

CLIMATE INVESTMENT FUNDS

PPCR/SC.6/6
June 7, 2010

Meeting of the PPCR Sub-Committee
Washington DC
June 23, 2010

MOZAMBIQUE: PROPOSAL FOR PHASE 1 FUNDING

Proposed Sub-Committee Decision

The PPCR Sub-Committee reviewed the proposal PPCR/SC.6/6, *Mozambique: Proposal for Phase 1 Funding*, and approves USD 1.5 million in financing to support the preparation of Mozambique's Strategic Pilot Program. The Sub-Committee invites the African Development Bank and the World Bank Group to work with Mozambique, in consultation with other development partners, to prepare the Mozambique's Strategic Pilot Program for Climate Resilience.

**PILOT PROGRAM FOR CLIMATE RESILIENCE
Summary Phase 1 Grant Proposal**

1. Country/Region:	Mozambique Africa Region	2. CIF Project ID #:	{Trustee will assign ID.}
3. Date of First Joint Mission:	November 30 to December 11, 2009		
4. Funding request:	USD 1.5 million		
5. Type of request:	Accelerated funding for phase 1: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		
6. Multilateral Development Banks/focal points:	<i>AfDB: Olagoke Oladapo</i>	<i>IDA: Jean-Christophe Carret</i> <i>IFC: Vladimir Stenek</i>	
7. National Implementing Agency:	Ministry of Planning and Development (MPD)/ Ministry for coordination of Environmental Affairs (MICOA)		

PILOT PROGRAM FOR CLIMATE RESILIENCE
Summary Phase 1 Grant Proposal

8. Project Description:

(i) **Key development challenges** (vulnerability) related to climate change/variability:

Mozambique is subject to extreme weather events that can ultimately take the form of drought, flooding and tropical cyclones and ranks third amongst the African countries most exposed to risks from multiple weather-related hazards. During the past 50 years, the country has suffered from 68 natural disasters, which have killed more than 100,000 people and affected up to 28 million. As much as 25 percent of the population is at risk from natural hazards. The country's economic performance is already highly affected by frequent drought and flood and rainfall variability. An analysis over the period 1981-2004 suggests that GDP growth is cut by 5.5 percent in average when a major water shock occurs, and many of these are the direct result of an extreme weather event. Assuming a major disaster occurrence every five years, there is an average GDP growth loss of 1 percent per year due to the impacts of water shocks. The 22 Global Circulation Models (GCMs) approved by the International Panel for Climate Change (IPCC) used to predict potential climate futures predict anywhere from a decrease of 31 percent of the average rainfall over, to a 16 percent increase in rainfall by 2050 compared to historical averages. The future temperature of Mozambique is estimated to increase between 1°C and 2°C by 2050 and appears to be relatively consistent between all of the IPCC approved GCMs. As a result of increased inter annual rainfall variability, extreme weather events may become more common which translates into increased frequency of flood and drought periods as well as tropical storms. At the sectoral level, preliminary analyses (from the *Economics of Adaptation to Climate Change*) show that rain-fed agriculture, coastal towns and transport infrastructure are sectors that are the most vulnerable to droughts, floods and cyclones. The health sector has not been assessed.

(ii) **Areas of intervention** – sectors and themes (indicative):

Mainstreaming climate change in central budget and planning. This component will allow the Ministry of Planning and Development (MPD) to actively engage with sector ministries and other stakeholders, in particular when developing Government investment plans (namely the next five-year development plan and the next PARPA (a PRSP). The PPCR would support mainstreaming resilience in two ways: by adjusting public investment planning in sectors, where quantitative information of potential climate change impacts is available and where sectoral models can help comparing different prioritization patterns of investments, such as transport and agriculture through central government led planning processes, and by building on the experience of learning by doing in agriculture, water management and coastal protection through “decentralized” planning processes.

Mainstreaming climate change in territorial sectoral investments. This component will address and pilot practical solutions to the three main climate risks Mozambique faces. It is proposed to invest in the four NAPA priorities (strengthening early warning systems; strengthening the capacity of farmers to deal with climate change; reduction of the impacts of climate change along the coastal zone; and water resources management) in three different pilot poles: the Zambezi basin where the main risks are both floods and droughts, the Limpopo watershed where the main risk is drought, and the coastal Town of Beira or possibly an alternative vulnerable coastal town where the main risks are floods, storm surges and cyclones.

Mainstreaming climate change in private sector. In addition to these sectoral investments, it is also proposed to create or improve the enabling environment for the private sector actors in sectors that are relevant to NAPA priorities and identified during the consultation process (urban water, especially in coastal areas; ports, tourism and forestry), as well as the necessary institutional arrangements for a permanent engagement of the private sector in building national climate resilience. Given the important roles of public institutions in these sectors and the public-private interactions, this component would include analyses of the gaps and needs of both private and public institutions of the mentioned sectors.

(iii) **Outcome:** The objective of the phase 1 activities is to prepare an initial strategic investment program for

PILOT PROGRAM FOR CLIMATE RESILIENCE
Summary Phase 1 Grant Proposal

climate resilience for Mozambique, which focuses on learning by doing and results on the ground while also addressing key knowledge and capacity gaps related to the three themes mentioned above

(iv) **Key Results:**

Climate vulnerability assessment of the next Five Year Development Plan, and identification of capacity building needs in MPD/MICOA and in key line ministries (transport, agriculture, water).

Coastal cities vulnerability study

In the three poles (Zambezi basin where the main risks are both floods and droughts, the Limpopo watershed where the main risk is drought, and the coastal Town of Beira or possibly an alternative vulnerable coastal town), institutional assessment and public expenditures review.

In the three poles, socio economic assessment and sectors' vulnerabilities studies and definition of climate resilience activities, including strengthening hydro metrological stations

Sector analyses of risks and barriers to adaptation to ports, urban water, tourism and forestry and identification of priority needs in these sectors, and initial scoping on health and gender.

Strategic Environmental and Social Environmental Assessment (SESIA) of the SPCR investment plan

9. Budget (indicative): USD1.5 million

Expenditures	Amount (\$) - estimates
Consultants: 1,175	
Equipment: 100	
Workshops/seminars: 75	
Contingencies: 150	
Total Cost: 1,500	

Other contributions (bilateral or private sector): none but DFID, UNDP and DANIDA are financing capacity building activities in MPD, MICOA and INGC

10. Timeframe (tentative) – milestones

Submission for Trust Fund Committee approval: June 23, 2010

Phase I – Second Joint mission: November 2010

SPCR for Trust Fund Committee approval: April 2011



REPÚBLICA DE MOÇAMBIQUE
MINISTÉRIO DA PLANIFICAÇÃO E DESENVOLVIMENTO
DIRECÇÃO DE INVESTIMENTO E COOPERAÇÃO

Oficio nº 06 / DIC/MPD/2010

To:

Ms. Patricia BLISS-GUEST
Program Manager. Climate Investment Funds
The World Bank
Washington DC, USA

Maputo, 21 March 2010

SUBJECT: Submission of Republic of Mozambique PPCR Phase 1 Proposal

Dear Ms. Bliss-Guest,

Please find attached a request for a technical assistance grant to assist the Government of Mozambique in the preparation of a Strategic Program for Climate Resilience (SPCR). The Phase 1 proposal was prepared in a consultative manner and with the help of the African development Bank and the World Bank Group.

We look forward to a positive answer from the PPCR sub-committee as well as for a acknowledgment that our request has been received by the PPCR secretariat.



Sincerely,

Adriano Ubisse

Director, Investment and Cooperation
Ministry of Planning and Development

Cc: *Rogério Wamusse*
Director, Ministry of Environment
Mr. Boris Utria,
World Bank Office – Maputo
Ms. Alice Hamer
Mozambique Country Office
African Development Bank

Preparation of a Strategic Program for Climate Resilience (SPCR)

Mozambique: Proposal for Phase 1 Funding

June 7, 2010

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List of acronyms

AAP - African Adaptation Program
ACIS – Industry and Commercial Association
AFD – French Development Agency
AfDB – African Development Bank
ALM – Adaptation Learning Mechanism
BCI – Commercial and Investment Bank
CC – Climate Change
CCA – Climate Change Adaptation
CFM – Mozambique Ports and Railways Authority
CIF - Climate Investment Fund
COMESA - Common Market for Eastern and Southern Africa
CSO – Civil Society Organizations
CTA – Private Sector Confederation
DANIDA -Danish Development Agency
DFID - United Kingdom Department for International Development
DHI – High Drought Hazard Index
DNA - National Water Directorate
DNSA – National Directorate of Agrarian Services
DRM - Disaster Risk Management
EACC – Economics of Adaptation Study
EACC - Economics of Adaptation to Climate Change
EC – European Commission
ENH – National Hydrocarbons Company
FAO – Food and Agriculture Organization
FIPAG – Water Investment Fund
GCM - General Circulation Models
GDP - Gross Domestic Product
GEF - Global Environmental Facility
GFDRR - Global Facility for Disaster Risk Reduction
GoM – Government of Mozambique
GPZ – Zambeze Valley Cabinet
GTZ - German Development Agency
HDI - Human Development Index
IDPPE - National Institute for Development of Fisheries
IFC – International Finance Cooperation
IIAM – Agrarian Investigation Institute of Mozambique
INAM - National Meteorologic Institute
INGC - Disaster Risk Management Institute
IPCC – International Panel on Climate Change
LAP – Limpopo Adaptation Program
MDB – Multilateral Development Bank

Mozambique

MICOA - Ministry of Environment Coordination
MINAG – Ministry of Agriculture
MPD - Ministry of Planning and Development
MW – Mega Watts
NAPA - National Adaptation Programme of Actions
ODA - Official Development Assistance
PARPA II - Action Plan for the reduction of absolute poverty 2006-2010
PIU – Program Implementation Unit
REDD - Reducing Emissions from Deforestation and Forest Degradation
SADC – Southern Africa Development Community
SESIA - Strategic Environmental and Social Impact Assessment
SETSAN- Technical Secretariat for Food Security and Nutrition
SMEs – Small and Medium Enterprises
SPCR - Strategic Program for Climate Resilience
TFESSD - Trust Fund for Environment and Social Sustainable Development
UEM – Eduardo Mondlane University
UNDP- United Nation Development Agency
UNFCCC- United Nations Frame Work Convention for on Climate Change
WB – World Bank
WFP –World Food Program

1. Country Background

1. Mozambique is widely considered to be a successful example of post-conflict economic recovery in Sub-Saharan Africa. The country's 16-year civil war, which ended definitively in 1992, cost over a million lives, stunted economic growth, and destroyed much of its infrastructure. Starting from this admittedly very low base, Mozambique has seen average annual growth rates of 5 percent since 1995.¹ The government of Mozambique initiated pro-growth economic policies such as reducing inflation, decreasing the costs of doing business, introducing a value-added tax, removing price controls and import restrictions, and privatizing state-owned-entities, among others. Due to its tight monetary policy, inflation was reduced to single-digit levels (from 70 percent in the mid-1990s). In 2007, Mozambique was even referred to as having a “blistering pace of economic growth.”² This growth was bolstered by a significant influx of foreign investment into the country and high levels of donor support—equivalent to 15 percent of GDP, compared with the African average of 4 percent.

2. Mozambique's high growth rates were accompanied by a decrease in rural poverty levels, which declined from 69 percent in 1997 to 54 percent in 2003. In particular, extensive agricultural growth in the last two decades, achieved primarily through expansion in the area farmed and increases in labor input, has driven this poverty reduction. Mozambique's economy is indeed largely dominated by the agricultural sector—at least as far as employment is concerned, with a large portion of the labor force employed in this sector (81 percent in 2007). The sector represents 24 percent of GDP.

3. Mozambique's Human Development Index (HDI), a measure of development and poverty, has improved over the years since the end of the civil war, from 0.2 to 0.3. This decline in poverty, as measured by both monetary and non-monetary indicators, occurred at all levels. However, the extreme poverty of Mozambique, with HDI levels well below the Sub-Saharan African level (0.5), much less the rest of the world (between 0.6 and 0.9), is still striking. Life expectancy remains dismally low at 47.8 years—166th out of 172 ranked countries—and Mozambique places 169th for per capita GDP with (purchasing power parity) US\$802/year.³ More than 50 percent of Mozambique's population today remains below the absolute poverty level, relative to 70 percent in 1997.⁴ Rural populations are disproportionately poor, with more than 80 percent of poor households located in rural areas and living from subsistence agriculture. Factors contributing to these high poverty rates are lack of infrastructure (especially road access to goods and services), distant markets to sell agricultural products, low-yielding agricultural techniques, lack of basic services such as health care, and low education rates (only 57 percent of rural Mozambicans have access to primary education at all), among many others. The rural households are also exceptionally vulnerable to natural disasters, notably droughts and floods: as a result, around one third of Mozambique population is still food insecure.

Climate Variability

4. It is the timing and magnitude of individual weather events over the course of many years that defines a climate's variability. Mozambique's current climate variability is defined by its seasonal patterns of precipitation and temperature and the frequency with which abnormal, or “extreme” weather events occur. Mozambique is subject to extreme weather events that can ultimately take the

¹ In fact, the economy registered an average annual growth rate of 8 % between 1996 and 2007.

² World Bank. “Beating the Odds: Sustaining inclusion in Mozambique's growing economy

³ Supra

⁴ IFAD, Rural Poverty Portal. Available at

<http://www.ruralpovertyportal.org/web/guest/country/home/tags/mozambique>

Mozambique

form of drought, flooding and tropical cyclones and ranks third amongst the African countries most exposed to risks from multiple weather-related hazards⁵. During the past 50 years, the country has suffered from 68 natural disasters, which have killed more than 100,000 people and affected up to 28 million. As much as 25 percent of the population is at risk from natural hazards. The country's economic performance is already highly affected by frequent drought and flood and rainfall variability. An analysis over the period 1981-2004 suggests that GDP growth is cut by 5.5 percent in average when a major water shock occurs, and many of these are the direct result of an extreme weather event. Assuming a major disaster occurrence every five years, there is an average GDP growth loss of 1 percent per year due to the impacts of water shocks.

5. *Drought is the most frequent disaster.* The National Institute of Meteorology, Mozambique states that the country is affected by drought. Droughts occur primarily in the Southern and Central regions, with a frequency of 7 in 10 and 4 in 10 years, respectively. 35 percent of the population is now thought to be chronically food insecure. Disaster costs to the national economy have been estimated at US\$1.74 billion during 1980-2003, but this largely underestimates socio-economic losses and impacts on the poor. Economic impacts of drought seem to be most significant in the Zambezi Province where production losses could range between 12 and 170 million USD for Maize alone depending on the severity of the drought. Areas that are classified as semi-arid and arid, where rain - even when above average - is inadequate for sizeable crop yields (Gaza, Inhambane, and Maputo) potential maize production losses range between 0.5 and 11 million USD.

6. *Floods in Mozambique* are caused by a number of geographical factors, which give rise to high coefficients of rainfall variability. Floods can prevail for several months, occurring most frequently in central and southern regions, along river basins, in low-lying regions, and in areas with poor drainage systems. They are linked not only to heavy rainfall, but also to water drainage from rivers in upstream neighboring countries: waters from nine major river systems from vast areas of South Eastern African region find their way to Indian Ocean through Mozambique. Fifty per cent of the water in Mozambique's rivers originates from outside the country. In Mozambique experienced its worst floods in 50 years killing about 800 people and displacing 540,000. It is estimated that about 200,000 people are affected by a floods with a return period of once every two years, 1 million for a fifty year flood, and 1.5 million for a one hundred year flood with the Zambezi, Gaza, and Tete provinces being most affected.

7. *Seawater inundation.* More than 60 percent of Mozambique's population of 21 million lives in coastal areas, and is therefore highly vulnerable to seawater inundation along its 2,700 km coastline. Seawater inundation includes saline intrusion of coastal aquifers and estuaries, beach erosion, and short extreme rises in sea-level due to tropical storms and cyclones. Saline intrusion of the coastal aquifers and estuaries holds serious implications regarding coastal agriculture and fishery production; however detailed studies regarding both have not yet been completed. The issue of beach erosion is very serious, threatening coastal infrastructure such as roads and housing. In some portions of Beira, 30 to 40 m of beach has been eroded in the past 15 to 20 years destroying natural mangroves and encroaching on homes and roads. Storm surge poses a huge threat to coastal infrastructure as it can temporarily raise sea level as much as 5 m. While many of the major coastal cities of Mozambique have infrastructure in place to stem the effects of such an extreme event, many are in need of serious maintenance. Furthermore, Mozambique is subject to 3 or 4 cyclones every year, and in addition to the extreme wind and rainfall caused by these cyclones, they can exacerbate seawater inundation threats, especially that of storm surge.

⁵ 2009 Global Assessment Report on Disaster Risk Reduction, UNISDR, 2009.

