development Programme

Called the "gift of the Nile," the state of Egypt has persisted for more than 5,000 years (USDS, 2010). Today, with a population of over 82-million people, the Arab Republic of Egypt is the second most populous country in Africa and the most populous country in the Arab world (USDS, 2010; CIA, 2011). The Nile Valley and its Delta remain the heart of Egypt, with roughly 97 per cent of the population living in this part of the country (Arab Republic of Egypt, 2010a).[70] The country's limited arable land—only 2.92 per cent of its 1,001,450 square kilometers—is mostly found along the Nile River and on the Nile Delta (CIA, 2011). The Sahara Desert dominates the remainder of Egypt and is sparsely inhabited.

Egypt has a well-developed and diversified economy that includes a high reliance on tourism,[71] oil and gas exports and revenue from the Suez Canal (USDS, 2010). Agriculture continues to play an important role in the country's economy; mostly irrigated by water from the Nile River, agriculture generates 13.5 per cent of Egypt's GDP (2010 estimate) and engages 32 per cent of its labor force (CIA, 2011). The main crops grown in the country are cotton, rice, onions, beans, citrus fruits, wheat, corn, barley and sugar (USDS, 2010). Egypt's GDP per capita is relatively high (US$6,200 in 2010), but average Egyptians remain poor (CIA, 2011).

[70] An estimated 43.4 per cent of all Egyptians live in urban areas—a number that is growing at a rate of 2.1 per cent per year (CIA, 2011).

[71] Tourism generates roughly 11 per cent of Egypt's GDP (Egypt State Information Service, 2008).

A. Adaptation Needs and Priorities

Egypt has a generally hot and dry climate, with mild temperatures and rain occurring in coastal areas in the winter months. Air temperatures in the country are increasing, along with the number of hazy days, hot days and misty days. Greater precipitation is also reported along the Mediterranean coast (a mean trend of +0.76 mm per year over the past three decades). Observed increases in the frequency and severity of sand storms and flooding are occurring, with negative consequences for the health, agriculture, livestock and tourism sectors (Arab Republic of Egypt, 2010a).

Climate change is projected to result in further temperature increases and a possible reduction in precipitation. Perhaps the most significant impact of these trends could be their implications for future water flows within the Nile River and its delta—home to the majority of Egyptians and much of the country's economic activity. Flow rates within the Nile are highly sensitive to changes in climate; estimates suggest that a 20 per cent *reduction* in precipitation accompanied by warming of 0°C, 2°C and 4°C would led to a decline in flows of 63 percent, 88 per cent or 98 per cent respectively. Correspondingly, if rainfall were to *increase* by 20 percent, and temperatures by 0°C and 2°C, flows in the Nile River would corresponding increase by 71 per cent and 1 percent; with a temperature increase of 4°C, flows would be reduced by 68 percent. However, there remains significant uncertainty regarding exactly how climate change will impact Nile River flows. The Nile River Delta also is at risk due to sea level rise—a situation enhanced by the ongoing (non-climate change related) subsidence of land in the Delta (Arab Republic of Egypt, 2010a). Economic estimates suggest that damage caused by natural disaster and climate change impacts over the period of 2010 to 2030 just in Alexandria could be as high as US$1.72 billion (in net present value); of this amount, 18 per cent may be attributed directly to climate change impacts (World Bank, 2011: 9).

Other sectors identified as being vulnerable to climate change by Egypt include coastal resources, tourism, health and agriculture and food security (Arab Republic of Egypt, 2010a). These vulnerabilities and proposed response strategies were identified in Egypt's National Communication and are present in Table 1. In addition, Egypt has identified some cross-sectoral actions that would contribute to its adaptation efforts:

- Public awareness campaigns;
- Development of Circulation Models capable of predicting the impact of climate change on local (Egypt) and regional (Nile Basin) water resources;
- Increasing the capacity of researchers in all fields of climate change;
- Encouraging exchange of data and information between Nile Basin countries; and

- Enhancing precipitation measurement networks in upstream countries of the Nile Basin as well as the installation of modern early warning systems.

Table 1: Climate change vulnerabilities and proposed responses in Egypt's priority sectors (Arab Republic of Egypt, 2010a)

Priority Sector	Vulnerabilities	Proposed Responses
Water Resources	• Decline in annual per capita share of water from 700 m^3 to 350 m^3 by 2040 projected independent of climate change impact considerations • Changes in the flow of the Nile • Possibility of a 50% reduction of rainfall on Egypt's Mediterranean coast • Groundwater could experience increased levels and salinity due to sea level rise and consequent sea water intrusion • Potential for conflict over water resources	• Maintaining storage at Aswan High Dam and creating other storage areas (e.g. Toshka and Quattara Depressions; Qaroun and Wadi El Natroun; and the coastal lakes of Manzala, Borroulas, Edko and Mariout). • Increasing cultivated areas especially at high elevations, in order to absorb surplus water. • Storage in upstream lakes. • Develop new water resources by: – Increasing Nile flows through upper Nile conservation projects. – Exploitation of deep groundwater reservoirs (Western Desert and Sinai Peninsula). – Rainwater harvesting on the coasts and in the Red Sea area where flash floods normally have destructive effects. – Desalination, including of brackish groundwater. – Recycling of treated wastewater (both domestic and industrial). – Increased reuse of land drainage water.
Agriculture	• Reduced crop production • Increased pests and disease • Decreased crop water use efficiency • Increased pressure on irrigation systems • Increased livestock stress, as well as stress on fodder crops • Increased livestock disease • Decreased water availability and quality for aquaculture, as well as fisheries in natural water bodies	• Conducting a national program for developing and testing cultivars of major crops that are heat, water, salinity, plant pest and disease stress-tolerant, and disseminating results to farmers. • Improving on-farm irrigation systems. • Assuring sustainable adaptation funds and climate hazards insurance system, including in the agricultural sector. • Changing sowing dates. • Improving livestock feeding programs to be better adapted to warmer climate conditions.
Coastal zones	• Sea level rise leading sea water intrusion • Extreme events of heat waves, sand and dust storms	• Establishing wetlands in areas of low-lying deltas vulnerable to sea level rise (e.g. Lake Manzala and Lake Burullus) • Protecting and fixing natural sand dunes systems that provide natural protection. • Protecting and enforcing the Mohamed Ali Wall as a first line of defense of the low lands south of Abu-Qir Bay. • Reinforcing the northern side of the international road along the Mediterranean coast so it can

Priority Sector	Vulnerabilities	Proposed Responses
		act as a sea wall—a second line of defense for the protection of the northern zone of the Delta. • Establishing an integrated coastal zone management plan under the direction of the National Coastal Zone Management Committee.
Tourism	• Coral reefs • Monuments • Local ecosystems	• "Expanding the marine protected areas and enforcing regulations. • Adopting an integrated coastal zone management approach for development in coastal areas. • Carrying out vulnerability assessments and protection of archaeological and touristic sites and roads against impacts of climate changes. • Redirecting growth away from sensitive lands and towards less vulnerable areas. • Developing a strong monitoring and law enforcement system to ensure the implementation of these measures." (Arab Republic of Egypt, 2010a: 91)
Housing	Increase in urban heat island effect	• Improving building standards (e.g. to reduce urban heat island effect) • Encouraging natural ventilation • Encouraging natural lighting
Roads	Deformation of roads	• Using appropriate bituminous materials in road construction or maintenance. • Re-orienting flood routes away from roads. • Slowing down, collecting, and storing rain and flood water. • Building bridges over waterways. • Reviewing proposed new road projects in low-lying areas in light of potential risk from coastal flooding due to sea level changes and storm surges. • Upgrading public transportation systems and encouraging non-motorized transport.
Health	• Communicable diseases: – increased Schistosomiasis, malaria, lymphatic filariasis, rift valley fever – potential for tuberculosis, avian influenza • Water-borne and food-borne diseases (e.g. diarrhea) • Non-Communicable diseases: cardiovascular diseases, respiratory diseases, malnutrition	• Reducing socioeconomic vulnerability • Maintaining national public health infrastructure • Improving access to quality health services • Improving vaccination programs • Developing early warning systems and control programs for infectious diseases
Fisheries	• Climate change may increase sea temperature causing fish to shift northwards and into deeper water • Aquaculture projects may suffer due to water shortages. More than 80 per cent of fish	

Priority Sector	Vulnerabilities	Proposed Responses
	production in Egypt comes from aquaculture. • Increasing salinity in coastal lakes may threaten these fisheries	

Egypt's *National Environmental, Economic and Development Study (NEEDS) for Climate Change* builds on the work of the country's Second National Communication and identifies, in particular, specific adaptation needs for the agriculture sector and coastal zones. These include the following (Arab Republic of Egypt, 2010b):

- *Agriculture:* irrigation; research including socio-economic studies; capacity building and training initiatives; observation and control of climate change; and land and agricultural production.
- *Coastal zones:* the report identifies institutional, capacity building, modeling, research, implementation, coral reef protection, and measures to protect against extreme events to respond to expected impacts of climate change on coastal zones.

Furthermore, the policy document elaborates on a number of priority adaptation projects in these areas, as discussed in Table 4 below.

B. National Level Policies and Strategic Documents[72]

Egypt first identified its vulnerabilities to climate change and desired response strategies in 1999 through its Initial National Communication and more recently (in 2010) in its Second National Communication. The content of the country's Initial National Communication was determined in part by a series of background studies completed between 1995 and 1999.[73] These studies included a vulnerability assessment of the country's freshwater resources; a review of the prior framework of the government's action plan on climate change; assessment of the policy options addressing climate change (mitigation and adaptation) in the agriculture sector; adaptation to sea level rise; and an adaptation technology assessment (Arab Republic of Egypt, 1999). A Climate Change Action Plan was also developed by Egypt at this time and released in 1999. However, the focus of this plan was on creating an inventory of greenhouse gas emissions from various sectors, determining policies and measures to reduce these emissions, and assess the economic impact of these abatement measures; it does not address adaptation needs (Arab Republic of Egypt, 1999).

[72] The official EEAA site, http://www.eeaa.gov.eg/, could not be accessed at the time of research. Therefore, information on national level activities was gathered from other sources.

[73] This work was financed through the U.S. Government's "Support for National Action Plan project and the GEF supported Building Capacity for Egypt Project" (Arab Republic of Egypt, 1999).

In 2010, Egypt released its Second National Communication to the UNFCCC. This document sets forward sectors identified as being vulnerable to the impacts of climate change, and presents proposed response strategies and. cross-sectoral actions that could contribute to its adaptation efforts. In the same year, the country released its *National Environmental, Economic and Development Study (NEEDS) for Climate Change*, which discusses the country's policy framework to address mitigation and adaptation, the anticipated economic costs of policy measures, as well as priority mitigation and adaptation actions. The document identifies a number of adaptation priorities focusing in particular on the agriculture sector and coastal zones.

The lead government bodies responsible for climate change are the Ministry of State for Environmental Affairs and the Egyptian Environmental Affairs Agency (EEAA) (Hassanin 2010). An Inter-ministerial National Climate Change Committee composed of governmental and non-governmental stakeholders and chaired by EEAA was created in 1997 (Arab Republic of Egypt, 1999). More recently, in 2009, a pri-ministerial decree to establish a national Center for Climate Change was issued. According to El Raey (undated), this Center could help improve institutional coordination of adaptation measures between various sectors.

Policy actions are also ongoing that, while not specifically integrating climate change adaptation, do address some of Egypt's key climate vulnerabilities. For example, to address the potential impacts of climate change on coastal areas, a National Committee for Integrated Coastal Zone Management has been established, and regulations introduced that require inclusion of Integrated Coastal Zone Management (ICZM) in development plans (El Raey, undated). As well, a National Integrated Coastal Zone Management Strategy is being developed. Elements of this strategy are expected to include: "1. upgrading adaptive capacity through establishment of institutional systems for monitoring, building databases, modeling and upgrading awareness; 2. adopting a proactive no regrets policy in planning and enforcing regulations for follow up; 3. carrying out research on renewable energy, salt tolerant plants, desalination; and 4. considering geo-engineering activities for protection against sea level rise" (El Raey, undated: 27). Furthermore, through implementation of its 2005 National Water Resources Plan, Egypt could reduce its vulnerability to future water shortages. Measures in this plan include: improvement of irrigation systems; redesigning canal cross sections to reduce evaporation loss; improving drainage; and more quickly resolving conflicts between users (Arab Republic of Egypt, 2010a).

Table 2: Key Government Policies and Reports reflecting Adaptation Needs, Priorities and Planned Actions

Name of Policy Action		Government Division Responsible	Status	Sector(s) of Focus	Summary description
1.	Initial National Communication to the UNFCCC[74]	Ministry of State for Environmental Affairs, Egyptian Environmental Affairs Agency (EEAA)	Released 1999	Agriculture, freshwater supply, human health, coastal zones	Focuses on agriculture, water resources, human health, and the coastal zone (particularly the Nile Delta). Includes identification of adaptation options.
2.	National Committee for Crisis Management and Disaster Risk Reduction	Egyptian Cabinet Information and Decision Support Center	Established in 2006	Disaster risk management	Developing mechanisms for the integration of risk reduction associated with existing climate variability and future climate change in the programs and plans for the reduction of disaster risk and adaptation to climate change; and ensuring that the management of risks associated with natural disasters are included in these programs and plans.
3.	Integrated Coastal Zone Management regulations			Coastal zone management	Requires integration of ICZM into developmental plans to both achieved better management of coastal resources and protect against climate change impacts (El Raey, n.d).
4.	Second National Communication to the UNFCCC[75]	Ministry of State for Environmental Affairs, EEAA	Released May 2010	Freshwater supply, agriculture, coastal zones, tourism, housing, roads, human health	Identifies water resources, agriculture, coastal zones, tourism, housing, roads and the health sector as priorities. Details potential adaptation actions in these areas.
5.	Egypt National Environmental, Economic and Development Study (NEEDS) for Climate Change under the UNFCCC	Ministry of State for Environmental Affairs	April 2010	Multi-sectoral	This policy document explores the national environmental, economic and development aspects of climate change, primarily based on the outputs of the Second National Communication. It provides an overview of Egypt's climate change policy framework, the expected costs of addressing climate change in the country, and elaborates on priority mitigation and adaptation measures.

[74] UNFCCC, http://unfccc.int/essential_background/library/items/3599.php?rec=j&priref=2434#beg
[75] UNFCCC, http://unfccc.int/essential_background/library/items/3599.php?such=j&symbol=%20EGY/COM/2%20E#beg

C. Current Adaptation Action

Given the size and diversity of Egypt, and its recognized vulnerability to the impacts of climate change (particularly with respect to water scarcity and sea level rise), a high number of adaptation projects relative to other countries in North Africa have been found to be underway in the country. However, this level activity is moderate, at best, if compared to the degree of adaptation action in countries in eastern, western and southern Africa. The number of projects are being undertaken exclusively in Egypt approximately is equal to its participation in regional projects.

Current projects are focused on the early stages of adaptation action—research, capacity building and assessment. Some pilot projects are underway, as well as efforts to support integration of climate change into policy processes. The main sectors being addressed are water, coastal zone management and disaster risk management, with some attention also being given to agriculture related concerns.

It should also be recognized that a number of internationally-funded projects that do not specify climate change adaptation as a goal are underway that could deliver adaptation benefits. For instance, a summary document from the Food and Agriculture Organisation outlines dozens of programs related to agriculture, water and economic resilience that do not focus on climate change, but which undoubtedly improve the adaptation abilities of rural areas (FAO, 2010b). Similarly, several seawater desalinization projects have climate change adaptation benefits, even though adaptation does not appear to be a driving factor for implementation (ITT, 2007; MED-CSD 2008). Therefore, conclusions about Egypt's engagement in vulnerability reduction efforts may be under-estimated when only those projects which strive explicitly to support adaptation are considered.

Table 3: Current Adaptation Projects and Programs active in Egypt

Name		Objectives	Funder(s)	Implementing Agency(s)	Type of project	Duration	Priority Sector(s)	Geographic focus (if any)
National Action								
1.	Adaptation to Climate Change in the Nile Delta through Integrated Coastal Zone Management[76]	To integrate the management of sea level rise risks into the development of Egypt's Low Elevation Coastal Zone in the Nile Delta.	SCCF; co-financing *Budget:* US$16.1-million	UNDP	Policy formation and integration; Field implementation	2009–2014	Coastal zone management	Nile Delta

[76] GEF, http://gefonline.org/projectDetailsSQL.cfm?projID=3242

2.	New Land, New Life: Agro-ecology West of Lake Nasser[77]	This project addresses the potential human and environmental effects of climate change in the resettlement area west of Lake Nasser. The linkages between climate change and factors such as water and vector borne diseases, land degradation and land management methods, flooding, temperature fluctuations, agriculture and food security will be established and tested. Ultimately, the aim of this project is to ensure livelihood sustainability for settlers in the area west of Lake Nasser and to provide conditions suitable for further settlement communities to populate the region.	DFID and IDRC through the CCAA program	Near East Foundation, Center for Development Services	Community-based adaptation; Capacity building	2008–2010	Agriculture; Freshwater supply	Lake Nasser area
3.	Climate Change Risk Management in Egypt[78]	The project will combine mitigation and adaptation under one integrated Climate Risk Management banner with a special attention given to the vulnerable poorest populations of Egypt through two complementary approaches: 1) mainstreaming greenhouse gas mitigation into national policy and investment frameworks; and 2) enhancing the country's capacity to adapt to climate change. The adaptation component of the project focuses on developing the capacity of Egyptian institutions and authorities to facilitate adaptation.	MDG Achievement Fund *Budget:* US$4.0-million	UNDP	Policy formation and integration; Field implementation; Capacity building	2008–2011	Government; Disaster risk management	Egypt
4.	Adaptation to the Impacts of Sea Level Rise in the Nile Delta Coastal Zone[79]	This project aims to demonstrate the value of stakeholder participation in evaluating the trade-offs between adaptation options in the	DFID and IDRC through the	IDRC; Alexandria University;	Research; Capacity building	2009–2012	Coastal zone management	Nile Delta coastal area

[77] Near East Foundation, http://www.neareast.org/projects/egypt_lake_nasser
[78] MDG Fund, http://www.mdgfund.org/content/climatechangeriskmanagementegypt and http://www.mdgfund.org/sites/default/files/Egypt%20-%20Environment%20-%20Mid-term%20Evaluation%20Report%20-%20Final%20-%20Website%20version.pdf
[79] IDRC, http://www.idrc.ca/en/ev-118939-201_105515-1-IDRC_ADM_INFO.html.

		stretch between Ras El Bar and Gamasa on the northern coast of Egypt. Researchers will carry out environmental assessments, investigate the socioeconomic and institutional aspects of vulnerability, deliberate with stakeholders on adaptation strategies, and build capacity through technology transfer, awareness raising, workshops, training exercises and institution strengthening.	CCAA program	Center for Development Services; National Water Research Center				
Participation in Regional and Global Actions								
5.	Adapting to Climate Change Induced Water Stress in the Nile River Basin[80]	To build the resilience of ecosystems and economies that are most vulnerable to climate change induced water stress in the Nile Basin countries through building key adaptive capacity and piloting adaptation in "hotspots" with technical, policy and financial interventions.	SIDA	UNEP, Nile Basin Initiative	Assessment; Capacity building; Policy formation and integration	2009–2012	Freshwater supply; Disaster risk management; Security	*African:* Burundi, DRC, Egypt, Eritrea, Ethiopia, Kenya, Rwanda, Sudan, Tanzania, Uganda
			In Egypt: Further information required.					
6.	Regional Coordination on Natural Resources Management and Capacity Building[81]	To help resource managers in the Arab region better understand the status of regional natural resources and make learned decisions on their use and management, including water/ international water, land and vegetation, especially in the context of climate change impacts. Such decisions will in the end help resources managers to optimize resource utilization and reduce environmental degradation, including	GEF Trust Fund, national government, bilateral aid Budget: US$87,679,545	Arab Water Council (AWC), Arab Water Academy, and relevant agencies of AWC member countries	Capacity building; Research; Assessment; Knowledge communication	2009–2014	Ecosystem conservation; Freshwater supply	*African:* Algeria, Egypt, Lebanon, Libya, Mauritania, Morocco, Tunisia
			In Egypt: Further information required.					

