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The **Social Dimensions** of Adaptation to Climate Change in **Mozambique**



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The **Social Dimensions** of Adaptation to Climate Change in **Mozambique**

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TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS	vii
ACKNOWLEDGMENTS	viii
1. INTRODUCTION AND OVERVIEW	1
<i>The EACC study</i>	1
<i>The Process of the Study</i>	3
<i>The Outline of this Report</i>	3
2. SOCIAL DIMENSIONS OF CLIMATE CHANGE IN MOZAMBIQUE	5
<i>Expected Physical Impacts of Climate Change in Mozambique</i>	5
<i>Current Hazards</i>	5
<i>How the Hazards Will Change Because of Climate Change.</i>	7
<i>National Planning for Climate Change: NAPA and Other Strategies</i>	8
<i>Overview of Social Vulnerability in Mozambique</i>	11
<i>Bottom-up Research Studies.</i>	11
<i>Studies Using the Household Food Economy Approach</i>	14
<i>Top-down Approaches</i>	15
3. RESEARCH METHODOLOGY	17
<i>Research Strategy and Questions</i>	17
<i>Site Selection and Sampling</i>	17
4. PARTICIPATORY SCENARIO DEVELOPMENT WORKSHOP RESULTS	21
<i>PSD Workshops: Design Overview</i>	21
<i>Overview of Results from Local and National Workshops</i>	22
<i>Xai Xai Key Insights.</i>	22
<i>Beira Key Insights.</i>	24
<i>Maputo Key Insights.</i>	25
<i>Synthesis.</i>	25

<i>Adaptation Options: Key Sectoral Themes</i>	26
<i>Agriculture and Ranching.</i>	26
<i>Agroforestry</i>	26
<i>Fishing</i>	26
<i>Trade and Commerce.</i>	26
<i>Identification of Most Vulnerable Groups</i>	28
<i>Relative Prevalence of “Hard” Versus “Soft” Adaptation Options</i>	29
<i>Congruence with National Plans, including NAPAs</i>	30
<i>Policy Preconditions and Institutional Base</i>	31
<i>Conclusions from the Workshop Track</i>	32
6. FIELDWORK RESULTS	33
<i>Results from Institutional Interviews</i>	33
<i>Results from Focus Group Discussions</i>	34
<i>Results from Household Surveys</i>	35
<i>Household Size, Resource Access, and Self-Sufficiency.</i>	36
<i>Experience with Climate Hazards.</i>	37
<i>Past Adaptation and Coping Practices.</i>	38
<i>Planned Adaptation and Strategies.</i>	40
<i>Who Should Help?</i>	40
<i>Synthesis of Quantitative Findings from Household Survey</i>	40
<i>Synthesis of Fieldwork Results</i>	41
7. SYNTHESIS AND DISCUSSION	42
<i>Adaptation Options</i>	42
<i>Differential Vulnerability</i>	43
<i>Limitations of the Study</i>	44
<i>Conclusions</i>	45
REFERENCES	47
APPENDIXES	50
APPENDIX 1. INTERESTING RESULTS FROM INDIVIDUAL FOCUS GROUP DISCUSSIONS	50
APPENDIX 2. SURVEY INSTRUMENT	54
APPENDIX 3. FIELD REPORT SUBMITTED OCTOBER 5, 2009, BY RAUL VARELA	59

TABLES

Table 1. Most Important Disaster Types in Terms of Numbers Affected and Killed	6
Table 2. Risk and Vulnerability Factors According to Natural Disasters in the Búzi District	12
Table 3. Adaptation Pathways Identified in the Maputo Workshop	25
Table 4. Workshop Results	26
Table 5. Specific Results and Suggestions from the Workshops	27
Table 6. Key Findings in the Fishing Sector	27
Table 7. Key Findings for the Trade and Commerce Sectors	27
Table 8. Key Adaptation Options from PSD Workshops	30
Table 9. Interesting Lessons from the Focus Group Interviews	34
Table 10. Aggregate Results from Focus Group Discussions	35
Table 11. Key Adaptation Options from Fieldwork	43

FIGURES

Figure 1. Social Vulnerability in Mozambique Projected to 2060	2
Figure 2. Number of People Affected or Killed by Natural Disasters in African Countries, 1990–2007.	5
Figure 3. a and b. Precipitation and Drought.	6
Figure 4. a and b. Flood Risk Maps.	7
Figure 5. a–d. Projections Made by the INGC Study.	9
Figure 6. Changes in Flood Risk.	10
Figure 7. Estimates of Changing Risk Levels between 2000 and 2060.	15
Figure 8. Social Vulnerability Hotspots.	19
Figure 9. Final Fieldwork Sites.	20
Figure 10. Steps in Regional and National Workshops.	23
Figure 11. Mapping of Geographical Origin and Expertise.	24
Figure 12. Vulnerable Regions Identified in the Xai Xai Workshop.	28
Figure 13. Regions Identified as Most Vulnerable in the Maputo Workshop.	29
Figure 14. Distribution of Household Sizes.	36
Figure 15. Proportion of Field Sizes in High and Lowland Areas.	36
Figure 16. Cumulative Distribution of Crops Kept for Household Consumption.	36
Figure 17. Number of Months that Household Grain Stocks From Own Harvest Last.	37
Figure 18. Proportions Affected by Climatic Hazards and Receiving Early Warning of These.	37
Figure 19. Ranking of Hazards by Residents.	37
Figure 20. Coping Mechanisms Before, During, and Immediately After Climatic Hazards.	39

ACRONYMS AND ABBREVIATIONS

CCGC	Coordination Council for Disaster Management
CRED	Center for Research on the Epidemiology of Disasters
EACC	Economics of Adaptation to Climate Change
FEWS-NET	Famine Early Warning System Network
GEF	Global Environment Facility
HEA	Household Economy Approach
IISD	International Institute for Sustainable Development
IPCC	Intergovernmental Panel on Climate Change
NAPA	National Adaptation Program of Action
INGC	National Disaster Management Agency
MDGs	Millennium Development Goals
MICOA	Ministry for the Coordination of Environmental Affairs
NAPA	National Adaptation Program of Action
PSD	Participatory Scenario Development
SRES	Special Report on Emissions Scenarios
UNFCCC	United Nations Framework Convention on Climate Change

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1. INTRODUCTION AND OVERVIEW

THE EACC STUDY

The purpose of the Economics of Adaptation to Climate Change (EACC) study is to better understand and estimate the true costs of adapting to climate change in less developed countries. The study is made up of three components. At a global level, there is an analysis of costs across different economic sectors. At a country level, there is an economic component and a social component, taking place in a set of representative case study countries. Mozambique is one of these countries.

The economic component of the Mozambique country study has the objective of identifying a set of robust adaptation options for the country, then comparing the direct costs and benefits of those options. To calculate the costs, the team has utilized a computable general equilibrium method. This method is data intensive—it requires a good model of the national economy—but can generate an estimate of the costs of targeted government interventions, in terms of reduced overall economic growth, once those effects have trickled through the labor and capital markets and the economy has returned to equilibrium. The economic team considered a range of adaptation options, which were gathered from the literature and from interactions with national level policy makers and other stakeholders.

The social component of the Mozambique country study has a less precisely defined purpose, and this reflects the relative ambiguity of the term “social vulnerability” in the first place. Crudely stated, the concept of

social vulnerability rests on the premise that the extent to which climate change harms people depends on a broad set of factors having to do with individual empowerment to weather storms and to make changes, and the extent to which social interactions contribute to or detract from that empowerment (Adger 1999; Brooks et al. 2005). So one purpose of this study is to find out what individual and social factors make people more or less vulnerable, and to identify adaptation strategies that would reduce that vulnerability (Cutter 2001). The idea of social vulnerability also rests on the premise that within any community there are some people who are especially vulnerable, and a just society should take steps to help them in particular. So a second purpose of this study of social vulnerability and adaptation is to identify those livelihood activities and people likely to be most harmed by climate change, and then identify realistic ways of improving their situations (Osborne et al. 2008).

This study builds on a recent assessment of social vulnerability in Mozambique, conducted as part of a study led by the National Disaster Management Agency (INGC). Patrick Nussbaumer took a standard social vulnerability framework from the literature—previously used to rank African countries (Vincent 2004; Vincent 2007)—that relied on a set of a dozen indicators. He estimated future trends in these indicators consistent with two development scenarios—the A2 and B1 Special Report on Emissions Scenarios (SRES) of the Intergovernmental Panel on Climate Change (Nakicenovic and Swart 2000)—to see where Mozambique will be in 50 years compared to now and compared to other African countries behind which it currently lags. Figure 1 shows the results. As is evident, the social vulnerability of Mozambique by 2060 looks

better than that of South Africa today. That is good news for people who think that South Africa is in relatively good shape. It would suggest, perhaps, that to estimate future climate change impacts on people in Mozambique in the future we should think about the effects on people in South Africa today.

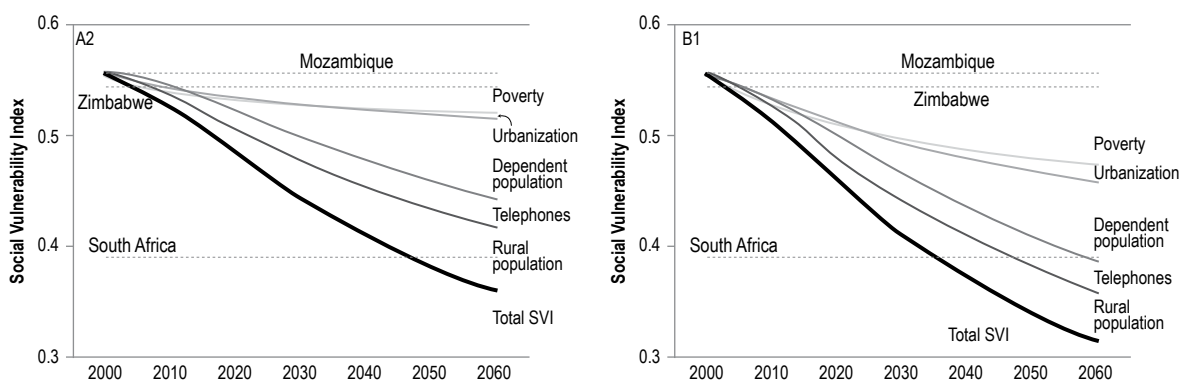
That study, however, was relatively silent on the issue of adaptation. A key issue for this study, then, is to move forward and reach conclusions about adaptation based on an appraisal of social vulnerability.

In this study, we have taken the deliberate approach of considering development first, and then putting climate change on top of that, rather than the other way around. This means identifying where the country and its people are headed and would like to go, and associating numerous activities and steps with the achievement of that progress. Then, we have looked at where climate change may interfere with those activities and steps, and hence threaten the development vision. Adaptations are things that allow the development vision to proceed. The alternative approach, which is what has arguably guided most research efforts to date, is to start with the identification of climate impacts, and see how these might negatively affect society as it is structured now. After having done so, one then sees how future development pathways may exacerbate or ameliorate this situation.

If one could be completely “rational” or “logical” in our analysis, the two approaches would end up in the same place. But we are not that perfect, and as researchers and as stakeholders tend to become anchored in particular visions of the world. By considering development first, we try to free our minds to consider a future for the country that is quite different than the present. Perhaps there will be no subsistence farmers in 50 years, just like subsistence farming vanished from North America and Europe in the 20th Century. If that is the case, then we free our minds from considering the impacts on subsistence farmers, and instead consider the impacts of people’s transition from being subsistence farmers into being something else.

Another purpose of this study, then, is to inform the process of vulnerability assessment, which continues to evolve to suit the needs of policy makers more completely (Patt et al. 2008). We are interested in seeing whether taking a development-first approach is even possible: It seems nice when written on paper, but can people really think this way when called to work on a study with climate change in its title? If we can take the approach, and stick to it, do we in fact arrive at results that are different from the more traditional impacts-led approach? This is a crucial issue to evaluate in the conclusion of this report.

FIGURE 1. SOCIAL VULNERABILITY IN MOZAMBIQUE PROJECTED TO 2060



Source: Patt and Nussbaumer (2009).

Note: The two graphs show the relative contribution of different factors to the reduction of social vulnerability, relying on a theoretically informed model.

THE PROCESS OF THE STUDY

In planning this study, the World Bank staff designed a five-step methodology, following an ambitious schedule. Phase 1 would summarize existing literature on different livelihood groups, including their relative vulnerabilities. It would then engage in discussions with a wide range of stakeholders to provide details on hotspots of vulnerability (i.e., by livelihood groups and by location), including a detailed description of that vulnerability and existing adaptive capacity. Phase 2 would conduct a number of workshops in order to develop adaptation scenarios. Phase 3 would analyze the social effects of the different scenarios. Phase 4 would add to the social analysis by incorporating economic analysis, using the results of computable general equilibrium models to identify distributions of costs and benefits. Phase 5, taking place contemporaneously, would be the preparation of a final country case study report so the results could be evaluated in conjunction with the other countries.

