HEINRICH BÖLL STIFTUNG
SOUTHERN AFRICA

Gender and Climate change:
Mozambique Case Study

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Executive summary

Mozambique is considered one of the countries in sub-Saharan Africa that has been hard hit by climate change due to its geographical location – downstream of the main rivers in southern Africa and a long coastline of 2,700 km – and the weak socio-economic situation. The major anticipated impacts of climate change are increase in the frequency and severity of floods, droughts and cyclones. Thus, adaptation measures to cope with the impacts of climate change are urgently needed at different levels in the country. These must be gender-sensitive, considering the differentiated role women and men play in rural societies. Recognizing the need to adapt to new environmental conditions, the Government of Mozambique has reformulated the national legal and institutional framework. Although the existing environmental legislation is conducive for the mainstreaming of climate adaptation, its contribution for mainstreaming a gender perspective into climate change adaptation it is still unrealised.

This study was conducted as part of a regional project funded by the Heinrich Böll Foundation (HBF) through its southern African regional office. It aimed at investigating the gender differentiated impacts of climate change in South Africa, Namibia, Botswana and Mozambique. However, this research looked at Mozambique. The research questions under study were:

- Are women and men in Southern Africa differently impacted by climate change?
- How women and men are differently impacted?
- What are the physiological, political, economic and societal causes for the differences experienced, if any?
- What are the current coping and adaptation strategies and capacities?
- How can the capacity of women and men be strengthened to better adapt to climate change and climate variability?

To achieve the objectives of this study, a qualitative study was conducted that uses a combination of various data collection and analysis methods. Data collection was performed through informal and semi-structured interviews to households and key informants (traditional and government's chiefs and heads of local associations), focus groups of discussion and histories of life of the oldest men and women of each community. Data analysis was performed using a combination of tools such as Gender Matrix Analysis (GMA), Impact Assessment, Influencing factors, Institutional analysis, Access and control and social profiles, Capacities and vulnerabilities analysis and Needs assessment.

The study was conducted in two communities of Gaza Province of southern Mozambique – Mapai-Ngale in Chicualacuala District and Magondzwene in Chibuto District. The former is located upstream of the Limpopo River and vulnerable to droughts while the latter is situated downstream of the same river and vulnerable to floods. The communities were selected based the following agreed common criteria for the region: rural, poor, vulnerable and already facing climate change effects.

The main results of this study reveal that women and men are differentially impacted by climate changes due to the current power relations and their differentiated roles in these communities. Women have access to but not control over natural resources and other property rights. Additionally, women do most of the reproductive and part of the productive work, while men are only responsible for productive work.

Successive droughts these communities have faced for the last two years has increased men's migration to South Africa and other places in search for jobs. As a consequence, women's role in productive work has increased considerably in the last two years. For example, women's participation in alcoholic drink brewing in Mapai-Ngale

and fisheries-related work in Magondzwene has increased in the last two years. This imposes pressure on women who have to spend extra time for productive work in detriment of the reproductive jobs and time spent with kids. On the positive side, men's migration has enhanced women's participation in the decision-making structures. This is especially evident in the Mapai-Ngale community where migration is more intense and as a consequence, the National Women Organization (OMM) has gained better position in the decision-making structures. However, this issue was not deeply explored in this study and thus a thorough investigation on this is recommended.

A number of coping and adaptation strategies are currently being deployed in these communities and these include alternative food sources such as *tinhirre, ulharo, canhu – marula* and, *massala – Strychnos spinosa* in Mapai-Ngale and *muambo* and *tinhirre* in Magondzwene, informal (charcoal, farms, livestock and construction) and formal (migration) jobs and adoption of different lifestyles. In terms of formal and informal organizations to discuss environmental problems, the Magondzwene community is better organized than Mapai-Ngale. However, Mapai-Ngale has a better representation of women in the decision-making structures through the OMM and the elderly advisory group which is stronger.

There is general consensus amongst policy-makers and academics that there are four ways to strengthen women and men's capacities for a better adaptation to climate change. These include: implementation of existing policies and programmes, allocation of resources, capacity building and reinforcement of women's participation in local institutions. Due to the key role women play in these communities, they should always be considered as the priority group in any activity.

Since agriculture is the main women's activity in these communities, we strongly recommend capacity building of women in agriculture and agro-processing techniques through for example the creation of farmers' clubs, the creation and reinforcement of local institutions and discussion forums and the formation of an environmental multi-institutional task force (including institutions as the Ministry for Environmental Coordination – MICOA, National Institute of calamities management -INGC, Ministry of Agriculture - MINAG, Non-governmental Organizations, etc).

1. Introduction

The most striking impacts of climate change over southeastern Africa are expected to be an increase in the frequency and severity of extreme events such as droughts, floods, and cyclones. Due to its geographical location, Mozambique is considered to be at high risk of being affected by climate change. It is located at the downstream of several major river basins in southern Africa – Zambezi, Rovuma and Limpopo – all of which are projected to have diminishing runoff of 25 – 40% (Arnell, 1999), and especially the dry season (June-August) is projected to get drier across Mozambique in the future (IPCC, 2007). At the same time cyclone activity in the Indian Ocean is expected to increase as a result of increased sea surface temperatures (Lal, 2001; McDonald et al., 2005), which tend to result in widespread flooding in the region. As a result of changing temperature and precipitation patterns, Mozambique ranks high in the climate change index based on annual and seasonal indicators of temperature and precipitation (Baettig et al., 2007).

Mozambique's vulnerability to climate extremes is exacerbated by extreme poverty. The current Poverty Reduction Strategy Paper (PRSP) in Mozambique has recognized the need to adapt to climate variability and change in order to reduce people's vulnerability (GoM, 2006ab). A 2005 review showed that Mozambique is unlikely to attain the Millenium Development Goals (MDGs) within the given timeframe of 15 years, a compromise that was assumed by the Government of Mozambique (GoM) in September of 2000. Progress has been slow in the areas of hunger eradication, extension of primary education, gender equality, HIV/AIDS reversal, and environmental sustainability (GoM, 2005a).

Recognizing the need to improve the country's capacity to overcome the consequences of slow progress and at the same time create strategies to adapt to climate change, the GoM reformulated and created several national legal instruments. The efforts are also supported by several Rio conventions ratified by Mozambique: the Biodiversity, United Nations Convention to Combat Desertification (UNCCD) and United Nations Framework Convention on Climate Change (UNFCCC).

The national climate change policymaking has failed to adopt a gender-sensitive strategy. This failure not only generates concern in terms of respect for gender equity at the international level, it also leads to shortcomings in the efficiency and effectiveness of climate related measures and instruments in Mozambique (genanet / LIFE e.V. / WECF, 2006).

Without a gender-sensitive approach, it is impossible to determine the full set of causes and potential effects of climate change. Furthermore, studies have shown that women and men experience climate change differently in terms of their adaptability, responsibility, vulnerability and aptitude for mitigation (Wilson, 2005). Therefore, the international climate change negotiation process – as well as climate policies at regional, national and local levels - must adopt the principles of gender equity at all stages: from research, to analysis, and the design and implementation of mitigation and adaptation strategies (genanet / LIFE e.V. / WECF, 2006).

While the discourse on gender and climate change is maturing quite rapidly there is very little groundwork that has been done especially in southern Africa with the result that most publications and reports quote the same sources and examples. As a result, it is important to understand the gender differentiated impacts of climate change and the existing coping strategies that must be strengthened and supported at the community level.

This study was conducted as part of a regional project that aimed at investigating the gender differentiated impacts of climate change in South Africa, Namibia, Botswana and Mozambique. The research questions under study are:

- Are women and men in Southern Africa differently impacted by climate change?
- How women and men are differently impacted?
- What are the physiological, political, economic and societal causes for the differences experienced, if any?
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The study was funded by the Heinrich Böll Foundation (HBF) through it southern African regional office. HBF is part of the green political movement that has developed worldwide as a response to the traditional politics of socialism, liberalism, and conservatism. Its main tenets are ecology and sustainability, democracy and human rights, self-determination and justice. The emphasis of HBF is on gender democracy, meaning social emancipation and equal rights for women and men. Thus HBF is in a unique position to provide new and cutting edge information regarding to mainstreaming of gender aspects into climate change. Furthermore, as a political foundation the information produced can and must be used to influence policy and decision makers to take into account the gender aspects of climate change at national, regional and international levels.

2. Literature review

2.1. Geographic and socioeconomic framework

Mozambique is situated on the eastern coast of southern Africa, between the parallels 10°27´ and 26°52´ S and the meridians 30°12´ and 40°51´ E (Figure 1). Mozambique is bordered to the north by the Republic of Tanzania, to the west by Malawi, Zambia, Zimbabwe, South Africa and Swaziland, to the south by South Africa and to the east by the Indian Ocean. Along the coastline of about 2,700 km there are several islands such as the Quirimbas archipelago, Mozambique Island, Bazaruto archipelago and, Inhaca and Xefina Islands in the south.

Administratively, Mozambique is divided into eleven provinces, which are sub-divided into 128 districts, Administrative Post and localities (Figure 1). The major urban centers are organized in 33 municipalities.

The climate in the northern region is under the influence of the equatorial low pressure zone with a NE monsoon in the warm season. The climate in the southern area of Zambezi River is influenced by subtropical anti-cyclonic zone. In the North of Sofala Province, along the Zambezi River, lays a transitional zone with high rainfall figures (Saetre *et al.*, 1979). To the north of the country the winds are influenced by the monsoon system with NE winds during the southern summer (November – March)

Figure 1: Location of Mozambique and its administrative division (Source: MICOA, 2003).

and SW winds during the southern winter (April – October). Central and southern Mozambique is dominated by the SE trade winds.

The average annual precipitation is about 1,200 mm (ranging from 400 mm in Pafuri, Gaza Province to 2,000 mm in Tacuane, Zambézia Province). The rainfall is mainly restricted to the warm season between November and April. The distribution of Mean Annual Temperature (MAT) is as follows: 18 – 20ºC in mountain areas, 22 – 24ºC in the central and north plateaus and to the west of the south region and 24 – 26ºC in the eastern parts of the north and central regions and to the interior of the south region.

Mozambique has more than 100 rivers, the main ones being: Rovuma, Lúrio and Zambezi in the North, Pungué, Buzi, Gorongosa and Save in the center and Limpopo, Incomati and Maputo in the South. These rivers drain about 208 km^3 of water rich in nutrients into the coastal waters. About 80% of this water enters the ocean from Sofala Bank, central Mozambique. Zambezi River, the largest river in Eastern Africa, alone, contributes 67% of the total river discharge in the whole country (and Jorge da Silva, 1982 cited by MICOA, 2003).

It is estimated that 73% of the population in Mozambique lives in rural areas. Population density varies throughout the country in relation to the bio-climatic conditions. The northern region has 23 inhabitants/km^2, followed by the centre region with an estimated 20 inhabitants/km^2 while the southern has a population density of 14.4 inhabitants/km^2 (MICOA, 2007). Statistics at hand shows that 2/3 of the Mozambican population live in the coastal zone, where the average population density is about 120 inhabitants per km^2 (MICOA, 2003). The population in Mozambique is expected to grow at an annual rate of 2.5%, and in the year 2025 it is estimated to be about 35 millions (MICOA, 2003).

The incidence of diseases is a fundamental cause of human suffering and increase in absolute poverty. Preliminary data analysis of main epidemic diseases shows that malaria affects the whole country, with greater incidence in the southern region (in terms of the percentage of affected population) especially in Gaza Province. HIV/AIDS is another epidemic that affects the country. According to studies about HIV (Ministry of Health, 2000), conducted in 20 health centers (11 urban and 9 rural) the incidence of HIV in adults (15-49 years) is higher in the center of the country (16.5%), followed by the southern (13.2%) and finally the northern part (5.7%).