[80] UNEP, http://www.unep.org/climatechange/adaptation/EcosystemBasedAdaptation/NileRiverBasin/tabid/29584/Default.aspx
[81] IW-LEARN, http://iwlearn.net/iw-projects/iwproject.2009-08-05.7974636515

		desertification and land degradation, and also help the society to adapt to impacts of climate change and variability.						
7.	Natural Disaster Preparedness for Coastal Cities of North Africa[82]	The objectives are to: assist the national and local governments of Egypt, Tunisia and Morocco in assessing and valuing the vulnerability of the coastal cities Alexandria, Tunis and Casablanca respectively to natural disasters while addressing their underlying the synergies with climate change vulnerability; and develop prioritized preparedness comprehensive action plans that will address urban coastal vulnerability and infrastructure for the three cities.	Global Facility for Disaster Reduction and Recovery *Budget:* US$250,000		Assessment; Policy formation and integration	2009–2011	Disaster risk management; Urban areas; Coastal zone management	*Regional:* Egypt Morocco Tunisia
			In Egypt: Helping the city of Alexandria to formulate an action plan that integrates disaster risk reduction and climate change adaptation.					
8.	Support to Policy Consultation and Actions to boost Sustainable Use of Water and Energy Resources for Agricultural Production and Livelihood Improvement in the Near East and North Africa Region in the context of Climate Change[83]	The project will assist in building the capacity of governments and civil society to prepare national reviews, analyze the current national policies for water development, examine cooperation on transboundary water management, and identify the investment needs and investment strategies for food, water and energy security to be adopted on a national and regional basis in the context of climate change. Its main objectives are: • Carry out studies and workshops to increase awareness of water-energy-food interrelation and their sustainable use. • Address food and energy security in the Near East and North Africa region through a convergent approach which integrates	FAO Budget: US$436,000	FAO; Organisation of the Islamic Conference	Capacity building; Policy formation and integration; Research	2010–2011	Freshwater supply; Energy; Agriculture	*Global:* 30 countries including: Afghanistan, Algeria, Djibouti, Egypt, Kazakhstan, Kyrgyzstan, Libya, Mauritania, Morocco, Pakistan, Somalia, Sudan, Tajikistan, Tunisia, Turkmenistan

[82] GFDRR, http://www.gfdrr.org/docs/Snapshots_MENA_Cities.pdf
[83] ALM, http://www.adaptationlearning.net/program/support-policy-consultation-and-actions-boost-sustainable-use-water-and-energy-resources-agr and SESRIC, http://www.sesric.org/activities-oicfao.php

		four critical resource factors - water, energy, technology, and knowledge under the stress of climate change. • Carry out studies on the use of water resources, on the management strategies and on the investment needs at national level. • Capacity building of governments and civil societies for optimal natural resource management.						Uzbekistan, Yemen
			In Egypt: to be identified.					

D. Proposed Adaptation Action

In its Second National Communication, Egypt highlighted three proposed adaptation pilot projects in the areas of agriculture, water and coastal zone management (see Table 3; Arab Republic of Egypt, 2010a). The concerned authorities, expected duration and financial resources needed to implement these projects are provided. As well, Egypt has prepared and submitted a proposal to the Adaptation Fund that revolves around the development of mariculture to reduce the risks associated with sea level rise. Egypt is also part of a regional proposal submitted to the Special Climate Change Fund (SCCF) focused on microeconomic analysis in the agriculture sector. The country's NEEDS document also identifies a number of priority adaptation actions in the areas of agriculture and coastal zones.

Table 4: Proposed Adaptation Projects and Programs in Egypt

Name		Objectives	Type of project	Priority Sector(s)	Geographic focus (if any)
1.	Pilot project for integrated management of land resources for agricultural production	Not available	Field implementation	Agriculture	Egypt
			Notes: Proposed in Second National Communication. Estimate would requireUS$15-million.		
2.	Pilot project for integrated water resources management	Not available	Field implementation	Freshwater supply	Egypt
			Notes: Proposed in Second National Communication. Estimate would requireUS$10-million.		
3.	Pilot project for integrated coastal zones management	Not available	Field implementation	Coastal zone management	Egypt–coastal areas
			Notes: Proposed in Second National Communication. Estimate would requireUS$15-million.		
4.	Promoting Mariculture as an	The project plans to address sea level	Field implementation	Coastal zone	Nile Delta–Rosetta Branch

Name		Objectives	Type of project	Priority Sector(s)	Geographic focus (if any)
	Adaptation Strategy to Sea Level Rise in the Nile Basin[84]	rise and associated problems such as coastal erosion, water-logging and water-bogging in the Rosetta branch of the River Nile. The project proposes to introduce mariculture (marine and coastal fish farms of native marine fish species) to help local populations build up their economic capital and be more resilient to future climate change. Coastal sea ponds will function as coastal buffers to further sea intrusion and, at the same time, provide a resilient economic development alternative. It is expected that over 5000 people will benefit from an alternative livelihood opportunity and that 50,000 m^2 of land will be made more resilient to the effects of anticipated category 2-3 meter storm surges.		management; Marine fisheries	
			Notes: This project has been initially rejected by the Adaptation Fund Board Technical Secretariat (June 2010). UNDP has been asked to reformulate the proposal and budget, taking into account the recommendations of the technical screening. • *Proposed Implementing Agency:* UNDP • *Proposed Executing Agencies:* Ministry of Water Resources and Irrigation; Coastal Research Institute; and National Water Research Center • *Proposed Value:* US$5,720,000		
5.	Microeconomic Costing of Discrete Adaptation Options in the Agriculture Sector: A sub-national level analysis of the welfare gains of dynamic adaptation[85]	Not available	Research	Agriculture	*Regional:* Burkina Faso, Cameroon, Egypt, Ethiopia, Ghana, Kenya, Niger, Senegal, South Africa, Zambia
			Notes: Proposed to the Special Climate Change Fund. Requested US$2-million.		
6.	Observation and control of climate change	Construction of research and information centers that may strengthen climate networks in Egypt using satellites, radars, etc.; construction of database and information systems on climate change.	Field implementation	Climate information services	National
			Notes: Identified in *National Environmental, Economic and Development Study (NEEDS) for Climate Change"* report (Arab Republic of Egypt, 2010b).		

[84] Adaptation Fund, http://adaptation-fund.org/system/files/AFB.PPRC_.2.5%20Proposal%20for%20Egypt.pdf; and weAdapt, http://www.weadapt.org/placemarks/view/499#/placemark/500

[85] GEF, http://www.thegef.org/gef/sites/thegef.org/files/publication/adaptation-actions_0.pdf

Name		Objectives	Type of project	Priority Sector(s)	Geographic focus (if any)
7.	Produce new strains of crops with high yield, high efficiency in water use, dry and temperature resistance	Unknown	Research	Agriculture; Freshwater supply	Rural
			Notes: Identified in *National Environmental, Economic and Development Study (NEEDS) for Climate Change*" report (Arab Republic of Egypt, 2010b).		
8.	Support farm management programs for animal husbandry improvement and to reduce emissions	Unknown	Capacity building	Agriculture	
			Notes: Identified in *National Environmental, Economic and Development Study (NEEDS) for Climate Change*" report (Arab Republic of Egypt, 2010b).		
9.	Preparation of climate maps of an agriculture region that may help in agriculture policy	Unknown	Research	Agriculture; Climate information services	
			Notes: Identified in *National Environmental, Economic and Development Study (NEEDS) for Climate Change*" report (Arab Republic of Egypt, 2010b).		
10.	Preparation of cropping patterns that may help to nationalize the use of irrigation water and agriculture rotations	Unknown	Community-based adaptation	Agriculture; Freshwater supply	
			Notes: Identified in *National Environmental, Economic and Development Study (NEEDS) for Climate Change*" report (Arab Republic of Egypt, 2010b).		
11.	Projections of human migration and possible new communities that may be established	Unknown	Research	Climate information services	
			Notes: Identified in *National Environmental, Economic and Development Study (NEEDS) for Climate Change*" report (Arab Republic of Egypt, 2010b).		
12.	Conduct study on pests, insects, diseases that may result from climate change	Unknown	Research		
			Notes: Identified in *National Environmental, Economic and Development Study (NEEDS) for Climate Change*" report (Arab Republic of Egypt, 2010b).		
13.	Integrated water management	Improvement of irrigation in the delta and valley area, and evaluation of available water resources under the effect of climate change in order to estimates impact on Nile Basin.	Research; Field implementation	Freshwater supply	Nile Basin
			Notes: Identified in *National Environmental, Economic and Development Study (NEEDS) for Climate Change*" report (Arab Republic of Egypt, 2010b).		
14.	Socioeconomic studies to estimate the specific impacts of climate change in Egypt	Conduct studies to estimate the impacts of climate change on communities and businesses.	Research	Urban areas; Rural areas; Private sector	
			Notes: Identified in *National Environmental, Economic and Development Study (NEEDS) for Climate Change*" report (Arab Republic of Egypt, 2010b).		

Name		Objectives	Type of project	Priority Sector(s)	Geographic focus (if any)
15.	Capacity building initiatives	Strengthen the role of the Institute of Meteorology to improve technical capacity, develop human skills in regions dealing with climate change in water and land sectors, and increase awareness of institutional and legislative level.	Capacity building	Government	
			Notes: Identified in *National Environmental, Economic and Development Study (NEEDS) for Climate Change*" report (Arab Republic of Egypt, 2010b).		

E. Assessment

Egypt has been actively engaged in addressing climate change since the later 1990s—with a stronger focus on efforts to reduce greenhouse gas emissions than on adaptation. The adaptation action taking place in the country is largely focused on coastal zones, freshwater scarcity and disaster risk management issues, reflecting the country's significant vulnerability in these areas. Implementation of emerging and established government strategies and plans (e.g. the National Integrated Coastal Zone Management Strategy and the National Water Resources Plan) could further support adaptation efforts. In combination with a number of ongoing projects, these measures are positive steps, but more effort is likely required given the scale of the challenge posed by Egypt's high reliance on the Nile River and its Delta.

Fewer agriculture focused initiatives have been identified, which is a concern given the number of Egyptians for whom this sector is their main livelihood activity. The proposed exploration of mariculture in the Rosetta branch of the River Nile suggests a promising alternative use of land that was perhaps once agricultural, but may be becoming more saline with sea level rise. Limited attention also appears to be given to some of the other sectors identified by Egypt as being vulnerable to climate change—including tourism (although this will benefit from actions focused on ICZM), health, housing, roads and fisheries. Expansion of efforts in these areas may be required. There is also room for adaptation projects that explicitly address gender considerations.

As well, the consequences of the recent political changes in Egypt with respect to the country's engagement in climate change adaptation (and mitigation) are uncertain. In the near-term, it may be assumed that policy and project level actions will be delayed.

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3.0 Libya

GDP	Gross Domestic Product
GEF	Global Environment Facility
GMMRA	Great Man Made River Authority
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNFPA	United Nations Population Fund
USDS	United States Department of State

Libya is dominated by the Sahara Desert. Despite its great size (1,759,540 km^2), 90 per cent of its 6.5 million inhabitants[86] live in 10 per cent of the country, mostly along the Mediterranean coast (USDS, 2010; UNFPA, 2010). The population is highly urbanized (78 percent), and concentrated in the north; the interior of the country is barren, and mostly desert (USDS, 2010; UNFPA, 2010). The Nubian Sandstone Aquifer System, the world's largest known fossil water aquifer system, lies underground in the eastern part of the Saharan desert, beneath the political boundaries of four countries: Libya, Chad, Egypt and Sudan. To address national water scarcities and agricultural production deficiencies, in 1983 the Libyan government launched the Great Man Made River project, an ambitious plan to extract water from the aquifer. Capital investments nearing US$20 billion have been made to extract 6.5 million cubic meters of water from the aquifer each day (GMMRA, 2008). The water primarily goes towards agricultural production in the Al Khufrah oasis. The country also uses desalination technology to address freshwater scarcities.

Libya is characterized as the most highly developed country in Africa, and is ranked 53 of 169 countries on the UNDP Human Development Index (UNDP, 2010). Its GDP per capita in 2008 was US$14,802, and life expectancy at birth in 2010 was 74.5 years (UNDP, 2010). The country's economy is overwhelmingly concentrated on the petroleum sector: petroleum products account for 95 per cent of export earnings, 75 per cent of governing receipts and 25 per cent of GDP (USDS, 2010).

[86] Libya's population is expected to grow to 9.8 million by 2050 (UNFPA, 2010).

A. Adaptation Needs and Priorities

Libya enjoys a Mediterranean climate along its coast, with warm summers and mild winters. Moving south, the dry, extreme desert climate of the interior soon dominates; the Saharan section of the country typically receives less than 50mm of precipitation per year (GEF, 2007). This lack of precipitation is reflected in a lack of permanent rivers or streams, and those perennial lakes which exist are typically brackish and salty (GEF, 2007). Generally low levels of precipitation mean that Libya's total water abstraction per year, as a percentage of long-term renewable freshwater resources, is greater than 90 per cent (Gueye et al., 2005).

The country is expected to experience a significant increase in temperature by 2100. Temperatures are expected to rise at a greater rate in North Africa than anywhere else on the continent, with summer temperature increases exceeding 4°C by the end of the century (Christensen et al., 2007). Within the country, southwest Libya is expected to be the site of greatest temperature increase. Significant decreases in precipitation are projected, particularly in the country's northern half: a 30 per cent decrease in annual mean precipitation is expected in the summer for the African Mediterranean coast by the end of the century (Christensen et al., 2007). Libya's coast can expect a rise in sea level of up to 0.9 meters by 2100 (World Bank, 2011).

In the absence of a national vulnerability assessment, the National Intelligence Council has identified the following sources of climate change vulnerability for North Africa; all sources of vulnerability apply to Libya (NIC, 2009):

- *Freshwater resources*: Libya's annual withdrawal of water is greater than the volume of its renewable water resources. With declining precipitation rates and a growing population, water stress is likely to increase.
- *Agriculture*: A lack of arable land (at just 1.03 per cent of total land, along the coast) means that 75 per cent of Libya's food is imported (USDS, 2010). Rising temperatures and declining precipitation could reduce agricultural productivity, and will impact heat-sensitive crops such as wheat.
- *Migration:* Climate change is expected to increase population movements in North Africa, with the region serving as both a destination and a transit point for migrants en route to Europe. At present, 70 to 80 per cent of migrants from sub-Saharan Africa to North Africa migrate through Libya, and an estimated 1 to 1.5 million sub-Saharan Africans currently live in Libya. Climate change could increase these migration pressures.
- *Natural disasters along coastal zones:* A sea level rise of one meter would be expected to impact three per cent of Libya's population (approximately 200,000 people), which is heavily concentrated along the country's coast.
- *Tourism:* Sea level rise could damage Libya's tourism industry, which is focused along the country's coasts.

- *Energy:* Libya has the largest proven petroleum reserves in Africa. Trade is heavily directed towards Europe, and a shift away from fossil fuels use in Europe to meet targets on reducing greenhouse gas emissions could negatively influence Libya's economy and thereby its resilience.

Libya's economic dependence on oil and gas—and the high revenues it receives from exporting these resources—makes it more resilient to the negative impacts of climate change. However a shift away from North Africa oil by consuming countries could considerably increase its vulnerability to climate change (NIC, 2009).

B. National Level Policies and Strategic Documents

Libya received funding from the Global Environment Facility (GEF) in 2002 to build up its scientific and technical capacity in support of the preparation of an initial national communication to the United Nations Framework Convention on Climate Change (UNFCCC). The implementing agency for the GEF project was the National Committee for Climate Change (GEF, 2007). One aspect of the proposed project was to establish a policy framework for implementing adaptation measures and response strategies. However, the project closed in 2005 and Libya has not yet submitted a national communication to the UNFCCC. The degree to which an adaptation policy framework was developed remains unclear.