Actual work on the study followed the same general outline to a large extent, but the scheduling changed a great deal, due to unanticipated difficulties finalizing contracts, scheduling meetings, and resolving payment issues. The only structural result of the change in scheduling was that the Phase 2 workshops preceded the stakeholder discussions designed for Phase 1; this had little practical significance. Thus, the first part of Phase 1 involved conducting an institutional analysis, an identification of socio-geographic zones, and a review of existing livelihood assessments in those zones. All of this was included in an inception report, submitted by the lead consultant in mid-February 2009. Phase 2 consisted of a set of “participatory scenario development” (PSD) workshops, under the guidance of the Mozambique country team and in coordination with a consultant team from Canada, ESSA Technologies, and the International Institute for Sustainable Development (IISD). ESSA Technologies and IISD organized a trial PSD workshop in Ghana in June 2009, at which final scheduling decisions were made, namely to hold three workshops in Mozambique in July and August. Following these workshops, in September, the country team conducted interviews and surveys in a targeted set of field sites, in order to supplement the existing literature. Results from this fieldwork were available

for analysis in November. Phases 3, 4, and 5 took place iteratively, commencing in mid-November and completed in January 2010. This report is a result of that work.

THE OUTLINE OF THIS REPORT

This report follows the chronology of the work in the country study as that work actually took place.

- The first section contains a review of existing knowledge about vulnerability and adaptation in Mozambique, including the institutional landscape within which adaptation planning has taken place. Much of the material in section 2 has been copied from the inception report.
- The second section describes the general approach to conducting original research within this project. This methodology was agreed upon over the course of several months, after the inception report had been submitted, and concluded with discussions in Ghana in June. It includes a map of the locations where fieldwork ultimately took place and the guiding questions for the work.
- The third section describes the results from the three PSD workshops. Results from the first of these workshops—which took place in Xai Xai—had already been submitted to the World Bank by this consultant, while the results from the third workshop—in Maputo—had been submitted by ESSA and IISD. The second workshop, in Beira, took place under the direction of the local Mozambique project team, and they supplied detailed notes about that workshop to this consultant. Hence, section 4 pulls these three sets of results together into one place, allowing for comparing across the three workshops.
- The fourth section describes the results from the fieldwork, which took place in late August and early September 2009. That fieldwork consisted of three activities: a set of institutional interviews, a set of focus group discussions with representative stakeholder groups, and a household survey. The results here are based on the field notes from the first two activities, translated from Portuguese into English by an additional consultant in Washington DC, and on a data file containing the results from the household survey.

- Finally, the fifth section synthesizes the findings and draws out the key conclusions that are relevant for policy.

There are three annexes. Annex 1 consists of this consultant's identification of the important lessons from each of the focus group discussions. These help to paint

a more complete picture of how participants conceptualized climate change vulnerability and adaptation.

Annex 2 consists of the household survey instrument. It is in Portuguese, which is the language in which it was written, and from which it has not been translated.

Annex 3 consists of the field report from the lead local consultant, Raul Varela.

2. SOCIAL DIMENSIONS OF CLIMATE CHANGE IN MOZAMBIQUE

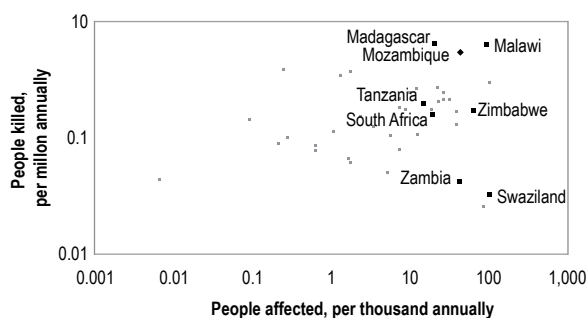
EXPECTED PHYSICAL IMPACTS OF CLIMATE CHANGE IN MOZAMBIQUE

Current Hazards

As with many other countries in Africa (Boko et al. 2007), Mozambique's vulnerability to climate change is in large part defined by its vulnerability to natural hazards (República de Moçambique 2007; Ehrhart and Twena 2006; Comité de Conselheiros 2003; Nkomo et al. 2006; and Mavie 2003). The three main hazards that Mozambique faces are droughts, floods, and tropical cyclones. Figure 2 plots out the numbers of lives lost, and the number of people otherwise affected (needing some sort of assistance) from these three hazards over the period 1990–2007. It is taken from the database of the Center for Research on the Epidemiology of Disasters (CRED). Each of the dots represents a single country in Africa, while Mozambique and its immediate neighbors are labeled. As can be seen, Mozambique has suffered among the greatest effects from natural disasters in Africa.

Table 1 lists the most important disasters recorded in Mozambique, sorted according to the number of people affected and requiring some sort of assistance during and after the event. Droughts have affected the most people and caused the most deaths. However, one needs to be cautious about how many people have been killed by droughts; for example, the drought of 1981 is

FIGURE 2. NUMBER OF PEOPLE AFFECTED OR KILLED BY NATURAL DISASTERS IN AFRICAN COUNTRIES, 1990–2007



Source: Center for Research on the Epidemiology of Disasters, The OFDA/CRED international disaster database.

Note: Mozambique has suffered among the highest losses of African countries in both cases.

attributed with 100,000 deaths, but it is unclear how many of these deaths were due in large part to the ongoing civil war, which made relief efforts problematic. Floods, while not typically affecting as many people, typically do cause loss of life but do cause even greater losses in terms of infrastructure. The flood of 2000, for example, caused an estimated \$419 million worth of damage and set back the country's development by years. Storms, most prominently tropical cyclones, are the third major hazard, and also cause a great deal of infrastructure loss. Epidemics are a secondary hazard often brought on by one of the other three, either

TABLE 1. MOST IMPORTANT DISASTER TYPES IN TERMS OF NUMBERS AFFECTED AND KILLED

Disaster	Number of events	Number affected	Number killed
Drought	10	16,444,000	100,200
Flood	20	9,039,000	1,900
Storms	17	3,002,400	700
Epidemic	18	314,000	2,500

Source: INGC.

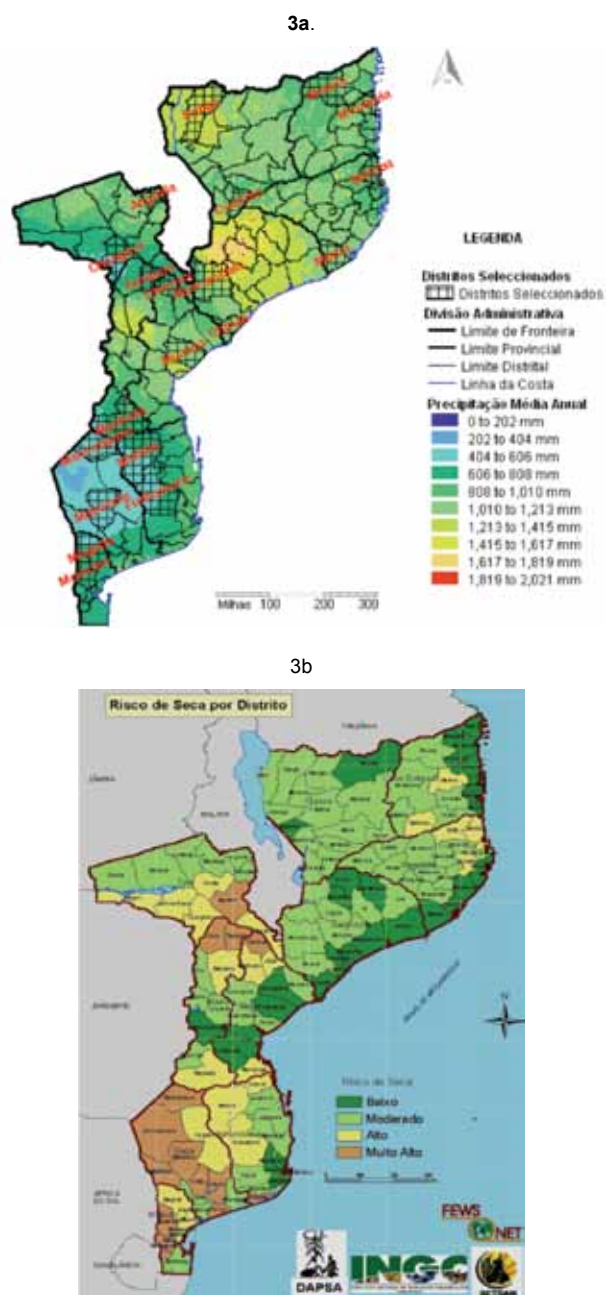
because of a deterioration in safe drinking water provision or the spread of tropical disease vectors.

One of the most important determinants of agricultural suitability is rainfall. Figure 3a is taken from the National Adaptation Program of Action (NAPA, p. 68) and shows average annual precipitation in millimeters of rainfall. It shows that most of the country receives an average of between 600 and 1,200 mm of rainfall annually, which is generally sufficient for maize or cassava cultivation. Some areas—mountainous regions in the north—receive more than this, while the low-lying inland region in the south receives substantially less.

Corresponding to the variability in rainfall is the risk of drought. Figure 3b shows the risk of drought throughout the country. The highest risk levels are, not surprisingly, where the average annual rainfall is also the lowest, and hence the chances of receiving insufficient rainfall to support crop growth is quite high. Also high in risk are several districts in the inland central region. These also receive relatively little rainfall.

While usually costing fewer lives than droughts, floods are often the most visible hazard hitting the country. The most notable recent example was in 2000. In early February 2000, heavy rains started to fall across much of southern Africa, hitting southern Mozambique the hardest. On February 9 the capital of Mozambique, Maputo, was flooded, with slums in the peri-urban areas hardest hit, and the road north to Beira underwater. The rains continued, and on February 11 the Limpopo River, north of Maputo, broke its banks, contaminating

FIGURES 3A AND 3B. PRECIPITATION AND DROUGHT



Sources: República de Moçambique, *National Adaptation Program of Action (NAPA) 2007*, p. 39, and INGC.

Note: The hash-marked areas in Figure 3a are those where stakeholder interviews were conducted in support of the NAPA, which is not relevant for this study. Figure 3b shows the drought risk mapped throughout the country, indicating the highest risk levels in the inland south—where average precipitation is also the lowest—as well as the inland central region of the country, where average precipitation is higher.

the water supply and bringing dysentery to the local population. The worst came on February 22, when Cyclone Eline hit the Mozambique coast near Beira, with winds of 260 km/h and torrential rains. Eline worked its way inland, dropping huge quantities of water on the Limpopo River catchment area. That water followed its way down the Limpopo River valley, and on February 27 flash floods occurred in the Gaza Province of Mozambique, arriving suddenly and burying the low-lying farmlands in the Chókwe and Xai Xai Districts under four to eight meters of water. Residents climbed trees and rooftops, but with only a few boats and less than a dozen helicopters available to evacuate over 100,000 people, over 7,000 people were stranded in trees for several days. Eight hundred people died, hundreds of thousands were left homeless, and 2 million were affected. Over 90 percent of the irrigation systems in Mozambique were lost. In the immediate aftermath of the floods, losses were estimated at \$273 million in direct costs, and \$428 million in optimal standard reconstruction costs (World Bank 2000).

Figure 4a shows the exposure to flooding in terms of actual floodplains (taken from INGC), while Figure 4b shows flood vulnerability at the district level. It shows the Limpopo River floodplain to be the most risky region in the country, followed by the floodplains near the Buzi and Zambezi rivers. Also at risk are coastal regions in the central and northern regions of the country, due to tropical cyclones. It should be noted that the tidal range in the central region of the country is exceptionally high due to tidal currents in the Mozambique Channel, which could account for the risk levels in the central region, outside of the Buzi River lowlands.

How the Hazards Will Change Because of Climate Change

A critical question is how these risks will change in the future because of climate change. Here, the results are somewhat ambiguous, as well as regionally differentiated. One reason for the ambiguity is that Mozambique straddles an area where the effects of climate change are likely to go in opposite directions. In southern Africa, the general trend as a result of climate change is for drier conditions. Certainly this is expected to be the case for Zimbabwe, and large parts of South Africa. In East Africa, by contrast, the

FIGURES 4A AND 4B. FLOOD RISK MAPS



Sources: República de Moçambique, *National Adaptation Program of Action (NAPA) 2007*; Sundararajan and Williams 2008, p. 21; and INGC project document.