The three most important economic sectors in Mozambique are agriculture, livestock and fisheries. Approximately 45% of the territory has potential for agriculture (Marzoli, 2007) and it employs (formally and informally) more than 80% of the active population. In 1998 some agricultural products (cashew-nuts, cotton, and tea among others), wood and fisheries contributed altogether with 50% of the total exportation value.

2.2. Political and institutional framework

In 2004 Mozambique adopted a new Constitution in which the GoM is committed to ensure sustainable development by adopting policies and promoting initiatives that guarantee the ecological balance, conservation and preservation of the environment, aimed at improving the quality of life of its citizens. The constitution also follows the principles of universality and gender equality (Constituição da República de Moçambique, Article 117).

To pursue these objectives, the GoM has made efforts towards integrating climate concern in national development planning as demonstrated in PARPA II, the current 5-Year Plan and Agenda 2025 (GoM, 2003, 2005, 2006a). These are assisted by a good collection of legal instruments including:

- The National Environment Policy (1995), the National Environment Programme (1996) and Environment Frame Law (Law n. º 20/97 of 01 of October) that were created to systematically integrate environmental aspects in development.
- The Energy Policy adopted in 1995, which aims, on one hand, to increase the feasibility and access to low cost supply of several forms of energy and on the other hand, foresees the development of

conservation technologies and environmental beneficial use of energy. The policy stipulates also the reduction in the consumption of wood-based fuels;

- The National Land Policy and its implementation strategies approved in 1996 and the Land Law (Law nº 19/97, of 1 of October), which ensure that the population have access to the land resources and participate in the management of such resources, for their sustainability and socially equitable use;
- The National Policy on Forest and Wildlife, adopted in 1997, which aims to manage of forest and wildlife resources, underlining the need for their sustainable use;
- The Policy on Disaster Management adopted in 1999 that aims at the elimination of poverty and establishment of a contingency plan in view of the recurring occurrence of calamities that affect the country's social and economic development.
- Other not less important policies and measures include: The National Agricultural Policy, Transports and Communication Law, commerce liberalization, access to health services and potable water.

Although the existing environmental legislation is conducive for the mainstreaming of climate adaptation, its contribution for mainstreaming a gender perspective into climate change adaptation has not been realized. Recognizing the need to strengthen the gender perspective in national planning, the GoM has undertaken some initiative such as: the inclusion of a holistic vision of gender in the current 5-year Plan 2005-2009 and the creation of the Ministry for Women and Social Action in 2005 (Presidential Decree no 13/2005 of 4th of February). Furthermore, legal instruments that can assist the materialisation of mainstreaming a gender perspective into climate change adaptation have been created and include:

- The National Gender Policy that aims at equity of participation and access for both women and men, recognizing their role pertaining to national sustainable development objectives. Its principles are based on the promotion and strengthening of both women and men at all levels and women's empowerment. This policy clearly states the need to guarantee women's use, access and tenure over natural resources, to promote the legal mechanisms for control tenure and heritage systems and to enhance the capacity of women on environmental management and conservation.
- The Gender Strategy for the Agrarian Sector designed in 2005 which aims at assuring access to and control over resources, benefits, rights and equal opportunities between women and men, enhancing the capacity of vulnerable farmers to improve food security and familiar income in order to contribute to poverty alleviation and a sustainable development incorporating a gender perspective.

Internationally, Mozambique acknowledged and adheres to international efforts aimed at ensuring environmental sustainability. Some of them include: Vienna Convention on the protection of the ozone layer; the UNFCCC – ratified in August 25th 1995; Kyoto Protocol (As a non-Annex I Party), Montreal Protocol on the substances that destroy the ozone layer and the respective London and Copenhagen amendments; Convention on Biological Diversity (CBD); UNCCD; Nairobi Convention for the protection, management and development of the East African marine and coastal areas; Basel Convention on the control of trans-border movements of dangerous residuals and their elimination; Bamako Convention on the prohibition of importation of dangerous waste and the control of trans-border movements of such waste in Africa; Convention on the elimination of all forms of discrimination against women (CEDAW) – ratified in 21st of April 1997 and the Beijing Platform for Action (BPFA).

The Ministry for the Coordination of Environmental Affairs (MICOA) created by presidential Decree nº 2/94 of 21 of December is the institution responsible for promoting a better inter-sectoral coordination and to indulge an appropriate planning and utilization of natural resources in Mozambique. It has also the responsibility of monitoring compli-

ance with obligations under the UNFCCC and other Rio conventions. In respect of these, MICOA works closely with the Ministry of Agriculture (MINAG) through the Technical Secretariat for Food Security and Nutrition (SETSAN – the body responsible for coordinating the implementation of the National Food Security and Nutrition Strategy), the Ministry for Foreign Affairs, through the Institute for Disaster Management (INGC – the coordinating body for disaster risk management), the Mozambique Red Cross (CVM) that provides immediate assistance to vulnerable people during and immediately after natural disasters, and with other relevant institutions such as Eduardo Mondlane University as a research institution. These institutions integrate several inter-institutional groups led by MICOA whose main task is to impel the implementation of existing legislation and actions.

Within the framework of the UNFCCC, Mozambique has prepared its First National Communication in 2003 the National Plan for Capacity Building in the context of the Clean Development Mechanism under the Kyoto Protocol and the National Adaptation Programme of Action (NAPA) in 2007. Other cross-cutting measures include: Strategy and Plan of Action for Biodiversity, Strategy and Plan of Action to prevent and control fires, Strategy and Plan of Action to prevent and control erosion, National Action Plan to Combat Drought and Desertification. Furthermore, under the Global Environment Facility (GEF) Mozambique is commencing its second National Communication to the UNFCCC secretariat. Regarding to this, it is important to assess climate vulnerability and adaptation options for those sectors not included in the first National Communication, e.g., health, education and fisheries, but that are important for the implementation of the NAPA (MICOA, 2003). Gender issues are also poorly addressed in both first national communication and NAPA as none concrete actions are presented. Thus, they must be included in order to assist mainstreaming of gender perspective in climate change adaptation.

Constraints to the implementation of the existing legal instruments on environment include poor information on natural resources and gender issues, considerable levels of corruption, inadequate capacity to implement legislation and the weak inter-sectoral coordination. In order to improve institutional coordination and the integration of cross-cutting issues such as climate change, food security, environment and natural disasters into development planning, it is important to create and strengthen environmental units in all relevant sector institutions. This can improve the network for awareness raising and organizational capacity building (Sietz et al., 2008). In addition, inter-institutional groups such the Biodiversity Unit and the Forum for land degradation and desertification already working with MICOA should be reinforced through active leadership and pro-active measures regarding climate change.

Given scarce resources to implement adaptation measures, enhancing synergies between activities to implement the other Rio Conventions would increase the effectiveness of existing resources in climate adaptation. MICOA has already undertaken valuable efforts to coordinate the work among the Rio Conventions (MICOA, 2005) and strategies to create synergies among the conventions are being developed (Telma Manjate – focal point of the UNFCCC, personal communication).

International support for implementing adaptation measures remains important. One way to advance the implementation of climate adaptation would include considerations for ensuring the integration of climate risks across all climate-sensitive sectors with a gender perspective, e.g., agriculture, water and sanitation, health and infrastructure, in Mozambique's "External Aid and Cooperation Policy" (Sietz et al., 2008). In addition, a clear aid policy statement from the Government of Mozambique, indicating preferences for receiving aid in form of programmatic, project and technical assistance would help to set priorities to the mainstreaming of gender in climate-informed development (GoM, 2006b; Killick *et al.*, 2005).

2.3. Climate change/variability in Mozambique

According to the UNFCCC climate change refers to a change of climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and that is in addition to natural climate variability observed over comparable time periods. Recently the Intergovernmental Panel for Climate Change (IPCC) defines climate change as any change in climate over time, whether due to natural variability or as a result of human activity (Fourth Assessment Report – AR4, 2007).

In the southern African context in general and Mozambique in particular, several factors constrain the understanding the limits between climate change and variability. For instance, in Mozambique there is evidence of several natural periods of floods followed by droughts since the 1800's (e.g the Limpopo Basin floods of 1950, 1977 and 2000), but increasing human population and high poverty levels exacerbate the effects of natural climatic variability. Limited information and access further contribute to that. Thus, the IPCC's AR4 definition of climate change is adopted in this study.

Climate change's more alarming impact on Earth is the increase in world temperatures of around 0.7°C since the advent of the industrial era and fast rates of increase (Watkins 2007). Even more shocking is the fact that in the course of the 21st Century, average global temperatures could increase by more than 5°C, albeit the threshold for dangerous climate change is an increase of only 2°C. This threshold broadly defines the point at which rapid reversals in human development and a drift towards irreversible ecological damage would become very difficult to avoid.

There is overwhelming scientific evidence linking the rise in temperature to increase in the concentration of greenhouse gases in the Earth's atmosphere, which has several impacts at different levels including increased frequency of droughts, floods and more intense storms, among others.

Across developing countries millions of the world's poorest people are already being forced to cope with the impacts of climate change. But increased exposure to drought intense storms, floods and environmental stress is holding back the efforts of the world' poor to build a better life. The likely direct impacts of climate change in Africa can be summarized as follows (IPCC's AR4, 2007):

- By 2020, between 75 and 250 million of people are projected to be exposed to increased water stress;
- By 2020, in some countries, yields from rain-fed agriculture could be reduced by up to 50%. Agricultural production, including access to food, in many African countries is projected to be severely compromised. This would further adversely affect food security and exacerbate malnutrition.
- Towards the end of the 21st century, projected sea level rise will affect low-lying coastal areas with large populations. The cost of adaptation could amount to at least 5 to 10% of GDP.
- By 2080, an increase of 5 to 8% of arid and semi-arid land in Africa is projected under a range of climate scenarios.

Mozambique has only 0.3% of the world's population and accounts for 0.1% of global emissions – an average of 0.1 tonnes of CO2 per person that is below the emission levels of Sub-Saharan Africa of 1 ton of CO^2 per capita (http: // hdrstats. undp. org/ countries/ country_fact_sheets/cty_fs_MOZ.html). Despite its low contribution to climate change the country (as other poor countries in the world) is already facing the effects of climate change/variability especially those living in extreme poverty conditions in both rural and urban areas. For instance, in some parts of southern Mozambique, it has not rained at all for a year and a half and in recent years, people have been forced to plant later in the year (WFP news, February 15th 2008). As a man from Mapai-Ngale community, Chicualacuala District says (Box 1) – one of the most arid areas of south Mozambique – *we have been forced to shift the growing season from September/October to November/December and, on top of that it is becoming shorter.*

Mozambique benefited from the US Study Program for Vulnerability and Adaptation Assessment in 2005.

This study simulated scenarios of climate change for the century 1975-2075 based on six General Circulation Models and using daily observed meteorological data for a period of thirty years (1951 – 1980) to set the baseline climate scenario (MICOA, 2005). The models were run to obtain "outputs" of air temperature, precipitation and solar radiation, after forcing concentration of carbon dioxide ($1 \times CO^2$) and for the doubling of current CO^2 concentration ($2 \times CO^2$). The results indicate that the danger of climate change is serious for Mozambique under the doubling of the current CO^2 concentration. Such a scenario predicts the following results for the year 2075 (US Study Program for Vulnerability and Adaptation Assessment, 2005 cited by MICOA, 2005):

- An increase in air temperature between 1.8 and 3.2°C;
- A Reduction in rainfall between 2 and 9%;
- An increase in solar radiation between 2 and 3%; and
- An increase in evapotranspiration between 9 and 13%.

The impacts of these changes are still uncertain and there is need for more empirical research in order to understand the effects of climate change and to define the appropriate adaptation measures. It is hard to prove that climate change is taking place in any certain period and region, but the prevalence is striking: southern Mozambique has always suffered from occasional droughts, but it has never had droughts for seven years in a row. The droughts and famine in 1980, 1983, 1985 and 1992, resulted in 100 000 deaths and affected over 17 million people (MICOA, 2003). Central Mozambique has always suffered from floods in the Zambezi River basin, with a big flood event about every 15 years – but the major floods of 2000, 2001, 2007 and now, again, in early 2008 are telling of a growing concern (WFP, http://www.wfp.org/). There are indications that coastal areas and resources are being negatively affected. Examples include the advance of the coastline in Chinde (Zambézia Province, north of Mozambique), serious erosion in Beira city (Sofala Province of central Mozambique) and Maputo city coastline in the south. The dry season (June-August) is projected to get drier across Mozambique in the future (IPCC, 2007).