C. Current Adaptation Action

A very low level of climate change adaptation action is being implemented in Libya. Current activity is confined to its participation in the following regional and global initiatives:

- The GEF and World Bank are funding a US$87 million regional project on coordinated natural resource management and capacity building in North Africa (along with Mauritania and Lebanon). The four-year project (2009-2013) seeks to reduce the threat of water scarcity, land degradation and climate change to vulnerable agricultural production systems and water resources. The project will focus on capacity building, research, vulnerability assessments and knowledge sharing, and will be implemented by the Arab Water Council, the Arab Water Academy and relevant national government partners. More information is needed on the specific actions being undertaken through the project in Libya (GEF, 2009).
- The Food and Agriculture Organization and the Organisation of the Islamic Conference are implementing the one-year project "Support to Policy Consultation and Actions to boost Sustainable Use of Water and Energy Resources for Agricultural Production and Livelihood Improvement in the Near East and North Africa Region in the context of Climate Change" involving a number of countries in North Africa and West Asia. The project will build capacity in each participating country to

analyze policies for water development and identify investment needs and strategies for increasing food, water and energy security in the context of climate change (SESRIC, undated).

Table 2: Current Adaptation Projects and Programs active in Libya

Name		Objectives	Funder(s)	Implementing Agency(s)	Type of project	Duration	Priority Sector(s)	Geographic focus (if any)
Participation in Regional and Global Actions								
1.	Regional Coordination on Natural Resources Management and Capacity Building[87]	To help resource managers in the Arab region better understand the status of regional natural resources and make learned decisions on their use and management, including water/ international water, land and vegetation, especially in the context of climate change impacts. Such decisions will in the end help resources managers to optimize resource utilization and reduce environmental degradation, including desertification and land degradation, and also help the society to adapt to impacts of climate change and variability.	GEF Trust Fund, national governments, bilateral aid *Budget:* US$87,679,545	Arab Water Council (AWC), Arab Water Academy, and relevant agencies of AWC member countries	Capacity building; Research; Assessment; Knowledge communication	2009–2014	Ecosystem conservation; Freshwater supply	*African:* Algeria, Egypt, Lebanon, Libya, Mauritania, Morocco, Tunisia
			In Libya: More information needed					
2.	Support to Policy Consultation and Actions to boost Sustainable Use of Water and Energy Resources for Agricultural Production and Livelihood Improvement in the Near East and North Africa Region in the context of Climate Change[88]	The project will assist in building the capacity of governments and civil society to prepare national reviews, analyze the current national policies for water development, examine cooperation on transboundary water management, and identify the investment needs and investment strategies for food, water and energy security to be adopted on a national and regional basis in the context of climate change. Its main objectives are:	FAO *Budget:* US$436,000	FAO; Organisation of the Islamic Conference	Capacity building; Policy formation and integration; Research	2010–2011	Freshwater supply; Energy; Agriculture	*Global:* 30 countries including: Afghanistan, Algeria, Djibouti, Egypt, Kazakhstan, Kyrgyzstan, Libya, Mauritania,

[87] IW-LEARN, http://iwlearn.net/iw-projects/iwproject.2009-08-05.7974636515
[88] ALM, http://www.adaptationlearning.net/program/support-policy-consultation-and-actions-boost-sustainable-use-water-and-energy-resources-agr and SESRIC, http://www.sesric.org/activities-oicfao.php

Name		Objectives	Funder(s)	Implementing Agency(s)	Type of project	Duration	Priority Sector(s)	Geographic focus (if any)
		• Carry out studies and workshops to increase awareness of water-energy-food interrelation and their sustainable use. • Address food and energy security in the Near East and North Africa region through a convergent approach which integrates four critical resource factors - water, energy, technology, and knowledge under the stress of climate change. • Carry out studies on the use of water resources, on the management strategies and on the investment needs at national level. • Capacity building of governments and civil societies for optimal natural resource management.						Morocco, Pakistan, Somalia, Sudan, Tajikistan, Tunisia, Turkmenistan Uzbekistan, Yemen
			In Libya: More information needed					

D. Proposed Adaptation Action

Libya, characterized as an Upper Middle Income country by the OECD (OECD, 2009), will not be preparing a National Adaptation Programme of Action under the UNFCCC. This fact, combined with the absence of a national communication on climate change, means that no action proposed by the government for climate change adaptation has been identified.

E. Assessment

Very little work on climate change adaptation is underway in Libya. Strained relations between the Libyan government and much of the international community over the past 40 years have likely contributed to this situation—and the impact of the country's current political changes on climate change programming and policymaking remains unclear.

Should efforts to support adaptation planning be initiated in the future, a first step could be to complete and submit its First National Communication on climate change. As part of this exercise, a climate vulnerability assessment must be conducted by the government, and appropriate response strategies are to be identified. Given the regional projections of climate change and trends in neighboring countries, it can be expected that Libya will face similar challenges in agriculture, water and coastal zone management. These challenges

need to be identified by the government and integrated into national decision- and policy-making. As well, based on the absence of national climate information and the closed nature of the national government, there is a need for improved climate data collection and dissemination.

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4.0 Morocco

BMZ	German Federal Ministry for Economic Cooperation and Development
CBA	Community-Based Adaptation
CCAA	Climate Change Adaptation in Africa
DFID	Department for International Development (UK)
DSM	demand side management
ENFI	Ecole Nationale Forestière d'Ingénieurs
FAO	Food and Agriculture Organization of the United Nations
GEF	Global Environment Facility
GFDRR	Global Facility for Disaster Reduction and Recovery
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (Germany)
ICARDA	International Center for Agricultural Research in Dry Areas
IDRC	International Development Research Centre
SCCF	Special Climate Change Fund
UNDP	United Nations Development Programme

Crossed from south-west to north-east by the Atlas Mountains, the Kingdom of Morocco lies at junction of the Atlantic Ocean and Mediterranean Sea. The majority of its population of nearly 32-million people (CIA, 2011)[89] lives west of the Atlas Mountains, particularly along the Atlantic coast. To the east of the Atlas Mountains lies the Sahara Desert (USDS, 2010).

A significant portion of Moroccans (about 45 per cent of the labor force) work within the agriculture sector, which generates about 17 per cent of the country's GDP (CIA, 2011). Morocco's economy is also based on light manufacturing, tourism and the export of phosphate (of which it is the world's greatest supplier). The country's GDP per capita is estimated to beUS$4,900 (CIA, 2011), which is reflected in Morocco's status as lower middle income developing country (OECD, 2009).

[89] Population estimated as of July 2011. Morocco's population growth rate is 1.067 per cent (2011 estimate) per year (CIA, 2011i).

A. Adaptation Needs and Priorities

The area of Morocco west of the Atlas Mountains has a Mediterranean climate characterized by hot, dry summers and cold, humid winters. The climate becomes more extreme in the interior and southern Saharan part of Morocco, where summers are typically very dry and hot (USDS, 2010n). Scientific and anecdotal evidence suggests that these climatic patterns have begun to change, with rainfall becoming more erratic and drought more frequent since the 1990s (OneWorld, 2010).

Climate change projections suggest that Morocco will experience higher temperatures and rates of evapotranspiration in the future, along with a 10 to 15 per cent decline in precipitation and increasingly erratic rainfall patterns (UNDP, undated; MMATUHE, 2010). In a detailed assessment of the Ouergha watershed, it has been suggested that runoff levels in the period of 2000 to 2020 could decrease by about 10 per cent if mean annual temperatures increased by 1°C and precipitation levels remained constant (Agoumi, 2003; cited in Boko et al., 2007). Other potential changes include lower mountain snowfall, modification of the Canary Current, and coastal erosion due to sea level rise (UNDP, undated).

These changes are expected to exacerbate the country's existing concerns related to chronic water scarcity and desertification. In rural Morocco, factors such as overgrazing and indiscriminate crop rotation are contributing to environmental degradation. In coastal areas, rapid expansion of cities, industry and tourism has overburdened groundwater resources and led to the loss of wetlands (OneWorld, 2010). Climate change could put additional pressure on these resources by potentially causing: disrupted river and stream flows; lower water tables; increased salinity of groundwater in coastal areas; a deterioration of water quality; and a decrease in dam capacity (MMATUHE, 2010).

These impacts naturally have implications for the country's agriculture sector, which is rainfall-dependent (USDS, 2010) with the exception of approximately 14,450 km^2 of irrigated land (CIA, 2011). Projections to 2020 suggest that cereal yields will be reduced by 10 per cent in normal years and by half in dry years. Other projected consequences include: a 7 to 12 per cent increase in water need by some crops; a shift and reduction in growth periods; increased risk of drought; the arrival of new diseases; and the extinction of some crop and tree species. These impacts have implications for the country's livestock production (MMATUHE, 2010).

Other sectors expected to be adversely affected by climate change include (UNDP, undated; MMATUHE, 2010):

- Coastal and marine resources, due in part to coastal erosion and the potential for changing patterns in the Atlantic Ocean's Canary Current to affect fisheries production;

- Forestry, as forest resources could become less resilient, leading to the decline and potential extinction of some tree species and disturbance of forest regeneration patterns; and
- Tourism, with coastal infrastructure, beaches and water resources being of particular concern.

Recognizing these future challenges, Morocco has identified a number of potential actions that it could take to reduce its vulnerability to the impacts of climate change, particularly with respect to its water and agriculture resources. These potential actions are summarized in Table 1 below.

Table 1: Potential adaptation actions identified by Morocco in its First and Second National Communications (Bennani, Buret & Senhaji, 2001; MMATUHE, 2010)

Sector	Potential Adaptation Actions
Freshwater Resources	• Improve irrigation by reducing water losses in some distribution networks and optimize consumption to the needs of different crops. • Expand use of treated wastewater in irrigation. • Use brackish water for irrigation of (to be identified) salinity-tolerant plant species in the Low Moulouya; demineralization of brackish water at Bou Areg and Sahel. • Map the major water tables prone to pollution. • Protect potable groundwater from pollution risks to ensure a steady supply to the cities of Tangier, Azilal and Sidi El Mokhtar; and improve enforcement of legal protection. • Install drinking water production plants. • Establish sanitary landfills for household waste, such as in the city of Guelmim. • Introduce appropriate technologies for collecting and storing storm water in arid and semi-arid areas. • Establish desalinization plants to supply drinking water to coastal cities along the Agadir-Tarfaya axis. Options include: (planned) desalinization plants at Laayoune and Agadir; and (desired) desalinization plants in the following zones: Tiznit-Sidi Ifni, Chtouka, Essaouira, Safi, El Jadida, Casablanca, Al Hoceima and Saidia. • Tap into the deep water tables of the western High Atlas Mountains. Introduce economic measures such as a tariff or fee system to reduce water consumption and a tourism tax for water use. • Pursue the construction of 59 large dams by 2030 and approximately 1,000 small dams. • Transfer water across the North-South axis to help alleviate water deficits: 400 million m^3/year from Sebu in phase 1; and 400 million m^3/year from Loukkos-Lau in phase 2.
Agriculture	• Restructure and develop oases to ensure continued agricultural activity by the surrounding populations and restore the date palm heritage. • Expand olive oil plantations as olives are well adapted to marginal zones. • Enable supplemental irrigation, especially in areas growing rain-fed cereal crops.
Cross-sectoral Knowledge	• Undertake in-depth research on the potential impact of climate change on agriculture and water. • Establish a research center on climate change impacts and a climate databank.

Sector	Potential Adaptation Actions
Generation	• Develop the agro-meteorological network. • Improve ability to predict extreme events (floods, heat waves etc.), and related early warning systems.

B. National Level Policies and Strategic Documents

Morocco has prepared both its first and second National Communications to the United Nations Framework Convention on Climate Change. Over and above these efforts, it appears that the government is taking actions that have the potential to reduce its vulnerability to climate change, although the degree to which adaptation is an explicit objective of these actions is unclear. For example, the Department of Environment, the Department of Water and the Ministry of Agriculture are introducing: programs for water recovery; green taxation to encourage water savings; drip irrigation; rehabilitation of irrigation systems; and financial support for the adoption of modern irrigation systems (UNEP, 2010).

As well, Morocco may be integrating climate change adaptation into the following plans:

- *National Initiative for Human Development*. Announced by the King of Morocco in 2005, the objective of this initiative is to improve inclusiveness, accountability and transparency in decision-making and implementation at the local level and it includes four components: (1) alleviate poverty in rural areas; (2) alleviate social exclusion in urban areas; (3) alleviate extreme vulnerability; and (4) mainstream identified governance mechanisms and strengthen institutional capacity (World Bank, 2007).
- *National Action Plan to Combat Desertification*. It is reported that climate change, biodiversity and sustainable agriculture will be integrated to a greater extent into the National Action Plan to Combat Desertification when it is updated—a consequence of the project "Nature Conservation and Desertification Control" (see Table 3).[90]
- *National Plan for Protection against Floods*. The goal of this work is to strengthen Morocco's national plan against flooding by expanding its warning system and contingency plan (UNEP, 2010).

[90] GTZ, http://www.gtz.de/en/weltweit/maghreb-naher-osten/marokko/16088.htm

Table 2: Key Government Policies and Reports reflecting Adaptation Needs, Priorities and Planned Actions

Name of Policy Action		Government Division Responsible	Status	Sector(s) of Focus	Summary description
1.	First National Communication to the UNFCCC[91]	Ministère de l'Aménagement du Territoire, du l'Urbanisme, de l'Habitat et de l'Environnement (Ministry of Territory, Urbanism, Habitat and the Environment)	Released October 2001	Multi-sectoral	Presents understanding of the vulnerability of Morocco to the impacts of climate and of potential adaptation actions, with a focus on water and agriculture.
2.	Second National Communication to the UNFCCC[92]	Ministère de l'Aménagement du Territoire, du l'Urbanisme, de l'Habitat et de l'Environnement	Released November 2010	Multi-sectoral	Provides an update of the current understanding of Morocco's vulnerability to climate change and appropriate adaptation measures related to water resources, agriculture, forests, coastal areas, health, meteorology

C. Current Adaptation Action

As captured in Table 3, Morocco is involved in several adaptation actions at present. A number of these current projects fall under the umbrella of Morocco's participation in the global "Community-Based Adaptation program" financed through the Global Environment Facility (GEF) Trust Fund's Strategic Priority on Adaptation. Morocco is also participating in the Africa Adaptation Program and the regional projects: "Natural Disaster Preparedness for Coastal Cities of North Africa;" "Regional Coordination on Natural Resources Management and Capacity Building;" and "Adapting the Framework of Forestry Policy to Meet the Needs of Climate Change in the MENA Region." A slight majority of projects underway in Morocco, however, have been developed specifically for implementation within its boundaries.

Reflecting its priority needs, most adaptation action underway in Morocco addresses needs in the freshwater and agriculture sectors. The focus of projects by and large remains on capacity building, knowledge communication and research. Morocco, though, is implementing several community-based adaptation and pilot projects that have the potential to concretely increase adaptive capacity.

[91] UNFCCC, http://unfccc.int/essential_background/library/items/3599.php?rec=j&priref=3230#beg
[92] UNFCCC, http://unfccc.int/essential_background/library/items/3599.php?such=j&symbol=MAR/COM/3%20E#beg

Table 3: Current Adaptation Projects and Programs active in Morocco

Name		Objectives	Funder(s)	Implementing Agency(s)	Type of project	Duration	Priority Sector(s)	Geographic focus (if any)
National Action								
1.	Nature Conservation and Desertification Control[93]	The project seeks to achieve lasting improvements in the management of nature reserves and control of desertification in Morocco. As such, it promotes: coordination between the different ministries involved in park management; capacity building related to cross-sectoral topics such as results-based monitoring, financing the sustainable use of resources and national strategies on eco-tourism, environmental education and participative resource management; and integration of climate change adaptation into policy and planning.	BMZ	High Commission for Water, Forestry and Desertification Control, Morocco	Capacity building; Policy formation and integration	2006–2011	Ecosystem conservation	Morocco
2.	Enabling Stakeholders in Moroccan Coastal Management to Develop Sustainable Climate Change Adaptation Policies and Plans (ACCMA)[94]	The aim of this project is to develop capacity for, and contribute to, policy and decision-making for strategic coastal land use planning and management, to reduce the vulnerability of coastal communities to the impacts of sea level rise, coastal flooding, and extreme weather events. Specific objectives will include the following: (1.) an assessment of the vulnerability and socio-economic impact of climate change-induced sea level rise,	DFID and IDRC through the CCAA program Budget: US$500,000	International Center for Agricultural Research in Dry Areas (ICARDA); Ecole Nationale Forestière d'Ingénieurs (ENFI); others[95]	Capacity building; Policy formation and integration	2007–2010	Agriculture; Coastal zone management	Primarily coastal zones of Nador and Berkane

[93] GTZ, http://www.gtz.de/en/weltweit/maghreb-naher-osten/marokko/16088.htm

[94] ACCMA, http://www.accma.un.ma; CGIAR, http://ongoing-research.cgiar.org/factsheets/enabling-stakeholders-in-moroccan-coastal-management-to-develop-sustainable-climate-change-adaptation-policies-and-plans/; AfricaAdapt, http://www.africa-adapt.net/aa/ProjectOverview.aspx?PID=UnQT3uhFR9c%3D; and Potsdam Institute for Climate Impact Research, http://www.pik-potsdam.de/~kropp/accma/vision.html

[95] Other participation organizations are: Coastal Union; University of Moncton; Potsdam Institute for Climate Impact Research; University Mohamed V Rabat Agdal; Interdepartmental Center of Research in Environmental Science; and the National Meteorological Directorate.