Mozambique

Climate change

8. Historical Climate trends in Mozambique have strong seasonal and spatial variation. Months of high precipitation occur between December and March for all of Mozambique in all provinces. Northern Mozambique (Niassa, Cabo Delgado, Nampula) is historically characterized by 800 to 1200 mm of annual rainfall with little annual variability. Central Mozambique exhibits substantial spatial variability with the Sofala and Zambezia provinces recording up to 1500 mm of rainfall while the Tete and Manica provinces just inland of Zambezia experience around 600 mm of average annual rainfall. Southern Mozambique (Inhambane, Gaza, Maputo) has about 800 mm of annual rainfall and significant spatial variability and inter annual variability.

9. Annual rainfall can range from 400 mm to 1200 mm depending on the location within southern Mozambique. Precipitation variability in the central and south portions of Mozambique appears to have increased between the 1990's and present time. Absolute rainfall deviations appear to have higher magnitude during these years especially in the southern and coastal regions of Mozambique also suggesting that variability may be increasing with time. There has also been an observed increase in annual rainfall in the northern portion of the country during the last two decades.

10. General circulation models (GCMs) predict a wide range of potential climate futures for Mozambique with rainfall suspected to be extremely variable in the future. The 22 GCMs approved by the International Panel for Climate Change (IPCC) used to predict potential climate futures predict anywhere from a decrease of 31 percent of the average rainfall over, to a 16 percent increase in rainfall by 2050 compared to historical averages (see figure 1 and 2 below). This means that potential surface water availability is going to be highly variable as well. In addition to the climate variability, changes in management of the upstream portions of the international basins may further exacerbate the variability and could seriously reduce cross-border flows. *Inter-annual variability is predicted to increase dramatically as well which suggests that extreme weather events may become more common which translates into increased frequency of flood and drought periods.*

Figure 1:
Mozambique "Wet"
Model Precipitation

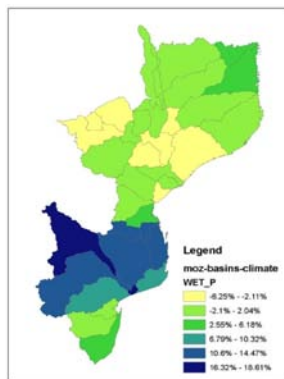


Figure 2:
Mozambique "Dry"
Model Precipitation

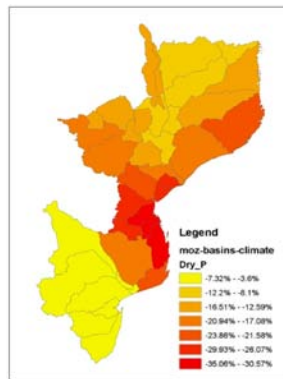


Figure 3:
Mozambique "Wet"
Model Temperature

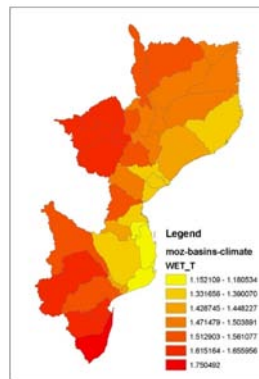
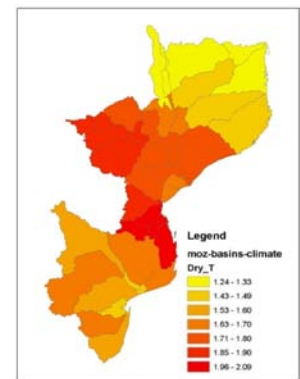


Figure 4:
Mozambique "Dry"
Model Temperature



Source: *Economics of Adaptation to Climate change Study, Mozambique Country Case study, World Bank 2009.*

11. Temperature trends have a strong seasonal and spatial dependence in Mozambique as well. The period between October and April is characterized by hot temperatures coinciding with the rainy season and May through September has much cooler temperatures. Minimum average temperatures during the winter months range from 14°C to 22°C country wide with northern Mozambique recording

the lowest temperatures. Maximum temperatures can range between 24°C and 32°C during the summer months with the central coast recording the highest temperatures.

12. *Inter-annual* variability of temperature varies between regions. The northern regions have experienced a relative rise in maximum temperatures since 1990 such that they are consistently over 30°C with little deviation. Inter-annual temperature variability in central Mozambique is historically low with maximum temperatures around 31°C with a sharp increase after 1990. However, this may be due to the increase of meteorological monitoring stations in the area that coincides with same period. A slight increase in the maximum temperature of southern Mozambique has been observed since the 1960's with the average remaining around 31°C.

13. Equally worth noting is the increasing trend in minimum temperatures across the whole of Mozambique. Seasonal variability is narrowing as the average minimum temperature is increasing to around 21°C. This is leading to a decrease in cold days with the average number of cold days and nights per year having decreased significantly since 1960.

14. *The future temperature of Mozambique is estimated to increase between 1°C and 2°C by 2050 and appears to be relatively consistent between all of the IPCC approved GCMs (see figure 3 and 4 above). This coupled with the narrowing of the seasonal and inter-annual variability will greatly increase the potential evaporation year round and more rapid drying and hardening of soils, as well as, when combined with wind events, increased vulnerability of crops, woodland and rural communities to damage from anthropogenically caused fires.*

15. At the sectoral level, preliminary analyses⁶ (from the *Economics of Adaptation to Climate Change*) show that rain-fed agriculture, coastal towns and transport infrastructure are sectors that are the most vulnerable to droughts, floods and cyclones. The health sector has not been assessed.

16. *Agriculture.* In all scenarios, the net average crop yield for the entire country is lower relative to baseline yield without climate change. The impact of climate change over the next forty years would lead to a 2-4% decrease in yields of the major crops, with yield decreases especially in the Central region.

17. *Hydro-energy.* Under all scenarios except the most pessimistic, the impact of climate change on electricity supplies would be only modestly negative (1.4% less electricity generated than “without” climate change). This is because the plans for new dams have largely already taken into account changing patterns of temperature and precipitation. The most significant impact would be from increased evapotranspiration (and hence less water available for electricity) from the reservoirs. Dam operators will need to pay particular attention to the timing of water releases to ensure sufficient downstream and environmental flows at times of low water and to avoid interference with port activities.

18. *Roads.* The average annual maintenance cost of the network of Mozambique roads is about \$250 million per year representing about 12 percent of total government spending (recurrent plus

⁶ The analysis define a “baseline” of a growth path “without climate change” from 2011 to 2050 reflecting government plans and global trends in sector and economic growth and compare it with a growth paths “with climate change” incorporating climate shocks on priority sectors (agriculture, energy, roads, coastal zones) under alternative climate projections. Since scientists are more certain of likely patterns of temperature increase than of changes in precipitation, the work describes for a “wet” and a “dry” scenario.

investment). Under all scenarios, the maintenance costs of paved and unpaved⁷ roads are increasing due to temperature and precipitation increase.

19. *Coastal Zone.* As far as sea-level rise is concerned, effects on coastal populations show substantial differences in the average number of people affected by flooding annually between the most conservative assumptions (200-400,000 people) and the more pessimistic assumptions (up to 1.6 million people). The main risk here is that climate will become increasingly variable and uncertain and that people and decision-makers need to plan for this uncertainty. Moreover, even modest levels of sea level rise (30 centimeters by 2050) will lead to salt water intrusion in lower river basins and will require measures to protect (or move) infrastructure in low-lying urban areas. Impacts will be particularly severe in the central region.

20. *Macro-economic Impact.* The overall impact of these changes on GDP could be substantial. A preliminary assessment finds a cost of climate change impacts in Mozambique averaging 3.5 percent of GDP even in the most conservative assumptions on climate change, and as high as 13.6 percent in the most pessimistic scenarios. Most of the decline is due to the increase in roads' annual maintenance cost.

21. *Forest sector.* It should be noted that Mozambique has 55 million hectares of forests and woodlands. Mozambique is engaged in the REDD (*reducing emissions from deforestation and forest degradation*) process: funds are presently lacking but Norway is assisting it with REDD readiness. The main forest degradation issues are caused by poverty related slash and burn agriculture which also increase vulnerability to floods and droughts. There are opportunities for synergies and double dividends in the forest sector

2. Institutional Context

Institutional Framework

22. ***As in many countries institutional coordination mechanisms for addressing climate risks are still evolving.*** While the Ministry of Planning and Development (MPD) has responsibility for overall budget coordination and expenditure prioritization, the Ministry of Environment⁸ (MICOA) has responsibility for coordinating work on climate change and territorial planning but not for implementation, while the Disaster Risk Management Institute⁹ (INGC) has responsibility for coordinating work on disaster risk, has good scientific knowledge and has developed a climate risk strategy. The National Meteorological Institute (INAM) and the National Water Department (DNA) are in charge of the development and maintenance of the hydro-meteorological station network and have the responsibility for collecting and disseminating hydromet information. There are currently 800

⁷ Unpaved road maintenance is primarily focused on the need to reseal the road every five years to preserve a usable driving surface and reduce the impact of erosion from precipitation

⁸ The Ministry for the Coordination of Environmental Action (MICOA) was created in 1994 with the mandate to (i) coordinate the sustainable development process, harmonizing the plans and programmes of all stakeholders in the exploitation, use, protection and management of natural resources; (ii) develop appropriate policies and laws that will ensure the sustainability of these resources; and (iii) develop public environmental awareness and culture in Mozambique. MICOA is a coordination body, not an implementing one.

⁹ INGC was created in 1999 as a public institution endowed with legal personality and administrative autonomy. Its mandate is to direct and coordinate disaster management at the national level, especially concerning prevention and mitigation activities, as well as assisting disaster victims. This Institute is under the Ministry of State and Administration (MAE). Since 2005, the INGC went through a restructuring process that "elevated" the statute of the institution. INGC is now managed by a General Director, appointed by the Council of Ministers.

pluviometric and 100 hydrometric stations that ideally should be expanded to 1000 and 300, respectively.

23. ***There is a broad consensus that climate resilience should be mainstreamed into local government programs as well.*** Mozambique is undergoing a "decentralization" as well as a "de-concentration" process, with responsibilities increasingly delegated to district and municipal authorities. The districts are seen by the Government as "polo de desenvolvimento", and land planning at local levels is important for adaptation strategies.

Phase 1 will build upon existing strategies and on-going analytical work

24. The country has developed a number of strategies to address climate risks which have used broad processes of consultation.

25. Government has addressed disaster risk in the *Action Plan for the Reduction of Absolute Poverty 2006-2010 (PARPA II)*. Government is currently preparing the next Five year Development Plan and maybe a PARPA III and intends to address climate risk in the programs. Meanwhile, the Ministry of coordination of Environmental Affairs (MICOA) has prepared a National Action Plan for Adaptation to climate change (NAPA) in 2007 that laid the foundations for a multi-stakeholder adaptation agenda with four priorities: **1)** strengthening early warning systems; **2)** strengthening the capacity of farmers to deal with climate change; **3)** reduction of the impacts of climate change along the coastal zone; and **4)** water resources management.

26. Mozambique is already committed to "bringing together" the work on disaster risk and climate resilience. Synergies between Disaster Risk Management and Climate Resilience have grown during the past 2 years. Indeed, the NAPA has identified the need of strengthening early warning systems as the first priority for intervention. INGC has identified the need to move towards a more integrated climate risk management approach, ranging from preparedness and disaster mitigation to broader adaptive activities, and taking into account the changing pattern of natural hazards in its disaster risk management planning process. In its recognition that climate resilience is not just about the far future, the INGC also wants to accelerate the implementation of corrective disaster risk management activities, addressing actual risks that are already well consolidated.

27. INGC and MICOA have recently jointly developed an action plan (called *INGC phase II*, a proposal of US\$ 4 million) aiming at: formulating a national strategy to respond to climate change; development of a systematic focus on climate change for sectoral policies; revision of the legal framework and secondary legislation to adjust fiscal policies; engagement of the private sector in adaptation to climate change (through provision of guidelines for mandatory adaptation standards and requirements for investors); and raising awareness at national, provincial and district levels. Denmark, UNDP and France have pledged money to finance part of the *INGC action plan*.

28. INGC has recently prepared a USD 5 million *Disaster Risk management Plan* aimed at building policy, strategies, and institutions; identifying, assessing and monitoring risks; and reducing underlying risk factors. It will be financed by the Global facility for Disaster Risk Reduction (GFDRR).

29.

30. ***Because of Mozambique's particular vulnerabilities it has been the subject of a range of innovative analytical studies with regard to climate resilience and adaptation.*** Denmark, GTZ and UNDP have funded a study on *the impact of climate change on disaster risks in Mozambique* (2009). The Global facility for Disaster Risk Reduction has funded a study on *the Economic Vulnerability and Disaster Risk Assessment* (2009). DFID, Netherlands and Switzerland are currently financing a study on *the economics*

of adaptation to climate change (on-going) which includes a mapping of agro-ecological zones by vulnerability as well as a review of the vulnerability of the hydropower sector. Mozambique was one of seven countries selected for in-depth analysis under the Economics of Adaptation to Climate Change Study, whose global track was presented at Copenhagen in December 2009. The World Bank has financed a Water Resources Strategy and detailed work on the Zambezi basin (2007) and is financing a study on *Making Transport Climate Resilient* (ongoing, TFESSD). Following the 2000 floods, quite good local awareness has been built of the risks posed by extreme weather events and local programs such as the internationally renowned “living with floods” approach are under way.

31. The challenge for Mozambique is to transform these strategies studies into “action on the ground” through learning by doing, while continuing to strengthen the analytical base in sectors which are less well understood, re-prioritizing public investment programs where the knowledge base exists, and building capacity at local as well as central level. A few climate change related projects have started or are under preparation

32. INGC and MICOA are about to start the implementation of a USD 3 million *Africa Adaptation Programme* (AAP), aiming at the institutional strengthening of the Government to manage the climate change agenda, financed by the Japanese Government and managed UNDP (see annex 6 for a detailed description).

33. Denmark is preparing a new USD 37 million *Environment Project* with MICOA and INGC which will have a USD 10 million climate change component with a co financing of around USD 8 million from the European Commission. The climate change component will finance strategy development as well as investments on the ground following the INGC phase II suggestions.

34. DFID has prepared or is preparing several climate change related projects with the Government of Mozambique. There are two national projects: *Mainstreaming Climate Change into Development* for around USD 2.2 million (£ 1.5 million, under preparation) that will help Government to coordinate the climate change agenda, participate in international climate change negotiations and model future climate outcomes and a flood plain management project implemented by Save the Children for around USD 1.8 million (£ 1.2 million, under implementation); and four regional projects: The Africa Climate Change Research Partnership (USD 4.7 million or £3.2 million, under preparation) and the Climate Development Knowledge Research (USD 22 million, around £15 million for 60 countries, under preparation), a technical assistance and advisory service implemented by Price Water & Coopers, the Adaptation Learning Program for Africa (USD 13 million for 4 countries, under implementation), implemented by Care in Mozambique and the Africa Climate Change Resilience Alliance (around USD 0.3 million for 3 countries, under implementation) implemented by a consortium comprising Oxfam GB, the Overseas Development Institute (ODI), Save the Children, Care International and Word Vision International in selected districts in Mozambique. The two national projects will complete and reinforce the SPCR in both its mainstreaming and investments on ground components.

3. Main Findings of the two joint missions

35. ***Extensive consultative processes have already been undertaken in previous climate-related analytical and capacity building work.*** The two main consultations took place during the preparation of the Disaster Risk Assessment phase 1, a detailed analysis of climate risks undertaken by the DRM agency the Disaster Risk Management Institute (INGC), and the National Adaptation Plan of Action (NAPA) undertaken by MICOA. The first joint mission held discussions with a range of Government entities, civil society organizations, the private sector, and development partners (see annex 1 for a list of people and organizations met during the two missions and annex 2 for a description of the outcomes of the

consultation process that was undertaken during the first and second missions). Consultations with NGOs and the private sector revealed that there is little understanding of the practical challenges and opportunities of climate variability and change.

36. ***The NAPA provides a clear vision of the country's priorities but lacks some sectors and a proper costing of adaptation options.*** The four priorities identified by the NAPA are robust, but they miss some important sectors such as roads. Roads have indeed been identified by the *Economics of Adaptation to Climate Change* Study as one of the sector where climate change is going to have a huge impact on Mozambique economic growth if nothing is done. Other sectors might be important too but have not yet been examined through the lens of quantitative assessment of climate change impact. Moreover, the NAPA is certainly very conservative (US\$9.2 million for the 4 priorities) when it comes to costing adaptation options in the four priorities areas.