Note: The highest risk levels are for the Limpopo River basin, with high risk levels as well for the Buzi and Zambezi river basins. Coastal regions in the north are also at risk from sea water inundation, particularly during tropical cyclones.

general trend to be expected with climate change is for wetter conditions. This is the case for Kenya and Tanzania. Mozambique, of course, borders both regions, and given uncertainty about where the line between the two directions of change will fall, it is very difficult to say what direction of change any part of the country will experience. That being said, it is more likely that the southern part of the country will experience a trend toward drier conditions, while the northern part of the country will experience a trend toward wetter conditions. But there is a great amount of uncertainty. Another reason for the uncertainty lies in the paucity of long-time series of historical climate data for Mozambique and the neighboring countries; this makes it hard to calibrate climate models, and hence to obtain reliable estimates for the future.

The best assessment to date of these changes was in a recent report carried out by INGC in 2008 and 2009 (Asante et al. 2009). The climate modeling team from the University of Cape Town in South Africa conducted a comprehensive downscaling of data from climate models across the region, and had access to the full set of Mozambique weather station data. This report made projections for changes in temperature and average precipitation, as primary impacts. As secondary impacts, the report made projections for changes in soil moisture availability (influenced by both temperature and precipitation) and flooding (influenced by precipitation and mapped out onto a statistical flooding model).

Figure 5 shows these projected changes that could affect the risk of drought. It is quite clear that temperature will rise. It also seems reasonably clear that most of the country—with the exception of the south—will experience a rise in average precipitation. These two effects oppose each other in terms of how they influence potential soil moisture, however, and so it is less clear what the combined effects will be. Except in the south, the median estimates are for slight increases in soil moisture, while in all cases the range of estimates from the ensemble of seven models indicates that the direction of change could go either way. What will this mean for drought risk? It is difficult to say, because drought risk depends not just on average rainfall and soil moisture, but also on the frequency with which there are severe negative deviations. A secondary analysis of the

INGC data suggested a slight increase, perhaps as much as 15 percent, in the frequency of drought, especially over the southern part of the country. Again, however, the range of estimates (derived from the range of models used) crossed into the range of a possible decrease in drought risk.

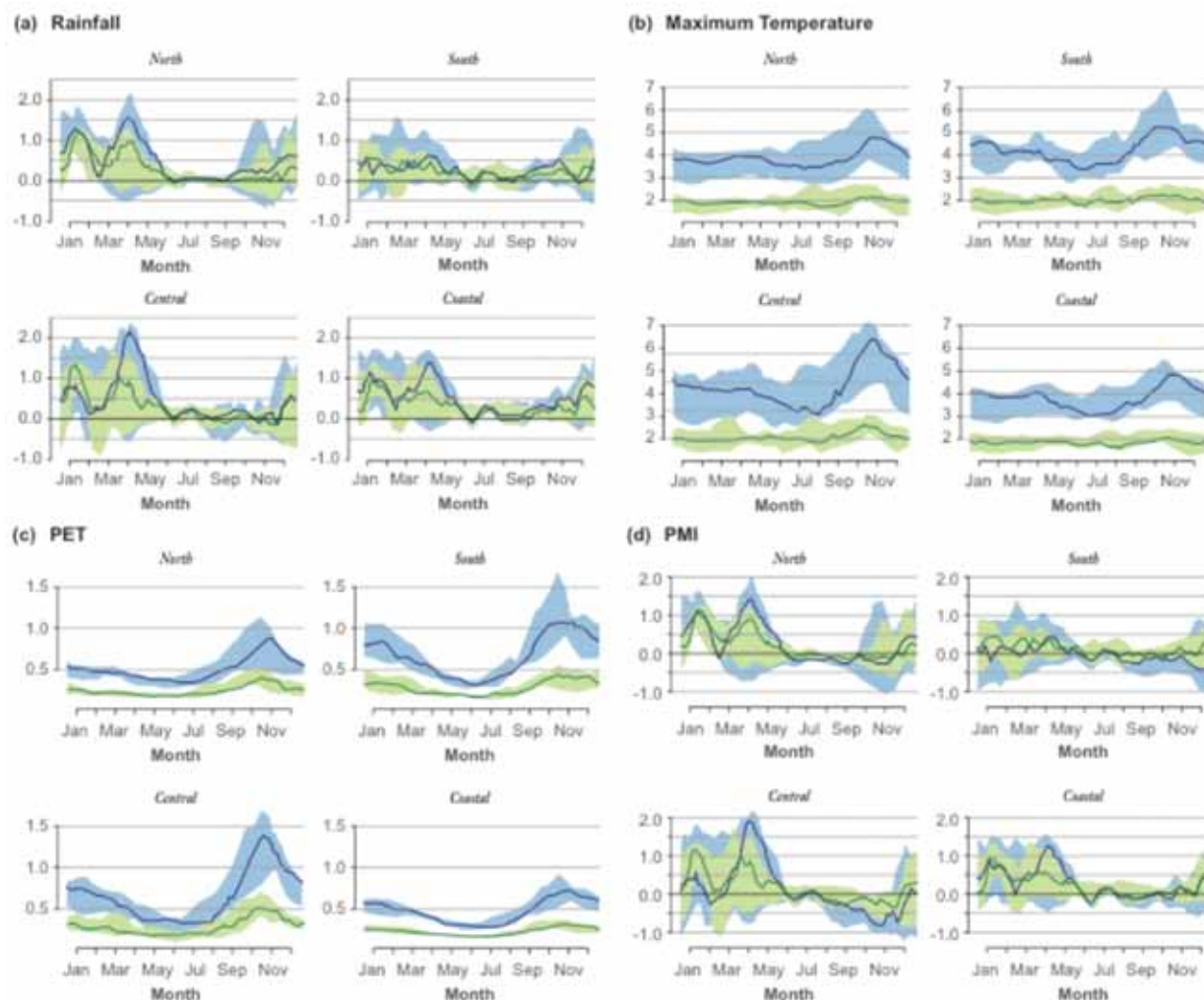
Figure 6 shows results from the INGC flood mapping work. The team used a statistical flood model—based not on exact hydrological characteristics and digital elevation map, but rather on the correlation between past climatic conditions and reported flooding—to estimate how the risk would change in the future. As the figure caption indicates, there is a great amount of uncertainty about the direction of change: Flood risk could increase in the future, or it could decrease. It is very difficult to say more. It is also difficult to identify clear regional trends within the country.

Finally, the INGC study attempted to characterize the changing risk levels due to tropical cyclones. Here, it is possible to identify the likely direction of change, but due to a lack of data it is very difficult to quantify that change. Both models and empirical data suggest a positive correlation between sea surface temperatures and cyclone intensity but no obvious correlation between sea surface temperatures and cyclone frequency. Given that sea surface temperatures are likely to increase (McDonald et al. 2005.; Bengtsson et al. 2007; and Emanuel et al. 2008), one can be confident that there will be a shift toward stronger cyclones, but not necessarily any change in their overall frequency. However, since damages are related to the cube of the wind speed, strong cyclones cause a much higher amount of damage than do weaker cyclones. Overall, one can expect more damages due to cyclones in the future.

NATIONAL PLANNING FOR CLIMATE CHANGE: NAPA AND OTHER STRATEGIES

To understand the policy and institutional landscape in Mozambique related to climate change vulnerability and adaptation, it is essential to pay attention to the degree of activity that is driven by external funders and donors on the one hand, and Mozambique's participation in the United Nations Framework Convention on Climate Change (UNFCCC) and commitments to achieve the Millennium

FIGURES 5A–5D. PROJECTIONS MADE BY THE INGC STUDY



Source: Asante et al. (2009).

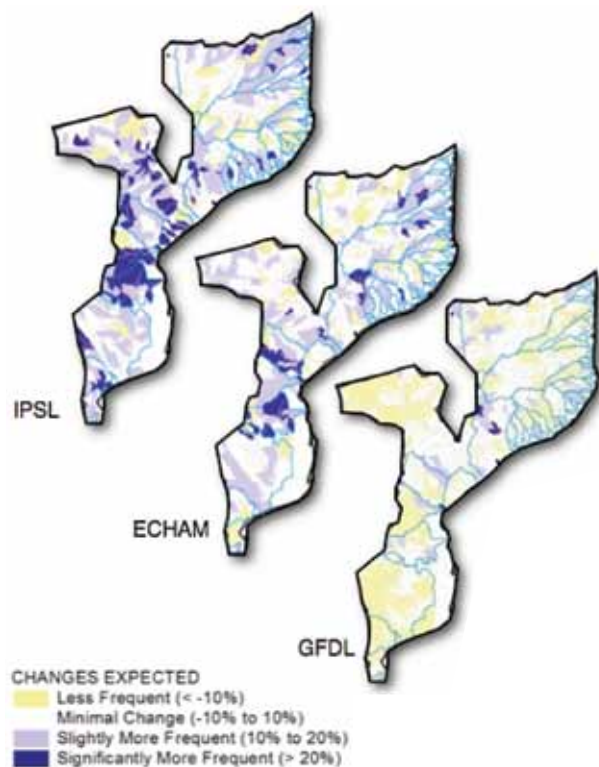
Note: Each chart shows projected monthly changes from the baseline period (1960–2000) until 2050 (green) and 2100 (blue). The shaded region represents the range captured by an ensemble of the seven climate models, while the solid line represents the median estimate of those models. Figure 5a shows projections for rainfall, in terms of mm per day. Figure 5b shows changes in maximum temperature, in terms of °C. Figure 5c shows changes in potential evapotranspiration, in terms of mm per day, and derived from temperature estimates and land cover data. Figure 5d shows the potential moisture index (indication soil water availability) derived from the other three estimates.

Development Goals (MDGs) on the other. In this section, we provide an overview of the activities that have been carried out to date.

One of the main drivers of planning activities in Mozambique in the area of climate vulnerability

reductions is the country's adoption of the MDGs and UNFCCC. In September 2000, Mozambique was one of 189 countries to formally adopt the MDGs. As part of its commitment to cut absolute poverty in half by 2015 (MDG 1), the government committed to developing a strategy for attainment, known generally as the Poverty

FIGURE 6. CHANGES IN FLOOD RISK



Source: Asante et al. 2009.

Note: Three different global climate models were used, and their results fed into a statistical flood model. The wettest of the climate models was the IPSL model, and this resulted in estimates of increased flood risks in most of the river basins in Mozambique. The driest of the models, GFDL, indicated a decrease in the frequency of flooding events across most river basins. The median model, ECHAM, indicated a mix, with many areas experiencing a slight increase in risk levels, and some experiencing a slight decrease.

Reduction Strategy Papers (PRSPs) and in Mozambique by the Portuguese equivalent of PARPA. Preparation and approval of PRSPs on an ongoing basis is a precondition for continued support from the International Monetary Fund (IMF) and the International Development Association (IDA), the branch of the World Bank responsible for helping the world's poorest countries; the two organizations are involved in funding and approving the PARPA and monitoring its implementation. The government completed the first PARPA in 2001 (República de Moçambique 2001–2005) and the second, PARPA II, in 2006 (República de Moçambique 2006–2009). The Ministry of Planning and Finance (MPF)

coordinated the preparation of PARPA material, which occurred across numerous government ministries and agencies and received assistance from a long list of national, international, and nongovernmental donors. IMF and IDA commented on the PARPA, noting that it advanced planning on poverty in Mozambique significantly, and yet left room for improvement in the area of vulnerability, and approved it as a satisfactory prerequisite for continued IMF and IDA support (IMF and IDA 2001). A similar approval process occurred for PARPA II, noting that it represented a significant improvement over the original PARPA (IMF and Republic of Mozambique 2007). Related documents suggest that the implementation of activities under the PARPA is progressing, but the extent to which this is taking place is unclear.

Mozambique ratified the UNFCCC in 1995, and as part of this committed to preparing National Communications, led by the Ministry for the Coordination of Environmental Affairs (MICOA), the UNFCCC focal point for the government of Mozambique. The first national communication was completed in 2003 (MICOA 2003), but due to a protracted period of governmental approval, submitted only in 2006. The initial national communication contains required information on greenhouse gas emissions, mitigation options, climate change vulnerability, and adaptation options. Under the UNFCCC, least developed countries (LDCs) receive financial assistance from the Global Environment Facility (GEF) to prepare National Adaptation Programs of Action (NAPAs). MICOA began this process in 2003, at the time it completed its initial national communication. It completed work on the NAPA in 2007 and submitted it to the UNFCCC in 2008 (República de Moçambique 2007). Once the NAPA has been submitted to the UNFCCC, the country becomes eligible to draw from the LDC fund, also managed by the GEF, to implement the planned activities. It is unclear whether any steps have been taken toward implementation of the NAPA.