Name		Objectives	Funder(s)	Implementing Agency(s)	Type of project	Duration	Priority Sector(s)	Geographic focus (if any)
		coastal flooding, and extreme weather events; (2) the development of adaptation strategies and coastal policy land use guidelines that reduce coastal population vulnerability and optimize the socio-economic and political trade-offs for different stakeholders; and (3) capacity development for local stakeholders.						
3.	Adaptation to Climate Change in the Agriculture Sector[96]	The detailed study covers fifty crops, major agroecological zones, and several climate change scenarios. The basic questions asked include: • How will yields change—over the 2030, 2050, 2080 time horizons—for a selected number of priority crops, both on average, and in years with poor climatic conditions? • How much additional water will be needed in irrigated areas to offset the yield impacts of climate change? • Among the large array of crops, which ones will suffer, and which ones may benefit?	World Bank, Kingdom of Morocco	FAO World Bank, Morocco Ministry of Agriculture and Maritime Fisheries, and several other national institutions	Research	[2008–present]	Agriculture	Morocco
4.	Integrating Climate Change in Development Planning and Disaster Prevention to Increase Resilience of Agricultural and Water Sector[97]	To assist the Government of Morocco in mainstreaming climate change in the national development planning process. The specific objectives are to a) improve the understanding of climate change implications for high level strategic development planning; and b) enhance	SCCF; co-financing *Budget:* USD 104,345,454	World Bank	Knowledge communicatio n; Policy formation and integration; Field implementati	2010–2014	Freshwater supply; Agriculture	Morocco

[96] FAO, http://www.fao.org/climatechange/67130/en/
[97] ALM, http://www.adaptationlearning.net/project/integrating-climate-change-development-planning-and-disaster-prevention-increase-resilience-

Name		Objectives	Funder(s)	Implementing Agency(s)	Type of project	Duration	Priority Sector(s)	Geographic focus (if any)
		resilience to climate change of key development sectors—water and agriculture—through strengthened institutional capacity, knowledge management, and piloting innovative climate change adaptation and disaster management options to reduce rural poor's vulnerability.			on			
5.	Integrated Eco-Systemic Approach for Optimization of Small Dams in Morocco[98]	This participatory action research project uses an ecosystem approach and will identify options relevant to the management of small dams to improve health, well-being and the ability of rural communities to adapt to climate change.	DFID and IDRC through CCAA program and IDRC's Ecohealth program	Institut National de la Recherche Agronomique (INRA)	Field implementation	[2008]–2010	Freshwater supply; Human health	Souss watershed in Chtouka Ait Baha province
6.	Using Demand Side Management to Adapt to Water Scarcity and Climate Change in the Saiss Basin[99]	Examine whether demand side management (DSM) for water can protect the basin's future in the context of growth and climate change. With a focus on agriculture, the project aims in part to improve information sharing and dialogue between commercial and subsistence farmers, water managers and researchers. Researchers will test technical options for DSM in large-scale irrigation systems; demonstrate the value of DSM to smallholders through pilot projects; create two operational water-users associations supported by training and capacity building; and promote better policy making,	DFID and IDRC through the CCAA program *Budget:* CND 402,600	Al Akhawayn University	Research; Knowledge communication; Policy formation and integration	2009–2011	Freshwater supply; Agriculture	Saiss Basin

[98] IDRC, http://www.idrc.ca/cp/ev-148997-201-1-DO_TOPIC.html and L'Espace, http://www.espace-associatif.ma/Nouvel-article,207?lang=en&calendrier_mois=2&calendrier_annee=2007

[99] IDRC, http://idrc.ca/minga/ev-154599-201_105439-1-IDRC_ADM_INFO.html and http://www.idrc.ca/uploads/user-S/12888142041Saiss_story.pdf

Name		Objectives	Funder(s)	Implementing Agency(s)	Type of project	Duration	Priority Sector(s)	Geographic focus (if any)
		enforcement and management on the part of local authorities and the relevant ministries.						
7.	Integrating Climate Change in the Implementation of the Plan Maroc Vert[100]	The project has two components: 1) development of the capacities of public and private institutions to integrate climate change adaptations in projects directed to small farmers in five target regions; and 2) dissemination of climate change adaptations among small farmers in five target regions.	World Bank *Budget:* US$31,300,000	Agence de Developpement Agricole	Capacity building	2011–?	Agriculture	
Participation in Regional and Global Actions								
8.	Community-based Adaptation (CBA) Programme[101]	The objective of the program is to enhance the capacity of communities in the pilot countries to adapt to climate change including variability. Planned outcomes are: Enhanced adaptive capacity allows communities to reduce their vulnerability to adverse impacts of future climate hazards; National policies and programs include community-based adaptation priorities to promote replication, up-scaling and integration of best practices derived from community-based adaptation projects; and Cooperation among member countries promotes global innovation in adaptation to climate change including variability.	GEF (Strategic Priority on Adaptation), co-financing *Budget:* US$6.7 million	UNDP	Knowledge communication; Capacity Building; Community-based adaptation	2009–2011	Multi-sectoral	*Global:* Bangladesh, Bolivia, Guatemala, Jamaica, Kazakhstan, Morocco, Namibia, Niger, Samoa, Viet Nam
			In Morocco: Three projects are being implemented in Morocco though this initiative: [102] • "Strengthening the Tarmguiste Oasis Ecosystem's Resiliency to the Impacts of Climate Change and Improving the Local Community's Capacity to Adapt to Reduced Water Resources and Soil Degradation." The project aims to increase the Tarmguiste oasis ecosystem's resiliency toward the impacts of climate change, particularly in regard to scarce water resources and accelerated soil degradation.					

[100] http://web.worldbank.org/external/projects/main?pagePK=64283627&piPK=73230&theSitePK=40941&menuPK=228424&Projectid=P117081
[101] UNDP, http://www.undp-adaptation.org/projects/websites/index.php?option=com_content&task=view&id=203
[102] UNDP, http://www.undp-adaptation.org/projects/websites/index.php?option=com_content&task=view&id=258&sub=1

Name		Objectives	Funder(s)	Implementing Agency(s)	Type of project	Duration	Priority Sector(s)	Geographic focus (if any)
			Implementing agency: Association de Développement Espace Rural de l'Oasis Tarmguiste - Espace Rural *Budget:* US$47,586 *Duration:* 2010–2011 • "Strengthening the Resiliency of the Iguiwaz Oasis Ecosystem to the Impacts of Climate Change and Improving the Local Community's Capacity to Adapt to Reduced Water Resources and Soil Degradation." Improving the Iguiwaz oasis ecosystem's resiliency toward the risks of climate change, including variability (in particular reduced water resources caused by increasing temperatures and reduced and unstable rainfall), through reasoned water management and the institution of a local participative dialogue policy. *Implementing agency:* Association Tiflit pour les exploiteurs des eaux d'agriculture *Budget:* US$47,137 *Duration:* 2010–2011 • "Strengthening the resilience of the Sidi Majbeur mountain ecosystem and reinforcing the community's adaptive capacities to increasingly erratic rainstorms and diminishing overall rainfall, through erosion control, conservation farming and income diversification, based on pilot vetiver application." To reinforce the resilience of the local ecosystem and strengthen the adaptive capacities of the Sidi Majbeur community in the face of increasingly severe rainstorms and decreasing overall rainfall. The project is based on the pilot application of vetiver, in combination with fruit trees, and on the establishment of better practices to retain top soil, rehabilitate farmable lands, and diversify and increase income. The adaptive capacities of the community will be strengthened through training and income diversification. *Implementing agency:* Association for the Environment and Development of Sidi Majbeur *Budget:* US$67,925 *Duration:* 2010–2012					
9.	Natural Disaster Preparedness for Coastal Cities of North Africa[103]	The objectives are to: assist the national and local governments of Egypt, Tunisia and Morocco in assessing and valuing the vulnerability of the coastal cities Alexandria, Tunis and Casablanca respectively to natural disasters while addressing their underlying	Global Facility for Disaster Reduction and Recovery *Budget:*		Assessment; Policy formation and integration	2009–2011	Disaster risk management; Urban areas; Coastal zone management	*Regional:* Egypt Morocco Tunisia

[103] GFDRR, http://www.gfdrr.org/docs/Snapshots_MENA_Cities.pdf

Name		Objectives	Funder(s)	Implementing Agency(s)	Type of project	Duration	Priority Sector(s)	Geographic focus (if any)
		the synergies with climate change vulnerability; and develop prioritized preparedness comprehensive action plans that will address urban coastal vulnerability and infrastructure for the three cities.	US$250,000					
			In Morocco: To be identified					
10.	Supporting Integrated and Comprehensive Approaches to Climate Change Adaptation in Africa (or Africa Adaptation Program –AAP)[104]	Under this program, UNDP is assisting 20 African countries in implementing integrated and comprehensive adaptation actions and resilience plans. The projects will ensure that national development processes incorporate climate change risks and opportunities to secure development gains under a changing climate. UNDP will help countries establish an enabling environment and develop the capacity required to design, finance, implement, and monitor long-term and cost-effective adaptation policies and plans.	Japan International Cooperation Agency Budget: US$92.1 million	UNDP	Capacity building; Policy formation and integration; Knowledge communication	2008–2011	Government	*African:* 20 African countries[105] including: Morocco and Tunisia
			In Morocco: Adaptation aux changement climatique au Maroc: pour des Oasis resilientes[106] • *Objectives:* This project will adopt an integrated and multi-sectoral approach based on local and regional dimensions to strengthen adaptation capacity • *Budget:*US$2.975 million					
11.	Support to Policy Consultation and Actions to boost Sustainable Use of Water and Energy Resources for Agricultural Production and Livelihood Improvement in the Near East and North Africa	The project will assist in building the capacity of governments and civil society to prepare national reviews, analyze the current national policies for water development, examine cooperation on transboundary water management, and identify the investment needs and investment strategies for food, water and	FAO Budget: US$436,000	FAO; Organisation of the Islamic Conference	Capacity building; Policy formation and integration; Research	2010–2011	Freshwater supply; Energy; Agriculture	*Global:* 30 countries including: Afghanistan, Algeria, Djibouti, Egypt, Kazakhstan, Kyrgyzstan,

[104] ALM, http://www.adaptationlearning.net/program/africa-adaptation-programme and UNDP-APP, http://www.undp-aap.org/

[105] These countries are: Burkina Faso, Cameroon, Congo, Ethiopia, Gabon, Ghana, Kenya, Lesotho, Malawi, Mauritius, Morocco, Mozambique, Namibia, Niger, Nigeria, Rwanda, Sao Tome et Principe, Senegal, Tanzania and Tunisia.

[106] UNDP, http://www.undp-adaptation.org/portfolio/projectR.php?id=128

Name		Objectives	Funder(s)	Implementing Agency(s)	Type of project	Duration	Priority Sector(s)	Geographic focus (if any)
	Region in the context of Climate Change[107]	energy security to be adopted on a national and regional basis in the context of climate change. Its main objectives are: • Carry out studies and workshops to increase awareness of water-energy-food interrelation and their sustainable use. • Address food and energy security in the Near East and North Africa region through a convergent approach which integrates four critical resource factors - water, energy, technology, and knowledge under the stress of climate change. • Carry out studies on the use of water resources, on the management strategies and on the investment needs at national level. • Capacity building of governments and civil societies for optimal natural resource management.						Libya, Mauritania, Morocco, Pakistan, Somalia, Sudan, Tajikistan, Tunisia, Turkmenistan Uzbekistan, Yemen
			In Morocco: To be identified					
12.	Regional Coordination on Natural Resources Management and Capacity Building[108]	To help resource managers in the Arab region better understand the status of regional natural resources and make learned decisions on their use and management, including water/ international water, land and vegetation, especially in the context of climate change impacts. Such decisions will in the end help resources managers to optimize resource utilization and reduce environmental degradation, including desertification and land degradation, and also help the society to	GEF Trust Fund, national government, bilateral aid Budget: US$87,679,545	Arab Water Council (AWC), Arab Water Academy, and relevant agencies of AWC member countries	Capacity building; Research; Assessment; Knowledge communication	2009–2014	Ecosystem conservation; Freshwater supply	*African:* Algeria, Egypt, Lebanon, Libya, Mauritania, Morocco, Tunisia
			In Morocco: To be identified					

[107] ALM, http://www.adaptationlearning.net/program/support-policy-consultation-and-actions-boost-sustainable-use-water-and-energy-resources-agr and SESRIC, http://www.sesric.org/activities-oicfao.php

[108] IW-LEARN, http://iwlearn.net/iw-projects/iwproject.2009-08-05.7974636515

Name		Objectives	Funder(s)	Implementing Agency(s)	Type of project	Duration	Priority Sector(s)	Geographic focus (if any)
		adapt to impacts of climate change and variability.						
13.	Adapting the Framework of Forestry Policy to Meet the Needs of Climate Change in the MENA region[109]	The objective of the project is to improve conditions for the sustainable management of forest ecosystems and for the maintenance of their environmental services in the face of climate change in the Middle East and North Africa (MENA) region.	BMZ implemented under the Collaborative Partnership on Mediterranean Forests[110]	High Commission for Waters, Forests and Combating Desertification, Morocco	Policy formation and integration; Research; Knowledge communication	2010–2014	Forestry; Ecosystem conservation	*Regional:* Algeria, Lebanon, Morocco, Syria, Tunisia, Turkey
			In Morocco: To be identified					

D. Proposed Adaptation Action

Although Morocco's National Communications suggest possible actions that could be taken to reduce its vulnerability to the impacts of climate change (as presented in Table 1), fully developed proposals for these ideas are not presented. Additional projects being prepared for implementation in Morocco have not yet been identified.

E. Assessment

The already overburdened water and agricultural resources of Morocco face additional risks due to climate change. Action is being taken in response to this threat both through targeted adaptation actions and through complementary policies and measures that address immediate needs and concerns. Less action appears to be underway in other vulnerable sectors such as coastal zone management, tourism, fisheries and health; nor do projects explicitly address gender concerns related to climate change. Greater attention could be given to these areas. As well, detailed planning at the national level of appropriate adaptation action appears to be limited, as represented by the content of the country's National Communications. More detailed strategic planning may be required.

[109] GTZ, http://www.gtz.de/en/weltweit/maghreb-naher-osten/tunesien/32875.htm
[110] FAO, http://www.fao.org/forestry/65365/en/

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5.0 Sudan[111]

AIACC	Assessments of Impacts and Adaptations to Climate Change
CCAA	Climate Change Adaptation in Africa
DFID	Department for International Development (United Kingdom)
GEF	Global Environment Facility
IDRC	International Development Research Centre
LDCF	Least Developed Countries Fund
NAPA	National Adaptation Programme of Action
UNDP	United Nations Development Programme

Sudan, with an area of over 2.5 million km^2 (including South Sudan, an area of 640,000 km^2; Beck, undated), has one of the continent's most diverse geographies—ranging from desert conditions in the north to wetlands and rainforests in the south. The country is physically divided from north to south by mountain ranges (BBC, 2011); from east to west by the Nile River, which is formed by the joining of the Blue Nile and White Nile Rivers at Khartoum. In 2005, Sudan's two decade long civil war formally ended with the signing of the Comprehensive Peace Agreement. This agreement led the basis for the succession of South Sudan from Sudan in July 2011. (This review reflects adaptation action in the political boundaries of Sudan prior to the establishment of South Sudan).

The long periods of civil war in Sudan has undermined its development efforts and left its infrastructure, particularly in south Sudan, largely absent.[112] Agriculture is the main livelihood activity in the country, employing about 80 per cent of the country's 41-million people (USDS, 2010). The main crops grown in the country are cotton and gum Arabic for export, and sorghum, millet, wheat, sesame seeds and peanuts for subsistence. Livestock production is also a significant economic activity. However, the country remains a net food importer, in part because its agricultural economy is constrained by a lack of infrastructure, including roads and irrigation (USDS, 2010). Economic growth is also stimulated by the development of Sudan's oil and natural gas assets, which mostly lie in the country's southern regions.

[111] The content of this profile was prepared prior to the succession of South Sudan from Sudan in July 2011. As such it reflects adaptation action occurring in the political boundaries of Sudan prior to South Sudan's independence.
[112] For example, in all of southern Sudan there are only about five kilometers of paved road (Beck, undated).

A. Adaptation Needs and Priorities

Climate change presents an additional challenge for Sudan, one that will exacerbate several factors that already make it highly vulnerable: limited water resources in large areas of the country; low soil fertility; common occurrence of drought; a high reliance on rain-fed agriculture; the legacy of a civil war; and political instability. These considerations, amongst many others, make the need for vulnerability reduction measures all the more important for the country to improve its economic, environmental and social stability.

Sudan's National Adaptation Programme of Action (NAPA) was completed in 2007. It identifies five of the country's agroecological zones as having a high degree of vulnerability: 1) the desert zone (River Nile State); 2) semi desert zone (North Kordofan State); 3) savannah on clay soil zone (Gedarief State); 4) savannah on sandy soil zone (South Darfour State); and 5) southern Sudan (Central Equatorial State). The NAPA explores "urgent and immediate adaptation needs" for each of these zones, focusing much of its attention on actions that could help farmers and pastoralists adapt. With 80 per cent of Sudanese dependent on crop production and/or livestock husbandry to earn their livings, and 90 per cent of agriculture production being rain-fed, farmers and pastoralists are identified as being particularly vulnerable to climate change. The vulnerability of this population is exacerbated by factors such as deep poverty levels, lack of income diversity, natural resource conflicts and environmental degradation (SMEPD, 2007).

Three priority sectors for adaptation have been identified by Sudan: water resources, agriculture (including forestry) and public health.[113] As listed in Table 1, Sudan's NAPA provides broad recommendations for adaptation needs for all three of these priority sectors throughout all five priority agro-ecological zones, and 32 proposed actions to meet these needs (see Table 3). In its First National Communication to the United Nations Framework Convention on Climate Change (UNFCCC), Sudan also identified a need for increased water research and integrated research studies between institutions to build capacity (SMEPD, 2003); these needs are not emphasized in the NAPA.[114]

[113] Sudan's First National Communication, which preceded the NAPA, also included forestry as a priority sector. In the NAPA, forestry is integrated as a sub-focus of the "agriculture" priority.