37. ***Investments in climate resilient activities are ongoing in different sectors but will require inter-sector and territorial coordination and significant additional investments.*** Several sectors have already incorporated climate resilience in their investment planning. For example, all weather roads are under construction in the Zambezi valley on higher ground free from flooding between Tete and Mutarara, soil and water conservation techniques are being tested in different provinces as well as irrigation and coastal cities are already investing in protecting their coast from erosion and in improving their storm water drainage systems. However, all these investments are beyond the capacities of the respective ministries or municipalities and will require ODA. Moreover, at the provincial level, there is room for more coordination between investments in the agriculture and transport sectors. A territorial focus for investments would help address synergies and see the real benefits of resilience.

38. ***There is functioning donor coordination.*** An active donor working group on environment exists, aiming at harmonizing support to Government on environmental issues in general and encompassing climate change portfolios. Out of this large group, a smaller group of donors comprising DANIDA, DFID, UNDP, World Bank and African Development Bank, are discussing coordination arrangements among the different projects mentioned above.

4. Mozambique's Strategic Program for Climate Resilience (SPCR)

Rationale and Objectives

39. The SPCR, targeted at low income countries which are highly vulnerable to climate risks, seeks to pilot the *mainstreaming* of climate resilience into development through piloting and demonstrating investments and approaches for integration of resilience in different sectors. Programs must be country led, designed within the broader context of sustainable development and poverty reduction, and build on existing work, including disaster risk reduction strategies and *National Action Plans for Adaptation* (NAPA), where these exist. They also should include support for (a) piloting and demonstrating approaches for integration of climate risk and resilience into development policies and planning; (b) strengthening capacities for mainstreaming at national and local level; (c) scaling up and leveraging investments, building on ongoing initiatives; and (d) enabling learning by doing and sharing of lessons.

40. Given the institutional context, and existing initiatives and building on consultations undertaken during the two mission, it is proposed to i) pilot mainstreaming activities in public and private sectors where enough information is available and in a selected regions or municipalities and ii) to pilot investments on the ground in a few sectors that are particularly vulnerable as identified in the NAPA and in selected regions that correspond to the main climate risks identified in the NAPA.

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41. It is proposed to focus investment, capacity building and knowledge activities under the Mozambique SPCR on: i) mainstreaming climate change into budget and planning at central level in two pilot sectors: transport and agriculture ii) tourism, ports, urban water and forests for the private sector because these sectors appear vulnerable to climate change, iii) agriculture, water management and transport in the Limpopo watershed and the Zambezi valley for the pilot investment in rural areas where the risks are floods and drought and iv) coastal protection and storm water drainage in one coastal town, possibly Beira for the pilot investment in an coastal city where the main risk is sea inundation (see annex 4 for more details about the three poles).

42. *Objectives of SPCR for Mozambique.* The long term transformational goal of the SPCR has been stated as “increased resilience in society to potential climate variability and climate change” in the harmonization of CIF results frameworks draft paper (March 2010). The Mozambique SPCR proposed activities would contribute to the four key outcomes mentioned in the paper as follows:

(a): “integration of inclusive resilience into development plans” through adjusting public investment programs in key sectors such as transport and agriculture, and building the knowledge base for doing so in other sectors;

(b) “increased consensus on approach to climate resilient development” through “learning by doing” and sharing results on the ground in key territorial areas, through enhanced knowledge and by building awareness and stakeholder support for climate resilience in both the private and the public sectors;

(c) “scaled up finance for climate resilient development” through supporting resilience in selected poles where SPCR funding will significantly increase the funding compared to baseline;

(d) “improved coordination among stakeholders” through capacity building support to improved inter-government and local government coordination.

Phase 2: Investing in Pilot Poles and Creating a Framework for Climate Resilience

43. *Mainstreaming climate change in central budget and planning.* This component will allow the Ministry of Planning and Development (MPD) to actively engage with sector ministries and other stakeholders, in particular when developing Government investment plans (namely the next five-year development plan and the next PARPA (a PRSP). The SPCR would support mainstreaming resilience in two ways: by adjusting public investment planning in sectors, where quantitative information of potential climate change impacts is available and where sectoral models can help comparing different prioritization patterns of investments, such as transport and agriculture through central government led planning processes, and by building on the experience of learning by doing in agriculture, water management and coastal protection through “decentralized” planning processes.

44. *Mainstreaming climate change in territorial sectoral investments.* This component will address and pilot practical solutions to the three main climate risks Mozambique faces. It is proposed to invest in the four NAPA priorities (strengthening early warning systems; strengthening the capacity of farmers to deal with climate change; reduction of the impacts of climate change along the coastal zone; and water resources management) in three different pilot poles: the Zambezi basin where the main risks are both floods and droughts, the Limpopo watershed where the main risk is drought, and the coastal Town of Beira or possibly an alternative vulnerable coastal town where the main risks are floods, storm surges and cyclones.

45. *Mainstreaming climate change in private sector.* In addition to these sectoral investments, it is also proposed to create or improve the enabling environment for the private sector actors in sectors that are relevant to NAPA priorities and identified during the consultation process (urban water,

especially in coastal areas; ports, tourism and forestry), as well as the necessary institutional arrangements for a permanent engagement of the private sector in building national climate resilience. Given the important roles of public institutions in these sectors and the public-private interactions, this component would include analyses of the gaps and needs of both private and public institutions of the mentioned sectors.

46. The proposed components and activities in phase 2 are summarized in the table below. It should be emphasized that these figures are tentative. Phase 1 will provide an opportunity to prepare more rigorous estimates based on field technical analysis and evaluation of options. The figure (US\$ 120 million) also tentatively plans for support from other development partners and is thus greater than the SPCR maximum funding envelope (US\$ 80 million). Phase 2 will also be prepared at different scales, so that it is adapted to different funding envelopes that may be available from SPCR and other financing.

Table 1: SPCR proposed Phase 2 components

Components	Indicative Activities	Estimated cost
A. Climate resilient budget and planning at central and local level	Adjusting public investment in the agriculture and transport sectors, MPD and line agency capacity building Building capacity in decentralized planning processes	Some US\$ 5 million
B. Climate resilient investments in agriculture, water and roads in 2 rural poles	Control of soil erosion and wildfire, soil conservation, small scale irrigation, water resource management, rural roads, hydromet stations	Zambezi pilot pole: US\$29 million Limpopo pilot pole: US\$40 million
C. Climate resilient investments in one coastal city (Beira or other coastal city)	Coastal erosion control, breakwater, storm water drainage	Some US\$23 million
D. Initiatives for private sector	Awareness, access to finance, demonstrational and pilot solutions, overall enabling environment	Some US\$18 million
E. Project management	project management, reporting monitoring and evaluation	Some US\$5 million

Phase 1: Preparing the Strategic Program for Climate Resilience

47. *The objective of the phase 1 activities is to prepare an initial strategic investment program for climate resilience for Mozambique, which focuses on learning by doing and results on the ground while also addressing key knowledge and capacity gaps.*

48. In line with the proposed objectives, components and activities in phase 2, and given existing initiatives, it is proposed to undertake the following activities during phase I to facilitate preparation of phase 2.

49. *Further focusing on gaps in the analysis of climate risks and needs for adaptation.* Considerable work has already been undertaken on the risks to different geographical zones, and to some key sectors such as agriculture, water and roads, both through the EACC study for the three sectors but also through the ongoing *Making Transport Climate Resilient* study. However, a number of key economic sectors where the private sector plays the key role either as an operator (e.g. ports or urban water supply) or investor (e.g. tourism) currently has a low or non-existing level of incorporation of climate impacts considerations in their operations, planning and investments. Given the importance of these additional sectors for the national economy and overall sustainable development, Phase 1 will analyze the gaps and the needs in four areas identified during consultations and aligned with NAPA (ports, urban water supply, tourism and forestry), identifying priority initiatives, including informational, policy and regulatory needs, and investments to be included in Phase II of the Program. Given the interaction and dependence between public and private stakeholders in these sectors (e.g. urban water supply where there are several public and private institutions involved in the supply chain) the analyses will not only

limit to the private sector but include the roles and needs of relevant stakeholders. This work will be done in coordination with related ongoing national initiatives (INGC's Phase II and the work of other development partners). Additionally, this component would analyze institutional arrangements needs for ongoing private sector engagement. Separate analyses would identify the more detailed work to be undertaken in phase 2 in hitherto relatively less studied areas such as health, and impact on gender.¹⁰

The key outputs of this component would be sector analyses of risks and barriers to adaptation to ports, urban water, tourism and forestry and identification of priority needs in these sectors, and initial scoping on health and gender.

50. *Institutional Analysis.* An institutional analysis of MICOA, INGCC and local governments was undertaken by UNDP during the preparation of the Africa Adaptation Program (AAP). The aide memoire for the first joint mission summarizes the findings of the analysis. The extensive analysis can be found in the AAP itself. However, there was consensus that institutional analysis and public expenditure review were needed at the regional level in each of the three poles.

The key output would include an institutional assessment, an analysis of existing regional and local planning documents and resources available for expenditures.

51. *Capacity Building.* The entire so-called "INGC phase II" is a capacity building exercise. It is financed by DANIDA and the AAP. The main beneficiaries will be INGC and MICOA who have recently joined the initiative. As far as SPCR phase 1 is concerned, it is proposed to finance three capacity building activities: (i) a part time technical advisor who will be based at MICOA helping the Ministry coordinate the activities that will be financed under phase I (ii) an assessment of the climate vulnerability of the 5 years government development plan currently under development; and (iii) an assessment of the capacity building needs of MPD, key line ministries and other actors, if need be. It will help the Ministry of planning (MPD) which has limited experience in mainstreaming climate risk management in government planning and who has requested some help on that regard. The assessment would be undertaken in coordination with UNDP which may launch a similar exercise under the AAP.

The key outputs would include coordination and reporting on phase 1 activities, a climate vulnerability assessment of the next Five year Development Plan, and identification of capacity building needs in MPD and in key line ministries (transport, agriculture, water).

52. *Consultation process and Strategic Environmental and Social Impact Assessment of SPCR.* Extensive consultative processes had already been undertaken in previous climate-related analytical and capacity building work, such as the INGC study, the INGC phase II and the AAP. Therefore, it is proposed to finance a strategic environmental and social impact assessment (SESIA) of the overall planned program, including alternatives in the three pilot poles, with consultations at the local level. . Consultations will include CSOs and community groups, local and provincial, public and private stakeholders. (Such consultative processes are relatively well established in Mozambique)

The key output would be a SESIA of the phase 2 SPCR

53. *Knowledge and Awareness Raising.* It appeared clearly in the consultations undertaken during the first joint mission that the civil society and the private sectors needed more information about climate risks. The INGC phase II propose, in its steady track (2010 and 2011), to finance training of media with a focus on radio and TV. There was consensus that further *Knowledge and Awareness Raising* activities were not necessary at this stage but that the SPCR will undertake a detailed analysis of key

¹⁰ By proposing to invest in climate resilient activities in the agriculture sectors in the Limpopo watershed and in the Zambezi valley, SPCR would nonetheless be gender sensitive as 2/3 of the farmers are women.

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vulnerabilities to economy and society in the Limpopo watershed and Zambezi valley and a detailed assessment of vulnerability in key coastal towns, focusing initially on Beira but also on alternative sites if appropriate (Maputo and Nacala), and a socio economic assessment (building on ongoing work) in each of the three poles.

The key outputs would be socio economic assessment in three poles, a study that will compare coastal cities vulnerability and a study that will compare vulnerabilities in different sectors in the two rural poles

54. *Definition of Priority Action Needs, including Investments.* The Phase 1 program would identify key areas for investment, in the land and water management and roads sectors, which would form the basis for the investment activities in the two rural poles under phase 2, including a more detailed analysis of needs for strengthening the early warning system network (including hydromets). Phase 1 would identify appropriate investment and policy solutions for strengthening resilience in one coastal city and undertake initial preparatory studies of the preferred options.

The key outputs would be investment programs for climate resilience in the Limpopo and Zambezi, an investment plan for strengthening hydromet, and an investment plan for strengthening the resilience of Beira or an alternative key coastal town(s).

Table 2: SPCR proposed Phase 1 activities: \$1.5 million Total

Tasks	Already done	Activities To be financed during phase 1	Tentative Costs (USD)	Responsibilities
Analysis of Climate Risks, Impacts and Needs	INGC phase I, Extreme events study and EACC	Analysis of vulnerability in 4 selected private sectors (urban water supply, ports, forestry, tourism) and related public sector institutions : Gaps and needs, priority initiatives and Investments	300,000	MICOA/INGC/IFC
Institutional Analysis	African Adaptation Program –AAP- (UNDP)	Regional institutions mapping and expenditure analysis in the three poles	240,000	MPD/MICOA/AfDB /WB
Capacity Building and Preparation of the Strategic Program	INGC phase II	Assessment of the 5 years government development plan climate vulnerability	75,000	MPD/MICOA/WB/ AfDB/UNDP/DFID
		Capacity building needs assessment (MPD, MICOA, key line ministries and other actors)	75,000	MPD/MICOA/WB/ UNDP/DFID
Consultation Process and preparation of a SESIA	Technical meeting for the evaluation of the AAP (May 2009) Consultation for the formulation of INGC Phase 2 (June 2009)	SPCR Strategic Environmental and Social Impact Assessment (SESIA) including policy analysis in 2 sectors, assessment of investments in pilot regions and consultation	150,000	MICOA/AfDB
Knowledge and Awareness Raising	INGC Phase 2	Socio economic analysis and vulnerability assessment in the Limpopo watershed and the Zambezi Valley	260,000	MPD/MICOA/SETS AN/ AfDB/WB
		Vulnerability assessment of coastal cities	130,000	MPD/MICOA/WB
Definition of priority Action Needs, including Investments	NAPA	Comparison of options for climate resilience investments with preliminary cost and benefits, once decision on districts and town is final	270,000	MICOA/MPD/AfDB /IFC/WB

5. Proposed Implementation Arrangement for Phase I of SPCR

55. SPCR phase 1 would build on existing implementation arrangements acceptable to both Government and MDBs. MPD agreed to use the PIU of the recently approved World Bank supported *Decentralized Planning and Finance Project* which has acceptable fiduciary standards to implement the \$ 1.5 million grant for SPCR-Phase 1. It was emphasized that this would be a transition arrangement for Phase I only to allow for a rapid signature and implementation of the grant. It is proposed that the SPCR grant be recipient executed by MPD and signed with the World Bank on behalf of the three MDBs. This approach again would minimize transaction costs, since the unit is already accredited for fiduciary management.

56. To complement this fiduciary arrangement, it is proposed to use expertise to guide on the technical activities with the support of a part-time coordinator (high level technical expert on project preparation) that would be recruited from the sub-region and placed in MICOA.

57. The strategic technical oversight role would be assumed by a technical inter-ministerial council co-chaired by MPD, MICOA and INGC. This inter ministerial council would also ensure coordination among the different climate change related projects (UNDP's AAP, DFID *Mainstreaming Climate Change into Development* and DANIDA *Environment Project*)

58. The MDBs would continue to engage cooperatively with the Government of Mozambique and other partners through joint missions where dialogue with MPD and MICOA on the one hand and the Environment Sector Group (through a smaller task force on climate change that will comprise DANIDA, UNDP and DFID) on the other end will be pursued.

59. In the development of the SPCR for Mozambique, and based on the preliminary discussions and work that has been undertaken during the preparation of the Phase I proposal, the AfDB will take the lead in working with the Government in the design and monitoring of the implementation of pilot interventions in the Limpopo basin. The potential interventions in the Limpopo basin will enhance synergies of on-going and recently completed AfDB interventions such as the Massingir dam and small holder agriculture project and the small scale irrigation project. As for the World bank Group (IDA and IFC), IDA will take the lead in working with the Government in designing the potential interventions in the Zambezi valley whether in coordination with its ongoing Market-led Small-holder Development in the Zambezi Valley Project and in designing interventions in one coastal town in coordination again with its *City Reform and Climate Change Project* whose preparation will start next fiscal year (July 2010). IFC will take the lead with activities related to private sector access to finance and enabling environment.