The NAPA represents the main area of planning for climate adaptation within the country (República de Moçambique 2007). Its conclusions are entirely consistent with a view of Mozambique's adaptation needs being driven by the three hazards of drought, flood, and cyclone. The four strategic options listed in the NAPA were:

- Strengthening the early warning system for floods, droughts, and tropical cyclones;
- Strengthening the capacities of agricultural producers to cope with climate change;
- Reduction of climate change impacts in coastal zones; and
- Management of water resources under climate change.

There has also been nationally driven planning. In 1999, the government adopted the National Disaster Management Policy. This creates a set of priorities and objectives, including better coordination between disaster planning and other government objectives, such as economic development. The policy established the National Institute for Disaster Management (INGC) and the Coordination Council for Disaster Management (CCGC). INGC is an independent legal entity, originally located within the Ministry of Foreign Affairs but since 2005 in the Ministry of State Administration. Its general competencies are to coordinate disaster management planning, information, and activities; to deal with donors in the area of disaster mitigation, planning, or management; and to increase the flow of information, both with neighboring countries and with the Mozambique public, related to disaster management. It has offices in each of the provinces, with the exception of the Maputo City Province. The CCGC is a council made up of representatives from a number of ministries, and with one representative from INGC. In addition to making sure that all necessary ministries are involved in disaster management and recovery efforts, the CCGC is charged with the approval of regularly updated disaster management plans. The first of these was completed in 1999, but a second one has not yet been developed. A more complete picture of the institutional history and framework for disaster planning and management can be found in a report developed and funded by the United Nations Human Settlements Program, UNEP, and the GEF (Muianga 2007).

To a large extent, the 2009 INGC study already mentioned (Asante et al. 2009) represents the most extensive nationally driven assessment of climate change hazards in Mozambique and can serve as the basis for additional planning. That study did not contain work on developing policy guidelines, however. In addition to

these planning activities of INGC, there have been a number of initiatives carried out by other agencies and ministries. These include contingency plans as a result of seasonal climate forecasts issued at the Southern African Regional Climate Outlook Forum (Muianga 2007; Lucio et al. 2007); mapping activities such as the Limpopo Atlas completed by CENACARTA with assistance from FEWS-NET; and others.

OVERVIEW OF SOCIAL VULNERABILITY IN MOZAMBIQUE

There have been a large number of place-based studies looking at social vulnerability in Mozambique, employing both bottom-up and top-down strategies.

Bottom-up Research Studies.

Reporting on work conducted by the German Agency for Technical Cooperation (GTZ), Ferguson (2005) analyzed the natural disaster risk in the Búzi District in Sofala Province. In collaboration with the Catholic University of Mozambique, a participatory methodology was used to identify the population at risk from different disaster types. The analysis suggested that different types of natural hazards threatened the safety and livelihoods of approximately one-third of the population. The study found that human activities—agriculture and deforestation—had degraded the study area's natural resources (forest and savannah). Ferguson argued that the population is particularly vulnerable due to a combination of factors, some related to the location of the area and its topography, and others related to the culture and socioeconomic conditions, and that it is this vulnerability that turns a hazard into a disaster.

Table 2 summarizes the factors leading to an increased hazard on the one hand and the vulnerability of the population on the other. The study chronicled adaptation measures that had reduced vulnerability: the construction of new settlements on higher ground and away from the river; the rebuilding of damaged infrastructure with due account of the need for being more resistant to cyclones; and the improvement of disaster preparedness through simulation exercises that practiced the implementation of early warning systems. As more frequent extreme climate events can be expected in the future, and considering the fact that relatively little can

be done to reduce the hazard, vulnerability reduction is of utmost importance to minimize casualties and material losses. In this regard, Ferguson saw an important role for the government to play at different levels, and argued that disaster risk management should be an integral part of rural development strategies.

Carmo Vaz (2000) reviewed the major flood episodes that occurred in Mozambique since independence in 1975 in the Maputo, Umbeluzi, Incomati, Limpopo, Save, Buzi, Pungoé, and Zambezi river basins, and analyzed the measures taken to mitigate floods in Mozambique. The author classified mitigation strategies into two categories: structural and non-structural. Structural flood mitigation measures included dams, levees, flooding areas, and river training, whereas non-structural measures comprised flood zoning, flood management, flood warning systems, emergency plans, raising awareness, and insurance. In regard to dams, the review noted that dams with sufficient storage capacity can play a significant role in attenuating floods. While all major reservoirs in Mozambique incorporate a flood reserve in their operating, Carmo Vaz underlined the potential perverse effect of dams as a means of

mitigating floods. Indeed, for small floods that are absorbed by the dams, the preparedness of socioeconomic systems might decrease and thus be hit even harder in the case of a major flood, since large floods can exceed by far the storage capacity of the reservoirs. Nevertheless, Carmo Vaz argued for including flood control in the planning, design, and construction stages of all new dams.

As part of a more general inquiry into adaptation to climate extreme events, Mirza (2003) reviewed the causes of high vulnerability in Mozambique and characterized extreme weather events in two categories: (1) primary climatic events such as floods, droughts, tropical cyclones, heat waves, or cold waves, as well as coastal storms and storm-generated surges; and (2) secondary events such as malnutrition or under-nutrition and hunger, outbreaks of diseases or epidemics, rural and urban water shortages, crop plantation failure or harvest failure, and landslides, mudflows, and saline water intrusion.

The author highlighted nine dimensions and areas for potential improvement. First, socioeconomic conditions were judged important factors to vulnerability. Forty

TABLE 2. RISK AND VULNERABILITY FACTORS ACCORDING TO NATURAL DISASTERS IN THE BÚZI DISTRICT

	<i>Hazard</i>	<i>Vulnerability</i>
Flood	<ul style="list-style-type: none"> • High precipitations (either in district or upstream) • High tide can temporarily obstruct the flow of the Rio Búzi to the sea 	<ul style="list-style-type: none"> • Low level of education • Proximity of towns to the river • Absence of high elevation point for escape • Most people cannot swim and do not have enough boats • Non-availability of warning system
Cyclones and tropical storms	<ul style="list-style-type: none"> • Cyclones develop over the Indian Ocean or the Mozambique Channel when the water temperature is warm; wind speeds can reach up to 300km/h, and are usually accompanied by heavy rain (which could simultaneously cause flooding) • Threat especially for settlements close to coast 	(Same as above) <ul style="list-style-type: none"> • Traditional houses are not designed and built to resist cyclones
Drought	<ul style="list-style-type: none"> • Climatic variation in Mozambique can lead to one or more years of precipitation below average • Influence of El Niño-Southern Oscillations, which cause high temperature and low precipitation in Eastern Africa, while La Niña causes heavy rains and floods • Intrusion of saline seawater into the groundwater and the soils during high tide when the water level of the Búzi River is low 	<ul style="list-style-type: none"> • Population living on subsistence agriculture; changes in climatic conditions exert significant impacts on socioeconomic systems • Incapacity of storing supplies as seed for the following year in case of insufficient yields • Alternative sources of food, such as fishing, small livestock, honey, do not allow for substitution • Almost no irrigation system is in place (Comité de Conselheiros 2003), neither traditional nor modern

Source: Ferguson (2005).

percent of the population live under the abject poverty line (less than \$1 per day), and another 40 percent live on less than \$2 per day. Second, Mozambique's debt repayment is drawing substantial financial resources from the national budget, which could otherwise be allocated toward promoting development. Third, most of the water causing devastating floods actually originates from abroad. Fourth, the primary objective of water dams is electricity generation, while a multipurpose management also would consider flood prevention. Fifth, design criteria for embankment construction typically consider 5–10 year flood return periods, rather than floods of higher magnitude and greater return periods. Sixth, rural areas are generally more affected by flooding than urban areas because they are more dependent on agriculture. Seventh, communication was poor during past natural disasters, thus preventing quick and effective humanitarian interventions. Eighth, although Mozambique had a rapidly growing economy, living conditions for the majority of the population had not significantly improved due to marked inequality in the distribution of resources. Ninth, human and material resources proved to be inadequate to deal with the major flood in 2000.

Patt and Schröter (2008) conducted a study funded by the World Bank on perceptions of changing vulnerability and risk levels. They analyzed three separate sets of data. First, they held workshops with farmers and local leaders in villages that had suffered from the Limpopo River flood of 2000, and with national level policy makers in Maputo. What they observed in the two sets of discussions was an apparent mismatch in concern over the primary risks: Farmers seemed less worried about the risks from future flooding events than they were about how the shortcomings in the previous recovery efforts remained apparent, while policy makers seemed unconcerned with the potential unintended consequences of their adaptation strategies. For example, in the policy-makers' workshop, the researchers divided participants into a number of working groups and asked each to identify several adaptation strategies, the barriers to successful implementation of those strategies, and the potential negative consequences of those strategies were they to be fully implemented. All of the groups were able to come up with the first and second lists. However, it was only the working group that contained the least expertise on climate adaptation that was actually able to envision negative consequences of

climate adaptation; the other groups simply listed additional barriers to implementation.

Second, the researchers conducted a survey asking policy makers and farmers to indicate the risk levels from climate-related and non-climate-related events. In general, policy makers saw the climate-related events as most risky, while the farmers saw the non-climate-related events as riskier. For example, there are different perceptions between farmers and policy makers as to which risks are presently becoming more severe. This in turn could explain why some adaptation measures, such as resettlement into villages outside of the floodplain could thus be viewed as unattractive because they could worsen the non-climate risks (crime, for example).

Finally, the researchers conducted a household survey, again in two villages in the Limpopo floodplain, in which they explored people's perception of climate change and the causes for the changes they observed. They found that while most people had observed changes, they did not attribute the changes to issues of pollution coming from outside their community or country. Rather, those surveyed believed that they had caused some of the changes by ignoring traditional practices. The researchers suggested that this could lead to an unwillingness to engage in adaptive behavior, since adaptive behavior would represent yet another departure from tradition and hence result in even more unwanted changes.

Eriksen et al. (2008) conducted a comparative analysis of three bottom-up vulnerability assessments in Mozambique and South Africa. The results are interesting both for the findings of the underlying assessments and for the added analysis comparing them. First, a number of agencies throughout southern Africa—including the Southern African Development Community (SADC), the UK Department for International Development (DFID), and the Famine Early Warning System Network (FEWS-NET)—formed vulnerability assessment committees (VACs) for Mozambique, Malawi, and several other SADC countries. The objective was to develop a coordinated system to monitor ongoing food insecurity, allowing for cross-national comparisons and the prioritization of relief aid. The assessments started in 2002 with the proposition that droughts were the primary trigger for food insecurity, which implied that rainfall and crop monitoring were the

most important activities to engage in as part of a food insecurity monitoring effort. Later, the VACs came to the conclusion that indeed there were multiple triggering factors for food insecurity, and hence it was essential to monitor a wider variety of indicators and take response measures that consider not just immediate hunger, but also the patterns of development that were the precursors to food insecurity.

The second assessment considered was the Economic Impacts of Climate Change vulnerability assessment, led by the World Bank in cooperation with the Norwegian climate research institute CICERO, the University of Oslo, Rutgers University, and the University Eduardo Mondlane. A key focus of this assessment was on the potential interaction between climate change and economic development. The assessment found that climate change tended to have the greatest negative effects precisely on those communities and households that lacked integration into markets and hence were failing to participate in economic growth. One explanation for this could be that market integration allows households to be more flexible in their livelihood strategies, and hence more adaptive to climate change impacts. The policy implication from this study was that greater attention to economic integration could be an important means of reducing the vulnerability to climate change.

The third assessment, on disaster risk management, was led by the German Agency for Technical Cooperation (GTZ), in cooperation with the Mozambique Red Cross (CVM) and the Catholic University of Mozambique (Ferguson 2005). This assessment focused on the Búzi River basin in central Mozambique and looked closely at conditions on the ground. The researchers engaged in two activities: First, they engaged in mapping to identify the need for specific infrastructure that would mitigate the effects of droughts and floods; second, they identified household- and community-level coping mechanisms and infrastructure. A major implication of their study is that policy interventions need to build upon local knowledge and local practice, rather than interfere with it.

In comparing the results of these three assessments, Eriksen et al. (2008) reached two main conclusions. First, it is essential to consider the multiple factors that

give rise to vulnerability: not just the drought or flood that is the triggering event for food insecurity or a loss of life, but the more fundamental patterns of development that exacerbate or mediate the effects of these risk factors on human suffering. Put into Intergovernmental Panel on Climate Change (IPCC) language, this is saying that assessments need to consider not just exposure, but also sensitivity. The specific factors that make people more sensitive are isolation from markets, a lack of information and education, and a lack of basic infrastructure. Second, it is essential to consider vulnerability as it operates at the household and community levels, taking into account household- and community-level knowledge and infrastructure. This is another way of focusing on the need to assess adaptive capacity, viewing the household and community as the initial repositories of this capacity. Policy interventions need to build on, rather than act against or interfere with, this capacity.