2.4. Vulnerability and adaptation to climate change/variability in Mozambique

The IPCC's 2nd Assessment Report (1996) defines vulnerability as the extent to which climate change may damage or harm a system; it depends not only on a system's sensitivity but also on its ability to adapt to new climatic conditions. Kelly and Adger (2007) define vulnerability in terms of the ability of individuals and social groupings to respond to, in the sense of cope with, recover from and adapt to, any external stress placed on their livelihoods and well-being.

The afore-mentioned definitions complement each other in the sense that the first focuses on the biophysical dimensions while the latter puts emphasis on socio-economic and institutional factors, which are two key aspects in understanding and confronting climate change issues. Considering the purposes of this research – differentiated gender impacts of climate change – both definitions are adopted in this research.

In the context of the definitions mentioned above, Mozambique is considered vulnerable to climate change due to its geographical location (biophysical vulnerability) and the frail socio-economic context (socio-economic vulnerability).

Geographically, Mozambique extends over a long coastline of 2,700 km (the third longest in Africa) and it is at the downstream of several major rivers in southern Africa – Zambezi, Rovuma and Limpopo – all of which are projected to have diminishing runoff of 25 – 40% (Arnell, 1999). Moreover, some areas such as Beira city are below sea level.

Semi-arid zones in Mozambique especially those in the south are characterized by high drought index (in a scale of low-medium-high), poor soils and high temperatures increasing the susceptibility of the system in those areas to experience the negative impacts of climate change (MICOA, 2003, FAO, 2007).

As part of the aforementioned US Study Program for Vulnerability and Adaptation Assessment, the vulnerability of the following resources was assessed: water, coastal zones, agriculture, forestry, rangelands and livestock. Other sectors such as human health, fishing and frequency of occurrence of extreme events were not covered due to lack of resources.

According to the US study Program for Vulnerability and Adaptation Assessment, coastal areas and resources in Mozambique are vulnerable to climate change because of the diversity of physical features such as sandy beaches, sand dunes, coral reefs, estuarine systems, bays, mangroves and sea beds. Moreover, these areas are under high and conflicting human pressures (120 inhabitants per km^2). The US Vulnerability and Adaptation assessment also indicated that Beira, in central Mozambique, is the most vulnerable city to the effect of sea level rise because it is below sea level.

Water resources are also vulnerable to climate change due to Mozambique's location downstream of the main African rivers. Surface water flows are likely to be reduced due to (i) irregularities in temporal and spatial distribution of rainfall and by the increase in temperature and solar radiation, which in turn will increase evapotranspiration levels and (ii) increased search for water for domestic and industrial needs and (iii) reduced flows from upstream.

Agriculture and pastures, two of the main sectors of Mozambican economy are also predicted to be affected due to a reduction in nitrogen absorption by crops. The content of nitrogen in biomass and grains may vary between 1.5% and –5.6% and from 9% to –9%, respectively, with implications for their nutritional value. A decrease is also expected in biomass and maize production from 7.5% to 5.9% and from 12% to 6%, respectively. In addition, the agriculture sector may be affected through the disruption of routine practices, infrastructures and the erosion of the soils. The US Program Study on vulnerability and adaptation assessment also indicates that forests would have the potential to retain some kind of tropical rain forests. Top biomass and height would increase between 12% and 13% for the majority of species. Fires conducted at the beginning of the agricultural season may also be aggravated in intensity and frequency imposing further stress on agriculture, pastures and forests. This issue is still not well known and investigation is in much needed.

The socio-economic context of Mozambique is very fragile with a large part of the population already living in extreme poverty conditions. The country ranks 172 out of 177 countries on the Human Development Index (HDI = 0.384) an index that provides a broad prism for viewing human progress and the complex relationship between income and well-being. In addition, high rates of population growth (2% a year), high incidence of epidemic diseases (such as cholera, malaria and HIV/AIDS), low level of literacy (only 38% are literate) and high dependency on natural resources exacerbates country's vulnerability to climate change.

In the face of the projected changes and country's vulnerability to climate change there is an urgent need to create adaptation strategies, which should focus on both biophysical and socio-economic aspects. Adaptation strategies may be constrained by several factors including limited information and understanding of natural resources and social dynamics, poor political background and the prevailing poverty conditions, which most Mozambicans are already facing. Any adaptation strategy should as much as possible be framed in the eradication of absolute poverty, reducing social inequalities manifesting as the country's develops and the growing of the national economy.

Recognizing the need for identification and prioritization of adaptation strategies MICOA (through its National Directorate of Environmental Management – DNGA) and the NAPA team conducted a survey in 30 districts of the country (MICOA, 2007). The result was the definition of actions that entail the use of local resources and, low cost and environmentally friend technologies. The 4 broad actions are: (i) enhancement of the existing early warning systems; (2) improvement of the agrarian sector's capacity to deal with climate change; (3) reduction of climate change impact on coastal areas; and (4) water resources management in the climate

change context. There are several specific activities, expected results, implementation plans and budget for each general action. Missing in this report is the need to account for gender equity. Moreover, the NAPA requires action at several different levels and sectors. Thus, it obligates an integrated approach in which people's needs are the hub (which must be gender sensitive) that drive the definition of proper adaptation measures.

Integrating adaptation measures across all sectors and institutional levels is important to safeguard existing and future development progress in light of the current high climate variability, the projected increase of extreme weather events and the development progress already being impacted by climate (Sietz *et al.*, 2008).

2.5. Gender and climate change

"Climate change will have different impacts on men and women and in most cases the adverse effects of climate change disproportionately affect women. For example, with increasing drought it is women who have to walk longer distances to collect water. Women are often the main repositories of vital local and traditional knowledge" (LEG, 2002, p3).

The United Nations system is formally committed to gender mainstreaming within all United Nations policies and programs. UNESCO (2004) maintains that gender mainstreaming will not be achieved unless gender equality issues are highly visible in organizational and sectoral policies and programs, including the need to systematically include gender perspectives within existing frameworks and analyses.

A multitude of authors have raised the gender issue fundamentally a response to the feminization of poverty, as well as the invisibility of women at most scales of the climate change debate (Denton, 2000). This is surprising given that addressing gender issues can increase the efficiency as well as the equity of a range of interventions, especially in relation to adaptation (Wamukonya and Skutch, 2002). Literature and experience all steer towards the conclusion that gender equality (i.e. women and men) is pivotal in developing successful initiatives.

The value of incorporating gendered stakeholder analysis into adaptation projects is obviously not in the portrayal of poor women as victims who need to be saved. Similarly, the point of gender analysis is not to reinforce binary oppositions or to place men in a subordinate role, it is simply to sophisticate the scope of multi-scalar analysis (Wilson, draft report).

Gender analysis and action has clearly added value in at least three key areas (Wilson, draft report). The first is **vulnerability** – the need to take account of the different forms of (and reason for) vulnerability of men and women and inequalities in the level of vulnerability between men and women, as well as compounding influences of other social characteristics. The second is **adaptive capacity** – the need to analyze the difference in options/potential and consequences for women and men in different areas of adaptive capacity. The third is in **policy making** – how to ensure that women and men have an equal, or equitable influence in knowledge production and decision making at all levels, and the policymaking resulting from the whole NAPA process. In all three areas gender-analysis can be approached as an essential element both in terms of program-efficiency and in terms of empowerment.

According to Osório (2003) the gender discourse in Mozambique is driven by its political and historical context, which in the last 40 years has been characterized by two wars (colonial up to 1975 and civil from 1977 to 1992) and three political systems. During the colonial period both women and men were deprived from their civil rights. It also recognized the role of the traditional structures that is men-dominated and as such women were "invisible". After the independence Mozambique adopted a mono-party regime with Marxism-Leninism ideals that recognized equal access to education and jobs for both women and men. However the regime emphasized the role of women as mothers and educators. During the Civil War with the political and economic defeat of the country, the Government of Mozambique Emphasized the role of women (as mothers) as the pillar of the family as a way to avoid further social rupture. From 1992 on

with the new Constitution and creation of new civic organizations (NGOS's etc) the discourse on gender has gained other dynamic. As a result the number of women in decision making positions such as the parliament (40% are women) and government as increased. However, this plurality is not translated in profound changes in the social and gender relations (Osorio, 2007). It is noteworthy to highlight that in the Mozambican context to mainstream gender in any field it is important to consider the social-cultural model that drives society's identity and attributes roles and rights based on sex and age.

3. Materials and methods

3.1. Sites selection and location

This research was carried out in Gaza Province of southern Mozambique (Figure 2), which extends over 75 709 km² and composes 11 districts namely: Massangena, Chigubo, Chicualacuala, and Mabalane to the north, Massingir, Chókwe, Guijá and Bilene to the center and, Xai-Xai, Mandlakaze, and Chibuto to the south. Gaza province extends from the coast in the south inland to the northwest, and entails a varied climate from semi-arid in the center and north to tropical sub-humid and humid towards the coast. It extends along the Mozambican portion of the Limpopo River Basin, comprising about 37.5% of it. Thus, Gaza is characterized by a complex hydrographic network of rivers, streams and lagoons, which covers almost all districts of the province. Given the geographic and climate situation the province includes 3 main ecological zones:

- Coastal area characterized by dune vegetation and mangroves including an extensive areas of beaches;
- Valley zone, characterized as an agricultural area

Figure 2: Study sites (Mapai-Ngale and Mangondzwene communities) in southern Mozambique.

- Inland area that includes woody and shrub savannas dominated by rich sweet veld. This is the area where the Limpopo National Park is situated.

On one hand the location and diversity of Gaza Province implies a variety of resources and thus, potential for agriculture, livestock, tourism, fisheries and industry development. On the other hand, it represents a susceptible area to climate changes and variability. In fact, Gaza Province has been the most affected province of Mozambique by natural disasters such as the floods of 1977 and 2000 and has experienced considerable long periods of droughts.

The NAPA for Mozambique identifies several districts of Gaza as vulnerable to drought and floods (MICOA/DNGA, 2007). Based on this and considering the selection criteria adopted in this study – rural area, considerable poverty, vulnerability and impacts of climate change/variability already visible – two communities were selected: One in Chicualacula District of the north – Mapai-Ngale Community – and one in Chibuto District – Magondzwene Community – of the south of the province (Figure 2). While the former is located in the inland ecological zone, the latter is situated downstream in the valley. Thus, they represent a good contrast in terms of environmental and socio-economic conditions. The two districts fall within the priority category targeted for the reduction of natural disasters' impacts and for gender mainstreaming in socio-economic development within the strategic plan for Gaza Province (Governo da Província de Gaza, 2006).

The strategic plan for Gaza province envisages sustainability, no poverty, social justice, equity and a sustainable socio-economic development. It is alongside with the Millennium Development Goal (MDG) of halving the current poverty index and food insecurity by 2015, through the intensification of its agrarian production, processing and commercialization as well as sustainable use of its natural resources, tourism potential and promotion of human capital. The strategic plan identifies 27 priorities to achieve socio-economic sustainable development. Those include among others, the sustainable management of water resources, and intensification of crop and livestock production, prevention and reduction of natural disasters impacts and, promotion of gender equity and increase in women's participation and contribution to the province's development.

3.2. Methodology

3.2.1. Data collection

An inception workshop was held in Cape Town between 27 and 31 of July 2008, in which the 4 participating countries discussed a common research methodology in order to make the case studies comparable. A qualitative research approach using three data collection techniques (semi-structured interviews, focus groups and life histories) was agreed to be used. For each research question a combination of techniques was used to obtain as much information as possible. We spent a total of 20 days in the field (10 days in each community). All conversations were held in *Xangane* (the local language) and immediately translated to Portuguese.