6. Timeline for Phase I (August 2010-March 2011: 9 months)

	August	September	October	November	December	January	February	Mar ch
Technical Adviser								
Assessment of Government Plan								
Capacity building in MPD and line Ministries								
SESIA								
Regional Institutional Assessment and PER								
Socio economic analysis and vulnerability Assessment								
Coastal Towns Vulnerability								

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Assessment								
Private sector vulnerability								
Comparison of options in poles								
Preparation of the strategic Program								

Annex 1: Stakeholders consulted during the first and second joint missions

No.	Name	Institution	Email	Contact Number
1	Emilio Zava	Ministry of Coordination for Environmental Affairs (MICOA)	emiliozava@yahoo.com	827840225
2	Atanasio Manhique	National Institute of Meteorology (INAM)	atanasio_m@inam.gov.mz	828293380
3	Andriano Maleiane	Malefin Consulting	malefin@tvcabo.co.mz	21418439
4	Aurelio Nhabetse	Ministry of Agriculture/ National Directorate for Agricultural Services (MINAG/DNSA)	anhabetse@yahoo.com.br	823267700
5	Hiten Jantilal	MINAG/DNSA	hjantilal@setsan.org.mz	
6	Rui Brito	UEM	ruimoz@gmail.com	823093340
7	Silvia Mulhavo	Ministry of Planning and Development (MPD)	smulhavo@mpd.gov.mz	825504543
8	Orlando Z. Mazive	MPD	omazive@mpd.gov.mz	827524330
9	Rita Almeida	Disaster Risk Management Institute (INGC)	ritaalmeida@ingc.gov.mz	824309940
10	Frauke Jungbluth	WB	fjungbluth@worldbank.org	829350417
11	Nelson Melo	MINAG-DNSA	nmelo@zebia.nem.mz	826075450
12	Ann Marie Alves	Ministry of Finance/ National Directorate of Treasury (MF-DNT)	amcalves06@gmail.com	825289506
13	Luina da Conceiqad	Ministry of Public Works and Housing/ National Directorate of Water (DNA)	lconceiqad@dngua.gov.mz	828308360
v14	Leonard Kranendonk	DNA	lstkranendonk@yahoo.com	827098080
15	Michelle Souto	IFC	msouto@ifc.org	
16	Nilza Puna	Green Resources	nilza.puma@greenresources.no	
17	Kelma Vaz	Verdeazul Consult LDA	kvaz@verdeazul.co.mz	
18	Dino Foi	CTA	Dfoi@cta.org.mz	
19	Camilla Lott	Vale	Camilla.Lott@vale.co.mz	
20	Rogario Wamusse	MICOA	rwamusse@yahoo.com	
21	Irene Visser	IFC	ivisser@ifc.org	
22	Luz Polonia	Millemmium bim	mpolonia@millemmiumbim.co.mz	
23	Paula Boca	BCI	boca@bci.co.mz	
24	Mario Marafona	BCI/ IFC	Mario.marafona@bci.co.mz	
25	Madalena Dray	Hidroelectrica Mphande Nkwa	madalena.dray@hmnk.co.mz	
26	Marilia Bene	CFM	marilia.bene@cfm.co.mz	
27	Flora Nalacha Manjiche	ENH	flora.manjiche@enh.co.mz	
28	Casituro Francisco	Riversdale-AMDCM	cfrancisco@tvcabo.co.mz	
29	Lolita Fondo	UNDP/FEMA	lolita.hilario@undp.org	
30	Oystein Botillen	Norwegian Embassy	oybo@mfa.no	823027720
31	Akiko Aikawa	Japanese Embassy	akiko.aikawa@mofa.go.jp	848277929
32	Karen Colin	AFD	colinverdierek@afd.fr	829669314
33	Henrik Franklin	AfDB	h.franklin@afdb.org	847138874
34	Helle Fredslund	Danish Embassy	helfre@um.dk	828447940
35	Tom Duray	MICOA-CRI	cri.d@intra.co.mz	843982343

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36	Ana Paula Reis Akide	FAO	anapaula.reis@fao.org	825648880
37	Fanida Saifodine	Danish Embassy	farsai@um.dk	823057280
38	Raul Hogo Comba	WFP	raul.comba@wfp.org	823286666
39	Mirjam Palm	Swedish Embassy	mirjam.palm@foreignministry.se	823270240
40	Nadia Vaz	WFP	nadia.vaz@wfp.org	823202050
41	Tomé Nhamadinha Capece	National Institute for Development of Fisheries (IDPPE)	tcapece@idppe.org/ tome_capece@yahoo.com	21490807/ 487347
42	Ernesto Poiosse Hele	IDPPE	epoiosse@idppe.org	
43	Juliao Alfredo Alferes	DNA	jalferes@dnaguas.gov.mz	21312571
44	Lily Nomboro	DNA	inomboro@dnaguas.gov.mz	21322191/2
45	José Álvaro Malanço	DNA	jmalanco@dnaguas.gov.mz	21309862/10 902
46	Therése Sjömander Magnusson	Swedish Embassy	therese.sjomander- magnusson@foreign.ministry.se	21480300
47	Marcela Libombo	MINAG- Technical Secretariat for Food Security and Nutrition (SETSAN)	mllibombo@setsan.org.mz	21461873/ 823021717
48	Ribero Joao	INGC- National Institute for Disaster Management	jriberiro@ingc.gov.mz	21477277
49	Eusébio Tumuitikile	MINAG – National Directorate for Forestry (DNTF)		21302555/ 820600350
50	Muino Taquidir	DNTF	muinotaq@gmail.com	823047334
51	Cristina Louro	Centro Terra Viva	cristinammlouro@gmail.com	827851107
52	Luis Muchanga	UNAC	lmuchanga@gmail.com	824253540
53	Rito Mabunda	WWF	ritomabunda@wwf.org.mz	824894840
54	Abel Otacala	WB	aotacala@worldbank.org	824802610
55	Edgar Jorge	CFM	edgarjorge@cfmnet.co.mz	823030138
56	Delfino Aleluia	CFM	anibalaleluia@cfmnet.co.mz	827829393
57	Francisco Pereira	Fundo de Estradas (FE)	pca@fe.gov.mz	823049290
58	Larry Herman	FE	larry@fe.gov.mz	827520880
59	Nelson Beete	FIPAG	nbeete@fipag.co.mz	
60	Frederico Martins	FIPAG	fmartins@fipag.co.mz	
61	José Forjaz	Arquitectos	jforjaz.arquitectos@tvcabo.co.mz	823018990
62	Janet Gardener	GHK Consulting	Janet.gardener@ghkint.com	+4420747180 00
63	Agnelo Mabote	FIPAG	agnelo@fipag.co.mz	+258- 21308840
64	Candido G. Jone	CFM	joneca@tdm.co.mz	+258- 23321007
65	Alima Issufo	National Directorate of Forestry	aissufo@yahoo.com	+258- 21312072
66	E. Chamba, T. Maculuve, J. Mafalacusser, C. Macia	Instituto de Investigação Agrária de Moçambique		+258- 846129450
67	Bartolomeu Soto	Ministry of Tourism	bsoto@tvcabo.co.mz	+258- 21303650
68	Obete Matine	Ministry of Mining	obete.matine@mirem.gov.mz	+258- 21305344

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69	Eusebio Mauricio Tumuitikile	National Directorate of Lands and Forests (Cadastre)	muitikile@gmail.com	+258-21302555
70	Bruno Leclerc	AFD	leclercb@afd.fr	+258-21304300
71	Karen C. de Verdière	AFD	colindeverdierek@afd.fr	258-213043001
72	Rauno Laitalainen	National Directorate of lands and forestry	Rauno.laitalainen@gmail.com	+258-21321804
73	Alfonso Mahumane	Aguas de Moçambique		
74	Jose Nhaca	AMATI		
75	Paulino Cossa	AFORAMO		
76	Camilo Abdul	Maputo Port	Camilo.abdul@portmaputo.com	+258-21313920
77	Carols Mesquita	Cornelder de Mocambique (Beira Port)	Carlos.mesquita@cornelder.co.mz	258-23322735
78	Arlito Cuco	Green Resources	Arlito.cuco@greenresources.no	258-21301002
79	Rui Monteiro	Rani Resorts		+258-823008100
80	Carrie Davies	ACIS, Associacao de Comercio e Industria	acis@acismoz.com	+258-844987650
81	Calisto A. L. F. Bias	Agriculture Research Institute - IIAM	calisto.bias@gmail.com	82 3281800
82	Wibke Thies	GTZ	Wibke.thies@gtz.de	84 3983319
83	Elias Paulo	National Roads Administration -ANE	epaulo@ane.gov.mz	82 6019120
84	Inacio T. Nhancale	Agriculture Extension - DNEA	inhancale@gmail.com	82 31447990
85	Manuel A. Maxhaieie	Gaza Provincial Directorate - INGC	maxlhaieie@ingc.gov.mz	282 26820
86	Fanuel Mabunda	Hidraulica de Chokwe E.P - HICEP	fanuelmabunda@hotmail.com	84 3074470
87	Alberto Banguine	Hidraulica de Chokwe E.P - HICEP	abanguine@tdm.co.mz	82 7177040
88	Dinis Juizo	Faculty of Engineering Eduardo Mondlane University	juizo@uem.mz ; juizo@hotmail.com	21475330
89	Roberto Zolho	IUCN		
90	Francisca Muluane	Gaza Province Permanent Secretary		
91	Manuel Tivane	MICOA- Gaza Province		
92	Carlos Tembe	MICOA – Gaza province		
93	Anatercia Dinis	Gaza Provincial Directorate for Agriculture		
94	Paulo Machava	Gaza Provincial Directorate for Agriculture		
95	Sebastiao Ferro	Gaza Provincial Directorate for Agriculture		
96	Andre Langa	Gaza Provincial Directorate for Agriculture		
97	Paulo Munembe	Ministry of Agriculture Xai-Xai		
98	Eduardo Cuamba	Ministry of Agriculture Xai-Xai		
99	Duarte Mugwane	Ministry of Agriculture Xai-Xai		
100	Leitao Isabel	Ministry of Agriculture Mabalane		
101	Amancio Mucio	Gaza Provincial Directorate - INGC		
102	Victor da Luz Bila	Gaza Provincial Directorate - INGC		
103	Jose Mahumane	Gaza Provincial Directorate for Public Works		

Preparation of a Strategic Program for Climate Resilience (SPCR): Proposal for Phase 1 Funding

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104	Adalberto Muhumane	Gaza Province - ANE		
105	Manuel Amane	IIAM		
106	Thomas Agulo	IIAM		
107	Daniel M. A. Clemente	Ministry of Agriculture	dtrindade@hotmail.com	84 3884356
108	Alfredo Zunguze	MPD Smallholder Project Leader	aricardoz@hotmail.com	
109	Tiago Luis	MPD Smallholder Project Leader	tiago.luis@teledata.mz	
110	Destino Chiar	MPD Smallholder Project Leader		
111	Dr. Sérgio Vieira	Director General of GPZ		
112	Serrao Quissimisse Picardo	Chief of Doa Administrative Post		
113	Wiliamo Francisco Wiliamo	Chief of Ancuase Locality		
114	Fernando Simao Nhate	Director of district Service of Education Science and Technology – Mutarara		
115	Marcos Gacor	INGC Regional Director – Caia		
116	Andre Chachine	ANE Quelimane		
117	Jeremias Liando	Urban Environment Manager - Beira	Jeremias.liando@municipioberiar.gov.mz	828524610/843988568
118	H.E. Mayor Daviz Simango	Mayor of Beira		825015070
119	Adriano Ubisse	Director, Directorate of Investments and Cooperation	aubisse@mpd.gov.mz	+843996380
120	Margot Van der Velden	Deputy Country Director, WFP	margot.vandervelden@wfp.org	+823251300
121	Lola Castro	WFP representative	Lola.castro@wfp.org	+823014280

Annex 2: Summary of Consultative Meetings with Government, Private Sector Development partners, and NGOs

Minutes Government Stakeholders Consultation – 12/01/09 – VIP hotel - Maputo

60. The following brief summarizes the outcomes from the discussion with the Government stakeholders to seek their feedback and input in light of the objectives outlined in SPCR documents.

61. The workshop, chaired by MICOA and facilitated by the National Institute for Disaster Management (INGC) and Joint Mission representatives, was attended by participants from the: National Institute of Meteorology, Ministry of Agriculture, Ministry of Planning and Development, INGC, Ministry of Finance, Ministry of Public Works and Housing, National Directorate of Water.

62. The workshop's presentation informed the participants about the implications of possible climate impacts on water, agriculture, transport infrastructure and coastal zone.

63. The discussion was initiated with questions to the participants about their perception on climate risks and impacts in their sectors, and appropriate adaptation measures. Feedback was sought on which initiatives and investments for climate resilience should be prioritized.

64. The main points and conclusions from the discussion were:

- *Selection Criteria.* Need to establish criteria for selection of activities into sectors, and be guided by science and existing studies and not just by intuition.
- *Sectors already identified.* Four sectors have already been identified by studies as well as the options for response: 1) early warning systems including meteorological information systems; 2) coastal protection in cities and a strategic investment plan for cities in the light of impacts of climate change (Vilankulo, Beira and Maputo identified as the most vulnerable urban areas. Pemba and Nacala are also vulnerable); 3) Agriculture including drought resistant crops, irrigation systems (micro dams), and livestock management due to new pests outbreak in the agriculture sector; 4) River basin management (negotiations erosion control, re-vegetation, bush fire control, river ecosystem restoration) and water supply. Both will require international
- *Fisheries and health.* Coastal ecosystem protection and restoration were not researched by INGC but are probably key to the country's development. Same thing for the health sectors.
- *Institutional Arrangements.* The issues of coordination and information management are key to ensure no duplication is made and are still not clear. There is also a question of leadership, of where the decision making lies, of who will eventually lead to decision making. It is suggested to create an overarching institution with capacity to decide at both the political and technical level. Maybe part of the SPCR funds could support this coordination role. Either Ministry of Planning and Development or Ministry of Coordination of Environmental Affairs can do this. The Government should decide.
- *Funding Strategy.* Funds maybe be spent in issues that are funds orphan (coastal protection for instance). Be strategic in terms of what is included in the SPCR proposal and favor areas that are difficult to fund with other sources.

Minutes Private sector Consultation - 12/2/2009 – VIP Hotel - Maputo

65. The following brief summarizes the outcomes from the discussion with the private sector stakeholders to seek their feedback and input in light of the objectives outlined in SPCR documents related to the private sector.

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66. The workshop, chaired by MICOA and facilitated by INGC and a Joint Mission representative, was attended by participants representing the views of a variety of sectors, including energy infrastructure, transport, agriculture and forestry, mining, oil and gas, and banking, as well as SMEs, represented by Mozambique Private Sector Confederation.

67. The workshop's presentation informed the participants about the implications of possible climate impacts on the private sector and on their sustainability, including increased operational, financial, and credit risks, and principal climate related threats in Mozambique.

68. The discussion was initiated with questions to the participants about their perception on the availability of relevant information and capacity to evaluate direct and indirect climate risks and impacts to their businesses and/or sectors, and the ability to choose and implement appropriate adaptation measures. Similarly, participants were asked for feedback about what they perceive as major barriers and needs that need to be fulfilled to enable successful increase of their climate resilience. Finally, feedback was sought on which initiatives and investments for climate resilience should be prioritized.

69. The main points and conclusions from the discussion were:

- Currently there is very little knowledge or awareness on the climate risks and how will these affect the private sector,
- The subject of climate risks and relevant economic impacts is new for most of the participants, and it is not possible to make decisions about specific adaptation priorities or activities without the necessary information,
- There is a need for analyses on direct and indirect climate impacts addressing specific sectors and from the private sector point of view,
- In addition to the information about the impacts, there is a need for specific adaptation options and solutions,
- The available and future information, as well as best practice examples, need to be appropriately disseminated. A few participants expressed the need for capacity building.
- There is a need to understand impacts on key infrastructure sectors
- There is an evident need for a sectorally oriented approach,
- There is a need for appropriate policies and regulations (e.g. building codes, zoning) that address climate change and resilience,
- There is a need for appropriate incentives (e.g. tax incentives) that would spur implementing adaptation initiatives,
- There is a need to develop appropriate insurance products that would address climate change and incentivize appropriate adaptation changes.

Minutes Donor Community Consultation - 02-12-09 – VIP Hotel - Maputo

70. The following brief summarizes the outcomes from the discussion with Development Partners to seek their feedback and input in light of the objectives outlined in SPCR documents.

71. The workshop, chaired by MICOA and Joint Mission representatives, was attended by participants from the: Norway, Sweden, Denmark, AFD, DFID, Japan, FAO, WFP, IFC, AfDB and UNDP.

72. The workshop's presentation informed the participants about the implications of possible climate impacts on water, agriculture, transport infrastructure and coastal zone.

73. The discussion was initiated with questions to the participants about their perception on climate risks and impacts in their sectors, and appropriate adaptation measures. Feedback was sought on which initiatives and investments for climate resilience should be prioritized.

74. The main points and conclusions from the discussion were:

- Coordination with the INGC Phase II Proposal. Most of what is listed under SPCR Phase I corresponds to INGC Phase II. Some donors are financing INGC Phase II (UNDP, Denmark, France potentially). INGC II includes donor coordination, the challenge now would be to ensure SPCR is in line with INGC II that is actually led by INGC and MICOA jointly.
- *Food security and Communities*. The impact of climate change on food security is still not sufficiently analysed and prioritized in policies. The impacts at community level also need to be addressed.
- *Pilot areas*. Idea of concentrating on a geographical scope of those sectoral priorities identified.
- *Coordination with REDD*. Forestry is a strategic sector for the future of Mozambique, and is already in the making. REDD and SPCR should work together.
- *Additional Funding*. Bilaterals are also getting funds for adaptation and it would make sense to supplement necessary funds in Moz and align them with SPCR.