Studies Using the Household Food Economy Approach

In Mozambique, the process of assessing household food economies has been undertaken by the Famine Early Warning Systems Network (FEWS.NET), first in 2002, and then again more recently since 2008. The 2002 assessment resulted first in a breakdown of the country into 39 food economy zones. Essentially, these were regions with a similar economic context within which people operated, and thus a homogenous set of threats to that economic context (FEWS-NET 2002b). For each zone, the report provides details on the administrative boundaries and the populations of men and women within those boundaries. It then describes the main sources of food, the main sources of income, and the main risks. It does not describe wealth levels or household food economies within each zone.

The 2002 assessment also resulted in two detailed food economy baseline profiles for the Alto Limpopo zone (FEWS-NET 2002a), and for the coastal Nampula and Southern Cabo Delgado zone (FEWS-NET 2002c). These provide more detailed information on actual household food economies within each zone and were meant as a proof of concept for putting the five-step methodology concept to use within an operational agency. In 2008, FEWS.NET resumed work on this, based on an updated set of assessment guidelines (FEG

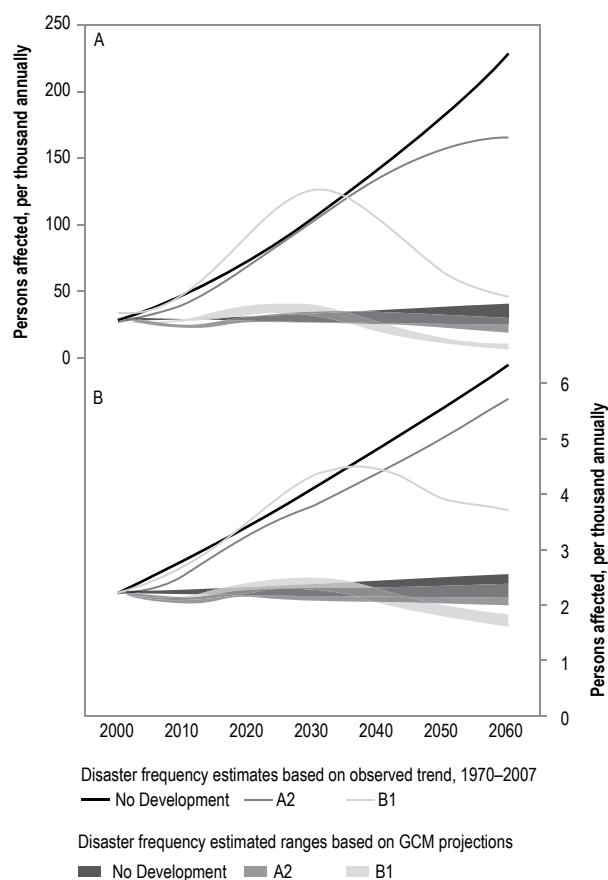
Consulting and Save the Children 2008), and has so far prepared an additional set of five detailed livelihood profiles (FEWS-NET 2008a, 2008b, 2008c, 2008d, 2008e). These profiles provide a richly detailed set of information on the zones that have been covered so far. Connected with the work in 2008, FEWS-NET also prepared in cooperation with the United States Agency for International Development (USAID) office for Mozambique a set of four briefing papers, in which they analyzed the impacts of the global food crisis on rural Mozambican households (USAID Mozambique 2008), assessing the vulnerability of the poor, the link between household food economies and vulnerability to natural disasters, and the utility of the HEA approach for development. These reports are rather brief, and provide an overview of the factors that relate entitlement, food security, and vulnerability.

Top-down Approaches

Finally, Patt and Nussbaumer (2009) conducted a study of social vulnerability as part of the larger INGC study on disaster risk (Asante et al. 2009). The authors examined the combined effects of both climatic drivers of vulnerability and socioeconomic drivers. To pull the two together, they conducted a cross-sectional study of losses resulting from climate-related disasters across the globe and built a statistical model that relied on both climate variables and socioeconomic drivers, particularly the Human Development Index. This part of the study was similar to what had been done previously in the context of several global studies (Brooks et al. 2005; Brooks et al. 2004; UNDP 2004; and Yohe and Tol 2002). They then assembled projections for both sets of variables—the climate ones from the team members in the INGC study, and the socioeconomic ones from IPCC and UNDP scenarios that had been assembled—in order to reach conclusions about likely changes over time. Their results suggested that the socioeconomic drivers could play an important role in driving vulnerability. Figure 7 shows their projections for vulnerability.

As the figure caption indicates, the upper figure shows the risk of being affected by a climate-related hazard, while the lower figure shows the risk of being killed. The three solid lines in each figure show estimates obtained using a linear extrapolation of past disaster frequency trends as the climatic driver in the future.

FIGURE 7. ESTIMATES OF CHANGING RISK LEVELS BETWEEN 2000 AND 2060



Source: Patt and Nussbaumer (2009).

Note: Figure 7A shows estimates for the change in the risk of being affected by a climate-related hazard, while Figure 7B shows the change in the risk of being killed by a climate-related hazard. The figures contain three socioeconomic scenarios and two climate scenarios.

The shaded regions, by contrast, derive climate projections from the INGC modeling results. For both, the black lines and shaded regions correspond to a socioeconomic scenario with no changes from the present, such as in income or fertility; the blue lines and shaded regions correspond to the IPCC A2 scenario; and the red lines and regions correspond to the IPCC B1 scenario. The A2 scenario generally suggests less economic growth in Mozambique, and less change in

other development factors such as life expectancy and fertility. It does, however, project higher urbanization rates. The B1 scenario projects greater improvements in human development and lower rates of urbanization.

What can one learn from this study? First, there is a lot of uncertainty about future vulnerability that is accounted for by uncertainty about future climate trends. The linear extrapolation of observed disaster trends leads to much higher estimates of risk levels than do the climate models. Which is right? Given the difficulty of modeling extreme event risks, it is hard to say. Second, the effects of the faster improvement in human development associated with the B1 scenario are also quite large. Indeed, human development projections from the B1 scenario could lead to falling risk levels by the middle of the century.

Taking the bottom-up and top-down studies together, it is clear that social and socioeconomic factors do play a large role in determining vulnerability to climate change now, and will in the future. The bottom-up studies suggest that factors such as people's perceptions and attributions of the underlying risk, and the information that they have at their disposal to respond to changes in risk levels, could influence their adaptive capacity. The studies also suggest that socially and economically marginalized groups will have a more difficult time coping with and adapting to climate variability and change and will therefore experience higher vulnerability. The top-down study shows that a rising economic tide could raise the overall ship of Mozambique, making it more resilient and less vulnerable to climate change. However, this study says nothing about how the socioeconomic changes will reach the most vulnerable communities within the country.

3. RESEARCH METHODOLOGY

RESEARCH STRATEGY AND QUESTIONS

Both the guiding questions and the research strategy for this study were, to a large extent, set in advance in the World Bank's original scoping materials for all country studies. The questions were to identify the special concerns faced by the most vulnerable populations in Mozambique and to identify adaptation strategies and pathways that would best respond to those concerns. At a project meeting held in Accra in June 2009, this was further refined to identify the extent to which the priorities set forth in existing adaptation plans—such as NAPA—would differ if one were to give special consideration to the needs of the most vulnerable communities. To a large extent, this would require identifying how the concerns of the most vulnerable differ from those of the population in general.

To address these questions, the research strategy included four key steps:

- A review of primary and secondary literature, supplemented by stakeholder interviews, to identify both existing knowledge about social vulnerability in Mozambique and current and planned efforts to reduce that vulnerability.
- A review of climate impact studies, including mapping, to identify key hotspots of social vulnerability and a set of sociogeographic zones.
- A series of participatory scenario development (PSD) workshops, with the last one held in the national capital and involving national-level

stakeholders, to identify the most vulnerable groups and appropriate adaptation pathways.

- Fieldwork in vulnerability hotspots to validate the results from the PSD workshops. The fieldwork was to consist of three methods: (1) a set of institutional interviews with representatives from key organizations; (2) a set of focus group discussions with people from different socioeconomic strata; and (3) a set of household surveys, with a sampling method to capture variance in the anticipated drivers of social vulnerability.

The first of these steps was carried out quickly by the lead consultant, with the results reported in the inception report. The inception report also proposed a set of sociogeographic zones. Following this, the local consultant suggested refinements to these zones, and engaged in GIS-based analysis to identify hotspots within these zones. Work then slowed, as bureaucratic complexities made the process of releasing funds for the PSD workshops and fieldwork difficult. Eventually, the team held three PSD workshops in July and August, with technical assistance from IISD and ESSA technologies. Fieldwork commenced in August, and was finished in mid-September. The initial processing of data yielded field notes by the end of September. These required translation into English, which took place by mid-October. Quantitative data was available in a form suitable for analysis by mid-November.

SITE SELECTION AND SAMPLING

In the inception report, the lead consultant proposed a set of six zones. These are:

- Coastal urban areas, most importantly Maputo and Beira. This zone is marked by highly differential vulnerability across income groups, with large peri-urban areas vulnerable to flooding from both rivers and the ocean.
- The non-urban coastal strip. This zone is marked by high vulnerability to coastal flooding and storm surges from tropical cyclones, as well as threats of erosion. It is relatively food secure, with low rates of poverty.
- The districts containing the Limpopo River valley upstream of Xai Xai. This zone is unique in being exposed to two very different threats at a high level: river flooding and drought. It has a relatively high population density, and hence high numbers of impoverished people. There has been extensive studying of this region, and so it is possible to access a great deal of baseline data.
- The other river valleys, in particular in the Buzi and Zambezi river valleys, which are highly susceptible to flood risk and to flooding caused by tropical cyclones, but are less susceptible to droughts. The Buzi River region has also been extensively studied, as part of German-funded activities, and so there is no shortage of baseline data.
- The drought-prone inland areas, in particular in the south. These areas are highly susceptible to drought—indeed years of adequate rainfall to support agriculture are the exception, rather than the rule—while the people are often dependent on remittances for survival. Population densities in these regions are low.
- The inland areas of higher agricultural productivity, including the highly productive and populated areas in Zambézia. These areas are perhaps the least vulnerable in Mozambique, facing adequate rainfall most years and no extreme risks from flooding or tropical cyclones. They are somewhat heterogeneous

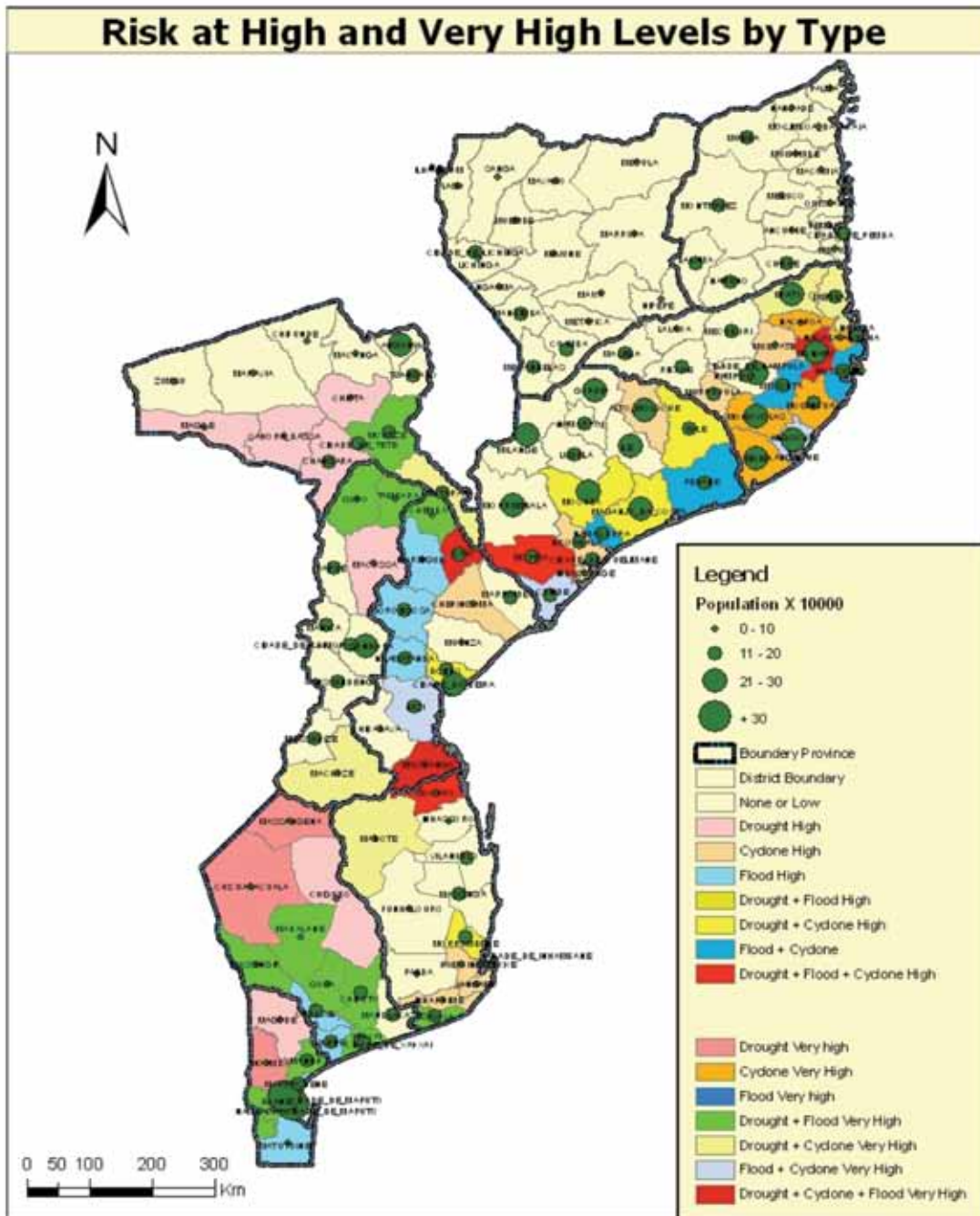
in terms of poverty rates and food security. The highly productive regions in Zambézia stand out for their high population density and relatively low vulnerability.