[114] The needs and priorities of Sudan were also identified through research conducted as part of the Assessments of Impacts and Adaptations to Climate Change (AIACC) program in the mid-2000s. Three reports were produced that highlighted climate change adaptation possibilities in Sudan: *Sustainable Livelihood Approach for Assessing Community Resilience to Climate Change: Case studies from Sudan; Adaptation Strategies to Increase Human Resilience against Climate Variability and Change: Lessons from the arid regions of Sudan;* and *Environmental Strategies to Increase Human Resilience to Climate Change: Lessons for Eastern and Northern Africa.* This AIACC-funded research also explored cost-effective adaptation measures that could be taken in agricultural areas of Sudan to bolster the population against the impacts of climate change. Information about the AIACC project is accessible here: http://aiaccproject.org/

Table 1: Key adaptation activities and needs by sector as identified in Sudan's NAPA (SMEPD, 2007)

Sector	Adaptation Activities and Needs
Agriculture	• Community-based forest and rangeland management and rehabilitation. • Replacement of household goat herds with sheep herds to reduce pressure on fragile rangelands. • Lessening of pressure on local forests through use of mud brick building design and alternative energy sources. • Land use conversion from agriculture to livestock raising. • Strengthening of agricultural and veterinary extension services, including demonstration. • Introduction of drought-resistant seed varieties, poultry and fish production. • Afforestation of areas denuded of trees for building construction and firewood. • Drought early warning systems for disaster preparedness. • Extension services in agricultural capacity strengthening for small-scale farmers. • Protection and/or rehabilitation of rangelands, including construction of shelterbelts to reduce windstorm impacts.
Water Resources	• Introduction of new water harvesting/spreading techniques making use of intermediate technologies. • Promotion of greater use of effective, traditional water conservation practices. • Rehabilitation of existing dams as well as improvements in water basin infrastructure for increased water storage capacity, particularly in central and western Sudan. • Construction of dams and water storage facilities in some of water valleys, particularly in western Sudan. • Introduction of water-conserving agricultural land management practices. • Improvement of access to groundwater supplies by humans and animals though installation of water pumps. • Enhancement of capabilities of regional meteorological stations to monitor hydro-climatic variables. • Introduction of a revolving micro-credit fund to support implementation of small water harvesting projects. • Extension services in capacity strengthening in water capture and storage techniques for small-scale farmers.
Public Health	• Improve community sanitation and medical services, including capacities for diagnosis and treatment. • Building of community awareness regarding preventative measures for malaria, meningitis and leishmaniasis. • Introduction of preventive measures to restrict malaria transmission such as mosquito nets and treatment/drying up of breeding sites. • Introduction of early disease diagnosis and treatment programs for malaria, meningitis, and leishmaniasis. • Improvement of irrigation system management so as to reduce breeding sites. • Provision of alternative water supply systems for domestic use that do not involve open standing water areas.

B. National Level Policies and Strategic Documents

While the need to mainstream climate change adaptation into national policy is being increasingly recognized by Sudan, the most articulated national level adaptation policy planning has been at through its First National Communication to the UNFCCC, completed in 2003, and NAPA, finalized in 2007.

Other national programs have aims that complement adaptation efforts, although climate change considerations are not integrated explicitly within them. For instance, the NAPA recognizes two policies and programs that are key to supporting adaptation efforts: Sudan's Poverty Reduction Strategy Paper (2004) and the Roll Back Malaria program. Other policies also have the potential to include climate change adaptation. One example is Sudan's National Biodiversity Strategy and Action Plan (2000), which was completed prior to the development of Sudan's National Communication and NAPA (SMET, 2000).

Table 2: Key National Level Policies and Reports reflecting Adaptation Needs, Priorities and Planned Actions in Sudan

Name of Policy Action		Government Division Responsible	Status	Sector(s) of Focus	Summary description
1.	Sudan First National Communication under the United Nations Framework Convention on Climate Change[115]	Ministry of Environment and Physical Development	Completed in 2003	All, with adaptation emphasis on agriculture and forestry, water and health	Adaptation priority sectors proposed are water, forestry, agriculture and public health (chiefly in relation to malaria).
2.	National Adaptation Programme of Action[116]	Ministry of Environment and Physical Development	Completed in 2007	Water, agriculture, health	Document developed through broad consultation identifies rain-fed farmers and pastoralists as those most vulnerable to climate change. Adaptation priority sectors proposed are water, agriculture and public health (chiefly in relation to malaria). The document puts forward 32 priority actions that take into consideration these sectors, and identifies five "high priority" actions.

C. Current Adaptation Action

Adaptation action in Sudan is currently high compared to other North African countries. In a 2009 report on vulnerability in Sudan it was noted that two years after its NAPA was completed in 2007, none of the projects identified by Sudan were being implemented (Zakieldeen, 2009). This changed in 2009 when the project "Implementing NAPA Priority Interventions to Build Resilience in the Agriculture and Water Sectors to the Adverse Impacts of Climate Change in Sudan" was initiated using funding from the Least Developed Countries Fund. This project incorporates some of the 32 priority projects identified in the NAPA (see Table 4).

[115] UNFCCC, http://unfccc.int/essential_background/library/items/3599.php?rec=j&priref=3800#beg
[116] UNFCCC, : http://unfccc.int/resource/docs/napa/sdn01.pdf

A couple of other current projects and programs, as listed in Table 3, are funded by multilateral development partners and UN agencies. These are multi-country projects, and include: Sudan's participation in the continental project "Community-Based Adaptation in Africa" being implemented by the African Centre for Technology Studies; and the one year project "Support to Policy Consultation and Actions to boost Sustainable Use of Water and Energy Resources for Agricultural Production and Livelihood Improvement in the Near East and North Africa Region in the context of Climate Change" implemented by the Food and Agriculture Organisation and the Organisation of the Islamic Conference. These projects are generally focused on water and agriculture/food security.

Table 3: Current Adaptation Actions in Sudan

	Name	Objectives	Funder(s)	Implementing Agency(s)	Type of project	Duration	Priority Sector(s)	Geographic focus (if any)
National Action								
1.	Implementing NAPA Priority Interventions to Build Resilience in the Agriculture and Water Sectors to the Adverse Impacts of Climate Change in Sudan[117]	To implement an urgent set of adaptation-focused measures that will minimize and reverse the food insecurity of small-scale farmers and pastoralists, thereby reducing vulnerability of rural communities resulting to climate change, including variability. Project components include: implementation of pilot adaptation measures; building national and local adaptive capacities; and knowledge management and codification of best practices.	Least Developed Countries Fund (LDCF); co-financing *Budget:* US$6.9 million	UNDP, Higher Council for Environment and Natural Resources	Capacity building; Field implementation; Knowledge communication	2009–2013	Agriculture	Sudan
Participation in Regional and Global Projects								
2.	Managing Uncertainty: Innovation systems for coping with climate variability and change[118]	Coping with risks and realizing opportunities associated with climate variability and change enhanced through appropriate strategies and institutional innovation. The project will: synthesize and disseminate knowledge to researchers and planners to	AfDB	International Crops Research Institute for the Semi-Arid Tropics	Research	2007–2010	Agriculture	*Regional:* Kenya, Rwanda, Sudan, Uganda
			In Sudan: To be identified					

[117] ALM, http://www.adaptationlearning.net/project/implementing-napa-priority-interventions-build-resilience-agriculture-and-water-sectors-adve and IIED, http://www.iied.org/climate-change/key-issues/community-based-adaptation/community-based-adaptation-africa-cbaa

[118] CGIAR, http://ongoing-research.cgiar.org/factsheets/managing-uncertainty-innovation-systems-for-coping-with-climate-variability-and-change/ and ICRISAT, http://www.icrisat.org/what-we-do/agro-ecosystems/aes-adaption-table.htm

Name		Objectives	Funder(s)	Implementing Agency(s)	Type of project	Duration	Priority Sector(s)	Geographic focus (if any)
		support decision making in the agriculture sector; formation of learning alliances and knowledge exchange systems between meteorological and agricultural research and extension systems; and test strategies and tools and promote "proof of concept" projects.						
3.	Managing risk, Reducing Vulnerability and Enhancing Productivity under a Changing Climate[119]	Using case studies from Ethiopia, Kenya, Sudan and Tanzania, this action-research project seeks to contribute to the development of adaptive strategies by gathering knowledge on vulnerability to drought within different social, political and economic contexts, and designing decision-making tools to reduce vulnerability. The impacts of climate induced crises will be mitigated and resilience improved through the adoption, by small-scale farmers, of innovative strategies that reduce climate risk and manage vulnerability.	DFID and IDRC through the CCAA program *Budget:* CAD $1,626,100	Sokoine University of Agriculture (Tanzania)	Capacity building; Field implementation	2007–2011	Agriculture	*Regional:* Eritrea, Ethiopia, Kenya, Sudan, Tanzania
			In Sudan: To be identified					
4.	Community-Based Adaptation to Climate Change in Africa[120]	To help communities adapt to climate change and share lessons learned from project activities with key stakeholders at local, national, regional and international levels in order to elicit their support for climate change adaptation. The project's specific objectives are to: • Test the efficacy of the methodology "Local Options for Communities to Adapt	DFID and IDRC through the CCAA program *Budget:* CND 1,398,500	African Centre for Technology Studies	Capacity building; Field implementation; Community-based adaptation; Research	2008–2011	Multi-sectoral	*African:* Kenya, Malawi, South Africa, Sudan, Tanzania, Uganda, Zambia and Zimbabwe

[119] IDRC, http://web.idrc.ca/en/ev-118881-201_104146-1-IDRC_ADM_INFO.html

[120] ACTS, http://www.acts.or.ke/index.php?option=com_content&view=article&id=60&Itemid=53 and IDRC, http://www.idrc.ca/cp/ev-83067-201_104898-1-IDRC_ADM_INFO.html

Name		Objectives	Funder(s)	Implementing Agency(s)	Type of project	Duration	Priority Sector(s)	Geographic focus (if any)
		and Technologies to Enhance Capacity;" • Develop a tried and tested methodology for setting baselines, monitoring and evaluating changes in climate adaptation capacity; • Enhance particularly vulnerable communities' capacity to adapt in eight African countries; • Develop the capacity of relevant stakeholders to mainstream climate change adaptation into plans and activities through knowledge exchanges and information provision; • Strengthen existing networks to enhance understanding of the climate adaptation needs of vulnerable communities; and • Enlarge the body of knowledge and information on vulnerability and adaptation.	*In Sudan:* Assessment of the vulnerability of Sudan to climate change completed in 2009. *Implementing organization:* Sudanese Environment Conservation Society *Geographic focus:* North Kordofan[121]					
5.	Security in Mobility: Advocating for safe movement as a climate change adaptation strategy for pastoralists in the Horn and East Africa[122]	The focus of the project was to: "1. Promote pastoralists internal and cross-border mobility needs as a climate change adaptation strategy; 2. Advocate for regional cross-border security needs to be reconciled with pastoralists' livelihood needs, including cross-border mobility for access to water and pasture; 3. Support regional governments to develop regional normative framework on migration	Swiss Agency for Development Cooperation	UN Office for Coordination of Humanitarian Affairs; UNEP; International Organization for Migration; Institute for Security Studies	Research; Knowledge communication; Policy formation and integration	2009–2010 (closed)	Pastoralism	*Regional:* Ethiopia, Kenya, Somalia, Sudan, Uganda

[121] ACTS, http://www.acts.or.ke/institute/docs/climate_sudan.pdf
[122] Relief web, http://reliefweb.int/node/360082

Name		Objectives	Funder(s)	Implementing Agency(s)	Type of project	Duration	Priority Sector(s)	Geographic focus (if any)
		and mobility for pastoralists to enhance cross border security."[123]	*In Sudan:* To be determined					
6.	Adapting to Climate Change Induced Water Stress in the Nile River Basin[124]	To build the resilience of ecosystems and economies that are most vulnerable to climate change induced water stress in the Nile Basin countries through building key adaptive capacity and piloting adaptation in "hotspots" with technical, policy and financial interventions.	SIDA	UNEP, Nile Basin Initiative	Assessment; Capacity building; Policy formation and integration	2009–2012	Freshwater supply; Disaster risk management; Security	*African:* Burundi, DRC, Egypt, Eritrea, Ethiopia, Kenya, Rwanda, Sudan, Tanzania, Uganda
			In Sudan: To be determined					
7.	Support to Policy Consultation and Actions to boost Sustainable Use of Water and Energy Resources for Agricultural Production and Livelihood Improvement in the Near East and North Africa Region in the context of Climate Change[125]	The project will assist in building the capacity of governments and civil society to prepare national reviews, analyze the current national policies for water development, examine cooperation on transboundary water management, and identify the investment needs and investment strategies for food, water and energy security to be adopted on a national and regional basis in the context of climate change. Its main objectives are: • Carry out studies and workshops to increase awareness of water-energy-food interrelation and their sustainable use. • Address food and energy security in the	FAO Budget: US$436,000	FAO; Organisation of the Islamic Conference	Capacity building; Policy formation and integration; Research	2010–2011	Freshwater supply; Energy; Agriculture	*Global:* 30 countries including: Afghanistan, Algeria, Djibouti, Egypt, Kazakhstan, Kyrgyzstan, Libya, Mauritania, Morocco, Pakistan, Somalia, Sudan, Tajikistan,

[123] Relief web: http://reliefweb.int/sites/reliefweb.int/files/resources/8E4A32AF1BCEE2544925775800065831-Full_Report.pdf
[124] UNEP, http://www.unep.org/climatechange/adaptation/EcosystemBasedAdaptation/NileRiverBasin/tabid/29584/Default.aspx
[125] ALM, http://www.adaptationlearning.net/program/support-policy-consultation-and-actions-boost-sustainable-use-water-and-energy-resources-agr and SESRIC, http://www.sesric.org/activities-oicfao.php

Name		Objectives	Funder(s)	Implementing Agency(s)	Type of project	Duration	Priority Sector(s)	Geographic focus (if any)
		Near East and North Africa region through a convergent approach which integrates four critical resource factors - water, energy, technology, and knowledge under the stress of climate change. • Carry out studies on the use of water resources, on the management strategies and on the investment needs at national level. • Capacity building of governments and civil societies for optimal natural resource management.						Tunisia, Turkmenistan Uzbekistan, Yemen
			In Sudan: To be determined					
8.	Great Green Wall[126]	The project will address desertification and food security through the creation of a biological corridor along participating countries. The goal is to increase investment in appropriate sustainable land and water management and technologies. In addition the project seeks to encourage cooperation within and among participating countries and for countries to incorporate evidence-based policy development. The program's goals are to: "expand investment in sustainable land and water management technologies in order to help communities adapt production systems to climate variability and change; improve land use planning; and improve climate and water monitoring network improvements, institutional cooperation within and across	LDCF; SCCF; World Bank; AfDB *Budget:* US$3.108 billion		Capacity building; Research; Policy formation and integration	2011–?	Agriculture; Ecosystem restoration	*African:* Benin, Burkina Faso, Chad, Djibouti, Eritrea, Ethiopia, Ghana, Mali, Mauritania, Niger, Nigeria, Senegal, Sudan and Togo
			In Sudan: More information required.					

[126] GEF, http://www.thegef.org/gef/node/4503

Name		Objectives	Funder(s)	Implementing Agency(s)	Type of project	Duration	Priority Sector(s)	Geographic focus (if any)
		countries, and evidence-based policy development."[127]						

D. Proposed Adaptation Action

As mentioned above, Sudan's NAPA identified 32 priority adaptation projects through stakeholder consultations in the country's five most vulnerable agro-ecological zones. Of these 32 projects, five were identified as being of "highest priority," and therefore were expanded upon in the NAPA. The highest priority projects are:

- Enhancing resilience to increasing rainfall variability through rangeland rehabilitation and water harvesting in the Butana area of Gedarif State;
- Reducing the vulnerability of communities in drought-prone areas of South Darfur State through improved water harvesting practices;
- Improving sustainable agricultural practices under increasing heat-stress in the River Nile State;
- Environmental conservation and biodiversity restoration in North Kordofan State as a coping mechanism for rangeland protection under conditions of increasing climate variability; and
- Strategies to adapt to drought-induced water shortages in highly vulnerable areas in Central Equatorial State.

A number of the projects proposed within Sudan's NAPA are being implemented through the LDCF funded project "Implementing NAPA Priority Interventions to Build Resilience in the Agriculture and Water Sectors to the Adverse Impacts of Climate Change in Sudan."

Table 4: Proposed Adaptation Actions as identified in Sudan's NAPA (SMEPD, 2007)

	Name	Objectives	Type of project	Priority Sector(s)	Geographic focus (if any)
1.	Improving sustainable agricultural practices under increasing heat-stress in the River Nile State	• Improve agricultural system practices of the targeted farmers. • Maximize the utilization of flood water for irrigation of more agricultural lands in order to reduce the food gap. • Control flood water to reduce its negative impact on	Capacity building; Field implementation	Agriculture; Freshwater supply	River Nile State

[127] IISD, http://climate-l.iisd.org/news/gef-council-approves-programme-that-includes-great-green-wall-initiative/

	Name	Objectives	Type of project	Priority Sector(s)	Geographic focus (if any)
		people and to store water for agricultural and domestic and animal uses. • Increase agricultural production and provision of solutions for socio-economic and security problems that arises due to loss of livelihoods and displacement.			
2.	Enhancing the resilience of water-stressed agricultural systems through agroforestry in River Nile State	Undefined		Agriculture	River Nile State
3.	Reducing the vulnerability of rangelands in North Butana areas to climate variability	Undefined		Agriculture; Pastoralism	River Nile State
4.	Reducing vulnerability to increased malaria transmission potential in El Zydab area	Undefined		Human health	River Nile State
5.	Environmental conservation and biodiversity restoration in northern Kordofan State as a coping mechanism for rangeland protection under conditions of increasing climate variability	• Awareness rising of the local people in order to ensure their participation in the rehabilitation process. • Achievement of sustainability of livelihoods through the wise use of resources and provision of alternatives. • Development of animal wealth sectors. • Fixation of sand dunes and combating desertification	Capacity building; Knowledge communication; Field implementation	Ecosystem conservation; Ecosystem restoration	North Kordofan State
6.	Rehabilitation of gum arabic belt for poverty reduction, combating desertification and conservation of biodiversity	Undefined	Restoration	Forestry	North Kordofan State
7.	Development of Gardoud lands for insurance of food security and improvement of coping capacity	Undefined		Agriculture	North Kordofan State
8.	Fodders production for livelihoods improvement and avoidance of conflicts over resources	Undefined		Agriculture; Security	North Kordofan State
9.	Development of Geraih Alserha area for adaptation to climate-induced changes and poverty reduction	Undefined		Agriculture	North Kordofan State