Minutes CSOs Consultation - 08-12-09 – World Bank Country Office - Maputo

75. On December 8th presentation to the CSO, was briefed that, In Africa, Mozambique is a country greatly affected by natural disasters, and is very vulnerable to climate change because of its long, low coast, The data indicates that climate change is already happening in Mozambique: i) The average temperature increased by between 1.1 ° C and 1.6 ° C; ii) The number of cold nights and cold days reduced; iii) The number of warm nights and hot days increased (the major changes occurred in the northern area); The dry days are characterized by higher, average maximum temperatures, thus increasing evaporation;

76. For Mozambique the SPCR intend to - fill (i) knowledge gaps in current dialogues on climate change for key sectors and (ii) provide investment for improved adaptation capability, both “hard” and “soft adaptation. This includes training and improved institutional organizations required to help ensure that climate change is incorporated into the national budget, the contingency plan, and the creation of a working structure until mid / late 2010.

77. SPCR team calls attention for a need for deep involvements of all stakeholders on an earlier stage of this process. Question and answer session:

- What can be the cost & benefit to be involved with climate change?
- To ensure community involvement with the SPCR, there is a need for capacity building within the CSOs working at a local level. Most notably with issues involving land rights (clarify the of meaning of community land)
- Part of CSO representation would like involvement with the regulation process.

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- On Climate Change (SPCR), the team was recommended to have approach on different focus, not only on Disasters, but also on Natural Resources, Sustainable Development, etc
- On government side, CSOs detected a lack in coordination among the GoM, for examples: the role of MICOA, INGC, etc.
- It's also came clear for the team, the CSO in Mozambique, are not well organized in way to help in the SPCR process.
- For the mission planned in March 2010, the invitation should be sent in advance using the CSO list of those who attended the December mission meeting. CSOs will distribute the invite among themselves.

Summary of consultation during the second joint mission (April 5-20, 2010)

In Maputo

78. *Ministry of Planning and Development (MPD) and MICOA.* The mission had meetings with Adriano Ubisse and Orlando Z. Mazive (MPD) and Rogario Wamusse (MICOA) to provide an update of the SPCR preparatory phase to facilitate the finalization of the phase I proposal. The mission reiterated that the Government will need to submit the SPCR phase I proposal to the subcommittee as soon as possible to ensure the fast tracking of the completion of the phase I. The preliminary investment options for phase II as outlined during the previous mission were discussed and Government indicated that they will lead the process and take full ownership of the investment plan. MPD indicated that an urban poverty strategy is under preparation and the investments there in could possibly be considered for the SPCR phase II.

79. *Institute of Agrarian Research (IIAM).* The mission met with Calisto Bias, Manuel Amane and Thomas Agulo. A new strategic plan for IIAM is currently under development and will be approved in June. IIAM has undertaken substantial research on short cycle varieties of certain crops. In the Limpopo Basin the Institute has been involved in two main projects addressing issues of dry land agriculture and water productivity. The Institute is in need of capacity building linked to modeling of crops under various climatic conditions and also meteorological data collection.

80. *Ministry of Agriculture (MINAG-DNEA, DNAS).* The mission held meetings with Daniel Clemente, Inacio T. Nhancale and Aurelio Nhabetse. An agriculture strategy is under conceptualization linking agriculture programs with planned activities upto 2014. This builds on the 2008 Food Production Action Plan that identified the main areas of interventions as well as the need for improved seed varieties and quality. Disease control in livestock is also a priority particularly at border areas. The DNEA emphasized the need for the development of the private sector in agriculture. The Department is making efforts to promote conservation agriculture to improve yields and soil conservation. However further training of the extension workers and farmers is required coupled with demonstration plots. DNAS elaborated on the irrigation investment plan drawn up in the early 1990s exists providing a strategy for expansion of irrigation facilities. Land cover maps also exist though currently the scale is 1:250,000. A recommendation was made to invest in more detailed maps at a scale of 1:50,000 that would be more applicable in local planning and investment.

81. *National Roads Authority (ANE)*. The mission met with Elias Paulo who provided an overview of the road investment priorities and maintenance strategy. The national roads network is maintained by ANE while the maintenance of unclassified roads is the responsibility of Districts. An annual budget is provided for the maintenance of the road network however at the District level this usually covers spot improvements. In flood prone areas the strategy is to potentially elevate roads and increase the number of culverts. The ongoing study being undertaken by COWI will provide further detail in the economics of adaptation to climate change in the road sector.

82. *German Technical Cooperation (GTZ)*. The mission met with Wibke Thies who conveyed some of the key interventions by GTZ linked to areas of community forestry management and conservation agriculture. GTZ is considering participation in the SPCR in Mozambique. In the Limpopo basin reference was made to an FAO project in agroforestry that the SPCR phase II could potentially build on. Lessons learnt from GTZ's work in the Limpopo National park buffer zone as well as trials to up-scale conservation agriculture can inform the decision making in the potential interventions in the Limpopo Basin under the SPCR phase II.

Field Visit to Limpopo Basin (April 12-15, 2010)

83. On 12-15 April 2010 the following members of the SPCR Joint Mission Team visited the Limpopo Basin in Gaza Province: Paxina Chileshe (AfDB), Cesar Tique (AfDB) and Henrik Franklin (AfDB). The objective of the field visit was to meet with the Provincial authorities and other stakeholders to further explore climate change adaptation options that can lead to identifying possible interventions under the SPCR. The mission met with: Gaza Province Permanent Secretary (Francisca Muluane), Ministry of Environmental Coordination – MICOA (Manuel Tivane and Carlos Tembe), Provincial Directorate for Agriculture (Anatercia Dinis, Paulo Machava, Sebastiao Ferro, Andre Langa), District Extension Officers for Xai-Xai and Mabalane (Paulo Munembe, Eduardo Cuamba, Duarte Mugwane and Leitao Isabel), National Institute for Disaster Management - INGC (Manuel Alonso Maxlhaieie, Amancio Mucio, Victor da Luz Bila), National Roads Administration – ANE (Adalberto Muhumane), Provincial Directorate for Public Works (Jose Mahumane), Hidraulica de Chokwe – HICEP (Alberto Banguine and Fanuel Mabunda) and the International Union for the Conservation of Nature – IUCN (Roberto Zolho).

84. *Gaza Province Permanent Secretary*. Emphasis was made on supporting the vulnerable communities in the northern and central parts of the Province that suffer from drought. Water harvesting was recommended as a possible area of investment and it was also recommended to address the lack of road access in these areas. With regards to roads maintenance it was suggested to adapt current maintenance and repair materials to make sure they are suitable for a changing climate. It was recommended to support pilot interventions both in the upper basin (drought prone) and lower basin (at risk of flood).

85. *Ministry of Environmental Coordination (MICOA)*. MICOA indicated that only the Massangena District has a land use plan. There is a need to develop these in the other districts. MICOA is implementing a pilot project on climate change adaptation in Chicualacuala District. Among others, a vulnerability assessment of the livelihoods has been conducted with the view of integrating climate change adaptation measures in the District Development Plan. The project also supports training of

teachers and elements of water harvesting. It was recommended to provide technical assistance for desalinization in the northern districts. Community forestry was also mentioned as an important area of development.

86. *Provincial Directorate for Agriculture.* The authorities explained that the two main adaptation strategies in the agriculture sector are: 1) irrigation, and 2) conservation agriculture. In terms of irrigation the following two priority areas in the lower Limpopo Basin represent priorities: 1) expansion of the Xai-Xai irrigation scheme to complete the 12,000 Ha (currently 8,250 Ha have been rehabilitated), for which designs are already available and for an estimated investment cost of US\$19 million, and 2) development of irrigation schemes in the Lumane tributary, for which feasibility studies will have to be conducted. Salt water intrusion represents a challenge. Although some minor investments have been done, it appears further analysis is required in order to identify the most appropriate measures.

87. *A visit was made to the Xai Xai irrigation scheme.* This system currently has approximately 800 direct beneficiaries from seven communities in Xai Xai. The system is divided into two areas, one that receives spring water through gravity (small scale agriculture) and another area that is partially developed (for medium to large scale commercial farming) and receives water that is pumped to an elevated tank from which the water is then distributed through gravity. The pumping station is used both for irrigation and drainage into the Limpopo River when there is excessive water. When the natural drainage to the system is not sufficient the pumps can also extract water from the Limpopo River. However, last year when extraction was necessary the Limpopo River was too salinized due to salt intrusion from the sea. The Government is in the process of selecting a company that will manage the irrigation scheme. One constraint for the full participation of small scale holders is the limited number of extension workers to assist in technology transfer. The proposed rehabilitation of the expanded area appears not to have any significant economically feasible scope for increasing water efficiency.

88. *A visit was also made to Mabalane District,* which is a semi-arid area, to meet with extension officers and visit existing irrigation schemes adjacent to the Limpopo River and water harvesting facilities in the interior. Efforts are currently being undertaken to promote conservation agriculture piloted in the irrigation schemes and results of impacts on yields are being awaited. These efforts, which are led by the Ministry of Agriculture, are being supported by other development partners such as the European Union (Chigubo, Masengena, Mabalane and Chokwe), UNDP (Cicualacuala) and IUCN (Chigubo and Cicualacuala) in various districts. Drought resistant crops (cassava, millet and sorghum) are being introduced and the rate of uptake is modest as community tastes are not very accommodating. The EU funded project is also financing infrastructure (small dams, irrigation schemes and boreholes), introducing short cycle crop varieties and supporting production through developing business plans. Existing water reservoirs generally dry up at the end of the rains except in cases where the soils are impermeable in which case the water lasts till August. These are multi-purpose water points with potential for conflicts among users (humans and animals). An improved reservoir with geo-membrane seal is being piloted in Chigubo (to be completed by August). Reference was also made to the use of boreholes and drip irrigation in Inhambane Province. Potential interventions under the SPCR phase II could benefit from the results of the trials in conservation agriculture and piloted improved water harvesting infrastructure.

89. *National Institute for Disaster Management (INGC)*. The Limpopo Basin suffers from both drought and floods, with the droughts being more recurrent. In terms of flood management, the basic strategy is to strengthen capacities and organization at the local level. 83 local disaster management committees of volunteers have been established out of a total of 125. Of these only 12 count on the necessary basic equipment. JICA, however, is expected to provide an additional 150 equipment kits. A priority is to formalize the committees and to develop the appropriate incentives to ensure their continued functioning. An early warning system is in place using radio as the main communication tool. The expanding coverage of cellphones is also facilitating the system. Maintenance of dykes was recommended as a priority measure. The possible construction of a dam in Mapai (upstream) could help regulate water flows. In terms of drought, INGC recommended further promotion of drought resistant crops through demonstration programs accompanied with appropriate incentive schemes. Development of rain water harvesting schemes was also recommended for the drought prone areas.

90. *National Roads Administration (ANE)*. In the drought prone areas the roads are generally graded. Maintenance represents a challenge as it requires water, which is not readily available. On the other hand, however, there is less rain to damage the roads. The estimated costs of maintenance are US\$5000/km. Among the main road developments includes the upgrading of Road 221 from Guija to Chicualacala (to be financed by Portugal). In the mid-central part of the Province flash floods that make the roads impassable during parts of the year are a challenge. Possible measures could include culverts, but specific measures would have to be studied. The tertiary roads at the District level are managed directly by the Districts, with the technical guidance from ANE. In order to identify possible investments in tertiary roads (for example linking producers to market) discussions would have to be held in each District.

91. *Provincial Directorate for Public Works*. In the northern districts the priority is to ensure water supply to communities through either bore holes and or water harvesting systems. In terms of bore holes they have recently invested in new drilling machinery, but there are problems with salinity in the ground water. Water harvesting involves multipurpose small dams and at the household level, rain capture tanks. A system of water storage for domestic use has been established in various localities, but they still need investments for the distribution system to reach various villages (based on solar power). These systems will be community managed schemes. Studies are currently being updated for the Mapai Dam in the upper Limpopo River, which was originally designed in the late 1980s. The construction of this dam would allow for regulating water flows and it has potential for hydropower generation. Salt water intrusion in the lower basin is affecting agriculture production potential and further studies and possible investments were recommended. An initial study on saltwater intrusion has been undertaken by the Directorate for Agriculture, but a more comprehensive analysis is required. In terms of roads the main focus is on the roads that lead from the coastal area towards the inland.

92. *Hidraulica de Chokwe (HICEP)*. The Chokwe irrigation scheme receives water from the Massingir dam. The area is 33,000 ha; of which 23,000 ha are arable lands (the remaining part is not arable due to salinity). Of the 23,000 ha, approximately 7,000 ha have been rehabilitated with funding from OPEC, AFD and the private sector. The Islamic Development Bank has committed to finance the rehabilitation of an additional 7,000 ha. This leaves approximately 10,000 ha, which still need to be rehabilitated for

an investment cost of US\$41,000,000 (including rehabilitation of primary canals, secondary and tertiary irrigation channels, land leveling and the drainage system). The main costs for rehabilitation come from the need of dredging the channels that have been filled with sediment during the 2000 flooding event. Further heightening the protection dykes along the Limpopo River could be an adaptation option, but economic analysis would have to be done to analyze the viability of such an investment. 95% of the users are small-scale holders that are organized in farmers associations and they have already identified markets for their crops (mainly Maputo and to a lesser extent the northern Districts in the Province). The main crops are rice, beans and horticulture. The rice yields range from 3.5 -5.0 T/ha. The farmers pay US\$30/ha per year to use the land and benefit from the irrigation.

International Union for the Conservation of Nature. IUCN is currently implementing a project financed by Finland to address climate change adaptation in three districts. Among others, they are supporting the construction of dykes to prevent salt water intrusion in the lower basin and conservation agriculture in the upper basin. For the latter their strategy is to train extension workers. This intervention could possibly be expanded further through the SPCR with direct training of farmers (incl. demonstration plots).

Field visit to the Zambezi valley and the coastal city of Beira (April 11-17, 2010)

93. The Zambezi field visits were conducted by four joint mission team members, all of which were members of the World Bank. The team consisted of Jean-Christophe Carret, Marjory-Anne Bromhead, Anne-Louise Grinstead (only in Beira) and Jean-Marc Mayotte.

94. *Sunday April 11th.* In Tete, the team plus Alfredo Zunguze (Mopai smallholder project leader) and Tiago Luis (Mutarara smallholder project leader) met with the General Director of the Zambezi Valley Planning Office (GPZ) Dr. Sergio Chiar to discuss climate risks and adaptation on the Zambezi River. He was of the opinion that wide scale irrigation would be the best option for helping those along the river.

95. *Monday April 12th.* The team, along with Alfredo, Tiago visited the regional water authority, ARA-Zambezi, to discuss climate change and the Zambezi River, the current state of hydro meteorological monitoring along the river, and the need for detailed basin surveys. ARA-Zambezi emphasized that the lack of data regarding the layout and natural conditions of the Zambezi River was a significant hindrance to basin planning and should be the first priority for further investment.

96. *Tuesday April 13th.* The team, Alfredo, Tiago traveled to Doa and Mutarara, two small, very rural towns completely reliant on rain-fed agriculture for food and livelihood. The group arrived first in Doa, at which time they met an agricultural extensionist and local agriculture expert to aid in their tour around Doa. The group was taken first to a small fishing village isolated from Doa “proper” which used a lake filled by the Zambezi River floods as its fishery and livelihood. The group was then taken to a small village on the other side of Doa and introduced to another village entirely dependant of rainfed agriculture for livelihood. Both villages have been experiencing drought conditions and are experiencing food shortages. The chiefs of the administrative posts were met in both small villages outside of Doa. After the meetings the group plus the agricultural extensionist picked up in Doa traveled to Mutarara for

the evening, but prior to the departure a brief meeting was held with Serrao Quissimisse Picardo, the Chief of the Doa Administrative Post to discuss what was seen and acquire his input.

97. *Wednesday April 14th*. The day began with a short meeting with Fernando Simao Nhate, the Director of District Service of Education, Science, and Technology and acting Chief of the Mutarara Administrative Post to discuss Mutarara and its flooding problems. After the morning meeting, the group went to a small village just outside of Mutarara whose crop land had been flooded and is no longer usable. The village had been forced to abandon the land and relocate it to less fertile land away from the river. The team was informed that small dikes used to protect the area from floodwater inundation but they were no longer functional thus leaving the land unusable. The group then went to a village a short distance away where the inhabitants were experience the opposite problem in that they had not enough water. The village is located on a seasonal river bed where surface water is available only 3 months a year during the rainy season. After this period water is only available in deep within the river bed and women are often times sent long distances to retrieve water. The last stop before departing Mutarara was just outside of the town where the Zambezi River was responsible for cutting the bridge between Mutarara and Mopai and effectively cutting the town off to transit and trade to the east. The “bridge” is just a series of culverts meant to drain a small amount of water between the river and a flashy tributary but because of deforestation the tributary has eroded into to a flood plain. During times of flooding, the culverts cannot adequately pass the water and the road is washed out. Inhabitants deal with the problem by forging the stream during times of low water with motorbikes and by foot but no cars or trucks may pass.