Further discussions among the entire project team agreed on these zones. The local consultant then engaged in two processes. First, he delineated them precisely, in terms of particular districts covered within each. Second, and more importantly, he identified districts within each zone that constituted risk hotspots. To do so, he first engaged in mapping the different levels of risk, for each of the major classes of risk, and overlaying areas of high population on these. Figure 8 shows the result of this. It was agreed to combine this analysis with the maps of the zones, in order to identify one or two districts within each zone that represented hotspots for that zone. Within each of these districts, the fieldwork would take place at multiple administrative posts, in order to capture potential variation within the district.

Budgetary factors and time constraints, ultimately, limited the number of districts considered in the field study. Figure 9 shows the locations of these sites.

In terms of the PSD workshops, it had been originally planned to hold one regional workshop, and one national workshop, back to back. During discussions in June in Accra, the project team decided instead to hold three regional workshops, one each in the northern, central, and southern regions of the country, followed by a national workshop in Maputo. Time constraints led to a scaling back; ultimately the team held regional workshops in Xai Xai and Beira, inviting stakeholders from both the central and northern regions of the country to the Beira workshop. A national-level workshop in Maputo followed.

FIGURE 8. SOCIAL VULNERABILITY HOTSPOTS



Source: Authors.

Note: The district map identifies areas where risks from drought, flood, and cyclone are considered to be high or very high.

4. PARTICIPATORY SCENARIO DEVELOPMENT WORKSHOP RESULTS

PSD WORKSHOPS: DESIGN OVERVIEW

The team organized three PSD workshops. The original intention was to conduct two one-day PSD workshops in each country. One of these would focus on involving local-level stakeholders, while the other would focus on involving national-level stakeholders. To assist in the development of these workshops, the World Bank issued a contract to a consortium of two Canadian partners—ESSA Technologies and the International Institute for Sustainable Development (IISD)—to develop a workshop program, prepare visual materials for the workshops, and in selected countries (so-called Tier 1 countries), attend and help to facilitate the workshops themselves. In the first of the African Tier 1 countries to hold a workshop—Ghana—the consultants from Mozambique and Ethiopia also attended, in order to observe the workshop in operation, so as to be able to repeat its key aspects. This Ghana workshop—involving national-level stakeholders—took place in June 2009.

The consultants attending the Ghana workshop were not entirely satisfied. Meeting the day after the workshop, they reached several new conclusions. First, it was essential to place more emphasis within the workshops on different stakeholder groups in order to stimulate more in-depth thinking about development and climate concerns. At the Ghana workshop, participants had broken out according to their geographical expertise. It was decided that for future PSD workshops, they

would break out according to their sectoral or livelihood group expertise or interest, and indeed the identification of relevant sectors or livelihood groups could be an outcome in and of itself of the workshop. Second, the consultants decided that for Mozambique it would be useful to have more than one local-stakeholder-level workshop, for two reasons. Holding a series of workshops in different regions of the country could reduce travel distances for workshop participants. Also, different regions of the country have different climate, development, and adaptation concerns, and it would be useful to address these in separate workshops. Originally the plan was to have three such workshops, but due to organizational constraints the number changed to two. The third conclusion was that the workshops would be over two days, rather than one. This would give more time for in-depth discussion. Fourth, ESSA and IISD would provide assistance to the Mozambique team, as with the Tier 1 countries, attending at least the first workshop. Given language abilities, the consultants Raul Varela and Isilda Nhantumbo would jointly facilitate both workshops in Portuguese, with additional assistance from students recruited from the University of Eduardo Mondlane in Maputo.

There were, however, several important differences in the designs of the three workshops. The first two workshops—in Xai Xai and Beira—each followed an eight-step procedure, while the national workshop in Maputo followed a seven-step approach. These appear in Figure 10. The two procedures differed in several respects. Most importantly, the eight-step approach was built much more around the idea of imagining a future vision for the country, and people's lives in that

future. After having done this, participants identified ways that climate change could interfere with that vision, and then thought of the appropriate adaptations that could lessen this interference. The seven-step approach, by contrast, was built much more around considering specific climate impacts, and identifying appropriate adaptation pathways to lessen those impacts. Roughly speaking, the eight-step approach reflects a development-oriented view of adaptation (making the development pathway more robust to climate change), whereas the seven-step approach reflected a climate-oriented view of adaptation (reduce the negative consequences associated with a range of potential climate impacts).

The second main difference was in the manner in which breakout groups were defined, and here the major difference was between the Beira workshop and the other two. In all workshops, participants identified early on where they were from, and where their geographical area of greatest expertise lay (Figure 11). In Xai Xai and Maputo, participants then divided into breakout groups along the lines of different economic activities or groups. These were agriculture and ranching, agroforestry, fishing, and commerce. In the Maputo workshop, the agriculture and ranching participants in turn divided into two groups, one concerned with subsistence activity and the other with commercial activity. In the Beira workshop, the breakout groups divided according to geographic location, with a separate group for each of the provinces represented at the workshop.

These different approaches led to very different units of analysis. In the activity-oriented approach, discussion focused on the constraints and opportunities people face while earning their livelihoods in particular ways, with the recognition that climate change threatens some activities more than others. The participants discussed governance issues at a more general level, with somewhat less attention to how different provinces would necessarily implement different types of policies, or on the combinations of policies needed to address the needs of different economic groups. In the geography-oriented approach, discussion focused more on the portfolios of activities present within each province, and the need for policies at the provincial and district levels to deal with the impacts of climate across multiple economic activities. The important justification for this

was to stimulate a different type of thinking, one focused on practical solutions that people working together along existing jurisdictional lines could address. A critical question was whether changing the framing of the unit of analysis for adaptation—from activities in the Xai Xai workshop to geographic regions in the Beira workshop—led to differences in substantive outcomes.

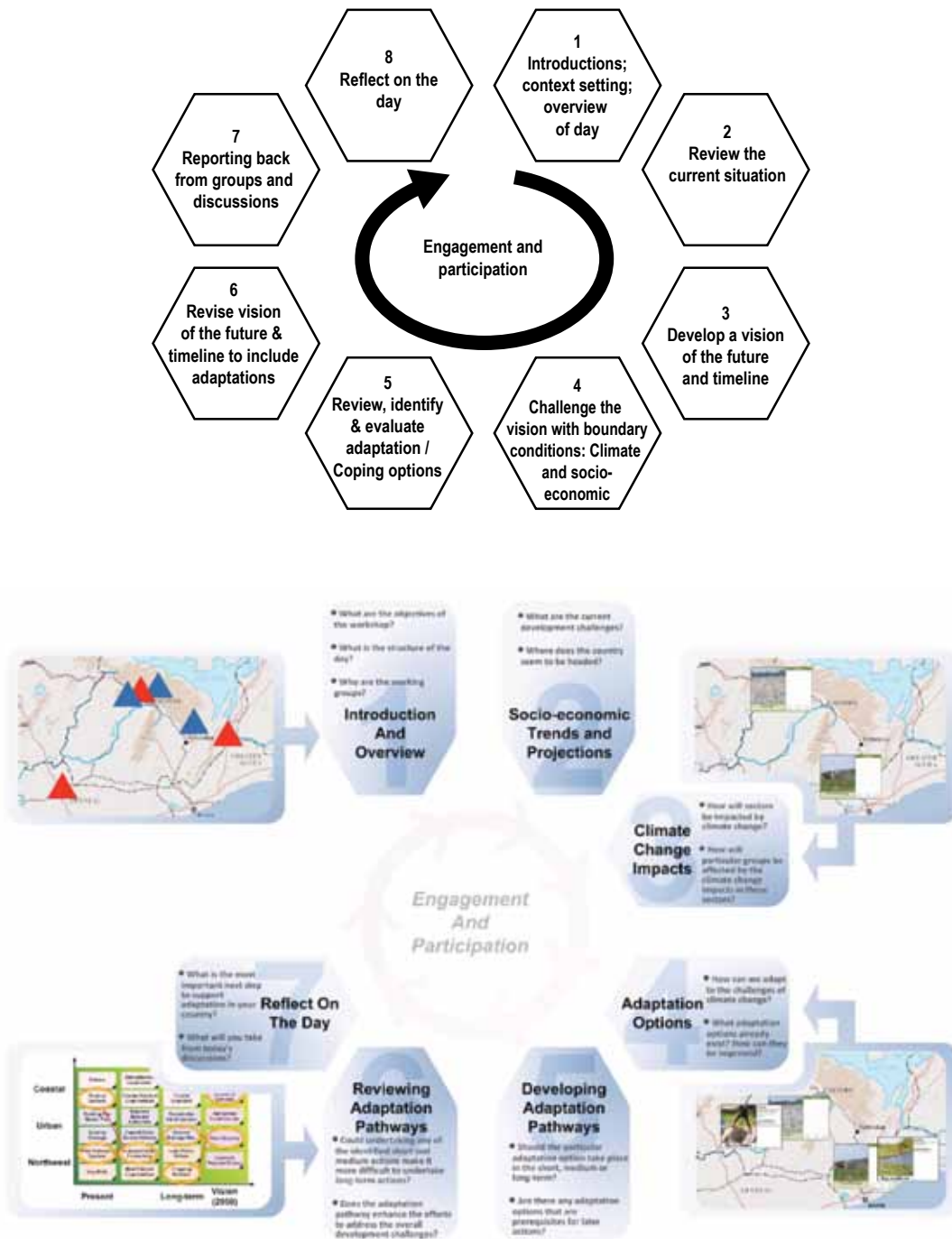
OVERVIEW OF RESULTS FROM LOCAL AND NATIONAL WORKSHOPS

The two local workshops were especially interesting, because unlike many other workshops they focused participants' attention first on development, and only then on the potential threats that climate would impose on that development. This was especially the case in the Xai Xai workshops, where each of the breakout groups considered how development would proceed for a particular sector of society. The result was somewhat less the case in the Beira workshop, where the separation into provincial breakout groups did not allow for discussion to be as specific on different societal sectors, and instead the discussion was more general in terms of improved quality of life for all people.

Xai Xai Key Insights

From the Xai Xai workshop, the most interesting observation is that in very few cases did the development challenges that people listed have much to do with climate change. The main exception was for agriculture. In the fishing livelihood group in Xai Xai, for example, there were challenges related to low fish catches, to the difficulty of selling what they had caught, and to the lack of a future for the children in these communities due to poor education. All of the 2050 vision points revolved around these issues. In the agroforestry group, the challenges for commercial actors related to poor infrastructure and access to credit, while for informal actors they related to poor forest management practices and ecosystem changes. In one case weather was listed as a challenge—the fact that charcoal producers need dry weather to work—but this is an issue more of insufficient ability to invest in building infrastructure for their operations. They were not saying that in Mozambique it rains too often, simply that rain presents a challenge.

FIGURE 10. STEPS IN REGIONAL AND NATIONAL WORKSHOPS



Note: The top figure shows the eight steps in each of the two regional workshops, while the figure on the bottom shows the seven steps taken in the national workshop.