	Name	Objectives	Type of project	Priority Sector(s)	Geographic focus (if any)
10.	New livestock routes to increase resilience of pastoralists and conserve natural resources in northern Kordofan state	Undefined		Pastoralism	North Kordofan State
11.	Reduction of vulnerability to increased malaria transmission potential in northern Kordofan state	Undefined		Human health	North Kordofan State
12.	Enhancing resilience to rainfall variability through rangeland rehabilitation and water harvesting in the Butana area of Gedarif State	• To rehabilitate Butana communal rangelands through the introduction of new fodder rotation and management schemes; • To improve household income diversity through the introduction of new cottage industries in order to provide alternative income sources during periods of low rainfall; • To identify optimal water harvesting, storage and spreading techniques relative to climate change and to implement these techniques to the fullest extent possible in the region; • Reduce pressure on rangelands resources through building awareness among pastoralists and other livelihoods regarding community forestry and alternative firewood resources; • To mitigate the potential for future conflicts over dwindling rangeland resources from rainfall variability by providing basic services for nomads and herders, including safe access and regress routes to minimize conflict between monads and farmers in the area.		Agriculture	Gedarief State
13.	Reduction of food security vulnerability around Sudd's Lake caused by recent frequent flooding that also cause health hazards in Gadarief State	Undefined		Agriculture;	Gedarief State
14.	Poverty reduction of traditional and smallholder farmers exposed to climate change in Gadambaliah area	Undefined		Agriculture	Gedarief State

	Name	Objectives	Type of project	Priority Sector(s)	Geographic focus (if any)
15.	Reduction of vulnerability to drinking water shortage due to climate change in Gedarif town through construction of stony and earthy sudd around the town	Undefined		Freshwater supply	Gedarief State
16.	Rehabilitation of gum arabic belt for increase of resilience, diversification of livelihoods and conservation of resources in Alrahad locality	Undefined		Forestry	Gedarief State
17.	Rehabilitation of hafiers for increasing coping capacity to drought and reduction of human and animals vulnerability to drinking water shortage and pollution	Undefined		Agriculture; Freshwater supply	Gedarief State
18.	Reducing vulnerability to Malaria and Leishmaniasis (Kalazar) diseases in Galabat area	Undefined		Human health	Gedarief State
19.	Reducing vulnerability to outbreak of meningitis in Eastern Galabat	Undefined		Human health	Gedarief State
20.	Reducing the vulnerability of communities in drought-prone areas of southern Darfur State through improved water harvesting practices	• Secure water supply in dry areas, which will increase productivity of arable and grazing land • Increase yields of rain fed farming so as to minimize the risk of crop failure in drought prone area • Supply drinking water for animals • Supply domestic water for people • Tribal conflict avoidance		Freshwater supply; Agriculture; Security	South Darfour State
21.	Development of a small ruminant bank in Nyala and Sharia localities	Undefined		Agriculture	South Darfour State
22.	Development of grazing enclosures in Agliry and Domayh Temit areas	Undefined		Agriculture	South Darfour State
23.	Development of social forestry schemes in Sharia, Almalam, Muhagria, Dirbat, Mershing	Undefined		Forestry	South Darfour State
24.	Diversification of household income as a strategy to reduce vulnerability to climate variability in Shadid and other areas	Undefined		Rural areas	South Darfour State

	Name	Objectives	Type of project	Priority Sector(s)	Geographic focus (if any)
25.	Improving fishery and fish utilization in East Jebbel Marra, Safia lake, Kundi, and Kidinir areas	Undefined		Freshwater fisheries	South Darfour State
26.	Combating Malaria and Bilharzia in all areas of South Darfour State, particularly the southern part	Undefined		Human health	South Darfour State
27.	Water harvesting and rehabilitation of water dams in Sharia, Muhagria, Mershing, and Nittaiga areas	Undefined		Freshwater supply	South Darfour State
28.	Strategies to adapt to drought-induced water shortages in highly vulnerable areas in Central Equatorial State	• Address the problem of water shortage due to drought in areas highly vulnerable (e.g. in the areas of Liggi, Tigore and Kuda). • Introduce agroforestry practices to increase the adaptive capacity to climate changes in west Juba areas. • Reduce the vulnerability of local communities to increased malaria transmission from climate variability; • Minimize the negative impact of floods in highly vulnerable areas (e.g. Jebel Lado, Mongalla and Gondokro. • Reduce the vulnerability of rangelands to climate change in the areas of Terekeka and Tali.	Community capacity	Freshwater supply; Forestry; Human health	Central Equatorial State
29.	Agroforestry to increase the adaptive capacity to climate changes in West Juba areas	Undefined		Forestry	Central Equatorial State
30.	Reduction of the prevalence rates and incidence of malaria in highly affected communities	Undefined		Human health	
31.	Minimization the negative impact of the floods in areas highly vulnerable (e.g. Jebel Lado, Mongalla and Gondokro)	Undefined		Disaster risk management	
32.	Reduction of the vulnerability of rangeland to climate change in the areas of Terekeka and Tali	Undefined		Agriculture	Central Equatorial State

E. Assessment

With peace, Sudan has the potential to sustainably develop its considerable natural resource base and improve the lives of its population. However, given the serious socio-economic implications of climate change for the country—particularly the vulnerability of the region's rural farming population to climate change-induced decreases in precipitation—this goal might only be achieved if Sudan's future governments, north and south, give appropriate attention to climate adaptation. With four of the five priority regions for adaptation identified in Sudan's NAPA being located in the northern half of the country (Gederif State, South Darfur State, River Nile State and North Kordofan State), adaptation action may be of greater importance for this region.

The creation of the Republic of South Sudan may create opportunities for increasing the amount of adaptation action underway in this new country. Its newly independent status could increase the engagement of bilateral donors in the country, many of whom suspended their provision of official development assistance (but not humanitarian aid) to Sudan following the 1989 revolution (USDS, 2010). South Sudan will require significant international development assistance after achieving independence to promote its sustainable development—therefore presenting tremendous opportunity in the near future for the integration of climate change considerations into development planning and for implementation of adaptation actions, particularly in the agricultural and water sectors.

However, uncertainty remains regarding the long-term nature of the peace agreement in Sudan. Tensions continue between the north and south, particularly over the disputed oil-rich Abyei region (Abdelaziz 2011; Gettleman 2011). As such the long-term prospects for expansion of adaptation in Sudan to address needs in all sectors, but particularly water, agriculture and public health, also remains uncertain.

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6.0 Tunisia

AAP	Africa Adaptation Programme
BMZ	Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung (Germany)
CPS	Country Partnership Strategy
DEFRA	Department for Environment, Food and Rural Affairs (United Kingdom
GDP	Gross Domestic Product
GEF	Global Environment Facility
GFDRR	Global Facility for Disaster Reduction and Recovery
GHG	greenhouse gas
IDRC	International Development Research Centre
IISD	International Institute for Sustainable Development
MENA	Middle East and North Africa
NCAP	Netherland Climate Assistance Program
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNFPA	United Nations Population Fund
UNITAR	United Nations Institute for Training and Research
WHO	World Health Organization

The Tunisian Republic, covering 193,610 km^2, is the smallest country in North Africa. The country is divided into two distinct sectors: an arable Mediterranean coast in the north, and desert to the south. Between the two lies a semi-arid transition zone (USDS, 2010). The country is highly urbanized; 67 per cent of its population of 10.4 million lives in the country's cities (UNFPA, 2010).[128] Life expectancy in 2010 was 74.3 years (UNDP, 2010b)

Tunisia is among the most developed countries in Africa, ranked 81 out of 169 countries on the 2010 UNDP Human Development Index; GDP per capita in 2008 was US$8,254 (UNDP, 2010b). The main economic sectors of the country are: services (which make up

[128] The population is expected to grow to 12.7 million by 2050 (UNFPA, 2010)

43 per cent of GDP, including 5.5 per cent for tourism); industry (31.5 per cent of GDP, which includes petroleum, mining and textiles); and agriculture and fishing (8.9 per cent of GDP) (USDS, 2010). Seventeen per cent of Tunisia's land is arable, and agricultural activities concentrate on a few key crops, including olives, grains, citrus fruits and dates.

A. Adaptation Needs and Priorities

Tunisia's current climate varies considerably across the country. Hot, dry summers give way to mild, rainy winters in the north. In the center, a semi-arid climate results in modest rainfall and relatively high temperatures. The south, dominated by the Saharan desert, experiences high temperatures and very low rainfall (TMELP, 2001). Tunisia's position between the temperate regions of the Northern hemisphere and the inter-tropical regions make it particularly vulnerable to climate change (TMELP, 2001). This situation is compounded by the current sensitivity of the Tunisian environment due to degradation; 3 million hectares in the center and north of the country are being strongly eroded, and 7 million hectares in the south suffer from secondary salinization, wind erosion and sand invasion (OneWorld, 2009). In addition, the country's total water abstraction per year, as a percentage of long-term freshwater resources, is greater than 50 per cent (Gueye *et al*, 2005).

Tunisia is expected to experience a significant increase in temperature by 2100. Temperatures are expected to increase at a greater rate in North Africa than anywhere else on the continent, with summer temperature increases exceeding 4°C by the end of the century (Christensen, 2007). Decreases in precipitation are projected, particularly in the country's coastal area: a 20 per cent drying in annual mean precipitation is expected for the African Mediterranean coast. A general increase in the intensity of high-rainfall events is expected across Africa; in Tunisia and North Africa more generally, this will likely be offset by a greater decrease in the number of rain days. Finally, Tunisia can expect a rise in sea level of between 38cm and 55cm by 2100 (Christensen, 2007).

The key climate vulnerabilities identified in Tunisia's First National Communication (2001) were largely framed in relation to sea level rise, rather than the impacts of temperature rise and changes in precipitation. Tunisia's coastal zone is particularly vulnerable to sea level rise. Human pressures have already made this a fragile ecosystem; two-thirds of the country's population is concentrated along the coast, as well as 70 per cent of its economic activity and 90 per cent of its tourism. Sea level rise will likely change national development patterns. Identified climate vulnerabilities include (TMELP, 2001):

- Saltwater intrusion presents a real threat to the country's coastal aquifers, particularly given the existing high withdrawal rates;
- An increase in high intensity rainfall events is expected to increase runoff and erosion;

- Coastal ecosystems, including lagoons and marshes, are threatened by sea level rise, as is coastal agriculture, which includes citrus production and irrigated crops; and
- 90 per cent of the country's tourism is coastal; unmitigated sea level rise is expected to damage beaches and coastal tourism infrastructure.

B. National Level Policies and Strategic Documents

The country's First National Communication was prepared by the Ministry of Environment and Land Planning, and submitted in 2001. The Ministry of the Environment and Sustainable Development is in the process of completing Tunisia's Second National Communication. Other actions taken by Tunisia to address climate change adaptation include establishing a national committee on climate change (Comité national sur les changements climatiques) in 1996. Made up of representatives from all affected government ministries and agencies (i.e. energy, coasts, environment, meteorology, and so on), the committee is mandated to coordinate national action on climate change and participate in international climate negotiations.[129] As well, the Ministry of Industry, Energy and Small and Medium Enterprises and the Ministry of the Environment and Sustainable Development have launched an informational website designed to transmit national data on greenhouse gas emissions, climate change and government response strategies.[130]

Climate change (along with sustainable development) has been identified as one of three main strategic pillars in Tunisia's Country Partnership Strategy (CPS) for 2010-2013, devised in collaboration with the World Bank. The strategy, aligned with Tunisia's 11th National Development Plan (2007-2016), includes projects implemented on water supply (including irrigation, groundwater resources and urban water systems) and coastal protection; a project on climate change and agriculture is currently under preparation (World Bank, 2010). In addition, the government has implemented soil and water conservation programs, developed greenbelts to combat desertification, and launched reforestation programs; these programs, though not explicitly relating to climate change adaptation, do address some of the country's key climate vulnerabilities (OneWorld, 2009).

[129] See http://www.changementsclimatiques.tn/latunisieetlescc_introduction.htm
[130] See www.changementsclimatiques.tn/

Table 1: Key Government Policies and Reports reflecting Adaptation Needs, Priorities and Planned Actions

Name of Policy Action		Government Division Responsible	Status	Sector(s) of Focus	Summary description
1.	Initial National Communication to the UNFCCC[131]	Ministry of Environment and Land Planning	Submitted October 2001	Multi-sectoral	The first document submitted to the UNFCCC by the government, this report presents an inventory of domestic greenhouse gas (GHG) emissions, provides an assessment of Tunisian vulnerability to sea level rise, and an assessment of the ways in which Tunisia could abate GHG emissions. The report concludes with an analysis of Tunisian needs for contributing to global climate change mitigation action.
2.	Second National Communication to the UNFCCC	Ministry of the Environment and Sustainable Development	In Progress	Multi-sectoral	The Second National Communication will present an updated national inventory of GHG and climate change vulnerabilities.
3.	Country Partnership Strategy[132]	Ministry of Development and International Cooperation	Launched 2010	Multi-sectoral	Launched in collaboration with the World Bank, the Country Partnership Strategy (2010-2013) sets out the enhanced strategic engagement of the World Bank in Tunisia in support of the country's 11th National Development Plan. The Government and the World Bank have agreed on three CPS strategic pillars: employment, growth and competitiveness; sustainable development and climate change; and improving the quality of service delivery.

C. Current Adaptation Action

Tunisia is currently involved in a number of regional adaptation projects, and a small number of national projects—leading it to have a high level of program based adaptation activity relative to other North African countries. The projects and programs currently underway reflect a strong mix of both focus sectors and project types (for project summaries, see Table 2 below). Agriculture and food security is the dominant sector, but projects also address vulnerabilities in natural resource management, infrastructure, water, health, tourism, cities, forests and coastal zone management. With regards to the types of projects underway, a number of vulnerability assessments are currently being implemented—a welcome trend, given the narrow focus of the vulnerability assessment presented in the 2001 National Communication. Projects also have a strong focus on research, capacity building, knowledge communication and policy formation and integration.

[131] UNFCCC, http://unfccc.int/essential_background/library/items/3599.php?such=j&symbol=TUN/COM/2%20B#beg
[132] World Bank, http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/MENAEXT/TUNISIAEXTN/0,,contentMDK:22463593~menuPK:310020~a:b~pagePK:2865066~piPK:2865079~theSitePK:310015,00.html

Tunisia is home to only a small number of national adaptation actions but is a participant in several regional and continental initiatives:

- The German Ministry for Economic Cooperation and Development (BMZ) is also supporting Tunisia's implementation of the UNFCCC. This five-year project, currently in its last year, is focused on building the capacity of the Tunisian government to implement (and meet its obligations under) the UNFCCC. The project focuses primarily on the capacity of the state to implement initiatives on climate change adaptation and emissions reductions, and to identify synergies for positive climate change action. It has focused on the agriculture, water, health and tourism sectors (GIZ, 2010).
- With funding from the Climate Change Adaptation in Africa program and the Ecohealth program of the International Development Research Centre (IDRC), the project "Analysis of the Health Impacts of Climate Change Adaptation Strategies: The case of transmission of zoonotic cutaneous leishmaniasis from Leishmania major in Tunisia" is being implemented. Using an eco-health approach, this study will identify strategies for reducing the risk of this disease due to climate change.
- The Global Environment Facility (GEF) and the World Bank are currently supporting the "Second National Resources Management Project," a US$67-million project aimed at improving the living conditions in rural communities in three of the country's districts (governates). The project, implemented by a number of government agencies and ministries, in part seeks to reduce the threat of land degradation and the vulnerability of agricultural production systems to climate change. The five-year project will be completed in 2015 (GEF, 2010).
- Regionally, Tunisia is one of two North African countries (with Morocco) participating in the program "Supporting Integrated and Comprehensive Approaches to Climate Change Adaptation in Africa," or the Africa Adaptation Programme. This US$92.1 million initiative was launched in 20 African countries by the Japan International Cooperation Agency in 2010. The Tunisian component of the program is a US$2.975 million project focused on promoting the development of adaptation options on the coasts of Tunisia. It will seek to: promote technological solutions to key coastal challenges (as prioritized in the country's first national communication), while building the capacity of local, regional and national stakeholders to: undertake science-based adaptation planning; explore long-term adaptation financing mechanisms; and—through research, awareness-raising and knowledge sharing—generate a better understanding of climate impacts and adaptation options (UNDP, 2010a).
- The World Health Organization (WHO) recently completed a two-year project examining the linkages between climate change and health. The project, entitled "Health Vulnerability and Climate Change Adaptation Assessments," was carried out in 15 countries from Africa, Asia and Latin America. The project identified potential health impacts of climate change in Tunisia (e.g., heat waves, floods, water-borne diseases, vector-borne diseases and air pollution), and aimed to serve as a baseline analysis to

monitor how health risks may be influenced by a changing climate over time. Work carried out in Tunisia under the project was done in collaboration with the BMZ project "Implementing the UNFCCC" referred to above (WHO, 2010).

- Three North African countries (Egypt, Morocco and Tunisia) are involved in the project "Action Plans for North Africa," funded by the Global Facility for Disaster Reduction and Recovery. The project focuses on the development of climate action plans for three municipalities (Alexandria, Casablanca and Tunis) as a means of increasing urban resilience to climate change and natural hazards (GFDRR, undated).
- The Food and Agriculture Organization and the Organisation of the Islamic Conference are implementing the one-year project "Support to Policy Consultation and Actions to boost Sustainable Use of Water and Energy Resources for Agricultural Production and Livelihood Improvement in the Near East and North Africa Region in the context of Climate Change" that involves a number of countries in North Africa and West Asia. The project aims to build capacity in each participating country to analyze policies for water development and identify investment needs and strategies for increasing food, water and energy security in the context of climate change (SESRIC, undated).
- The GEF and World Bank are funding a US$87 million regional project on coordinated natural resource management and capacity building in North Africa (along with Mauritania and Lebanon). The four-year project (2009-2013) seeks to reduce the threat of water scarcity, land degradation and climate change to vulnerable agricultural production systems and water resources. The project will focus on capacity building, research, vulnerability assessments and knowledge sharing, and is being implemented by the Arab Water Council, the Arab Water Academy and relevant national government partners.
- BMZ, in cooperation with the Collaborative Partnership on Mediterranean Forests, has launched a four-year project aiming to improve conditions for sustainable management of forest ecosystems in the face of climate change in the Middle East-North Africa (MENA) region. The project is being implemented by the High Commission for Water, Forests and Combating Desertification (Morocco), and is being carried out in Algeria, Lebanon, Morocco, Syria, Tunisia and Turkey.