The first 2 to 3 days in the field corresponded to logistical and administrative organization of the work. This included explanations of the project to the district and administrative post authorities and, local and governmental authorities in the community. In each community, we spent a day and a half exploring the area in order to get familiar with it, meet people, explain our intention and observe the environmental conditions.

Both **informal and semi-structured interviews** were conducted with key informants and households. Informal interviews were part of the every day conversations with both local authorities and people. We concentrated our informal discussions on environmental related issues, gender related roles and responsibilities. Semi-structured interviews were conducted using a guiding questionnaire designed during the inception workshop (Appendix I). We randomly selected a number of families that corresponded to not less than 10% of the total number

of families. This gave a total number of 35 and 20 interviews for Magondzwene and Mapai-Ngale, respectively. Additionally we interviewed several key informants including the traditional chief, the president of the community (the government authority), one businessman in Magondzwene and one charcoal maker in Mapai-Ngale. In average an interview lasted for 2 to 3 hours.

The **Focus group** technique was also adopted in this study aiming at gathering information from specific groups of natural resources users within a certain age range and divided by sex (these criteria were defined at the inception workshop). This technique motivates group discussion regarding to a topic – climate change and gender in this case. Questions were asked in an interactive group setting where participants were free to talk with other group members (Figure 3). For each community a total of 4 to 5 groups according to the aforementioned criteria and availability of people. The number of participants per group varied between 5 and 15 according to people's availability. We worked with 4 groups in Magondzwene community:

- group of middle age women working on fisheries (9 participants);
- group of young women working only in agriculture (15 participants);
- group of middle age men working only in agriculture (12 participants);
- group of middle age fishermen (12 participants).

And 5 groups in Mapai-Ngale community:

- group of middle age women dedicated to bread-based alcoholic drink production/selling (7 participants);
- group of young women dedicated to agriculture (6 participants);
- group of middle age men dedicated to agriculture (8 participants);
- group of middle age men working in South Africa (5 participants).

People were gathered in the community's meeting room (under the shade of a marula tree) and we initiated the discussion by explaining the purpose of our visit, the aim of the group discussion regarding to gender issue in climate change and then we proceeded with the guiding questions defined at the inception workshop. The discussions were facilitated and guided by the researchers, but we allowed them to talk and discuss the topic freely, intervening only to clarify points and avoid misleading conversation. Discussions were also focused on alternative strategies to cope climate changes/variability. Each group conversation lasted for about 3 – 4 hours (a morning or an afternoon).

A third technique used in this research is the **life histories** (case studies), which as discussed at the inception workshop, intended to capture information on climate changes/variability and environmental problems over time through infor-

Figure 3: Two group discussions held with middle age women working on fisheries in Mangondzwene community (left) and middle age men working in South Africa in Mapai-Ngale (right).

mal conversations with two elders (one man and one woman) in each community. We had relaxing conversations starting by explaining our objectives and how valuable the information they could give us was (Appendix II). They were all open and very aware of the already existing climate related environmental problems in their communities. However, we had a problem with the oldest man in Magondzwene community, an 84 year old man who decided not to collaborate and kept on asking for government's help. Thus, we decided to stop the conversion and selected a second senior to talk with. All conversations were tape recorded and each lasted about 4-5 hours.

3.2.2. Data analysis

The methodology for data analysis was also discussed at the inception workshop and agreed to be common for the four countries. Similar to data collection a combination of gender tools for data analysis was used for each research question. The following techniques were used (Table 1):

Gender Analysis Matrix (GAM)

Gender Analysis Matrix (GAM) is a technique that is generally used to help determining the different impacts of a project/issue on women and men, by providing a community-based technique for identifying and analyzing gender differences. It separates out the different impacts (and other vulnerable groups) so researchers may accommodate the different needs and interests of these groups. This technique helped answering research question 1 and 2.

Impact assessment

Impact Assessment focuses on what are the possible impacts of climate change on women and men in the community. The first step of this technique is to identify how climate change concerns women and men in the community. Following is whether there are differences between men and women in the scope of climate change concerning 4 key areas namely: rights, participation, resources and norms and values. This tool was used to address questions 1 and 2.

Influencing factors

Influencing factors are those that determine/influence the differences identified in the gender division of labor and with regards to access to and control over resources. They can be: race, demographic, economic, political/institutional, health and disability, education and training, cultural and religious, history and community norms and social hierarchies. It intends to answer the question on what are the social, political and economic situation and the cross-cutting issues. It indicates which opportunities/constraints affect women and men and vice-versa aiming at increasing the involvement of specially women. This tool was used to address question 3.

Institutional analysis

Deals with how institutions, i.e. structures and mechanisms of social order and cooperation governing the behavior of two or more individuals, behave and function according to both empirical rules – informal rules-in-use and norms - and also theoretical rules – formal rules and law. It aims at finding how individuals and groups construct institutions, how institutions function in practice, and the effects of institutions on society (http://en.wikipedia.org/wiki/Institutional_analysis). With this tool we were able to answer questions 4 and 5.

Access and control and social profiles

These techniques intend to answer the question who has access to and control of knowledge, resources, services and decision-making and what kind of relationships exist that create and reproduce differences between women and men. Access to and control profile lists the resources people use to carry out the activities, indicates whether people have access to resources, which control the use and distribution of benefits of a community's use of resources. On the other hand, the social profile identifies social relations to assess what the roles and responsibilities of the community are, their rights, the control they have over their own life and the availability of tangible and intangible resources. The two techniques

were used to answer questions 2 and 3.

Capacities and vulnerabilities analysis

Capacities and vulnerabilities aims at identifying what will help (capacities) and what will hinder (vulnerabilities) the adaptation to climate change. Vulnerabilities are the long- term factors that weaken people's ability to cope with challenges, while capacities are the existing strengths of individual and social groups in terms of physical, material and social resources and their beliefs and attitudes. This tool was used to respond to questions 4 and 5.

Needs assessment

Provides a method of assessing the practical needs and what are the strategic insterests women and men have that must be addressed. Practical needs are those that if met would assist people in their activities, while if strategic interests are met, it would transform existing inbalance power. This means achieving the objectives of social justice, participatory democracy, non-violent resolution of conflict and ecologically-sustainable development. This tool was helpful in answering question 5.

3.2.3. Limitations

The main constraints to this work were found during the fieldwork and were related to the poor accessibility of the study areas, especially the Mapai-Nagale community and low levels of participation by people in interviews and focus groups. The main reason for that is, according to them *"we are tired of being interviewed and not seeing any palpable results"*. To overcome this situation we had to spend extra time explaining the objectives and the relevance of the study. There are other reasons for the low involvement of people. For example in Mapai-Ngale community, most men have migrated and women were reluctant to express their own opinions. In both communities, but especially in Magondzwene, drunken people attended the interviews and focus group discussions. Some of them would give evasive answers.

The interviews were too long and some of the people got tired in the middle and decided to give quick responses or just ask us to stop the interview. To overcome this situation, after the first few interviews, we grouped some of the questions to reduce the time spent with each household.

Additionally, for the group discussions we experienced prolonged period for ice-breaking and a few people dominating the discussions. Apparently, in both communities they haven't done this kind of discussions very often and this held back initial momentum. In the Magondzwene community, some men would sit down in women's group discussion and give their opinion. In this case women seemed

Table 1. Gender tools adopted in the study to respond each research question

TOOL ADOPTED /RESEARCH QUESTION (RQ)	RQ 1	RQ 2	RQ 3	RQ 4	RQ 5
Gender Analysis Matrix (GAM)	X	X			
Impact Assessment	X	X			
Access and control and social profiles		X	X		
Influencing factors;			X		
Institutional analysis;				X	X
Capacities and vulnerabilities analysis				X	X
Needs assessment					X

to refrain from of freely expressing their opinions. We frequently had to kindly ask men to leave the discussion, which was not welcomed by them.

Another difficulty with the interviews was in explaining the concept of climate change. At first, people had problems understanding it, so we had to give examples and ask specific questions. For instance, has Bambene Lagoon ever been the same for the past 10 years? Has the Limpopo River course changed over the last 10 years? Have you noticed changes in the rainfall/ temperature patterns? When do you started noticing these changes etc.

4. Results

In this section we present the major findings of this research organized in two sub-sections. First, we present a description of each community's bio-geographic setting, social and institutional organization, activities and, major constraints and capacities. Second, for each research question we comparatively present and discuss the results for both communities.

4.1. Communities' description

Mapai–Ngale Community (Chicualacuala District)

Mapai–Ngale community is located in the administrative post of Mapai in Chicualacuala District, northwest of Gaza Province, in the east side of the Limpopo River margin (Figure 1). It is a small community of about 500 people (more than half are women) distributed in 130 families.

Subsistence agriculture is the main activity in this community (100% of the interviewed households practice agriculture), followed by livestock production (85% of the interviewed households). Rain-fed agriculture is carried out between September/October and April when people cultivate maize, beans, groundnuts and squash. During the dry season people take advantage of the river margins to produce watermelon, tomatoes, lettuce among others. The natural vegetation is degraded mopane woodlands, dominated by *Colophospermum mopane* and a few other tree species with less than 20% canopy cover not more than 10 m high. From

Figure 4: Overview of Mapai-Ngale community: (a) Dry Limpopo River bed; (b) Margin of the Limpopo River; (c) The government authority's house; (d) a typical house.

the woodlands people collect fruits, worms (in good rainfall years), construction material (stakes and thatch) and firewood. Additionally, the woodlands are used as forage for the livestock (see Appendix III). Alternative livelihood strategies include charcoal production, bread-based alcoholic drinks production and informal jobs (construction and farms). Limpopo River is the main source of water, but during the dry season it dries up for several months (Figure 4a). During these months people dig a few meters underground to get water.

Ninety five percent of the interviewees revealed that they have faced several climatic/environmental changes over the last few years. The main identified changes are: (i) prolonged drought (100% of the interviewees said that they have experienced two years in a row with no rains,) and (ii) high speed winds (85% of the interviewees). Due to this situation 100% of people said agriculture is the activity that is affected the most – "agriculture is the base of our subsistence, but in the last few years the productivity has been decreasing drastically due to the lack of rains. In the past, we knew that with the winds from the south came the rain, but now the winds are stronger, destroy our houses and bring no rain" (group discussion with men in Mapai-Ngale). 55% of the interviewees noted that livestock has also been affected by drought.

Hundred percent of the households highlighted that as a consequence of the climatic changes, the community is facing several environmental problems as presented in Figure 5.

Moreover, the community is facing high level of men's migration (especially to South Africa) and increasing levels of diseases such as (in decreasing order of importance): HIV and AIDS, malaria, cholera and malnutrition.

Indigenous fruits and roots and other alternative livelihood strategies have gained importance in this community (see section 4.2. response to research question 4).