98. *Thursday April 15th*. The team’s first meeting was with the Regional Director of INGC’s Zambezi Field response office. He emphasized that the lack of road access between towns and districts was a great hindrance to flood response and often times forced teams to respond via boat. He also helped to clarify the institutional responsibility of INGC, in that they are responsible for anything deemed to be flood response (i.e. rural relocation and road re-building of flood affected roads).The second meeting was with Andre Chachine of the National Road Administrate (ANE) in Quelimane. The meeting focused on the poor quality of the roads along the lower Zambezi specifically between the villages of Mopai and Luabo and along the coast between Quelimane and Chinde along the central coast of the country. There was also a discussion differentiating the responsibilities of INGC and ANE in regards to the restoration of flood damaged roads and dikes meant to protect them.

99. *Friday April 16th*. The team first met with Mr. Jeremias Liando, the Urban Environment Manager of Beira. The discussion was about the rainfall and storm surge flooding that affects the sewage and drainage systems of Beira. Current storm water drainage is set up such that storm water is allowed to flow out to sea when the sea is low. However, during high seas, the sewers are shut in order to prevent seawater from inundating the drainage system. If high seas coincide with a heavy rain event then significant urban flooding can occur due to a lack of drainage. Running through the city of Beira is a natural stream that used to aid as a natural drain during rain events but the river’s outlet has been filled in to accommodate the ever growing port essentially making the river stagnant. Circumventing Beira are two canals which are used to divert seawater around the city during times of storm surge however the canals no longer work correctly and the circulation of sea water once achieved is no longer. Another

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major topic of discussion was the degradation of the mangroves along the beach and the beach itself. Current adaptation measures (breakwaters, dunes and dune restoration, and an ill-placed seawall) are not sufficient enough to maintain the beaches of Beira thus allowing seawater to encroach closer and closer to inhabitants and infrastructure each year.

100. The second meeting of the day was with the Mayor of Beira, His Excellency Mayor Daviz Simango. The discussion, again, revolved around the storm water drainage and its inefficiencies and reemphasized the importance for beach protection and restoration. H.E. was adamant that coastal protection was Beira's first priority and everything else paled in comparison to its importance, but was keen to the idea that smaller adaptation measures and project implementation could be just as useful (i.e. restoration of the natural river flows and institutional capacity building). The day ended with the team visiting the deteriorating breakwaters, the disappearing beaches, the stagnant inner-city river, the degraded storm surge canals, and the mouth of the storm drainage system. Most impressive was the rate at which the beach was disappearing and its ever increasing proximity to important infrastructure such as roads and housing.

Annex 3: Stocktaking of past and ongoing Climate Change Adaptation activities

Studies

101. During the SPCR it was made apparent that there is substantial knowledge regarding climate change and its impacts in Mozambique. The Purpose of the studies portion of the SPCR Stocktaking is to make the current knowledge base available to those interested.

102. The current studies examine on the impacts of climate change at a broad, country wide, scale. This broad view of the impacts can provide information on where the most problematic and vulnerable areas of Mozambique may be. For example, the INGC Phase I study focuses on a substantial subset of Mozambique's disaster prone areas and how their vulnerability is affected in lieu of climate change. The agricultural sector appears to stand out as particularly vulnerable. Phase II of the INGC study (the proposal is mentioned in the stocktaking) builds on the knowledge base of phase I and will build a more acute view of climate effects in specific areas.

103. The studies within the stocktaking should be used to sharpen the knowledge base and provide qualitative backing for specific impacts and adaptation strategies. If done effectively, adaptation strategies can begin to be implemented immediately and little time and resources can be wasted.

Programmes, Projects, Strategies, and Studies

104. Substantial progress has already been made by the government of Mozambique and many of the development institutions within regarding the framework for implementing adaptation strategies. If the programmes, projects, strategies, and policy guidance mentioned within these the SPCR stocktaking are used as the framework for development adaptation strategies may be implemented rather rapidly.

105. The framework has already been set regarding adaptation to climate change at a broad level. Adaptation priorities, specific institutions, and general adaptation strategies have been outlined. Little additional effort should be put into changing this framework.

Programmes and Projects

1. Africa Adaptation Programme: Climate Change Adaptation Action and Mainstreaming in Mozambique, Government of Mozambique and the United Nations Development Programme (UNDP), 2009
2. Joint Programme: Environmental Mainstreaming and Adaptation to Climate Change in Mozambique, FAO, UNDP, UNEP, UN/HABITAT, UNIDO, WFP, Ministry of Coordination and Environmental Affairs (MICOA), Ministry of Agriculture (MINAG), National Disaster Management Institute (INGC), National Meteorology Institute (INAM), 2008
3. Responding to Climate Change in Mozambique: Project Proposal INGC Phase II, National Institute for Disaster Management (INGC), JUNE 2009
4. Strengthening Local Risk Management and Mainstreaming Disaster Risk Reduction, Government of Mozambique National Disaster Management Institute and United Nations Development Programme Bureau for Crisis Prevention and Recovery, 2009
5. Market-led Small-holder Development in the Zambezi Valley Project. World Bank. 2007

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6. Mozambique Country Disaster Risk management Plan. World Bank. 2009

Strategies

7. Mozambique Country Water Resources Assistance Strategy: Making Water Work for Sustainable Growth and Poverty Reduction, The World Bank, August 2007
8. National Adaptation Program of Action (NAPA), Ministry for the coordination of Environmental Affairs (MICOA), December, 2007

Studies

9. Climate change modeling and analyses for Mozambique, Final report detailing the support provided to the *Instituto Nacional de Gestão de, Calamidades* (INGC) adaptation to climate change project
10. Disaster Risk Profile: Mozambique, Disaster Risk Management Programs for priority countries Africa, 2009
11. Economics of the Adaptation to Climate Change, The World Bank, 2009
12. Mozambique Climate Risk Fact Sheet *DRAFT*, The World Bank, 2007
13. Mozambique: Economic Vulnerability and Disaster Risk Assessment, RMSI and The World Bank, September, 2009
14. Study on the Impact of Climate Change on Disaster Risk in Mozambique: Main Report (Phase I), National Institute for Disaster Management (INGC), June 2009
15. Zambezi River Basin Multi-Sector Investment Opportunity Analysis: Preliminary Report, NIRAS & BRL *ingenierie*, May, 2009
16. The Zambezi River: Its Threats and Opportunities: 7th River Symposium, Zambezi River Authority, Michael J Tumbare, September 2004
17. Making Transport Climate resilient. World Bank. 2010 (on going)

Annex 4. Brief description of the proposed three Poles

The Limpopo Watershed

106. Mozambique shares the Limpopo basin with three other countries, namely, Botswana, South Africa and Zimbabwe, and it hosts 19.3% of the total basin area. In the Limpopo basin, drought is the most common and devastating natural hazard affecting the livelihood of the population. The Chicualacuala District, in the Province of Gaza, is the geographical entry point of the Limpopo Basin into Mozambique.

107. The Limpopo River has five effluents: the Munene, Nuanetzi, Chefu, Singuedzi and Elephants rivers. The flow rates vary considerably during the year and the basin area experiences increasingly frequent and severe climate related disasters in the form of droughts and occasional floods, which have serious negative consequences on the livelihoods of the people living there. According to INGC, on a scale of Very Low-Moderate-Very High Drought Hazard Index (DHI), Chicualacuala has a high DHI. Consequently, there is a high chance of crop failure and/or agricultural production variation due to erratic rains that occur only a few days during a 2-3 month period (with less than 500 mm of rain per year).

108. A severe drought in 1991-93 affected 1.32 million people throughout the whole country. The Limpopo Basin faces droughts regularly, such as the 2002 drought that affected some 43 districts in the South and Central Provinces. The flow of the Limpopo River is irregular during the dry season and it comes close to drying out upstream. Occasionally, heavy and excessive rains may occur and the water level of the Limpopo River rises. The severe flood of 2000, caused by unusually heavy rainfall and the additional burden of three cyclones, killed approximately 800 people, affected 2 million people along the main branch of the Limpopo River and damaged productive infrastructure (for example the irrigation schemes). For instance, about 90 percent of the population of the Chicualacuala district (one of the worst affected areas by the drought) lives in poverty, thus not being able to meet their basic food and non-food needs. Chigubo district is another area that is frequently adversely affected by droughts.

109. A land suitability map indicates several constraints for agriculture, with most of the area classified for pasture and forest and small patches for agriculture with low productivity. The suitable areas for agriculture/livestock are situated at the eastern boundaries, which may receive some rains during the winter. Downstream there are 90 000 ha of potentially suitable land for irrigated crop production, yet to be properly exploited rainwater harvesting techniques and investments in efficient irrigation systems will be required. Given this situation, livestock production/animal husbandry and wildlife game farming (60% of the Limpopo National Park forms part of Chicualacuala district) might offer the predominant opportunities for development to improve and diversify community livelihoods. Logging, harvesting of wood for poles, firewood and charcoal are the main non-agricultural income generating activities.

110. During SPCR phase 1, an evaluation of climate change impact on livelihoods (crops, forestry, livestock, water, fisheries etc.) will be undertaken in selected districts in order to determine the levels to which these livelihoods are vulnerable to adverse climatic events. Options for livelihoods diversification will then be identified through a participatory mechanism with local communities. This analysis will build upon, among others, the recently completed vulnerability assessment carried out in the Chicualacuala district within the framework of the Joint Programme on Environmental Mainstreaming and Adaptation to Climate Change in Mozambique financed by the United Nations. Lessons learned from other previous programmes in the Limpopo basin will also be considered (for example past and ongoing FAO projects).

111. The pole will be an integrated adaptation demonstration project that can build upon previous and ongoing interventions. Currently the African Development Bank is financing the Massingir Dam and smallholder agricultural rehabilitation project, through which an additional spillway in the dam will be constructed and the damaged bottom outlets will be repaired in order to ensure efficient utilization of the water in the Dam for irrigation downstream. The Massingir Dam is the only large scale water regulating and storage infrastructure in the upper basin. Consultations with the Ministry of Agriculture showed that the drought mitigation and adaptation approach for the Limpopo basin would focus on water harvesting in the drought prone areas, coupled with the promotion of conservation agriculture and drought resistant crops. Water efficient irrigation schemes (i.e. drip irrigation) could possibly also be considered in the upper basin (either linked to the Massingir Dam or smaller reservoirs that could be created). In the lower basin where water is more readily available the approach would be to rehabilitate and expand the irrigation network, as well as address issues related to salt water intrusion. INGC has pointed out that additional water regulating infrastructure would be beneficial for flood control. There is also a need to upgrade the existing hydro and agro-met system in order to ensure accurate and timely available information required for decision making. Also in our discussion with SETSAN the Limpopo basin has also been identified as a weak and vulnerable link in the food basket chain in the southern part of Mozambique with considerable threats of food insecurity. The proximity of Maputo, the capital, to the Limpopo makes the Limpopo basin an excellent supplier of food commodities if an adaptation project is introduced. During Phase I of the SPCR an assessment would be carried out to identify the most appropriate water harvesting measures and techniques for the drought prone areas, as well as an assessment of the existing hydro and agro-met system.

112. Among the adaptation concepts to be applied and because of the short duration of the agricultural growing season, it is imperative to introduce short-cycle varieties and techniques for soil improvement and moisture conservation, in order to enhance household food security for the rural population. In Phase I of the SPCR a study would be conducted to assess past and current experience in the Basin on conservation agriculture and design appropriate measures to expand uptake (i.e. incentive schemes, technology transfer mechanisms, sustainability measures). The Bank is currently financing, together with other development partners, a rural finance program. During Phase I of the SPCR an analysis will be undertaken to identify opportunities for promoting climate change adaptation projects under this financing scheme (i.e. adapting credit manuals and criteria, establishing a special credit line for conservation agriculture).

113. In order to address the needs of the people in the Limpopo basin and taking account of its current climate vulnerability, it is important to: (i) identify and map the zones that are likely to be most affected; (ii) reinforce the mechanism to forecast the occurrence of climate-related events thus the installation of agro- met stations; (iii) embark on integrated activities that increase the resilience of communities; and (iv) incorporate climate change adaptation into strategies, policies and development sectoral plans (agriculture, land use, infrastructures, irrigation, etc..). Some of the specific actions include increasing water quality and supply for different purposes; increasing livestock production and milk supply; planting indigenous and exotic trees with a view to improve the fodder supply and protect crops against wind and heat; introducing drought-resistant crops; construction and using small-scale irrigation systems and appropriate water management techniques; building compost plans to diversify the supply of organic fertilizers thus reducing the chemical fertilizers bill and increasing the production yield per hectare by improving soil conditions; mulching to improve soil moisture; encouraging milk processing; establishing an accessible financing mechanism; and promoting developing markets for agricultural products. All of these will need to be implemented in a manner that improves gender equity,

empowers women, and builds the capacity of local communities to bargain and negotiate their terms of trade and diversifies and sustains their livelihoods.

114. Thus, the Limpopo Adaptation Project (LAP) may include three components:

- i. A “hard” adaptation component developing infrastructure for water harvesting in the drought prone areas, coupled with efficient irrigation schemes (such as drip irrigation), and in the lower basin small scale infrastructure aimed at preventing further salt water intrusion as well as adapting current large scale irrigation schemes to make them more water efficient and climate proof;
- ii. A “soft” adaptation component consisting of: community based water resources management; small scale irrigation; small scale holders conservation agriculture; improving access to markets, value addition on produce and post-harvest loss minimization; construction of compost plants to provide organic fertilizers; animal husbandry and biogas household digesters for production of electricity for cooking; reforestation and afforestation and community woodlands management; erosion and soils management; and selected policy interventions related to the investments;
- iii. Project management, capacity building and monitoring and evaluation.

115. The table below provides an indicative budget for the potential investments under SPCR Phase II in the Limpopo Basin

Indicative investment item	Indicative budget
Water harvesting improvement and expansion <ul style="list-style-type: none"> • Water harvesting infrastructure at the community level; • Community capacity building in water harvesting techniques and water resources management • Efficiency enhancement in irrigation schemes 	12,000,000
Salt intrusion prevention measures <ul style="list-style-type: none"> • Salt water intrusion prevention infrastructure • Salt tolerant plants • Technology transfer mechanisms 	4,000,000
Improvement of agriculture production systems <ul style="list-style-type: none"> • small scale irrigation; • small scale holders conservation agriculture (training, demonstration plots, inputs, special line of credit); • drought resistant crops; • short cycle crop varieties; • improving access to markets, value addition on produce and post-harvest loss minimization; • construction of compost plants to provide organic fertilizers; • animal husbandry and biogas household digesters for production of electricity for cooking; • reforestation and afforestation and community woodlands management; • erosion control and soils management; 	18,000,000
Climate Change Adaptation Policies and Institutional Strengthening <ul style="list-style-type: none"> • Adjustment to building codes for public infrastructure (for example schools, health posts, government buildings) in drought prone areas (water efficient structures); • Integrating climate change in territorial and land–use planning (adjusting 	2,000,000

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guidelines and application in selected areas and districts); <ul style="list-style-type: none"> • Reforms to rural finance to incorporate climate resilience (guidelines, credit evaluation criteria, special credit lines); • Incorporating climate change adaptation modules in selected tertiary and vocational education curriculum; • Adjustment of road maintenance standards and material composition to better withstand climatic variability; • Introduction of climate change adaptation criteria in agriculture food production action plan. 	
Project management, capacity building and monitoring and evaluation	4,000,000

116. During the mission in April 2010 the following studies have been identified for funding under the SPCR Phase I:

- i. Evaluation of climate change impact on livelihoods (crops, forestry, livestock, water, fisheries etc.) in three selected districts in the Limpopo Basin in order to determine the levels to which these livelihoods are vulnerable to adverse climatic events and identify options for livelihoods diversification through a participatory mechanism with local communities.
- ii. A study on climate change adaptation options for water and food security that would:
 - a. Evaluate existing local water harvesting techniques in the Limpopo Basin and propose options for further improving water harvesting capacities;
 - b. Carry out an economic analysis for the expansion of water harvesting options;
 - c. Carry out a climate change vulnerability assessment of current agricultural production systems in the Limpopo Basin (including the irrigation schemes) and explore opportunities to further expand conservation agriculture as an adaptation measure (i.e. incentive schemes, technology transfer mechanisms, credit schemes, sustainability measures);
 - d. Carry out an economic analysis of reinforcing the protection of production infrastructure (irrigation schemes) vs. periodic rehabilitation following extreme events (such as the 2000 floods);
 - e. Analyze the threat from salt water intrusion and salinization on food production (both in lower and upper Limpopo basin) and identify options for addressing this threat (including potential infrastructure);
 - f. Assess the existing agro and hydro-met system in the Limpopo Basin and a preliminary design of an improved system.
- iii. A situational analysis of climate change adaptation focusing on various institutional actors and their roles in achieving the objectives of the SPCR particularly in the water, transport, agriculture and fisheries sectors.