FIGURE 11. MAPPING OF GEOGRAPHICAL ORIGIN AND EXPERTISE



Note: These are the locations identified by participants in the Xai Xai workshop and show the effort to obtain stakeholders from a wide geographical range. Breakout groups, however, followed sectoral expertise.

Again, the 2050 visions were consistent with reducing these challenges. In the trade and commerce group, again the challenges were related to poor infrastructure (such as roads, water, and electric grid), poor institutions and governance (such as lack of education, especially for girls; poor spatial planning; poorly developed markets; and inadequate access to credit), and generalized effects of poverty (such as a low standard of living, poor health, and high unemployment). This group did identify one climate-related challenge: the incidence of natural hazards. The visions for 2050 were again consistent with addressing these challenges, although it is noteworthy that the vision did not contain anything about

reducing exposure or sensitivity to natural hazards. Only in the agriculture and ranching group did climate factors play an important role as a barrier to development. This group listed drought and floods as two of the three most important barriers. For this group, about half of the adaptations listed had something to do with reducing vulnerability to droughts and floods, while the rest related to issues of general poverty alleviation and greater access to markets.

Beira Key Insights

To test the effects of changing the workshop format, the project team divided participants into geographically identified groups. Each of the provinces identified a set of development targets, in terms of life expectancy, per capita income, fertility, population, education, and the size of the economically active workforce. They then listed the factors that would allow these targets to be realized, with similar ideas and suggestions across provinces. They then identified the potential climate impacts and the negative effects each could have in the province. There were some differences across provinces. First, Tete Province is in the driest part of Mozambique, where local communities have more limited livelihood strategies. Second, Nampula is a region normally hit by very strong hurricanes. Third, from Beira to Rovuma River, a long coastline of communities depend on fishing, using poor fishing methods, and thus are potentially more vulnerable to sea level rise and changes in storm intensity. Fourth, the central and northern regions have large forest areas, potentially susceptible to the combination of strong winds and drought, leading to highly damaging fires such as those that devastated Manica and Sofala in 2008. Fifth, there is large-scale contract farming for cotton (for example, in Nampula) and tobacco (for example, Tete); this may mean that those communities engaged in such activities may have more income, and hence greater adaptive capacity. It may also mean that volatile price markets, especially for cotton, can weaken their capacity to cope.

However, no group focused on the specific relationship between the factors leading to development targets and the climate impacts, and so it is hard to see whether they identified linkages or lack of linkages. Likewise, each of the groups listed adaptations

appropriate for different climate impacts, and these options are consistent with those appearing in the NAPAs and the literature more generally, with near complete agreement across provinces as to the types of adaptations they see as important. What one can learn from these results, however, is that the adaptation needs that people identified were quite homogenous across the country. It was not the case that each province needs its own unique ways of adaptation to each climate hazard.

In terms of workshop design, one conclusion to draw is that the geographic groupings may have been useful for developing discussions among a group of colleagues who could then later implement their collective ideas together (since they worked in the same province). However, it was a less successful strategy for eliciting detailed information about challenges associated with different livelihood activities, but to a large extent common across provinces.

Maputo Key Insights

The Maputo workshop devoted less time to identifying ways in which climate may affect particular sectors—indeed suggestions, collated from the regional workshops, were handed to participants on note cards—and more attention to developing pathways of adaptation, something not done in the two regional workshops.

Table 3 lists these pathways for each of the five break-out groups.

These suggested pathways are similar to the results from Xai Xai, in that very few of the adaptation strategies have much to do with climate change and much more to do with development in general. The major exception is for agriculture, both subsistence and commercial. This also finds its way into the longer term vision for the commercial sector, i.e., enhancing the sustainability of trade in agricultural products.

Synthesis

Across the workshops, the more interesting results were in Xai Xai and Maputo, where participants focused their attention on particular economic and livelihood activities. Here, the common finding was that outside of agriculture, climate change does not present many clearly identifiable threats to the improvement in people's livelihoods. Attention within these sectors has to concentrate on improving existing management practices, from efforts to avoid overfishing and overharvesting of forests, to the continued development of a healthy commercial sector that can provide people with reliable sources of income. Within the agricultural sector, the threats from increased prevalence of both floods (in the fertile floodplains) and droughts (everywhere else) require a response that must take the form of both hard and soft measures.

TABLE 3. ADAPTATION PATHWAYS IDENTIFIED IN THE MAPUTO WORKSHOP

	2009–2015	2015–2030	2030–2050
Forestry	Wildfire management and changes in standards	Alternative income-generating activities	Reforestation, forest management and (environmental) education particularly in forest concession areas (commercial forestry)
Trade	Rehabilitation of rural commerce and trade networks; Simplification of licensing procedures for small and medium enterprises	Post-harvest processing; building silos; improved family/community storage facilities	Construction of infrastructure with can withstand climate disasters especially related to trade in agriculture
Fisheries	Improved fishing nets & improved fish management to promote sustainable use of resources	Building infrastructure for processing and conservation of fish (increase yield and increase quality of product)	Education for skills development influence in behavior and attitude to enforce seasonal fishing restrictions; use improved fishing nets
Subsistence agriculture	Conservation agriculture including planting crops resistant to drought	Water harvesting techniques (ie. water storage tanks for consumption and irrigation)	Education so that people can learn to live with drought
Commercial agriculture	Construction of dykes for water retention (small scale)	Construction of flood gates and dams in areas vulnerable	Reforestation so the areas destroyed by forest harvesting to floods and wildfires are reduced

ADAPTATION OPTIONS: KEY SECTORAL THEMES

In all three workshops, participants identified the same four basic activity sectors—agriculture, forestry, fishing, and commerce—as crucial for a consideration of adaptation pathways. In the Beira workshop these were all considered, even if discussion took place in geographically defined groups. Here are results from each of the four sectors, across the three workshops.

Agriculture and Ranching

Table 4 presents the specific results from each of the three workshops.

Across the workshops, the theme emerged that the agriculture and ranching sectors would be the hardest hit by climate change. Potential increases in the likelihood and magnitude of drought, flooding, cyclones, and coastal flooding and intrusion would lead to reduced yields and greater insecurity. The adaptation options that people identified were a combination of infrastructure projects, the improved use of drought-resistant crops, and options that would allow people to diversify their incomes and self-insure.

Agroforestry

Across the workshops, deforestation emerged as a repeated problem. It was unclear in many people's minds the extent to which this would be a direct consequence of climate change, or simply of poor forest

management practices, or of some combination of the two. Without resolving this question, almost all groups suggested approaches to improving forest management and forest access for commercial uses. Many of the participants suggested greater empowerment of local community groups, both in the design of management policies and in their enforcement, such as through community-based natural resource management.

Fishing

People were worried about the direction that fisheries were heading, but there was very little consensus on the extent to which climate change was a driver of this problem, except for the fact that increases in cyclone strength could threaten fishing fleets in the absence of adequate early warning. In the Xai Xai workshop, participants suggested that the impact of climate change on fisheries would be indirect, by threatening agricultural production and in turn leading to a greater reliance on fish as a food source and source of income.

Trade and Commerce

There was a concern that climate change could negatively affect trade and commerce through several different pathways. One pathway was in terms of losses in agricultural productivity; since agricultural commodities are the main thing traded, this would have a direct negative effect, both on supply of commodities from the rural areas into trade networks, and in terms of loss in purchasing power by rural people. Another pathway was in terms of a loss of infrastructure from extreme events,

TABLE 4. WORKSHOP RESULTS

	<i>Key impacts from climate change</i>	<i>Consequences for development</i>	<i>Adaptation options</i>
Xai Xai	Droughts, floods, cyclones, and sea level rise	Loss of production, loss of soil fertility and increased salinity, destruction of infrastructure, increased mortality	Construction of water retention and flood protection infrastructure; construction of barns for animals, silos for grain storage, and food processing facilities to give greater market access.
Beira	Drought, flood, cyclone	Malnutrition, loss of yields, loss of possessions in low-lying areas	Drought-resistant crops, water conservation, income diversification through improved market access, resettlement
Maputo	Drought, desertification, loss of soil fertility	Reduced crop yields, poverty, disease, malnutrition, food insecurity, loss of grazing land, loss of forest land	Crop diversification, rainwater conservations, expanded irrigation, improved social services and health care, livelihood diversification, micro-finance for value added activities and market access

TABLE 5. SPECIFIC RESULTS AND SUGGESTIONS FROM THE WORKSHOPS

	<i>Key impacts from climate change</i>	<i>Consequences for development</i>	<i>Adaptation options</i>
Xai Xai	Drought, flood, cyclone, and sea level rise	Changes in forest ecosystems, destruction of forest access ways, loss of coastal vegetation	Reforestation, road construction, community resource conservation, early warning systems
Beira	Drought, flood, cyclone	Wildfires, deforestation	Community forest management, increased consumption of wild fruits, reforestation
Maputo	Wildfires, loss of vegetation, loss of soil fertility	Food insecurity, reduced forestry yields, destruction of housing	Improved forest management including better enforcement of existing laws, community-based reforestation, improved control of wildfires, establishment of fire breaks, infrastructure to protect housing from fire

TABLE 6. KEY FINDINGS IN THE FISHING SECTOR

	<i>Key impacts from climate change</i>	<i>Consequences for development</i>	<i>Adaptation options</i>
Xai Xai	Drought, flood, cyclones, and sea level rise	Loss of agriculture leading to higher pressure on fisheries, reduction in catches, loss of fluvial fisheries	Adaptive agriculture, reforestation, early warning, introduction of new fish species, aquaculture.
Beira	Drought, flood, cyclone	None identified	Moving artisanal fishing areas to those more suitable, community risk management, early warning
Maputo	Changes in fish availability	Overexploitation and extinction of some species, reduced catches and attendant income, food insecurity	Improvements to fishing nets, storage, and processing facilities; education and skill training; livelihood diversification away from fishing; improved early warning

TABLE 7. KEY FINDINGS FOR THE TRADE AND COMMERCE SECTORS

	<i>Key impacts from climate change</i>	<i>Consequences for development</i>	<i>Adaptation options</i>
Xai Xai	Drought, flood, cyclones, and sea level rise	Wild fires, loss of agricultural productivity, destruction of infrastructure, displacement of people, loss of land for economic development	Reforestation, adaptive agricultural practices, more resilient infrastructure, improved coastal erosion control
Beira	Drought, flood, cyclone	Loss of infrastructure	Building stronger infrastructure, improving transportation, food processing and storage, and market places, improved social assistance, improved finance for small businesses
Maputo	Reduced and more variable agricultural production, loss of infrastructure, coastal flooding and erosion, cyclones	Market price fluctuations and commodity scarcity, degradation of transportation networks	Construction of grain and fish storage facilities, price monitoring, micro-insurance, improved roadways, flood protection barriers

both buildings in town and roadways. In addition to addressing these causes directly, participants suggested that better access to credit and information would stimulate a diversification and general development of the sector, thus making it more resilient.

IDENTIFICATION OF MOST VULNERABLE GROUPS

One of the important goals of the workshops was to identify the people and places that could be most vulnerable to the effects of climate change. The results, in general, were unsurprising as to both.

In terms of vulnerable places, these seemed simply to mirror where climate-relevant activities took place and the hazards were high. In the Xai Xai workshop, for example, the participants identified areas within the southern region of “most vulnerable” and “second most

vulnerable” status, for each of the four livelihood activities. Figure 12 shows these identified areas, and in general they seemed to match up with the overlap of high hazard level and the particular activity. For agriculture, it corresponded most closely to areas prone to drought but where people nevertheless farm. In the case of fishing, it appeared to be the result of thinking about where inland fishing is taking place and resources are under threat from overfishing. Coastal fishing also was seen as a hazardous activity, especially as artisanal fishers increasingly go out farther from shore to find stocks. In the case of trade and commerce, it appeared that people were most likely to consider not the main cities, but rather smaller commercial centers that are marginal, and could be threatened in their existence by increasing rural poverty or decreasing crop yields.

In the Beira workshop, participants split into working groups according to provinces, and so there was not the opportunity to identify those places that were most vulnerable across the whole region. However, participants identified the vulnerable groups within their provinces. These included (a) fishermen vulnerable to hurricanes and possible sea level rise; (b) the farming communities using fire for land clearing and the communities near the forests, both of whom were considered vulnerable to wild and manmade fires as propagation may become easier during lengthy drought periods; and (c) pastoralists in Tete, where the ranching of small ruminants such as goats is a very important enterprise and the exacerbation of drought conditions has the potential to reduce pasture availability and worsen erosion.

In Maputo, participants again engaged in mapping—as in Xai Xai—with very similar results. Figure 13 shows the results for two sectors—fishing and forestry—and in both cases (as well as other sectors) the identified regions of high vulnerability were where risk levels are high and large numbers of employed people are employed.