The division of labor between men and women is unbalanced. In fact, most men migrate to either South Africa or other places in the country leaving women in charge of the household for long periods of time. Migration has revised the gendered nature

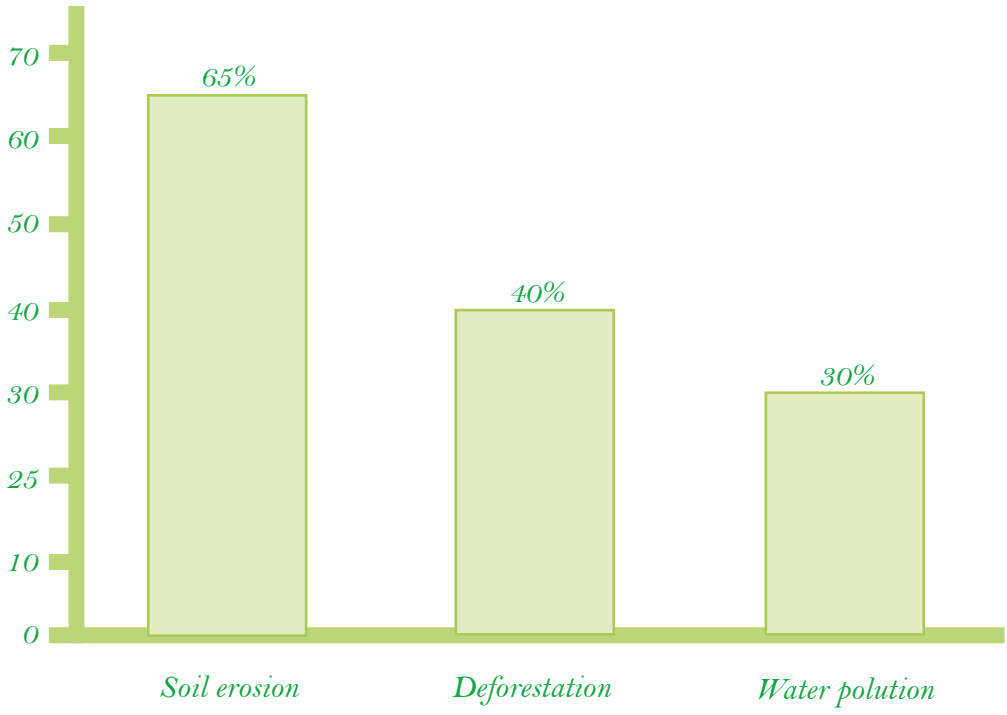

Figure 5: Main environmental problems experienced by the community of Mapai-Ngale.

of division of labour in rural communities. For instance, more than 50% of the interviewed families were female-headed households at least for part of the year (most of the times men come home only once a year). Moreover, migration has resulted in de-jure and de-facto female headed households. Thus, women are in charge of both productive and reproductive work, while men are only responsible for productive job. For female-headed households, the day-to-day decisions have to be made by women. However, whenever there's a major decision such as find a new place to live, cultivate, etc. it is done by men. Decision making despite migratory patterns remains male-dominated activity. Agriculture is carried out by both women and men, while livestock and charcoal production are men's responsibility. Women are also responsible for water, firewood and fruit collection (Table 2).

Table 2: Activity Profile for Magondzwene and Mapai-Nagale communities of Gaza Province.

COMMUNITY	ACTIVITY	MEN'S ROLE	WOMEN'S ROLE	ACCESS & CONTROL
MAGONDZWENE	**Subsistence Agriculture:** the most important activity in this community. Uses rudimentary techniques such as slash and burns, small axe and plough	In low years of production men helps women in plough and harvest. In good years of production they participate in all activities.	Women are in charge of agriculture being helped by children and men.	Both men and women have access to land for cultivation. However, men are the ones who have the control over land (They decide where to cultivate and what to do with the exceeding production). Only in case of women-headed households and in case that there are no family men in the community, can women control land.
	Fishing: it has gained relevance in the last few years, due to drought. It is both commercial and subsistence. They use small boats and fishing nets.	Men are in charge of this activity.	Women work as helpers through cleaning and selection of fish for commercial purposes. They get paid either by product or money.	Women have limited access and control over this activity and the profits from it.
	Livestock production: Nowadays this is the third most important activity, but used to be as important as agriculture. Due to the prolonged drought most people lost their animals.	Men are exclusively in charge of this activity. They basically take the herds to the grasslands and to the drinking points in the morning and in the afternoon they have to bring the herds back home.	No role in this activity	Both access and control over this activity is done by men. Due to the fact that cattle are an expression of wealth, men are the ones in charge of everything and the inheritance process is from father to sons only.
	Trading: this activity has gained importance in the last few years as a result of decrease in crop production and the need to get money to buy day-to-day products. it is done both within and outside the community. Trading includes also alcoholic drinks that have gained popularity lately.	Men are in charge of this activity, especially in selling fish outside the community. They are also the main consumers of alcoholic drinks from women.	Women are in charge of selling fruits and vegetables in small amounts. They also produce and sell alcoholic drinks, but the money they earn is controlled by men.	Both men and women have access to this activity, but men are the one that control it. All the profits from the trading activity are controlled by men.

COMMUNITY	ACTIVITY	MEN'S ROLE	WOMEN'S ROLE	ACCESS & CONTROL
MAGONDZWENE	**Migration:** this activity has increased drastically in the last few years due to the degradation of environmental conditions.	Men are the only members of this community that migrate to either South Africa or other places in the country in search of jobs and other sources of income	No role in this activity	Men are the only ones that have both access and control over this activity. They decide when and where to go and also when to return. Some just disappear. The destiny of the profits is decided by men.
	Charcoal production: charcoal has seen as one major source of income but at the current levels of forest degradation it is not sustainable.	Men's are exclusively in charge of this activity (production and selling)	No role	Men are the ones with access and control over this activity. They decide where to produce, which species to use and where to sell.
	Firewood, water and fruits collection: firewood is the main source of energy in the community, while fruits have gained higher importance lately due to ow crop production	No role	Women are exclusively in charge of this activity.	Women have access and control over this activity. They usually do it close to the houses but according to most of them the distances are increasing.
MAPAI-NGALE	**Susbsistence Agricullture:** the most important activity in this community. Uses rudimentary techniques such as slash and burns, small axe and plough. During the wet season is conducted in higher places, but during the dry season people cultivate along the Limpopo River	In low years of production men help women in plough and harvest. In good years of production they participate in all activities.	Women are in charge of agriculture being helped by children and men.	Both men and women have access to land for cultivation. However, men are the ones who have the control over land (They decide where to cultivate and what to do with the surplus production). Only in case of women-headed households and in case that there are no family men in the community, can women control land.
	Livestock production: nowadays this is the third most important activity, but used to be as important as agriculture. Due to the prolonged drought most people lost their animals.	Men are exclusively in charge of this activity. They basically take the herds to the grasslands and to the drinking points in the morning and in the afternoon they have to bring the herds back home.	No role in this activity	Both access and control over this activity is done by men. Due to the fact that cattle are an expression of wealth, men are the ones in charge of everything and the heritage process is from father to sons only.
	Trading: this activity as gained importance in the last few years as a result of decrease in crop production and the need to get money to buy day to day products. it is done both within and outside the community. Trading includes also alcoholic drinks that have gained popularity lately.	Men travel to the main village (about 17 km away) to buy products that they sell in the community.	Women are in charge of selling products from their farms but due to the low productivity they are forced to abandon it. Bread-based alcoholic drinks are the main product being commercialised by women in this community. The profits are enough to sustain the families	Both men and women have access to this activity, but men are the one that control it. All the profits from the trading activity are controlled by men. Since most of the households are women headed, the control over this activity is being taken over by women.

COMMUNITY	ACTIVITY	MEN'S ROLE	WOMEN'S ROLE	ACCESS & CONTROL
MAPAI-NGALE	**Migration:** this activity has increased drastically in the last few years due to the degradation of environmental conditions. More than 50% of the households are women-headed.	Men are the only members of this community that migrates to either South Africa or other places in the country in search of jobs and other sources of income	No role in this activity	Men are the only ones that have both access and control over this activity. They decide when and where to go and also when to return. Some just disappear. The destiny of the profits is decided by men.
	Charcoal production: charcoal seen as one major source of income but at the current levels of forest degradation it is not sustainable.	Men's are exclusively in charge of this activity (production and selling)	No role in this activity	Men are the ones with access and control over this activity. They decide where to produce, which species to use and where to sell.
	Firewood, water and fruits: firewood is the main source of energy in he community, while fruits have gained higher importance lately due to low crop production	No role in this activity	Women are exclusively in charge of this activity.	Women have access and control over this activity. They usually do it close to the houses but according to most of them the distances are increasing.
	Beer brewing (local trade): this is a new activity that women have been involved with for the last 2 years. They buy bread and brew a beer which they sell locally.	No role in the preparation and/or selling but the biggest consumers of this product	Women are in charge of this activity.	Women have the complete control over this activity.

However, the decision-making structure is composed by the elderly (both men and women), the traditional chief (the *Regulo*), the government authority that includes the president and its secretary and, the Mozambican Women Organization (OMM). This structure is responsible for the decision-making regarding to land allocation, conflicts resolution among other. Other institutions in the community include the OMM and a NGO – the JAM life. OMM helps solving women-related problems, while JAM life provides food for orphans and children attending school.

The Magondzwene community (Chibuto District)

The Magondzwene community is located in the Administrative Post of Chaimite in Chibuto District, south of Gaza Province (Figure 2). It is located downstream of the Limpopo River Valley in the surroundings of the Bambene Lagoon (one of the biggest in the Limpopo River Basin, Figure 6). It is composed of 1,297 inhabitants (more men than women) belonging to 237 families.

Subsistence agriculture is the main activity in this community (97% of the interviewees), followed by fishing (87% of the interviewees) and livestock production (55% of the interviewees). Rainfed agriculture is carried out during the wet season (September/October – April) when people cultivate maize, beans, groundnuts, squash, *golocotso*, *nhuru*, sesame and cassava. During the dry season people produce watermelon, tomatoes, lettuce among others. The natural vegetation is a degraded acacia savanna with less than 10% tree cover and no grass layer. From the savanna people collect fruits, construction material (stakes and thatch) and firewood. Additionally, the savanna is used as forage for the livestock. However, the area is facing considerable levels of desertification (Figure 6) and as a consequence resources from the savanna have become scarce. For example, grazing areas have

Box 1: Brief history of life of Mr. André Meque Chaúque (Mr. Gaba), the oldest man in Mapai-Ngale community

Mr Gaba was born in 1934 in Mapai-Ngale. He remembers growing up with abundant food and livestock. He also remembers several climatic events such as the floods of 1950 and 1977, but none was as bad as the floods of 2000. Mr Gaba says that after 2000 the environmental situation changed drastically. The soil around the river isn't the same so they had to abandon some plots and even though they produce the same crops, the production reduced considerably (compared to his childhood). As a consequence there is increased pressure on forests in search of fruits (marula, *tiswapo, massala, marula* nuts, tinhirre, ulharo) and roots (xicutsi), charcoal. The forest is decreasing as the regeneration is not being allowed. Mr Gaba used to have around 40 cattle heads, but he lost everything due to the floods and the recent two-year drought. The river is drying up. He remembers as a young boy, playing around the river, and fishing and to be aware of crocodiles. But now during the dry season they can play and walk in the river bed and fishing it's a forgotten activity. He remembers also several fruit trees in the river margins, but now they have disappeared especially after the floods of 2000. He says that nowadays young men have no choice but migrate to South Africa (or other places), but they also produce charcoal to sell in main village of Mapai about 20 km away. He thinks agriculture is slowly losing its place as a livelihood strategy as diversify into formal employment, selling drinks, etc

decreased and people (mostly men) have to travel longer distances to feed their animals (Appendix III). Alternative livelihood strategies are scarce and include collection of fruits (which are already scarce) and informal jobs (construction, livestock and farms), commerce and charcoal production (Box 2). Bambene Lagoon is the main water source for the community but, it has become salty so, people have to buy water from nearby communities (at a cost of about 2 Mt/liter ~ US$0.08).

Similar to the Mapai-Ngale community, the division of labor is unbalanced, with women in charge of both reproductive and productive work while men are only responsible for productive work. The rate of migration to South Africa is lower than Mapai-Ngale, but it occurs. Men usually are the ones in charge of the fishing activity, but women are responsible for sorting, cleaning and packing the fish [Figure 6; (c) and (d)]. For this, they receive an amount of fish, which has become the most important nutrition source in the area. Agriculture is carried out by both women and men, while livestock and charcoal production are men's responsibility. Water and fruits collection are performed by women (Table 2).