Table 2: Current Adaptation Projects and Programs active in Tunisia

Name		Objectives	Funder(s)	Implementing Agency(s)	Type of project	Duration	Priority Sector(s)	Geographic focus (if any)
National Action								
1.	Implementing the UNFCCC[133]	This project is focused on building the capacity of the Tunisian government to implement (and meet its obligations under) the UNFCCC. It will focus on climate change adaptation, emissions reduction and synergies.	BMZ	Ministry of Environment and Sustainable Development	Research; Capacity building; Field implementation	2006–2011	Government	National
2.	Analysis of the Health Impacts of Climate Change Adaptation Strategies: The case of transmission of zoonotic cutaneous leishmaniasis from Leishmania major in Tunisia[134]	This research project will study climate change adaptation strategies which reduce transmission of zoonotic cutaneous leishmaniasis from Leishmania major in an area at to the risk of the disease in Tunisia. Using a multidisciplinary ecosystem approach, the project will test technical solutions (e.g. early warning systems for epidemics), to identify and test appropriate preventive actions to mitigate the vulnerability of women to the disease.	DFID and IDRC through the CCAA program and IDRC's Ecohealth program *Budget:* CND 400,900	Agence Tunisienne de Coopération Technique; and l'Observatoire des Maladies Emergentes	Research	2009–?	Human health	Tunisia
3.	Second Natural Resources Management Project[135]	The project's development objective is to improve the living conditions of rural communities in three governorates in terms of access to basic infrastructure and services, sustainable income increase, and improved natural resource management practices by fostering an integrated approach to community-based development. The global environment objective is to reduce the threat of land degradation and climate change to vulnerable agricultural	GEF, World Bank *Budget:* US$67,620,000	Ministry of Agriculture and Water Resources; National Sewerage and Sanitation Agency; General Directorate of Rural	Research; Field implementation Community-based adaptation	2010–2015	Rural areas	Three governates

[133] GIZ, http://www.gtz.de/en/weltweit/maghreb-naher-osten/tunesien/29182.htm
[134] IDRC, http://www.idrc.ca/cp/ev-120851-201-1-DO_TOPIC.html and http://www.idrc.ca/uploads/user-S/12598745721Investments.pdf
[135] GEF, http://gefonline.org/projectDetailsSQL.cfm?projID=3669

Name		Objectives	Funder(s)	Implementing Agency(s)	Type of project	Duration	Priority Sector(s)	Geographic focus (if any)
		production systems in the target areas while developing options to address land-based pollution affecting the Mediterranean Sea.		Engineering; General Directorate of Environment and Quality of Life				
Participation in Regional and Global Projects								
4.	Advancing Capacity for Climate Change Adaptation (ACCCA)[136]	The rational for this project is that countries lack scientific knowledge and understanding of climate risks, and that this is an impediment to addressing climate variability. Activities include the following: identify and prioritize climate risks; assess available knowledge about risks and adaptation opportunities; develop, test, and disseminate risk communication materials that are designed to assist adaptation decisions; and identify critical knowledge gaps that impede effective adaptation decisions.	IDRC; DEFRA; Swiss Federal Office for the Environment ; NCAP; European Commission	UNITAR	Assessment; Capacity building; Policy formation and integration	2007–2010	Multi-sectoral	*Global:* 17 countries in Asia and Africa[137] including Tunisia
			In Tunisia: To be identified					
5.	Supporting Integrated and Comprehensive Approaches to Climate Change Adaptation in Africa (or Africa Adaptation Program – AAP)[138]	Under this program, UNDP will assist 20 African countries in implementing integrated and comprehensive adaptation actions and resilience plans. The projects will ensure that national development processes incorporate climate change risks and opportunities to secure development gains under a changing climate. UNDP will help countries establish	Japan International Cooperation Agency Budget: US$92.1 million	UNDP	Capacity building; Policy formation and integration; Knowledge communication	2008–2011	Government	*African:* 20 African countries[139] including: Morocco and Tunisia

[136] ACCCA, http://www.acccaproject.org/accca/

[137] *African countries include*: Burkina Faso, Cameroon, Ethiopia, Ghana, Kenya, Malawi, Mali, Niger, Nigeria, Tanzania, Tunisia and South Africa. *Asian countries include*: Bangladesh, India, Mongolia, Nepal and the Philippines.

[138] ALM, http://www.adaptationlearning.net/program/africa-adaptation-programme and UNDP-APP, http://www.undp-aap.org/

[139] These countries are: Burkina Faso, Cameroon, Congo, Ethiopia, Gabon, Ghana, Kenya, Lesotho, Malawi, Mauritius, Morocco, Mozambique, Namibia, Niger, Nigeria, Rwanda, Sao Tome et Principe, Senegal, Tanzania and Tunisia.

Name		Objectives	Funder(s)	Implementing Agency(s)	Type of project	Duration	Priority Sector(s)	Geographic focus (if any)
		an enabling environment and develop the capacity required to design, finance, implement, and monitor long-term and cost-effective adaptation policies and plans.	*In Tunisia:* The project will promote the development of adaptation options on the coasts of Tunisia that are cross-sectoral, thereby breaking with the traditional, sectoral and infrastructure-heavy approaches of the past. It will seek to demonstrate soft and innovative technologies to address the key coastal challenges, while building the capacity of local, regional and national stakeholders to undertake science-based adaptation planning. Financial mechanisms and risk sharing schemes will also be explored in order to internalize the costs of adaptation in the long term. Finally, the project will aim at generating a better understanding of climate impacts and adaptation options through targeted research, awareness-raising, and knowledge sharing and dissemination. • *Implementing agencies:* Ministry of the Environment and Sustainable Development, Coastal Management and Protection Agency • *Priority sector:* Coastal zone • *Budget:* USD2.975 million.[140]				
6.	Health Vulnerability and Climate Change Adaptation Assessments[141]	To provide national level evidence of the linkages between climate and health; improve understanding of local and specific health risks and vulnerabilities; provide the opportunity for capacity building; and serve as a baseline analysis to monitor how health risks may be influenced by a changing climate over time.	World Health Organization	National Ministries	Assessment	2008–2010 (Closed)	Human health	*Global:* 15 countries including Bolivia, Brazil, Cambodia, Costa Rica, Ghana, India, Kyrgyz Republic, Mongolia and Tunisia
			In Tunisia: Conducted in collaboration with the GTZ-funded project "Implementing the UNFCCC" • *Implementing organizations:* Ministry of Public Health; Directorate of Hygiene and Environmental Protection • *Duration:* 2006–2011					
7.	Natural Disaster Preparedness for Coastal	The objectives are to: assist the national and local governments of Egypt, Tunisia and	Global Facility for		Assessment; Policy	2009–2011	Disaster risk management;	*Regional:* Egypt

[140] UNDP, http://www.undp-adaptation.org/portfolio/projectR.php?id=140
[141] WHO, http://www.who.int/globalchange/mediacentre/events/2010/costa_rica_consultation_200710/en/index.html

Name		Objectives	Funder(s)	Implementing Agency(s)	Type of project	Duration	Priority Sector(s)	Geographic focus (if any)
	Cities of North Africa[142]	Morocco in assessing and valuing the vulnerability of the coastal cities Alexandria, Tunis and Casablanca respectively to natural disasters while addressing their underlying the synergies with climate change vulnerability; and develop prioritized preparedness comprehensive action plans that will address urban coastal vulnerability and infrastructure for the three cities.	Disaster Reduction and Recovery *Budget:* US$250,000		formation and integration		Urban areas; Coastal zone management	Morocco Tunisia
			In Tunisia: Focus on the city of Tunis.					
8.	Support to Policy Consultation and Actions to boost Sustainable Use of Water and Energy Resources for Agricultural Production and Livelihood Improvement in the Near East and North Africa Region in the context of Climate Change[143]	The project will assist in building the capacity of governments and civil society to prepare national reviews, analyze the current national policies for water development, examine cooperation on transboundary water management, and identify the investment needs and investment strategies for food, water and energy security to be adopted on a national and regional basis in the context of climate change. Its main objectives are: • Carry out studies and workshops to increase awareness of water-energy-food interrelation and their sustainable use. • Address food and energy security in the Near East and North Africa region through a convergent approach which integrates four critical resource factors - water, energy, technology, and knowledge under the stress of climate change. • Carry out studies on the use of water	FAO Budget: US$436,000	FAO; Organisation of the Islamic Conference	Capacity building; Policy formation and integration; Research	2010–2011	Freshwater supply; Energy; Agriculture	*Global:* 30 countries including: Afghanistan, Algeria, Djibouti, Egypt, Kazakhstan, Kyrgyzstan, Libya, Mauritania, Morocco, Pakistan, Somalia, Sudan, Tajikistan, Tunisia, Turkmenistan Uzbekistan, Yemen
			In Tunisia: To be identified					

[142] GFDRR, http://www.gfdrr.org/docs/Snapshots_MENA_Cities.pdf
[143] ALM, http://www.adaptationlearning.net/program/support-policy-consultation-and-actions-boost-sustainable-use-water-and-energy-resources-agr and SESRIC, http://www.sesric.org/activities-oicfao.php

Name		Objectives	Funder(s)	Implementing Agency(s)	Type of project	Duration	Priority Sector(s)	Geographic focus (if any)
		resources, on the management strategies and on the investment needs at national level. • Capacity building of governments and civil societies for optimal natural resource management.						
9.	Regional Coordination on Natural Resources Management and Capacity Building[144]	To help resource managers in the Arab region better understand the status of regional natural resources and make learned decisions on their use and management, including water/ international water, land and vegetation, especially in the context of climate change impacts. Such decisions will in the end help resources managers to optimize resource utilization and reduce environmental degradation, including desertification and land degradation, and also help the society to adapt to impacts of climate change and variability.	GEF Trust Fund, national government, bilateral aid Budget: US$87,679,545	Arab Water Council (AWC), Arab Water Academy, and relevant agencies of AWC member countries	Capacity building; Research; Assessment; Knowledge communication	2009–2014	Ecosystem conservation; Freshwater supply	*African:* Algeria, Egypt, Lebanon, Libya, Mauritania, Morocco, Tunisia
			In Tunisia: Will include the establishment of a "climate node," a research and climate tool-development center in Tunisia.					
10.	Adapting the Framework of Forestry Policy to Meet the Needs of Climate Change in the MENA region[145]	The objective of the project is to improve conditions for the sustainable management of forest ecosystems and for the maintenance of their environmental services in the face of climate change in the Middle East and North Africa (MENA) region.	BMZ implemented under the Collaborative Partnership on Mediterranean Forests[146]	High Commission for Waters, Forests and Combating Desertification, Morocco	Policy formation and integration; Research; Knowledge communication	2010–2014	Forestry; Ecosystem conservation	*Regional:* Algeria, Lebanon, Morocco, Syria, Tunisia, Turkey
			In Tunisia: More information required.					

[144] IW-LEARN, http://iwlearn.net/iw-projects/iwproject.2009-08-05.7974636515
[145] GTZ, http://www.gtz.de/en/weltweit/maghreb-naher-osten/tunesien/32875.htm
[146] FAO, http://www.fao.org/forestry/65365/en/

D. Proposed Adaptation Action

Tunisia, as a country of High Human Development (UNDP, 2010b), will not be preparing a National Adaptation Programme of Action. The country's First National Communication did not identify potential adaptation strategies, projects or programs. However, under the World Bank-Government of Tunisia Country Partnership Strategy (see Section B), climate change has been identified as one of three key strategic pillars; a project on climate change and agriculture is currently under preparation as part of implementation of the CPS (World Bank, 2010).

E. Assessment

This review of current and planned adaptation action in Tunisia suggests that the following steps could be taken to strengthen its capacity to adapt to the impacts of climate change:

- Based on the absence of national climate information, there is a need for improved climate data collection and dissemination in Tunisia.
- A more thorough national climate vulnerability assessment is required, to get a better idea of the impacts on climate change on the country's agricultural sector, water resources, health sector, energy production, gender concerns and so on. The vulnerability assessment presented in the First National Communication concentrated on the impacts of sea level rise; more areas of vulnerability need to be identified.
- Despite the focus on coastal zones in the First National Communication, and the strong concentration of population, industry and tourism on Tunisia's coasts, not many current projects have explicitly addressed coastal vulnerabilities. Should coastal zones continue to be identified as vulnerable in the country's Second National Communication (currently under development), this represents a sector for potential future adaptation investments.
- Adaptation funding has thus far come from both multilateral and bilateral sources, with bilateral adaptation funding dominated by support from Germany.
- A substantial proportion of climate change funding received by Tunisia has gone into mitigation strategies. For example, U.S. fast start funding has gone to support the Clean Technology Fund (CTF), under which Tunisia has developed an investment plan that would use USD186 million in CTF funding for utility-scale concentrated solar power and transmission.[147] Climate change funding from the GEF has largely focused on the energy sector.
- More could be done to integrate gender considerations into adaptation actions.

[147] See http://www.state.gov/g/oes/rls/rpts/faststart/middleeast/151667.htm

Finally, it should be noted that the impact of the February 2011 political changes in Tunisia on climate change programming and policymaking remains unclear. New opportunities for increasing understanding of and responses to the risks associated with projected climate change impacts may emerge in the future.

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7.0 Yemen

EPA	Environmental Protection Agency
GDP	Gross Domestic Product
ICARDA	International Center for Agricultural Research in the Dry Areas
LDCF	Least Developed Countries Fund
NAPA	National Adaptation Programme of Action
PPCR	Pilot Program for Climate Resilience

Located in the southern half of the Arabian Peninsula, the Republic of Yemen continues to make development strides, yet profound poverty and other challenges persist. Factors such as adult literacy (at 46 per cent of the general population; significantly lower for women), GDP per capita (at US$893/year), and total fertility rate (at 7.6 percent, second only to Niger) combine to place Yemen near the bottom of the Human Development Index (at 133th; UNDP 2009; UNDP, 2010). Since the adoption of its Third Development Plan for Poverty Reduction (2006-2010), the Government has scaled up its efforts to spur non-oil growth and create jobs in sectors such as agriculture, fisheries, natural gas, urban manufacturing and services, and the financial sector (World Bank, 2010). Still, Yemen's economy remains largely dependent on its rural natural resources; more than 75 per cent of the population is rural-base and engaged in farming and pastoralism—and therefore highly reliant on favorable climatic conditions for their livelihoods (YEPA, 2009).

A. Adaptation Needs and Priorities

In the mountainous regions of western Yemen, the climate is temperate while its coastal areas are humid. The remainder of the country is extremely hot and dry.[148] Historical data (since 1970) on temperature indicates that Yemen has become progressively warmer, with temperatures rising more in the summer (+0.2°C per decade) than the winter (+0.15°C per decade). The average total annual precipitation recorded for about the past 100 years shows variability but without an obvious and unpredictable trend. However, extreme rainfall causing localized flooding is becoming a challenge for the country (Cruz et al., 2007). For example, in 2008, a flood in the Hadramout and Maharah Governorates claimed the lives of more than 140 persons and left more than 20,000 without shelter (Abu-Lohom and Babaqi, 2010).

[148] USDS, http://www.state.gov/r/pa/ei/bgn/35836.htm

Over the next century, temperatures in Yemen are expected to rise steadily; according to the Intergovernmental Panel on Climate Change, Yemen is expected to warm by 3 to 4°C by the 2080s, which is roughly 1.5 times the global mean response (Cruz et al., 2007). Future precipitation patterns are less clear, as there is a wide divergence in projected rainfall, but it is generally agreed that rainfall variability and intensity will increase (World Bank, 2010). Changes in precipitation intensity seem to be increasing over time and more significant drier periods with short-term heavy rainfalls are being projected (Abu-Lohom and Babaqi, 2010; Cruz et al., 2007).

Yemen is vulnerable to the climate change-related impacts it is likely to experience, including drought, extreme flooding, pests, sudden disease outbreaks, rainfall pattern changes, increased storm frequency/severity and sea level rise. Of particular concern is the country's current level of water stress; even in the absence of climate change, the country's groundwater reserves are expected to be mostly depleted in two to three decades. The result of this depletion could be a reduction in agricultural output by as much as 40 per cent (World Bank, 2010). A brief overview of the country's potential vulnerabilities and needed adaptation options is contained in its National Adaptation Programme of Action (NAPA). Vulnerabilities are identified in few key sectors, including water, agriculture and food security, biological diversity, coastal areas, communities, infrastructure and ecosystems, health and tourism. These key vulnerabilities are listed in Table 1.

Effective adaptation measures that address identified challenges in these priority sectors, when taken proactively and in coordination with national planning processes, will help to minimize future damages to physical infrastructure, natural resources, and household assets (YEPA, 2009). Yemen has identified and prioritized a number of these potential adaptation measures to guide project development. Summary of ranked set of priority adaptation options could be listed as follows (YEPA, 2009):

1. Develop and implement Integrated Coastal Zone Management programs;
2. Water conservation through reuse of treated waste water and grey water from mosques, and irrigation saving techniques;
3. Develop and implement an awareness raising program on adaptation to the potential impacts of climate change;
4. Establish and maintain a database for climate change and adaptation;
5. Planting and re-planting of mangroves and palms for adaptation to projected sea level rise;
6. Develop and implement programs to improve Yemen's preparedness to cope with extreme weather events;
7. Rainwater harvesting through various techniques including traditional methods;
8. Rehabilitation and maintenance of mountainous terraces;
9. Promotion of research on drought resistant and heat- and salinity-tolerant crops;
10. Design and implement sustainable land management strategies to combat desertification and land degradation;
11. Sustainable management of fisheries resources; and

12. Incorporation of climate change and adaptation to school education.

The need to implement a number of these adaptation measures is also highlighted in a recent World Bank report on the vulnerability of Yemen's water and agriculture sectors (World Bank, 2010). The report notes the need for measures that include: strengthening the country's forecasting and early warning system; improving the collection and analysis of hydro-meteorological data; investing in efficient irrigation systems; introducing incentive policies for efficient water resources management; strengthening traditional, agricultural and water harvesting techniques; adapting farming practices; and adopting integrated water resources management.