The Zambezi Basin

Introduction

Analytical work has identified Central Mozambique, including the Zambezi Valley, as especially vulnerable to the effects of climate variability and change, including both floods and droughts.

117. The Lower Zambezi Basin in Mozambique is home to 5 million people, one-quarter of Mozambique's population. With 5.5 million hectares of arable land it accounts for 15% of the country's total arable area. Hard-hit by the war, recovery has been impressive but many areas still suffer from poor access and high levels of poverty. Subsistence agriculture is the predominant economic activity, one third of the population is judged to be food insecure, enrolment in secondary school is less than 10 percent and in primary school less than 60 percent. Road access is very poor and access to electricity almost non-existent outside the main towns. The basin includes Tete province and parts of Zambezia and Sofala provinces. Much of the population lives close to the Zambezi River and its tributaries and delta. The most fertile land is found in the flood-prone riverine wetlands and delta, which is also important for fisheries. Tete is growing rapidly as a regional centre, linked to mining developments as well as its accessibility to nearby Malawi and Zimbabwe. Mining and the activities associated with its processing and export (much is good quality and will be exported) will play a major role in the transformation of the local economy.

Key climate vulnerabilities

118. Central Mozambique is highly vulnerable to climate variability and change, with vulnerability to both floods and droughts. Rainfall varies substantially within the basin, with Sofala and Zambezia provinces recording up to 1500 mms of rainfall while rainfall in Tete averages 600 mms. Climate models predict increasing variability of rainfall in the region, and incidence of both floods and droughts in the basin. Summer temperatures are the highest in Central Mozambique, and temperatures are predicted to increase by 1 to 2 degrees Celsius by 2050. Models also indicate that the sectors most affected are agriculture, road infrastructure and coastal developments. Vulnerabilities are exacerbated by the pressure on ecosystem services from current subsistence-based land-use practices. Developing climate resilient agricultural and forest land-use practices and investing in climate resilient road infrastructure is thus key to the economic well-being of the population of the Basin.

119. Mozambique as the downstream riparian of the Zambezi, is vulnerable to the impact of land and water management practices in the upstream countries. Total average annual run-off is estimated at 108 billion m³ per year, of which about three-quarters originates in the upstream countries and nearly 20 percent from the Shire river, which originates in Malawi and enters the lower Zambezi about 200 kms upstream of the delta. Except for water originating in the Shire, the middle and lower Zambezi is largely regulated by two large dams developed largely for hydro-electric power, the Cahora Bassa in Tete province and Karibe on the border between Zimbabwe and Zambia. There is substantial potential for further developments along the basin hydro-electric power generation to serve growing markets in South Africa, Maputo and the SADC countries and a number of schemes are under study. These could generate revenues for the government over the long term to use for further socio-economic development programs which would benefit local populations and reduce vulnerability through broad based development and diversification, but could impact further river flows within Mozambique. As long term very large scale investments they fall outside the scope of the SPCR at this time. Within Mozambique the Cahora Bassa dam and its large reservoir, developed for hydro-electric power, also influences flows downstream.

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120. There are also plans to build another dam, with a smaller reservoir, downstream of Cahora Bassa, the Mphanda Nkuwa, which could generate a further 2200 MW. This proposal together with broader options for development of the Zambezi have been the subject of an investment analysis options study (Zambezi basin: Multi-sector investment opportunities Analysis May 2009), whose implications for Mozambique are summarized in the attachment to this annex. Although they are very important to the overall development of the SADC countries they lie outside the scope of the SPCR. Furthermore despite the regional importance of Zambezi development, much flood damage within Mozambique's borders is also caused by flashy floods originating in smaller tributaries.

121. There is a protocol for cooperation on water resources development among the Zambezi basin countries (SADC Protocol on Shared Watercourse Systems, 1995) which commits the riparian countries to integrated water resource management principles. A Basin strategy was prepared in 2008 which identifies key actions to address climate variability and change, including vulnerability assessment, improved flood and drought management and land use planning.

Institutional context

122. Mozambique has gone through a de-concentration and decentralization process, with decision-making increasingly delegated to local authorities at provincial, district, municipal and local level. The Zambezi Valley Development Authority (GPZ), located in Tete, coordinates overall development within the Mozambique portion of the basin, while river basin development is coordinated by the Zambezi river Basin organization (ARA). The Zambezi Basin Disaster Risk Organization INGC is located in Caico, and coordinates disaster preparedness, early warning and recovery organizations as well as resettlement programs for families who have lost their homes in floods. There is a long term program, with strong community participation, to resettle over 200,000 households from flood plains to higher ground. There may be scope, however, to advance further alternative "living with floods" strategies which do not entail moving communities. Meteorological stations are maintained by INAM but there is inadequate coverage in the Basin. Mozambique benefits from a relatively well developed local government structure, at district, administrative post and village level with a good tradition of local consultation. Institutions, at provincial and local government level, show a high awareness of climate risks and a number of government funded activities to address these risks are ongoing.

Infrastructure

123. Improved access through an adequately maintained rural and secondary road network has been identified by the Economics of Adaptation Study as a highly cost-effective adaptation strategy, permitting also development of more diversified, resilient economies and trade. Both national and local authorities and local populations also regard improved access as a high priority.

124. Roads are constructed and maintained by different authorities, depending on the road class; the National roads authority has responsibility for national roads and district authorities for local roads. Transport infrastructure in the basin is inadequate. Secondary and rural road coverage in particular is inadequate, with culverts not constructed, and lack of access following rains. Goods are generally carried on bicycles or by people directly in head-loads. Road access from Tete to the railway bridge crossing at Sena is being re-routed away from the river to higher ground following broadly the line of the railway. Japanese assistance has financed major bridges but the road overall is in poor condition.

125. A strategy of increasing budget allocation to maintenance and construction of all-weather roads would appear to be a priority for the basin. The single-track rail line from Beira to Tete has recently been rehabilitated and will open to traffic shortly. The ferry across the Shire river does not function for safety reasons in the flood season. In the delta towns and villages are frequently cut off; construction of a road

from Quelimane to Chinde in the delta is regarded as a priority by the provincial department of the National Roads Administration. Regarding lower lying roads for which there is no alternative route the Roads administration is considering different design options, including raising the level of the road, increasing the number of drainage channels and culverts, and constructing protective dykes.

One option to be considered as part of a strategy addressing resilience and poverty reduction in the Zambezi Basin would be a focus on improving road infrastructure.

Agriculture, Forestry and Fisheries

126. Rainfed agriculture is by far the principle source of livelihood in the Lower Zambezi Valley, accounting for employment of 80% of the economically active population and 28% of the Valley GDP. The main crops are sorghum, millet and maize, with cassava in the more humid areas and rice in the delta. Beans and cotton are the main cash crops, and agriculture is predominantly rainfed. About 450,000 ha is currently cultivated though there are 5.5 million ha of potentially arable land. There is a large irrigated sugar plantation (5,700 ha) and irrigation development both for smallholders and for largescale production is seen as a priority adaptation strategy. Its cost (US\$ 5,000 per ha) and the lack of experience of smallholders with irrigation in the Valley, imply that a cautious approach should be taken to smallholder development. The Government have asked for World Bank assistance in development of a new project focused on irrigation in the Zambezi Valley. Preparation is likely to start early next year, and to combine small-holder, outgrower and larger scale, private-sector led developments, together with both land capability and land use mapping.

127. Despite the potential yields are low and one-third of the population is regarded as food – insecure. There is much that Mozambique in the Zambezi valley to improve land-use practices and make its population more resilient to climate variability and change. Access to improved agricultural inputs is limited; only 4% of farmers use fertilizer and 10% animal traction. Hence agricultural and woodland land-use practices are extensive, exposing soils to erosion and with widespread seasonal burning. 60% of Mozambique’s irrigable area is in the Zambezi Valley but apart from some small-scale NGO-led interventions, initiatives to promote irrigation have so far had little success.

128. The Valley is already participating in a World Bank and GEF supported program for market-led small-holder development, which is being implemented in five districts through Mozambique’s decentralized planning mechanisms. The project includes participatory agricultural and land-use planning processes, and support to climate resilient sustainable land management intervention measures such as agro-forestry, soil conservation, wetland protection and fireless honey collection methods, small scale irrigation and improved grazing management, and access infrastructure. It builds on the NAPA and supports (i) improved collection of meteorological data and weather forecasting, (ii) enhanced capacity of farmers to collect and store water to mitigate droughts and develop drought and flood management plans; (iii) mapping of land cover dynamics and erosion vulnerability in coastal regions; (iv) improved characteristics and use of hydrological resources; and (v) training and capacity building. It specifically supports development of a dynamic landscape/water resource analysis framework for the Zambezi Basin, including predictions of the consequences of climate variability and land use/land cover change; and geospatial hydrological models. Impact monitoring programs have also been developed. The recently completed mid term review of the project rated the GEF conservation agriculture component the most successful of all of the program activities.

129. Fisheries make a major contribution to the local economy of the Lower Zambezi, with highly productive flood plains, wetlands and the delta. The reservoir of Lake Cahora Bassa also produces about 16,000 tons of fish per year. Average catch in the Delta is estimated at 10-14,000 tons of shrimp and a minimum of US\$ 10,000 of freshwater fish; fish from the river floodplains are also processed (smoked

and/or dried) and exported to Malawi. Fisheries production can successfully be co-managed with flood plain agriculture, which is common in the delta, but both are highly dependent on river management regimes.

130. A second option for the proposed PPRC program in the Zambezi Basin would build on and scale up these interventions, “learning by doing” and with additional focus on monitoring and integrating natural resource and agriculture interventions with interventions to address climate risks in roads and buildings. The objective would be to support integrated climate resilience at a scale sufficient to have substantial impact and provide lessons for sectoral and spatially based interventions elsewhere in the country.

In summary, the SPCR phase 1 would examine options for investment in climate resilience in the Zambezi Valley, focusing on road access and improved land use and water management practices. It would firm up an investment program based both on prioritization exercises undertaken with local stakeholders, on “readiness,” complementarity with ongoing programs, institutional assessment and cost-effectiveness, and on options which emphasize poverty reduction, learning by doing and building more resilient communities.

Attachment 1: Implications of Water management practices for the Lower Zambezi

131. The Zambezi River Basin Multi-Sector Investment Opportunities Analysis: Preliminary Report was completed in May of 2009, funded by the World Bank and completed by NIRAS and BRL Ingénierie. It is a very detailed analysis of the entire Zambezi River basin which is meant to examine the historic and future management of basin.

132. The study received some criticism for its climate change analysis as it only accounted for changes in evapotranspiration due to increased temperature and did not account for changes in runoff widely predicted by General Circulation Models. Nevertheless the historic analysis was done with exceptional care, and remains one of the only comprehensive studies regarding the entire Zambezi River Basin. The issues in Mozambique regarding flood timing and the management of Cahora Bassa are not solely due to climate change and its effects on precipitation and potential evapotranspiration. While climate variability plays a significant part in natural flood timing, the level of current development on the Zambezi River Basin and the management practices at the barrages within will play as significant a role as climate change itself. The Multi-Sector Investment Opportunities Analysis examines these management practices very well and models potential future basin management under a suite of scenarios. The following paragraphs summarize the principle conclusions regarding current water management for Mozambique.

Cahora Bassa and the Lower Zambezi

133. The Zambezi River Basin accounts for almost 1.4 M km² of catchment area and more than 100,000 Mm³ of estimated mean historic annual runoff flowing into the Indian Ocean. Of this, more than 80 % of water runs goes through the Tete province and through the Cahora Bassa barrage. The remaining runoff comes from the Shire River/Lake Malawi and the Zambezi Delta. Current management practices at Cahora Bassa aim at meeting a “Firm Energy” requirement, i.e. Cahora Bassa will be able to supply the promised amount of energy with 95-99% confidence. This requires the reservoir to operate with a consistently high storage elevation such that there is little variance in the hydropower output and to ensure that during times of little or no rain, this power output can be met. Most of the electricity generated is exported or transported other regions.

134. It is estimated that at its fullest, Cahora Bassa holds 66,000 Mm³ of water and covers over 3000 km² of land. This is about 70% of the mean annual flow of the entire basin above the barrage. This suggests that there is more than enough capacity in Cahora Bassa to manage flooding if it were seen as the number one priority, but this is not practical given that Cahora Bassa has over 2,000 MW of potential currently installed and the market for electricity in South Africa is substantial. Therefore, the reservoir's primary operation is currently used solely for hydropower production and insuring the firm power output. This means that for the downstream portions of the basin the flood timing is significantly changed. During the wet season, reservoirs retain water by releasing less than what is entering the reservoir. This storage is then released during the dry season in order to insure the firm power demand is met during low flow periods resulting in a complete change in flood timing downstream of Cahora Bassa. The natural peak flows are reduced and the traditionally low flows during the dry period are increased thus "spreading" the annual runoff across the entire year instead of polarizing it into low-flow and high-flow periods.

Implications of Cahora Bassa management practices

135. The changes in the natural flood timing affect the Lower Zambezi Basin in many ways; some of which are desirable changes, others are not.

136. The management regime results in reliable power output at the barrage providing steady revenue to Mozambique as per the design of the barrage. Cahora Bassa has also managed to reduce the flood flows resulting from high flow on the upper reaches of the Zambezi Basin. This has both desirable and undesirable effects. On one hand this benefits the population of the lower Zambezi in that it all but eliminates flash flooding events close to the barrage and reduces the river's inundation of the lower Zambezi floodplains during the flooding season. However, it is these benefits that are the primary cause of some significant problems downstream. The reduced flow rate during flooding periods results in a slower flow velocity and increased sediment deposit in the mid reaches of the basin. As sediment deposits accumulate, the river becomes shallower in certain areas which increases both the river's and the floodplain's width and thus exacerbates the effects and unpredictability of flood events.

137. Furthermore, as sediment deposits upstream less will continue on into the Zambezi Delta thus affecting the fisheries. River deltas are excellent places for spawning as a direct result of the increased sediment in the water. The sediment added to the water decreases the visibility and increases the nutrient concentration thus providing optimal conditions for young fish. As sediment is deposited further upstream of the delta, less is allowed to reach the estuary, the ecosystem becomes a less optimal spawning ground, and fishery yields are decreased.

Conclusions

138. Flooding in the Zambezi River basin is a significant problem, regardless of its natural or altered timing. The management at Cahora Bassa has reduced the peak flow rates during the flood season but flooding remains to be a significant problem in the Zambezi River Basin, a problem that cannot be "fixed" by changing the operation or storage capacity of Cahora Bassa alone. While it is physically possible for Cahora Bassa to further mitigate flooding on the Zambezi contractual obligations to provide a firm power demand prevent any substantial deviation from current operating rules. Furthermore, much of the flooding in the Zambezi River Basin is on the Zambezi's tributaries below Cahora Bassa and cannot be mitigated at the barrage.

139. Managing the flooding in the Zambezi River Basin will require an integrated approach; one involving many variables, the involvement of many agencies and, ideally, international cooperation

between upstream and downstream users. Among the priorities to the basin, and the country at large, is to increase the knowledge of the physical characteristics of the basin via detailed geographic surveys, increased climate and flow monitoring capacity, and adequate hydrologic modeling.

140. Consultations with stakeholders in Maputo, Tete, Caia, and Mutarara, (the last three being cities within the Zambezi Basin) all agree that the surveys of the Zambezi valley are too old and do not reflect current basin characteristics. In order to accurately assess the condition of the Zambezi River and its floodplain there must be detailed topographic information of the basin itself, especially in areas of dense population. Without this information development strategies may not achieve desired affects. The same consultations also expressed the need for additional capacity to monitor transient basin characteristics (i.e. flow rates and precipitation). As previously mentioned, much of the flooding along the main stem of the Zambezi is a direct result of flash flood events on the tributaries of the Zambezi River. Stakeholders repeatedly stressed that there is a severe lack of data, let alone real-time information regarding the meteorological conditions and flow rates on these tributaries. This information is vital in order to insure that further development of the Zambezi basin is done such that it is in harmony with the river's ever changing characteristics and to aid in changing the paradigm on the lower Zambezi River from that of the interests of individual users to a more homogenous view of the lower basin in its entirety.