In Magondzwene, the decision-making structure comprises the elder (both men and women), the traditional chief (the *Regulo*) and the government authority that includes the president and its secretary. This structure is responsible for the decision-making regarding to land allocation, conflicts resolution among others. Other institutions in the community include the Fishermen Association which includes both men and women. This association functions as a discussion forum that deals

Figure 6. Overview of Magondzwene community: (a) village; (b) degraded acacia savannas dominate the area; (c) women working on fisheries in bambene Lagoon; (d) men fishing in Bambene Lagoon.

with all issues related to fishing activity, but they also discuss environmental problems that have become a concern on the last few years.

Ninety seven percent of the interviewees revealed that they have faced several climatic/environmental changes over the last few years. The main identified changes are: (i) Prolonged drought (100% of the interviewees said that they have experienced two years in a row with no rains,); (ii) high speed winds (97% of the interviewees) and floods (88% of the interviewees). Associated with this, this community is facing land degradation and desertification [Figure 6, (a) and (b)].

Seventy seven percent of the interviewees noted that agriculture is the activity that is affected the most by ongoing environmental changes – *"we used to live from agriculture, but nowadays our production is too low so we have to work for others and get some money to buy food, but this is hard because there aren't many alternative jobs in this community* (group of women working on fisheries in Magondzwene). As result, fishing and other alternative strategies (see section 4.2, response to research question 4) have gained importance. However, 42% of the interviewees highlighted that fishing activity is compromised by the fact that fish sizes have been decreasing. According to them, this results from a reduction in the Bambene Lagoon's size and water salinisation.

Hundred percent of the interviewees revealed that as a result of the climatic changes, the community is facing several environmental problems as presented in Figure 7.

There has been also an increase in levels of diseases such as (in decreasing order of importance): HIV/AIDS, malaria, cholera and malnutrition.

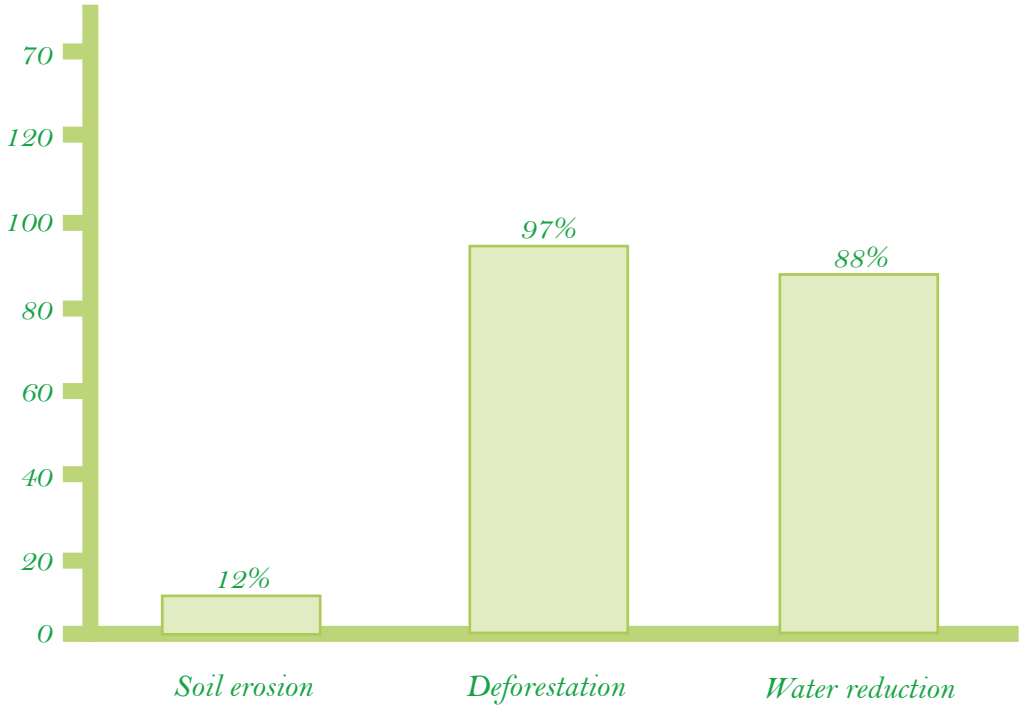

Figure 7: Major environmental problems in Magondzwene community.

4.2. Gender differentiated impact of climate change/variability

The organization of this section follows the research questions sequence. However, as agreed at the inception workshop to avoid unnecessary repetition, the first question will be analyzed together with the others and the answer to it will be provided in the conclusions chapter. Following is an analysis of questions 2 to 5.

Research question 2: How are women and men differently impacted by climate change?

The analysis tools used for this question reveal that the envisaged impacts of climate change will be gender differentiated.

Due to the harsh environmental conditions of the last few years (drought, strong winds and environmental degradation) in Magondzwene and Mapai-Ngale communities, women and men have spent more time in agriculture to get the same (or sometimes lower) production than they used to obtain. As a consequence, there has been an increasing trend for men to migrate to South Africa or other places within Mozambique and, this phenomenon is stronger in Mapai-Ngale community. Although out-migration of men is a historical phenomenon it has increased greatly in the last eight years and the pattern of migration has changed (Pendleton et al., 2006). Pendleton *et al.*, 2006 refer to an increased trend for migration of household-heads (and not single young men as used to be) in southern Africa, though in Mozambique it only happens in 28% of the households. The reasons and consequence are still not evident, but according to the people of Mapai-Ngale migration of household-heads men happen because of environmental degradation. Also, in this community there is an increasing number of men that don't return to the community (*"our sons and husbands go to South Africa and come home sick or they never come back*" says

Box 2: History of life of Mr. Mário Mhalene Macamo, the second oldest man in Magondzwene community.

Mr Mário was born in 1946 in the former Mangondzwene Community, now known as Macondlho Community. He remembers as kid and young boy having good production years and using *dzebela* – a type of plant that used to occur in the river margins and used to make flour and eaten as porridge. They also used to plant fruit trees, which together with crop production was enough to eat and sell. The changes he has been observing are shift in the growing season from September/October to November/December. And it is becoming shorter. Some fruit trees such as ndocomela, cashew, *macua*, *nwambu* e *lharu* have been reducing, while others such as canhu and nhire have been increasing. Hunting used also to be an important activity in this area, but nowadays all animals have disappeared. Regarding the fishing activity they used to use a type of net called *tintangane* made of bamboo, but now people use modern nets and Mr Mario says this may be the reason why fish is reducing in Bambene Lagoon. Mr Mario remembers also that formal work in cotton plantations during the colonial Era was an obligatory job, but nowadays they need these kind of work to compensate for the impacts of drought. For example in 2006 the community worked on road construction (between Muhambe and Maqueze) and they received maize, vegetable oil and groundnuts. He says that these kind of jobs might be an alternative way of life for the community.

Mrs. Evelina; Box 3). Further research on patterns, causes and consequences of migration is recommended for Mapai-Ngale community. In Magondzwene community, migration is more negligible but it has also been increasing.

The consequences of increasing men's migration are already evident in Mapai-Ngale community. Households with migrating men are able to rely less on natural resources activities for both income and nutrition. De Vletter (2006) says that southern Mozambique is traditionally less productive than the centre and north of the country but its pool of economic assets of the average rural household is higher. He attributes this to the larger labour migration in southern Mozambique.

On the negative side, migrating men contribute little to family activities, increasing the workload of women and other household members including children. In general, women become *de facto* household heads, especially in Mapai-Ngale (60% in Mapai-Ngale are women-headed households and only 27% in Magondzwene) taking on men's roles in addition to their productive and reproductive activities. For example, in both communities women are responsible for the household but, due to low crop production they have been pressed to find alternative income-generating activities such as brewery and selling of alcoholic drinks in Mapai-Ngale and fishery related activities in Magondzwene. According to women in both communities, these jobs provide an additional income for the family, but the consequence is that they have less time to dedicate to the household reproductive activities.

Box 3: History of Life of Mrs. Evelina Justino Xerindza, the oldest women in Mapai-Ngale community.

Mrs. Evelina was born in 1947 in Vilanculos, Inhambane Province and moved to Mapai - Ngale in 1960. She remembers when she came to the community, the soil and rains were good to cultivate. They used to have abundant production of maize, sorghum and beans. But now she says "the temperatures are higher, rains are becoming scarcer and the winds are stronger". Consequently, the crop season is now shorter (they can only sow for one season, otherwise they loose seeds) and is shifting (from October/November to December January). The herd of cattle in the area is shrinking drastically. The unpredictability of the farming system and recurrent droughts has forced men to migrate to South Africa in search of better jobs. However, in many cases they are killed, disappear or come back home sick. She revealed that she diversified into brewing alcoholic beverages for resale order to compensate for the low crop production.

As a result of migration, men become vulnerable to some diseases such as HIV/AIDS and tuberculosis and also to death (some even die before return back home, Box 2). Indirectly, women suffer the consequences of increasing epidemic levels of HIV and tuberculosis by being contaminated by men. Women also carry increased burdens as carers of Aids patients in the context of home-based care. Increasing levels of disease imposes additional pressure over women since apart from suffering (from diseases) they are also responsible for finding either formal or informal health services for the family.

Another extra load on women's lives is that the reproductive work that is not entirely women's responsibility has been requiring extra time. For example, the distances for water (about 2 km and 4 km in Mapai-Ngale and Magondzwene, respectively) and firewood collection (about 2 km and 1 km in Mapai-Ngale and Magondzwene, respectively) have been increasing in the past few years due to environmental degradation.

The immediate consequence of extra time needed is that women have less time to spend with kids (which in turn are either left by their own or forced to abandon school to help adults) and for the household tasks. This may, although not yet visible, lead to a disruption in community's social structure, which may in turn constrain the adoption of adaptation measures to climate changes/variability.

Although women are crucial and active members of these communities they don't have much of an active voice since most community structures are male-dominated. At the family level, women submit to their husbands. If he is not present, they submit to either the oldest son or the closest family man to make decisions. At the community level, the decision-making structure is still also male-dominated.

Men's migration has however, indirectly benefited women in terms of their participation in the decision-making structures. For example in Mapai-Ngale where most men migrated, OMM has become a stronger organization in the decision-making structure (there are 8 women and 6 men in the decision-making structure). In contrast, in Magondzwene where men's migration is lower, women still don't participate actively in the decision-making process (8 men and 2 women in the decision-making structure). Given the fact that women know environment's state-of-the-art better than men (they know where to collect water, where to go when someone gets sick, the best places to cultivate and graze animals) stronger women position represent an advantage to cope the effects of climate change. This aspect of women empowerment on decision-making should be further explored.

Research Question 3: What are the physiological, political, economic and societal causes for the differences experienced, if any?

The analysis tools for this question reveal that the envisaged impacts of climate change may be gender differentiated due to unbalanced labor division and the decision-making structure of these communities.

At the family level, one of the main causes of the differentiated impact of changing environmental conditions is the power relations, which gives women access to but not control over natural resources (see response to question 2, p.7). For instance, the customary law in both communities is that land, cattle and other assets can only be inherited by men because women may leave the community when they get married. This creates a dependency of women on men's decision about where to establish houses and what livelihood strategies they should adopt even though women (because they never leave the area and depend more on natural resources) usually know the area better.

Another important cause of the differentiated impacts of environmental changes is the established rule that women are responsible for reproductive work but at the same time its role on productive work is increasing. This imposes higher pressure on women as they have to guarantee family stability at all levels (health, nutrition, economics, etc).

At the community level, women's participation on decision-making regarding resources and conflict resolution is still rudimentary, thus resulting in weak women's capacity to give advice on aspects they know better than men. However, this might change in the future with increasing men's migration and the consequent empowerment of women as decision-makers (see response to question 2, P.8). The result may be that decision-making about coping strategies will be taken according to the reality of the communities.

These communities have both strong religious beliefs which constrain decision and/or adaptation measures. The majority of the people said they can't do much – even move to a better place – "*because God has the power to make things happen and if He wants the situation to be like that we will have to die for it*" (response of 90% of the interviewees to the question of what will they do if environmental degradation get worse).