Through the development of its NAPA, Yemen also identified a number of barriers to taking action to assess and adapt to climate change. These barriers can be summarized as follows (YEPA, 2009):

- Weak institutional structures and environmental legislations (weak inter-linkages, lack of executive bills, poor implementation of laws and bills, weak law enforcement);
- Lack of explicit policies to facilitate the implementation of Yemen's NAPA recommendations;
- Lack of appropriate data (in terms of lack of adequate monitoring and collection, difficulties experienced in accessing databases, lack of technical capacity to analyze and manipulate data for vulnerability and analysis; and lack of quality assurance);
- Uncertainties in regional, local climate change, and socio-economic scenarios; low awareness of policy- and decision-makers regarding climate change;
- Inadequate institutional, technical and financial capacity to develop, modify or interpret existing models and methodologies; lack of financial sources to implement the adaptation measures;
- Scarce research work on the practical application of policy measures for adapting to climate change (the scientific community has not had an active role in addressing vulnerability and adaptation); and
- Entrenched poverty conditions worsen local conditions and constrain efforts to build resilience.

Table 1. Overview of Yemen's key vulnerabilities by sectors (YEPA, 2009)

Sector	Major vulnerabilities
Freshwater	• Difficult water availability and quality situations, due to changing patterns of rainfall, impact directly on the livelihoods of the communities. Groundwater sources are at risk from sea level rise induced salt water intrusion.
Agriculture & Food Security	• Drought, temperature variability and changes in precipitation regime can lead to disastrous consequences for agriculture and food security. Climate changes may imply degradation of agricultural lands, soils and terraces, and potentially desertification, which

	negatively affects agricultural incomes for local communities specifically and leading to national food insecurity as food production levels change.
Biological Diversity	• Frequency in drought, temperature fluctuation and changes in precipitation patterns due to climate change will lead to the deterioration of and changes in the habitats of endangered and endemic species. For example, as sea levels rise and storms become more frequent, Yemen may see an increase in intense wave activity from storms—which already damages near shore coral reefs in the Red Sea and Gulf of Aden.
Coastal Areas & Communities	• Flooding of low-lying areas and coastal erosion threaten local communities and their livelihoods. Communities may experience damage to household assets and property, constraints on services such as water supply and quality, and damage to agriculture.
Coastal Environment & Infrastructure	• Deterioration of wetlands and mangrove forests along the shoreline, as well as in islands in the Red Sea, may occur. • As a result of sea level rise, Yemen can expect damage of infrastructural assets in coastal cities as well as to cultural heritage assets.
Human Health	• Changes in climate will create more suitable conditions for the occurrence and spread of vector borne and water borne diseases such as malaria.
Tourism	• Impacts include loss of beaches, degradation of coastal ecosystems, saline water intrusion, damage to infrastructure, and coral reef loss and bleaching.

B. National Level Policies and Strategic Documents

A limited amount of policy-related activity has taken place in Yemen to date. The country's main initiatives have been the development of its first National Communication in 2001 and its NAPA submitted in 2009. Activities consistent with efforts to adapt to the impacts of climate change (such as more efficient irrigation, better data collection and water harvesting) are also included in Yemen's National Water Sector Strategy and Investment Program (World Bank, 2010).

Table 2: Key Government Policies and Reports reflecting Adaptation Needs, Priorities and Planned Actions

Name of Policy Action		Government Division Responsible	Status	Sector(s) of Focus	Summary description
1.	Initial National Communication under the United Nations Framework Convention on Climate Change[149]	Environmental Protection Council	Submitted October 2001	Multi-sectoral	Provides an overview of Yemen's national circumstances with respect to greenhouse gas emissions and understood vulnerabilities to the impacts of climate change.
2.	National Adaptation Programme of Action[150]	Environmental	Submitted 2009	Multi-sectoral	Identifies the urgent and immediate adaptation

[149] UNFCCC, http://unfccc.int/essential_background/library/items/3599.php?rec=j&priref=3197#beg
[150] UNFCCC, http://unfccc.int/resource/docs/napa/yem01.pdf

Name of Policy Action		Government Division Responsible	Status	Sector(s) of Focus	Summary description
		Protection Agency			needs in Yemen, particularly in the sectors of freshwater resources, agriculture and food security, biological diversity, coastal zone management, health and tourism.

C. Current Adaptation Action

Involvement of Yemen in regional and national initiatives on adaptation to climate change is currently low relative to other North African countries. Currently the country is part of two regional initiatives: participation in the "Pilot Program for Climate Resilience," which emphasizes integration of adaptation considerations into national policy processes and includes efforts to reduce the vulnerability of particularly vulnerable communities (particularly women); and a one year regional project financed by the Food and Agriculture Organization (FAO) that aims to improve policy making related to water, agriculture and energy. The few other major adaptation projects being implemented in Yemen are focused on risk assessments, coastal management and agro-biodiversity management in the rain-fed Highlands of Yemen. This includes funding received through the Least Developed Countries Fund (LDCF) that supports implementation of actions identified by Yemen in its NAPA.

Table 3: Current Adaptation Projects and Programs active in Yemen

Name		Objectives	Funder(s)	Implementing Agency(s)	Type of project	Duration	Priority Sector(s)	Geographic focus (if any)
National Action								
1.	Integrated Coastal Zone Management in the Gulf of Aden[151]	To help coastal communities adapt to impacts of climate change through institution strengthening, knowledge management, and demonstrated implementation of the National Decree of the Integrated Coastal Zone Management approach at national and local levels.	LDCF *Budget:* US$14.95 million	World Bank, Ministry of Fish Wealth, and Environment Protection Authority (within the Ministry of Water and Environment)	Policy formation and integration Capacity building; Field implementation	2009–2016	Coastal zone management	Bir Ali-Burum (Hadramout governorate) and Kamaran-Luhaiyah (Hodeidah governorate)

[151] World Bank, http://gefonline.org/projectDetailsSQL.cfm?projID=3840

Name		Objectives	Funder(s)	Implementing Agency(s)	Type of project	Duration	Priority Sector(s)	Geographic focus (if any)
2.	Adaptation to Climate Change Using Agrobiodiversity Resources in the Rainfed Highlands of Yemen[152]	The objectives of the project are: (a) to enhance capacity and awareness at key national agencies and at local levels, to respond to climate variability and change; and (b) to better equip local communities to cope with climate change through the conservation and use of agro-biodiversity. Components of the project include: • an agro-biodiversity and local knowledge utilization and assessment; • climate change modeling and capacity building; and • integrating climate change into rain-fed agriculture	GEF Trust Fund's Strategic Priority for Adaptation, ICARDA, Government of Yemen *Budget:* US$8.2 million	Ministry of Agriculture	Field implementation; Knowledge communication; Capacity building	2010–2014	Agriculture; Biodiversity	
Participation in Regional and Global Actions								
3.	Pilot Program for Climate Resilience (PPCR)[153]	PPCR aims to pilot and demonstrate ways in which climate risk and resilience may be integrated into core development planning and implementation in a way that is consistent with poverty reduction and sustainable development goals. In this way, the PPCR provides incentives for scaled-up action and initiates transformational change. The pilot programs and projects implemented under the PPCR are country-led, build on NAPAs and other relevant country studies and strategies.	World Bank's Strategic Climate Fund *Budget:* US$971.75 million pledged as of February 2011	World Bank	Policy formation and integration	2008–ongoing	Multi-sectoral	Bolivia, Cambodia, Mozambique, Nepal, Niger, Tajikistan, Yemen, Zambia *Regional Programs:* Caribbean and Pacific (includes

[152] GEF, http://gefonline.org/projectDetailsSQL.cfm?projID=3267; See also: World Bank, http://web.worldbank.org/external/projects/main?pagePK=64283627&piPK=73230&theSitePK=40941&menuPK=228424&Projectid=P103922; and Adaptation Atlas, http://www.adaptationatlas.org/activityDetail.cfm?id=2533.

[153] CIF, http://www.climatefundsupdate.org/listing/pilot-program-for-climate-resilience

Name		Objectives	Funder(s)	Implementing Agency(s)	Type of project	Duration	Priority Sector(s)	Geographic focus (if any)
								Papua New Guinea, Samoa, Tonga)
			In Yemen: • *Objective:* to address climate resilience as a core development issue, and as part of a comprehensive response to various vulnerabilities facing Yemen. Specifically: (1) mainstream climate change and resilience into national and sectoral development, policies, plans, and programs including private sector initiatives; (2) target vulnerable stakeholders and communities, especially women, who are disproportionally affected by climate change; (3) raise awareness and strengthen capacity to deal with climate change in government, the private sector, local communities, and civil society groups; and (4) scale-up successful climate resilient pilot investments to bring about transformational change. • *Implementing Organization:* Environmental Protection Agency[154] • *Funding:* US$1.5-million received; potentially US$110-million upon completion of second phase.[155]					
4.	Support to Policy Consultation and Actions to boost Sustainable Use of Water and Energy Resources for Agricultural Production and Livelihood Improvement in the Near East and North Africa	The project will assist in building the capacity of governments and civil society to prepare national reviews, analyze the current national policies for water development, examine cooperation on transboundary water management, and identify the investment needs and investment strategies for food, water and	FAO Budget: US$436,000	FAO; Organisation of the Islamic Conference	Capacity building; Policy formation and integration; Research	2010–2011	Freshwater supply; Energy; Agriculture	*Global:* 30 countries including: Afghanistan, Algeria, Djibouti, Egypt, Kazakhstan, Kyrgyzstan,

[154] Climate Investment Funds, http://www.climateinvestmentfunds.org/cif/sites/climateinvestmentfunds.org/files/Phase%20I%20PPCR%20Presentation%20to%20PPCR-SC%20-%20YEMEN%20-%20Mr%20Shidiwah-June%2023.pdf; and World Bank, http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2010/11/24/000334955_20101124015959/Rendered/PDF/541960ESW0Gray1OFFICIAL0USE0ONLY191.pdf

[155] Climate Investment Funds, http://www.climateinvestmentfunds.org/cif/sites/climateinvestmentfunds.org/files/Yemen_PPCR_Nov%2012.pdf

Name		Objectives	Funder(s)	Implementing Agency(s)	Type of project	Duration	Priority Sector(s)	Geographic focus (if any)
	Region in the context of Climate Change[156]	energy security to be adopted on a national and regional basis in the context of climate change. Its main objectives are: • Carry out studies and workshops to increase awareness of water-energy-food interrelation and their sustainable use. • Address food and energy security in the Near East and North Africa region through a convergent approach which integrates four critical resource factors - water, energy, technology, and knowledge under the stress of climate change. • Carry out studies on the use of water resources, on the management strategies and on the investment needs at national level. • Capacity building of governments and civil societies for optimal natural resource management.						Libya, Mauritania, Morocco, Pakistan, Somalia, Sudan, Tajikistan, Tunisia, Turkmenistan Uzbekistan, Yemen
			In Yemen: To be identified					

D. Proposed Adaptation Action

For future adaptation actions and projects, the country's NAPA outlines a number of projects focusing on diverse areas prioritized during the NAPA development process (YEPA, 2009). These projects include coastal zone management, agricultural production and irrigation, health and climate-related data management and awareness-raising about climate change and adaptation. The projects also try to promote traditional land and coastal management approaches that are resilient in the context of current challenges, including climate change impacts.

Some of the adaptation actions identified in the NAPA are being addressed through the current project "Integrated Coastal Zone Management in the Gulf of Aden" financed through the LDCF.

[156] ALM, http://www.adaptationlearning.net/program/support-policy-consultation-and-actions-boost-sustainable-use-water-and-energy-resources-agr and SESRIC, http://www.sesric.org/activities-oicfao.php

Table 4: Adaptation Projects and Programs proposed in Yemen's NAPA (YEPA, 2009)

Name		Objectives	Type of project	Priority Sector(s)	Geographic focus (if any)
1.	Develop and implement Integrated Coastal Zone Management	This project aims to develop and implement comprehensive Integrated Coastal Zone Management Plans for four areas in order to strengthen the resistance of the coastal zones to variability and climate change as well as strengthen community livelihood and conserve national marine resources.	Policy formation and integration; Knowledge communication; Capacity building	Coastal zone management; Marine management	Four locations in the Red Sea and Arabian Sea
			Notes: Estimated cost: US$3.2 million Implementing Agency: Environmental Protection Agency (EPA) and Marine Science and Biological Research Authority		
2.	Water conservation through reuse of treated waste water and grey water from mosques, and irrigation saving techniques.	To conserve groundwater resources used for agriculture through water saving technologies, techniques and practices; and to eliminate climate change impact on ground water resources	Knowledge communication; Capacity building	Freshwater supply; Agriculture	Dhamar, Lahj and Marib, Aden, Hodiedah and Mukalla Taiz, Sana'a and Hajja
			Notes: Implementing Agency: Ministry of Water and Environment (through EPA) and Ministry of Agriculture and Irrigation Estimated cost: US$3.2 million		
3.	Awareness raising on adaptation to climate changes	Promote community-based participatory planning and management of climate change issues at local levels through enhanced public awareness.	Knowledge communication	Civil society	
			Notes: Implementing Agency: EPA in coordination with Ministry of Water and Environment, Civil Aviation and Meteorological Authority, local communities, NGOs Estimated cost: US$650,000		
4.	Establishment and maintaining of climate change database	• To establish an accessible database for climate change. • To strengthen the country's capacity to aggregate, analyze and disseminate climate change information. • To improve capacity in producing and interpreting climate modeling and scenarios.	Research; Knowledge communication; Capacity building	Climate information services	Sana'a
			Notes: Implementing Agency: EPA in coordination with Civil Aviation and Meteorological Authority and all relevant institutions Estimated cost: US$350,000		
5.	Planting and re-planting of mangroves and palms for adaptation to sea level rise.	• To protect coastal wetlands, estuaries, aquifers and infrastructure from potential saline water intrusion, coastal flooding and sea level rise associated with climate change. • Restoration and conservation of mangrove forests and wetlands, preservation of sand dunes, and	Field implementation; Capacity building	Coastal zone management	Three pilot areas (Red Sea and Arabian Sea including islands)
			Notes: Implementing Agency: EPA, Ministry of Agriculture and Irrigation and MFW Estimated cost: US$2.45 million		

Name		Objectives	Type of project	Priority Sector(s)	Geographic focus (if any)
		establishing green belts at critical areas.			
6.	Develop and implement programs to improve Yemen's preparedness to cope with extreme weather events.	To predict and prevent the potential effects of climate variability and extreme weather events (drought and flashflood) on Yemeni people, and to strengthen the nation's adaptive capacity to cope with such events.	Research; Knowledge communication; Capacity building	Disaster risk management	
			Notes: Implementing Agency: Civil Aviation and Meteorological Authority Estimated cost: US$5 million		
7.	Rainwater harvesting through various techniques including traditional methods	• To maintain agricultural production during dry periods. • To improve animal productivity and standard of life of farmers.	Knowledge communication; Capacity building; Community-based adaptation; Field implementation	Freshwater supply	Haggah , Taiz and Almahwit Governorates
			Notes: Implementing Agency: Ministry of Water and Environment/EPA and Ministry of Agriculture and Irrigation Estimated cost: US$2.81 million		
8.	Rehabilitation and maintenance of mountainous terraces	• To reduce soil erosion through rehabilitation of critically degraded terraces land in two pilot areas of Yemen highlands • To stabilize terraces through increased rangelands, increase area of wood cover, and introduction of fruit trees and cash crops in replacement of food crops of low returns. • To rehabilitate terraces and rangeland and improve productivity of native species and range management	Knowledge communication; Capacity building; Community-based adaptation; Field implementation	Agriculture; Ecosystem conservation	Almahweet, Taiz, Haja, Ibb and Dhamar
			Notes: Implementing Agency: Ministry of Agriculture and Irrigation Estimated cost: US$4.78 million		
9.	Promotion of research on drought, heat and salinity tolerant varieties	• To increase agricultural productivity so as to improve living standards and sustainable livelihoods of vulnerable rural communities. • To develop and disseminate new varieties of crops such as wheat, maize, potatoes and sorghum etc., to tolerate saline and drought conditions	Knowledge communication; Field implementation	Agriculture	
			Notes: Implementing Agency: Agricultural Research Institutions Estimated cost US$3.15 million		
10.	Sustainable land management to combat desertification and land	To demonstrate in pilot areas a successful and transferable for combating desertification in the mountainous areas and lower-lands rangelands	Knowledge communication; Capacity building; Field implementation	Ecosystem conservation; Freshwater	Mareb and Tihama

Name		Objectives	Type of project	Priority Sector(s)	Geographic focus (if any)
	degradation	through integrated management of natural resources with focus on water and vegetative cover including using low quality water in dryer environments.		supply	
			Notes: Implementing Agency: Ministry of Agriculture and Irrigation Estimated cost US$2.33 million		
11.	Sustainable management of fisheries resources	• To improve sustainable management of fisheries resources through strengthened research, planning, regulation, and monitoring. • To increase income derived from fisheries sector development and production through better fish handling, quality and marketing. • To ensure the establishment of rules and norms taking into consideration the requirements of fish habitat in the planning process of coastal development.	Policy formation and integration; Knowledge communication; Capacity building; Field implementation	Marine fisheries	
			Notes: Implementing Agency: Ministry of Fish Wealth/ Marine Science and Biological Research Authority Estimated cost: US$1.18 million		
12.	Incorporation of climate change and adaptation into school education	The aim of this project is to make future generations aware of climate change and adaptation through education at schools.	Knowledge communication	Civil society	
			Notes: Implementing Agency: Ministry of Education, EPA and Civil Aviation and Meteorological Authority in coordination with all relevant institutions Estimated cost: US$820,000		

E. Assessment

Yemen has considerable social-economic and institutional development challenges that are made more complex by the impacts of current climate variability and future climate change. While there are number of projects identified in the county's NAPA, only a few are at present underway and improving adaptive capacities and actions in the country. These projects are focused on coastal zone management and agricultural adaptation in the county's highlands. Major gaps in the country's adaptation activities could be listed as follows:

- Limited availability of people with the expertise and skills needed to help address climate change impacts, adaptation and the mainstreaming of climate risk management into frameworks, programs and policies aimed especially at agriculture, health and natural resource management.
- Limited monitoring and data collection that could be used to develop effective early warning systems and potential risk reduction strategies.

- Greater attention appears to be needed with respect to integrating climate change into development strategies as this process is crucial for the country's development; strategies need to be "climate-proofed" to significantly alter the sensitivities of people and ecosystems to climate change and help create adaptive capacities.
- The proposed projects directly address the adaptation needs of the country but most give limited attention to the transfer of lessons learned, sharing of experiences with pilot applications and applying them in other parts of the country and perhaps elsewhere.

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