Attachement 2: Monitoring of Mozambique's Transient Hydrology

141. Development and management of water resources requires an efficient and reliable means of communicating the transient state of the system. This information is a very important for safety and operation of the system (i.e. reservoir releases), helps to see the system as a homogenous entity, and, at the same time, benefits individual stakeholder interests. Currently, there is little capacity to monitor, in real-time, exactly what the weather conditions are in Mozambique, let alone provide a substantial forecast. With accurate information about precipitation timing and quantity, stakeholders may make informed decisions regarding use of the water. For example, a farmer may choose to not lay fertilizer on a day suspected of rain for fear of it leeching into the groundwater and becoming unusable, a reservoir operator can begin a slow and timely release of storage knowing of an approaching storm, or residents on a tributary stream could be given warning of an approaching flash flood.

142. Adequate hydrologic monitoring for a region requires the monitoring of current weather conditions and the resulting surface water runoff. Weather stations can provide real-time estimates of rainfall, temperature, humidity, pressure, and other valuable information. Stream gauges monitor the amount of precipitation that turns into runoff. The data generated at both can be used for academic purposes and immediate implementation. Secondary to this would be the ability to forecast near-future weather conditions (hour, day, week forecasts).

143. The current monitoring capacity in Mozambique is not good. The majority of those consulted during SPCR field visits emphasized that monitoring along the Zambezi River was insufficient, especially along tributary rivers of the Zambezi River. Flash flood events along tributary rivers are responsible for much of the flood problems along the Zambezi River and there is little or no warning of their approach. Streamflow monitoring on the Zambezi itself at the border of Zambia and Mozambique is not sufficient. Managers at Cahora Bassa must rely on the information being given to them from further upstream at Kariba regarding streamflow. Agriculture management and land use planning is done without sufficient information regarding characteristic precipitation in the region.

144. The capacity to maintain current monitoring stations and process data is insufficient. Building this capacity (i.e. maintenance technicians, data collectors, guards to protect remote stations, etc) is needed at the same time as the installation of the monitoring stations. Currently, the Mozambique

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Institute for Agronomic Research (IIAM) is responsible for maintaining weather stations and disseminating information to other agencies in need of the data. Consultations with them revealed that they do not have sufficient capacity to maintain the current number of stations and record data. Recent studies by the National Institute of Disaster Management (INGC) use meteorological station data (precipitation and temperature) for much of the analysis, but they are limited to only 27 stations for the whole country, most of which are concentrated along the coast (Figure 5). According to the INGC study, the Gaza Province, known historically for being a place of significant water stress and arguably one of the most important places for adequate modeling, has no working meteorological stations and precipitation data for these areas is interpolated using the costal data. The Tete Province, an area with extremely spatially varied rainfall and the Cahora Bassa barrage, has one working station.

Figure 5: Meteorological stations used in INGC study



145. Building the capacity to monitor Mozambique's transient hydrology is important in order to properly develop its abundant water resources. Consultations with IIAM suggested that the entire network would need to be redone; starting from scratch using new, more automated technology. Automatic weather stations and stream gauges require less on-site attention to collect data as it is sent remotely, via satellite or radio, and needs little infrastructure surrounding it because most are solar powered. However, many of the components of the station can be highly valuable meaning the stations must be protected from vandalism.

146. Installation and monitoring of the network would almost certainly be led by IIAM. However, the design of the network should be done in cooperation between all stakeholders such that the information from each station can be used for a variety of purposes.

Coastal Protection, including the Town of Beira

The NAPA identified coastal protection as a priority, as did the EACC (Economics of Adaptation Study). INCG studies have indicated that the coastline central Mozambique, including the city of Beira, is particularly vulnerable to the effects of climate variability and change, including floods, coastal erosion and the effects of sea surges from storms at sea. These weather events are likely to become more frequent and extreme over the coming decades. 60% of Mozambique's population lives on or near the coastline. Central Mozambique has considerable variations between high and low tides (7 meters, compared with 2 to 3 metres in the north and south) and is especially vulnerable to tidal surges associated with tropical storm events.

147. Beira, in the province of Sofala in Central Mozambique, has a population of about 600,000 and is the oldest and second largest city in the country. It is a major port and gateway to Zimbabwe and Zambia, and has extensive, attractive beaches to its northern suburbs as well as a city centre with some historic features. There is substantial irrigation and commercial agriculture potential in the Pungwe Valley. Badly damaged in the war, the economy is now recovering. The port area is liable to flooding and is protected by a sea-wall, which, however, is inadequate to deal with increasingly frequent high water events. Even the most conservative climate models predict that the wall will need to be raised over the next 30 years. The port itself requires frequent dredging, because of sediment flows from upstream combined with tidal surges. The low lying areas of the city are also liable to flooding by high water in the estuary. To the north, vegetated dunes provide some protection.

148. In the past the city benefited from a natural drainage system from a 7 km tidal creek entering the estuary near the fishing harbour, which also kept soils moist. This has been partially blocked, leading to building subsistence and loss of the natural drainage system. There are in addition 13 kms of constructed large small drains and 27 kms of smaller drains, which were built with sea-gates to protect the city from sea-invasion at times of storm surge and high tide. When such tidal events combine with heavy rains from the Piungu River the gates are closed, and the city may be flooded from the river. Mangroves protecting the shoreline and beaches north of the city center were cut down during the war for security purposes, and their destruction has contributed to beach erosion there. The natural dunes to the north of the city are complemented by breakwaters, many of which, however, were not built with sufficient strength to withstand the wave events.

149. The city municipality has a clear sense of priorities to help the city increase its resilience in the short to medium term, while also developing longer term strategies. Partial rehabilitation of the constructed drainage system, including the gates to the sea, is ongoing with EU assistance. Short term priorities are restoration of the city's natural tidal drainage channel, improved solid waste collection (to keep the drains free-flowing), restoration of the coastal mangroves, and rehabilitation, to higher standards, of a number of the breakwaters along the beach dunes to the north. Preparedness and evacuation plans in the event of a cyclone could also be considered. Longer term strategies include participatory land use planning to reach consensus on avoiding new building on flood prone land, cyclone proofing of buildings and construction of safe havens, and examination of long term alternatives such as dune strengthening, raising the sea wall, and new drainage systems.

150. Other coastal cities are also vulnerable, including Maputo and Nacala. Muxixe and Inhambane will be the subject of an integrated hazard mapping analysis supported by the Global Fund for Disaster Risk Reduction (GFDDR). MICOA is undertaking a strategic environmental assessment of the entire coastline.

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The SPCR phase 1 preparation grant would support development of climate resilience investment options and an investment plan for the preferred option, together with longer term resilience strategies for the city of Beira. Depending on government priorities other cities may also be selected.

Annex 5: Private Sector: Climate Impacts, Barriers to Adaptation, and Solutions

151. The Joint Mission consultations have identified 4 sectors where the private sector has a key role and a high dependence on and interaction with the public sector (see para. 42 and 46, and Second Joint Mission Annex) as particularly sensitive and important in the context of national development: **urban water supply** (particularly in the coastal region), **ports, forestry and tourism**. Considering these characteristics, the sectors will be included in the focus of the SPCR, as well as the institutional arrangements that are needed for ongoing private sector engagement in building national climate resilience.

152. The consultations identified the already existing evidence of climate related impacts on the four selected sectors. For example, some groundwater resources and rivers are affected by saline water intrusion, levels of spring tides in some ports are approaching the top level of the keys, changing wind directions and intensities are affecting some operations, floods are affecting or destroying assets with increasing frequency, etc.

153. Despite the rising evidence of climate impacts and related financial implications, at the moment there is low or non-existent level of incorporation of climate related concerns in operations and investments of the several key sectors. This is of particular concern as there are a number of sectors or projects where significant investments in long-term infrastructure or operations will be made in the near future. Additionally, there has been very limited or non-existent work on future climate trends that may not be manifesting themselves at the moment but may be relevant for the future economic, as well as social and environmental sustainability of investment projects, and should be considered at the moment of planning and investment.

154. Phase 1 analyses will therefore include components that will identify gaps, barriers and needs to create an enabling environment for increased climate resilience in the selected sectors, as well as a general approach to private sector involvement. Given the interdependence of private and public sector institutions (e.g. the urban water supply chain relies, or is planned to rely, on a number of public and private institutions where each actor may have a different need), **the analyses will consider both private and public sector institutions needs and roles**.

155. The analyses will include informational needs, including those related to climate impact indices relevant to specific sectors and its supply chain, sector relevant climate change information, policy, regulatory, and financial needs, technological options and necessities, demonstrational or pilot projects and investments, research and development needs, and similar. The results of the 1st phase will produce a list of priority investments to be included in the 2nd phase of the Program.

Annex 6: the Africa Adaptation Programme

156. The AAP is a USD 3 million programme funded by the Government of Japan and convened by UNDP. Its formulation is based on elements from all already ongoing activities and policies. This project seeks integration with the current adaptation efforts being spearheaded through the implementation of the NAPA, the long-term adaptation programme (INGC Phase II), the UN Joint Environmental Programme and other adaptation programmes with development partners in up-scaling the mainstreaming of CCA in the legal, political and socio-economic processes targeting the national, provincial and district levels. The following responses are envisaged under the 5 programme outputs.

Output 1: Dynamic, long-term planning mechanisms to cope with the inherent uncertainties of climate change in Mozambique strengthened

157. INGC will develop the climate risk assessments. The Ministry of Planning will implement the integration of adaptation into national development planning processes.

158. Under this output the response will focus on risk assessments and planning where gaps have been identified. Building on the national risk analysis (INGC, 2009), sector-specific climate risk assessments will be supported. The ToRs for the work will be developed collaboratively between INGC and line ministries to ensure that the research is relevant to planning processes and used by line ministries and sector specific institutions (e.g. Health, Agriculture/SETSAN, Fisheries, Water/DNA, etc.)

159. Guidelines for mainstreaming CCA into national development planning will be developed for Mozambique to help the integrate adaptation into Mozambique's PARPA III and the next Five Year National Plan, due to commence in 2011. A long-term CCA strategy will be developed under this output, which will take forward the NAPA process and the work of the Second National Communications.

160. New and reliable information that is sector or national development specific and relevant will allow all enable stakeholder not yet fully embracing CC dimensions in their operations to engage in CC sensitive planning and decision-making. Developing a national climate change strategy, aligned with the PARPA and other national plans, will be essential to promote adaptation and to coordinate adaptation efforts across sectors.

Output 2: Leadership and institutional frameworks to manage climate change risks and opportunities harmonized, coordinated and strengthened (INGC and MICOA)

161. This output will facilitate the establishment and operationalisation of a national CCA multi-stakeholder coordination and technical forum. Modelled on experiences of National Climate Change Committees (previously active in Mozambique; under review in several countries in Africa), such a platform will assist the country in planning and addressing the required multi-sectoral, integrated CCA responses needed. It is critical to include different actors of government i.e. MICOA, DNA, SETSAN, INAM, State Administration (incl. INGC), national and international NGOs (incl. IUCN and WWF) and development partners e.g. UN agencies, the World Bank, EC.

162. Further, this output will assist the Government of Mozambique with identifying the most strategic and effective long-term institutional arrangements that will lead the adaptation portfolio in future. Through the facilitation of participatory and consultative processes, a strong mechanism and institutional arrangement will be put into place, and be capacitated through project interventions (e.g. financial support for infrastructure investments of such institution, if needed, training of staff).

163. The project will identify existing CCA leadership capacities and gaps at national level, especially relating to the above introduced structures, and develop targeted training and capacity support actions. Capacity building will also target skilled personnel and students in CC disciplines building on and

supporting the “skills challenge and the design and delivery of Global Change Education under the Mozambique Grand Challenge for Adaptation to Climate Change” component of the National CCA programme concept. Such training packages integrate knowledge and experiences from this project as well as other already existing information on the CC threat in Mozambique and how to address it.

164. A nation-wide awareness campaign will be developed and implemented to disseminate information on why adaptation matters and to advocate for change.

Output 3: Climate-resilient policies and measures implemented in priority sectors and through demonstration projects (Line Ministries, e.g. responsible for Food Security, Fisheries, Agriculture, Health, Water, Environment, Infrastructure, Energy, and district authorities)

165. Building on work undertaken in Output 1 in collaboration with INGC, line ministries will develop recommendations on policy adjustments needed to support adaptation. This could encompass further analyses to understand how current policies promote or inhibit adaptation, who the main investors in adaptation are, and options for changing policies to promote adaptation. These analyses can feed into the development of the climate change strategy, developed under Output 1.

166. It is envisaged that various sector Ministries might establish CCA focal points and committees to contribute to the development and articulation of a national CCA strategy under Output 1.

167. Pilot projects that address adaptation priorities identified e.g. in the NAPA or as part of the Grand Challenge for Adaptation will be supported under output 3, based on the climate risk assessments undertaken in Output 1 and the policy analyses undertaken by line ministries in Output 3. Themes that have been identified to be of major concern in risk and vulnerability studies (e.g. food security, fisheries, health, etc) will be envisaged. A major part of the Mozambican AAP project is focused on piloting suitable adaptation measures on the local level. Through the Grand Challenge or another pilot project concept, the AAP will pilot CCA interventions using multi-sectoral and multi-stakeholder approaches to addressing local level adaptation priorities. Local level planning for adaptation will be supported through community-level awareness raising on the CC risk and vulnerabilities, the participatory planning of appropriate adaptation measures, and finally the mainstreaming of adaptation concept.

168. Decentralisation of the CCA agenda to a provincial level is critical to set the foundation for effective long-term governance of the CC development threat. Provincial-level mechanisms addressing CCA will be piloted. Three districts will be supported, including through the establishment of CCA committees, which formulate CCA action plans. After the three years AAP period, selected districts should have some CCA plan in place, together with strengthened capacity to implement and update the plans.

Output 4: Financing options to meet national adaptation costs expanded at the provincial and national level, and integrated into sectors (Ministry of Finance and MPD responsible for planning, coordination and decentralisation, sector Ministries, Provinces, the private sector and investors)

169. The AAP project will set up a consultative technical committee that will be led by the Ministry of Finance and will assist the Government in establishing a meaningful work programme under output 4. By reviewing the activities that are already underway with the support of other cooperation partners, priorities will be identified that will be rolled out over the three year AAP period. The work programme will include scoping how:

- national budgeting processes and investment/spending plans could be adjusted to promote adaptation

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- the private sector can be incentivised to invest their resources in a way that minimises risks to climate change effects
- how international adaptation funds could be used to pay for adaptation, in complementarity with the above two financing options.

170. The information will be the basis for the development of national adaptation financing plan, with recommendations and work programme for implementing adjustments to national budgets, adjustments to the fiscal and regulatory framework and policies, and for a plan on accessing international adaptation funds.

171. Adaptation needs to be paid for. Mozambique will have a coordinated and integrated plan for financing adaptation, drawing on national resources, the private sector and the international funds. A plan to minimise the damage from climate change on national investment/spending plans will be developed.

Output 5: Knowledge on adjusting national development processes to incorporate climate change risks/opportunities generated and shared, including through an advocacy strategy (Wide range of public institutions, private sectors, the public, a special focus on high level decision makers, the international community and SADC partners)

172. This output will focus on strengthening the weak CC knowledge management systems currently existing, and develop a targeted CCA awareness raising strategy and implement it. A strong and focused advocacy component is included, which aims to bring forward the results from all AAP actions and coordinate them through this output. A common platform for sharing knowledge and lessons learnt from ongoing adaptation initiatives will be established, and linked to the knowledge management components of ongoing projects, as well as reach AAP component. It will provide a unified mechanism, most probably linked to the CCA institutional framework to be established under output 2. As the target groups in need of CCA information are extremely diverse, varied awareness raising and communication approaches are needed to reach a broad base of targets. The establishment of CC knowledge management mechanism therefore can make a major contribution to knowledge exchange and accessibility. Links to the AAP Regional Support Component and the international UNDP Adaptation Learning Mechanism (ALM) will be established as critical and strategic linkages to promoting regional knowledge sharing. Mozambique, as a partner in regional fora such as SADC and COMESA, should engage in a regional debate on CCA, and learn from international experiences while also contributing the Mozambican national experience. There are regional CCA support programmes underway (e.g. a GTZ sponsored project that assists with formulating and negotiating regional positions for various UNFCCC fora), in which Mozambique needs to position itself as a strong contributor. Output 5, together with output 2 of the AAP programme will contribute to shape such leadership.

173. Information on CC and CCA will be made available to a wide range of stakeholders and users; today such information is scattered and often not readily accessible. A platform for exchanging experiences and adaptation learning is created; results from the AAP are readily shared within the country and internationally.