The existing policy/institutional system in the country still doesn't provide a strong basis for gender equality and equity. However, the situation is changing and the legal framework is being adjusted to guarantee the mainstreaming of gender issues in climate change adaptation strategies (see section 2.2). For example the strategic plan for Gaza Province has as one of its priorities "to promote gender equity and increase women's participation in the socio-economic development of Gaza Province". To achieve this some of the planned measures are: (i) To empower women in aspects of leadership; (ii) to promote women's participation on politics and decision-making structures; (iii) improve women access to the work-market; (iv) to implement programs for the diversification of subsistence crops and access to improved technologies including agro-processing; (v) improve the access to health care services and nutrition programs.

Research Question 4: What are the current coping and adaptation strategies and capacities?

Coping and adaptation strategies and capacities exist in these communities and are especially focused on alternative food sources, jobs and lifestyle. Due to drought conditions and consequent decrease in crop production people have adopted the strategy of cultivating dry season's vegetables (lettuce, pumpkin, tomatoes, etc) all year around. This has been happening since 2006 in response to the drought conditions. In general, people dig a few meters and get underground water to irrigate their fields.

People are also relying more on forests as sources of food (fruits and roots), but the sustainability of this activity is questionable. In Mapai-Ngale, forests have higher diversity of resources than Magondzwene, which is probably due to lower levels of forest degradation in the former. For instance, in

Mapai-Ngale they rely on fruits such as *tinhirre, ulharo, marula* and, *massala*, roots of *xicutsi*, which they mix with an animal skin to make a porridge-like food. In contrast Mangondzwene inhabitants rely only on two fruit trees namely *muambo* and *tinhirre*. This community has some experience in cultivating fruit trees (mango and cashew), a past experience that was abandoned due to the current drought. However, some families managed to grow the trees, so they think it can be an option for limited crop production. It is worthwhile to mention that forest-related activities (fruits and roots collection and firewood collection) are all women's responsibility thus, increasing their burden in response to climate change.

In the Magondzwene community fishing activity has gained importance in the last few years. But, this has imposed some pressure on the Bambene Lagoon. For example, even though the rule is to catch only fish of a certain size, it hasn't been observed due to high demand for fish. Reduced water and increased salinity levels in the lagoon resulting from drought conditions impose further strains on fishing activity. Although a Fishermen's Association exists, this institution doesn't have the capacity (material and financial) to control the activity and thus, it should urgently be strengthened. Women play a key role in this activity and it is increasing considerably, especially in processing and fishing.

Charcoal production has increased in both communities, but in Magondzwene it is limited by the scarcity of forests. This activity isn't sustainable in both Mapai-Ngale and Magondzwene communities due to the levels of forest degradation. In fact, people indicate longer distances and scarcity of "good" charcoal species as the main limitations for this activity. Charcoal production is regulated by the government, which requires a license with further limiting the activity through costs.

In Mapai-Ngale, an alternative livelihood strategy that gained importance in the last two years for women is the fabrication and commerce of a bread-based alcoholic drink. This activity has the advantage that women don't leave home for long periods of time and thus, have more time for household activities. However, it has the disadvantage of promoting drunk-related problems such as violence, diseases and promiscuity. In fact, during the field work some people didn't want to collaborate simply because they were drunk (both women and men). From our point of view, this activity should be discouraged in this community.

Informal jobs such as helping in construction, cattle herding and farms have also gained some importance in these areas. The creation of alternative jobs in these communities should be considered as a relevant opportunity to overcome harsh environmental conditions and low crop production. These activities are mostly done by men and their promotion could probably increase men's settlement in the communities (reduce migrations).

Magondzwene community is better organized than Mapai-Ngale in terms of formal and informal organizations to discuss environmental problems. For example, they have a Fishermen's Association that meets regularly to discuss problems (including environmental issues). On the other hand, Mapai-Ngale has a better representation of women in the decision-making structure – the OMM is becoming stronger and better positioned – which may help balancing the gender differentiated impacts of climate change.

Research question 5: How can the capacity of women and men be strengthened to better adapt to climate change and climate variability?

There is general consensus amongst policy makers and academics that there are four ways to strength women and men's capacities for a better adaptation to climate and/or environmental changes. These include the implementation of existing policies and programmes, allocation of resources, capacity building and reinforcement of women's participation in local institutions. Due to the key role women play in these communities, they should always be considered as the target group in any activity.

As discussed previously, there is a good spectrum of legal instruments at both national and local scales that indicate priorities to cope and adapt

to climate changes. These include NAPA, Strategy of the Agrarian Sector, and Strategic Plan for Gaza Province among others. All these tools prioritize agriculture, forestry, water and education sectors as well as cross-cutting issues. However, there is still a need to put those plans in action, which requires first the harmonization of the different instruments to find synergies among them, second a prioritize activities according to their need and effectiveness and last, allocation of resources (financial, material and human) to implement them at all levels.

Lack of material resources such as seeds, food, tools and infrastructure among others, exacerbate the effects of climate/environmental changes in these communities and must be considered a priority to help people cope and adapt to environmental changes. In this context, improving access to resources include create banking facilities (such as leasing, credit, microfinance, etc), subsidies on inputs, distribution of drought resistant seeds, promotion of agro-processing techniques, access to markets among others. Promoting traditional techniques is also important as for example the now abandoned fishing net made of wood that avoided catching small fish. Given that water is one of the main constraints to agriculture and the fact that people use ground water to irrigate farms in Mapai-Ngale for example, the construction of an irrigation scheme should be considered in order to avoid people from abandoning farms.

Capacity building is another major strategy to help these communities in coping and adapting to climate changes. This includes training women and men on new agriculture, forestry and fishing techniques such as irrigation schemes, drought resistant varieties (sorghum, cassava, maize), sustainable use techniques for native plant species (*xicutsi, tinhirre*, etc), fruit tree cultivation, etc. Exchange visits to other communities facing the same problem in which group discussion would be promoted could help finding additional strategies and measures of adaptation.

The creation and reinforcement of local institutions and discussion fora in which women's participation should be encouraged, could also help these communities in dealing with new environmental situation. People are aware of climate changes/variability, but they don't formally discuss the problem (causes, consequences and ways of coping) among them. Additionally, the forums might be an opportunity to improve women's participation in the resolution of environmental and social problems, especially because they are the "permanent" members of these communities. Institutional capacity is weak in both communities. For example while a fishermen's association exists in Magondzwene, Mapai-Ngale doesn't have any of these kinds of institutions. Women participation in the fishermen's association is encouraged and they should be empowered regarding to fishing activities especially relatively to the type and the amount of payment they receive as helpers. Similar kinds of groups such as fishermen's are recommended especially for the priority sectors such as agriculture. For instance, since individual production is decreasing, a group of women (and men) farmers – *farmers' club* -cultivating together in a common plot could be created. This would promote sharing of tools; seed and knowledge while at the same time would encourage discussion and facilitate the resolution of some problems.

At district or provincial level, the formation of an environmental multi-institutional task force (including institutions as MICOA, INGC, MINAG, water, NGO's etc) would help in strengthening these communities. A unit like that would be responsible for identify and discuss problems, promote and strengthen people's capacities and find alternative ways of life. It could also be the channel through which existing legal instruments are implemented.

Regarding to reinforcement of coping strategies, the Mapai-Ngale community is better positioned than Magondzwene. There is a joint-programme between several national and international institutions (FAO, UNDP, UNEP, Ministry for Coordination of Environmental Affairs, UN/HABITAT, Ministry of Agriculture, UNIDO, National Disaster Management Institute, the WFP and National Meteorology Institute) which aims at environmental mainstreaming and adaptation to climate change

in Chicualacula District, which is starting this year (2009). The programme is intended to provide the communities with the necessary tools to become more resilient to the impact of climate change, and to adopt alternative livelihoods options as sources of income generation. Capacity building is an essential component and building block for the implementation of the programme. Simultaneously, the programme has a component that aims to integrate results into policy formulation and planning initiatives at a wider, i.e. provincial and national, level.

5. Conclusion and recommendations

Environmental changes are in place in both Mapai–Ngale and Magondzwene communities of Gaza Province in the south of Mozambique. The impacts are noticeable at several levels including increased men's migrations, focus on alternative livelihood strategies of life, higher incidence of epidemic diseases, extra time needed for several household activities and reduced crop production.

Women and men are differently impacted by climate change/variability mostly because they have dissimilar roles and also because of the decision-making structure in the communities. Moreover, women's access to and control over the resources is weak. Because women tend to be more settled in the communities they, on one hand, are the ones that directly suffer the consequences of environmental changes. On the other hand, they may gain better societal positions (and it is happening in Mapai-Ngale), which might empower them as decision-makers. If this happens it will help in defining better adaptation strategies to climate change. Migration has exposed men to several diseases such as HIV/AIDS and tuberculosis which they transmit to women once they return home (when they do). Local institutions either don't exist or are weak imposing further limitations on discussion and decision-making about environmental issues.

People have several coping strategies that are increasingly gaining importance in these communities. Those include bread-based alcoholic drinks in Mapai-Ngale, fishing in Magondzwene and, native fruits collection and charcoal production in both. However, the alternative livelihood strategies are mostly based on the use of natural resources and their sustainability under a changing environment is questionable. Thus, there is an urgent need to find sustainable alternative livelihood strategies of life. This would only be possible through materialization of existing policies and programmes, allocation of resources, capacity building, and reinforcement/creation of local institutions on environmental gender-related issues.

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8. Appendices

Appendix I: Model Questionnaire

Question Zero:

1. Do you know about climate change? If yes
2. What do you know about climate change?
3. Where did you get your knowledge on climate change?
4. What is your understanding about climate variability?
5. Would you say there is a difference between climate change and climate variability? If yes, what would you say the difference is?
6. If no, why do you think there is no difference?

Research Question One: Are women and men in Southern Africa differently impacted by Climate Change?

1. What kind of activities are women and men involved in?
   - What is the status attached to each activity?
   - How much time is used in each activity?
2. What are the main livelihood strategies?
   - What other livelihood strategies are used and what is their contribution?
   - What kind of formal and informal employment is available in the community
   - What criteria are used in recruitment?
3. What climatic events/ natural disasters have been experienced in the community?
   - Which of the events are the most frequent?
   - How do these climatic events/ natural disasters impact on the community and individuals within the community?
   - What activities is the community/individuals involved in that are affected by these climatic events/ natural disasters?
   - How far does the impact of the climatic events stretch?
   - Has there been an increase in the number of these extreme climatic events/ natural disasters?
4. What natural resources are available in the area?
   - What are the uses of these resources?
   - Rank the natural resources in terms of value and importance
   - What are the local rules with regard to the use of these resources
   - Who has access to the resources identified?
   - Who has the right to use the resources identified?
   - Who owns the resources identified?
   - Who makes decisions about natural resource ownership, use, access and benefit sharing?
   - What are the gender differences in access to resources and what is the reason for these differences?
5. What are the current land tenure rights in t he community
   - Who has land rights in the community?
   - What are the major land uses within the community?
   - How is land allocated in the community
   - Do men and women have equal opportunity to own or inherit land? How?
6. What are local institutions and programmes exist in the community?
   - What is the number of women and men in the management of such institutions?
7. What are the norms and values of the community?
   - What is the justice system of the community and do women have access to it?
   - What is the process of decision making and how do women participate in this process?

Research Question Two: How are women and men differently impacted?

8. What kind of activities are women and men

involved in?
   - What is the status attached to each activity?
   - How much time is used in each activity?
9. What are the main livelihood strategies?
   - What other livelihood strategies are used and what is their contribution?
   - What kind of formal and informal employment is available in the community
   - What criteria are used in recruitment?
10. Has there been any change in the amount and duration of rainfall in the community?
   - Has there been any change in the quality and quantity of the crops harvested over the past ten years?
   - Has there been any change in the quality of the soil over the past ten years?
   - Has there been any change in the varieties, quantity and quality of wild plants, animals and grass species?
   - Has there been a change in the number of livestock over the past ten years?
   - Has there been any change in grazing: reduced grazing area, increased number of livestock, lack of grass cover? Can these be attributed to a change in climatic conditions or poor management?
11. What climatic events/ natural disasters have been experienced in the community?
   - Which of the events are the most frequent?
   - How do these climatic events/ natural disasters impact on the community and individuals within the community?
   - What activities is the community/ individuals involved in that are affected by these climatic events/ natural disasters?
   - How far does the impact of the climatic events stretch?
   - Has there been an increase in the number of these extreme climatic events?
12. Is there a group of people that is better prepared for these climatic events/natural disasters? Why is this so?
13. Is there a platform where environmental problems are discussed and/ or information is shared?
14. How far do the community/ individuals travel to collect fuelwood, water, fruits and edibles, thatch, and household construction materials?
15. Who makes decisions about natural resource ownership, use, access and benefit sharing?
16. What community groups or resource user groups exist in the community if any?
17. Are there any mechanisms that control who has access to and control of productive resources? If yes explain.
18. Have women's and men's health changed over the years?
   - How do women and men access health facilities? And health services?
19. How have women and men's agricultural practices changed over the years, if at all?
   - What agricultural products are produced in the community?
   - Is there a market for local products and produce?
   - How does the community access markets for their agricultural products?

Research Question Three: What are the physiological, political, economic and societal causes for the differences experienced, if any?

20. Who makes decisions about natural resource ownership, use, access and benefit sharing?
   - Who allocates land in the community?
   - Who facilitates inheritance of land and property in the community
   - Who ensures that the laws on land and natural resource use are adhered to?
   - Who resolves conflict in the community?
   - Who decides how benefits from government, natural resources or donors are shared?
   - Who prioritizes the needs of the community?
21. Have women's and men's health changed over the years?
   - How do women and men access health facilities? And health services?
   - What are the most common health problems in the area?
   - How are theses health problems dealt with?

22. Is there a market for local products and produce?
23. Who possesses agricultural indigenous knowledge in the community?
    - How useful is the knowledge?
    - Does everyone have access to this knowledge?
24. What other environmental problems are experienced in the area?
    - How do they affect food security and livelihoods?
25. What are the current land tenure rights in the community
    - Who has land rights in the community?
    - What are the major land uses within the community?
    - How is land allocated in the community
    - Do men and women have equal opportunity to own or inherit land? How?
26. What are local institutions and programmes exist in the community?
    - What is the number of women and men in the management of such institutions?
    - What do the institutions do?
    - Who are the members and how does one become a member?
    - Are certain people excluded from being members? If so why?
27. What are the norms and values of the community?
    - What is the justice system of the community and do women have access to it?
    - What is the process of decision making and how do women participate in this process?

Research Question 4: What are the current coping and adaptation strategies and capacities?

28. What climatic events/ natural disasters have been experienced in the community?
    - Which of the events are the most frequent?
    - How do these climatic events/ natural disasters impact on the community and individuals within the community?
    - What activities is the community/ individuals involved in that are affected by these climatic events/ natural disasters?
    - How far does the impact of the climatic events stretch?
    - Has there been an increase in the number of these extreme climatic events?
29. How did each household and the community deal or cope with the climatic events/ natural disasters mentioned above?
30. What social structures (e.g. social networks) help the community to cope and deal with climatic events/ natural disasters?
    - Who makes use of these social structures?
    - Who benefits from these social structures?
31. What norms, beliefs, laws and programmes (local and national) make dealing with climatic events/ natural disasters more difficult and reduce ability to cope?
32. What norms, beliefs, laws and programmes (local and national) make dealing with climatic events/ natural disasters easier and increase ability to cope?
33. Which weather or climate related problems make agricultural production difficult and also affect household livelihoods (access to natural resources)?
34. What is done to prepare for and deal with such problems?
35. What will individuals, households and the community do if:
    - Flooding becomes more frequent
    - Drought becomes more frequent
    - Pests and insect outbreak becomes more frequent
    - Changes in growing seasons (shorter growing season)
    - Shortage of water
    - Areas suitable for crop production becomes less
    - Areas suitable for grazing becomes less
    - Conditions becomes more drier
    - More disease outbreaks
    - Increased good rainfall years
36. What natural resources and services help individuals, households and the community

cope better with climatic events/ natural disasters?

- During natural disasters are there natural resources (mopane worms, thatch, indigenous fruits etc) that become more abundant and contribute towards household livelihoods?

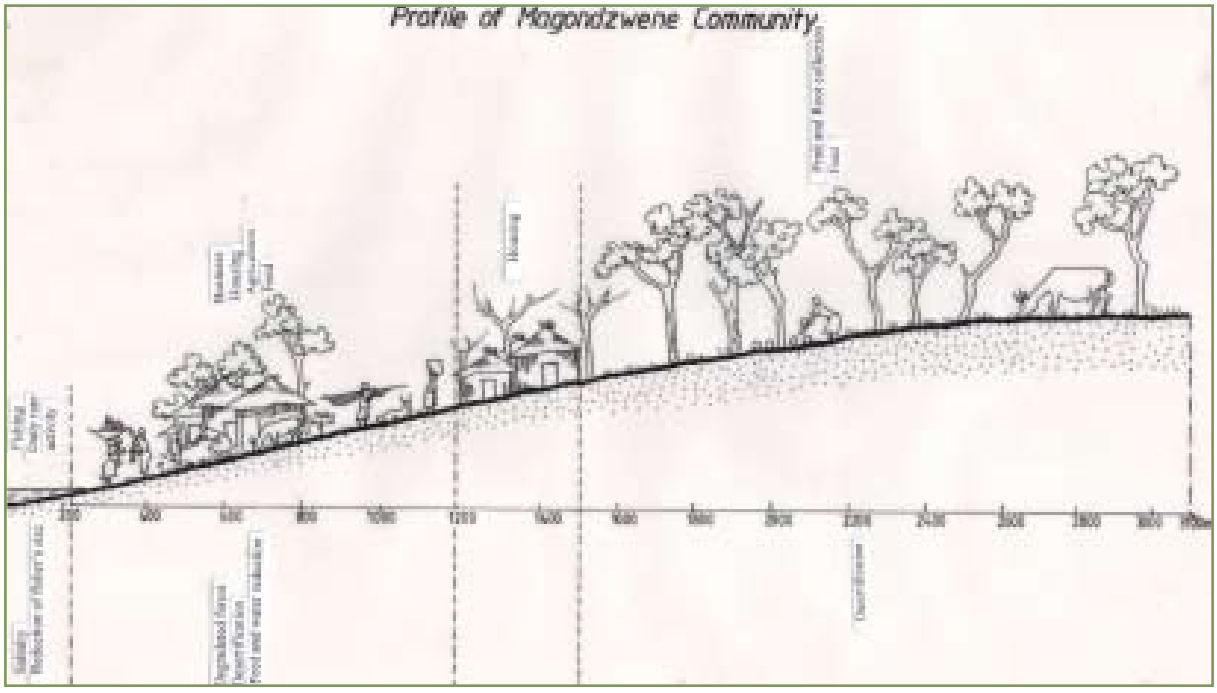
Research Question Five: How can the capacity of women and men be strengthened to better adapt to climate change and climate variability?

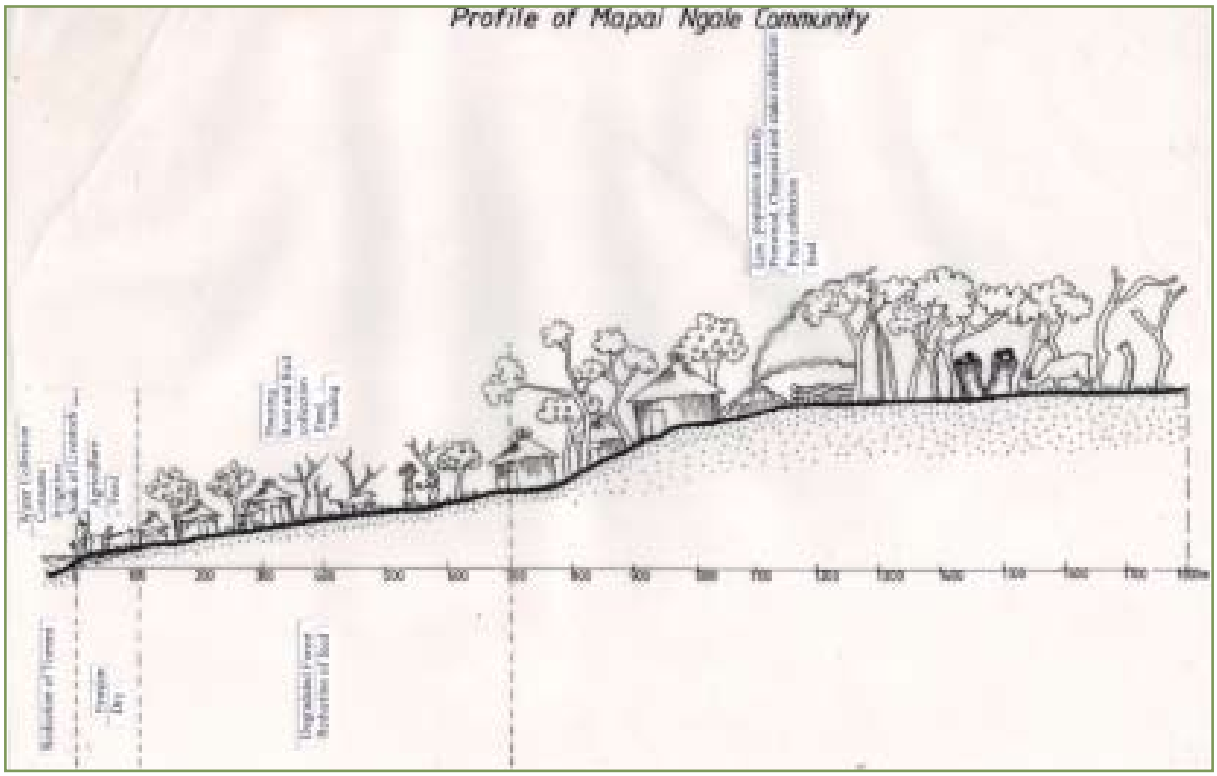
37. What are the aspirations of women and men in the community?
38. What would you like to see happen that will help women and men cope better and adapt to climate variability and climate change?
39. What adaptation options can be developed and implemented to lower risk and vulnerability to climate change?
40. What kind of policies or programmes do you think would be effective in reducing vulnerability of women and men to climate variability and future climate change?
41. Are there any specific needs you feel should be addressed urgently in order to build the coping and adaptive capacity of women and men?

Appendix II: Guide questions for life histories

1. How long have you lived in this community?
2. What climatic changes have take place over time?
3. Would you describe the changes to be good or bad? If bad explain.
4. If good explain.
5. What changes have taken place due to change in the climate?
6. What climatic events are most frequent?
7. How do men and women cope with these climatic events?
8. Are people coping better today than in the past? Explain your answer.
9. What was it like in the past?
10. What has changed today?
11. What has caused the change in the way people cope to climatic events?
12. What makes men and women vulnerable?
13. How do men and women currently cope with climate variability?
14. Are there any social networks to help reduce vulnerabilities of men and women? Explain
15. What are the existing challenges that affect men and women's ability to cope and adapt to current climate variability?
16. What are the existing challenges that may affect men and women's ability to cope and adapt to future climate change?
17. What would be the best way to empower men and women so as to reduce risk and vulnerability to climate variability and future climate change?

Appendix III: Profile of Magondzwene and Mapai-Ngale communities





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Our foremost task is civic education in Germany and abroad with the aim of promoting informed democratic opinion, socio-political commitment and mutual understanding. In addition the Heinrich Böll Foundation supports artistic and cultural as well as scholarly projects, and co-operation in the development field. The political values of ecology, democracy, gender democracy, solidarity and non-violence are our chief points of reference. Heinrich Böll's belief in and promotion of citizen participation in politics is the model for the foundation's work.

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