Across sectors at the Maputo workshop, the participants identified the following areas as most vulnerable:

- Coastal Nampula and southern Cabo Delgado, including the cities Nampula and Pemba. This would appear to be driven by fears of sea level rise and increases in cyclone strength and frequency.

FIGURE 12. VULNERABLE REGIONS IDENTIFIED IN THE XAI XAI WORKSHOP

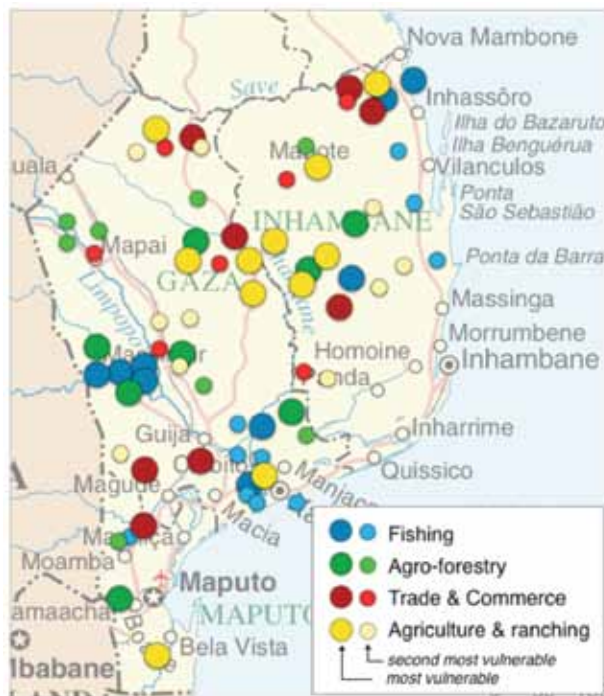
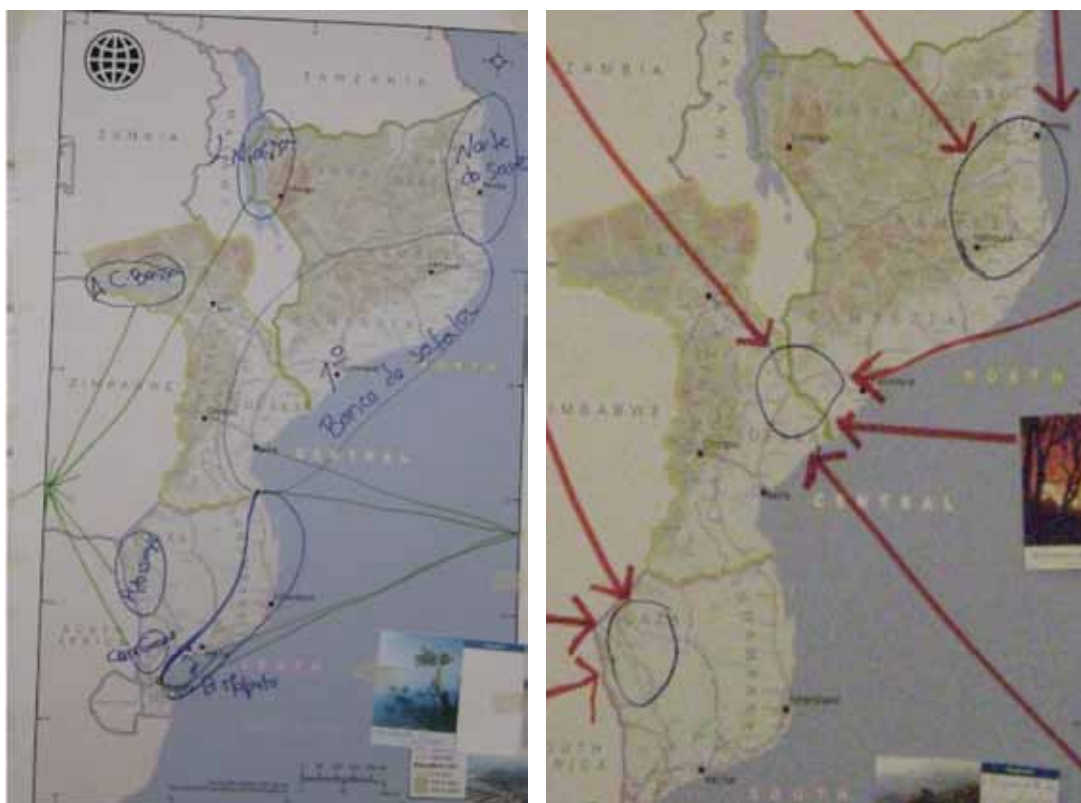


FIGURE 13. REGIONS IDENTIFIED AS MOST VULNERABLE IN THE MAPUTO WORKSHOP



Note: The left-hand picture shows results for the fisheries sector, while the right-hand figure shows results for the forestry sector.

- Northern Sofala and southern Zambezia. This would appear to be driven by fears about increased risk of flooding.
- Both inland and coastal areas of Gaza. This would appear to be driven by fears of increased risk of drought.

Participants also identified groups of people they considered to be the most vulnerable. All workshops considered this question and arrived at similar answers: Generally, the most vulnerable were those people without the resources to withstand livelihood shocks, without the capacity to adapt, and without social support networks. Specifically, they included (a) children, in particular orphans; (b) women, in particular women who head households; (c) the elderly; and (d) those with physical or mental handicaps.

In all workshops, participants suggested that members of each of the above groups were most vulnerable when engaged in dry-land farming as their main livelihood activity. They suggested that existing social support mechanisms, such as social security offered by the government, are inadequate to ensure the members of these groups with adequate livelihood security.

RELATIVE PREVALENCE OF “HARD” VERSUS “SOFT” ADAPTATION OPTIONS

One workshop result that stood out was that people saw both hard and soft adaptation options as important. Within each category, people also saw a mix of options that would be centrally planned and delivered by the government or NGO community, and those that would be operationalized at the household or

community level. Another axis where adaptation options differed was in terms of whether they directly addressed a particular climate risk, or would primarily act by increasing adaptive capacity. In the following table, the latter appear in italics.

One interesting result was that when participants had to identify which options would directly benefit the most vulnerable communities, they were much more likely to identify soft centralized options, and in particular those that addressed underlying problems of adaptive capacity. These included better credit, better information, and improved health care and social services and support. This is unsurprising, since what separates the most vulnerable from the others is their lack of access to these things. Specifically, the Maputo workshops listed the following adaptation options as most directly benefiting the most vulnerable:

- Improved rural trade, with fewer barriers to entry, and technical assistance programs for vulnerable groups
- Improved agriculture practices, including more use of wild resources such as fruits, apiculture, and non-timber forest products, and better mapping of agro-ecological zones
- Education for capacity improvement, combined with better micro-credit.

Participants at the workshops covered a wide range of experience, both in terms of the level of activity in

which they were engaged, and the sector in which their experience lay. The workshops did not record results at the individual level, however, and all group work contained stakeholders with a variety of backgrounds. Hence, it is not possible to identify whether there were significant differences in views as to adaptation options across different classes or groups of stakeholders.

CONGRUENCE WITH NATIONAL PLANS, INCLUDING NAPAS

One intention of the PSD workshops was to find out whether an approach to adaptation planning that explicitly considered (a) the needs of most vulnerable communities, and (b) the potential for climate impacts interfering with development visions, would differ substantially from previous adaptation planning exercises, such as the NAPA. The main conclusion that one can reach is that there are very few differences in outcomes between the NAPA process and the PSD process.

The NAPAs identified four priority areas for national planning and policy development. These were:

- *Strengthening the early warning system for floods, droughts, and tropical cyclones.* This would benefit the safety of people engaged in all areas of economic activity threatened by disasters. It would also have significant economic implications for the agricultural sector—the activities of which are directly affected by flooding and droughts—and the

TABLE 8. KEY ADAPTATION OPTIONS FROM PSD WORKSHOPS

	<i>Centralized</i>	<i>Distributed</i>
Hard	<ul style="list-style-type: none"> • Flood control dikes and levies • Coastal flood control gates • Dams and irrigation channels • <i>Improved roadways</i> • <i>Improved communication infrastructure</i> 	<ul style="list-style-type: none"> • Farm-scale water storage facilities • More robust buildings • <i>Grain storage facilities</i> • <i>Improved food processing equipment</i>
Soft	<ul style="list-style-type: none"> • Improved early warning of hazards • Better planning and management of forest, fish, and other natural resources • Resettlement of populations to lower risk zones • <i>More credit and financial services for small businesses and rural development</i> • <i>Better education and information for the rural areas</i> • <i>Improved health care, social services, and social support for the poor</i> 	<ul style="list-style-type: none"> • Better utilization of drought-resistant crops • Use of highland areas for living and lowland areas for farming • Better household and community management and use of natural resources • Practice of soil conservation agriculture • <i>Diversification of livelihoods away from agriculture</i> • <i>Better planning of how much grain to save for personal consumption, and how much to sell for income generation</i>

Note: The items appearing in plain text directly respond to anticipated climate hazards, while those in italics respond to the need for improved adaptive capacity.

fisheries sector, given the exposure of its infrastructure to tropical cyclones and the need to bring fishing fleets into safety.

- *Strengthening the capacities of agricultural producers to cope with climate change.* This attention to capacity includes both hard and soft adaptation measures, and also addressed the general state of development. Putting in place flood control and irrigation infrastructure would clearly improve people's capacities. So would improving their knowledge about how to use early warning systems to mitigate losses from floods and droughts. Improving capacities could also, however, mean developing other income-generating activities for people now engaged solely in agriculture, as these would better enable people to withstand climatic hazards.
- *Reduction of climate change impacts in coastal zones.* This would likely involve a great deal of infrastructure to protect urban areas and transportation routes, and thus would have the greatest impact, from a social perspective, on commerce and industry. It would also involve a wider range of measures beneficial to both fishing and coastal agricultural communities.
- *Management of water resources under climate change.* This would likely have the largest impact on the agricultural sector, which relies on a continuous supply of rainfall or irrigation during the growing season and is most vulnerable to flooding. It would also have an impact on energy production, and thus indirectly on commerce, as well as on public health through improved sanitation.

Other national plans have contained similar or identical priorities for adaptation and development. The congruence between these plans and the results of the PSD workshops can be seen in two respects:

- The PSD process independently identified all of the adaptation priorities previously noted in the NAPAs. First, the PSD workshops identified that, among sectors, agriculture is the most vulnerable, both because of its high climate exposure and because of the social vulnerability of the people practicing it. Second, within the agricultural sector, it identified that a range of measures is required, from those that address climate impacts such as flooding and drought directly with new

infrastructure and knowledge, to those that allow farmers to broaden their livelihoods by engaging in commercial activities. Third, the workshops did identify the threats to infrastructure in the coastal zone, including roads, fishing boats, and buildings. Fourth, the PSD workshops identified early warning system improvements as a key cross-cutting adaptation. Fifth, the workshops identified the better management of water, such as through the practice of conservation agriculture, as an important adaptation option.

- The PSD workshops identified the options previously noted in the NAPAs as the most important elements of adaptation pathways that directly addressed climate concerns. In the Beira workshop, participants focused most closely on the different climate impacts and how to adapt to each of them. All of the options they identified as most important match one of the NAPA priority areas.

In one respect, however, the PSD workshops—especially the one in Xai Xai—reached an implicit conclusion different from that of the NAPA process. The conclusion was that, except within agriculture, development goals in general were not threatened very much by climate change, and that far more important are those development initiatives that make sense independent of climate change. This conclusion can be reached when starting by considering development visions within different economic sectors, moving on to considering the threats to those visions, and finally considering how climate change may contribute to these threats. In the NAPA process, by contrast, the question was somewhat different: what can be done to adapt to those climate impacts that could pose a threat to development. This is the same question that guided the Maputo PSD workshop. When considering this question, the Maputo PSD came up with answers similar to the NAPA process.

POLICY PRECONDITIONS AND INSTITUTIONAL BASE

In all workshops, some of the most important adaptation options represented improvements in existing government programs and practices. For example, many participants suggested that the forestry sector did not necessarily need new laws to promote more sustainable forest management, but rather more effective and fair

enforcement of existing laws. Statements such as these thus suggest a necessary improvement in the ability of the government to act effectively—what many might consider a precondition.

The Maputo workshop was the only one to address directly the issue of preconditions. Participants identified the following list of options:

- Improving the competence of government
- Combating corruption
- Improving vocational training
- Creating a more attractive policy for investment in Mozambique
- Mainstreaming climate issues into sectoral policies.

Does this list make sense? Certainly, having a competent government free of corruption does make sense and is consistent with the messages from the other two workshops. Vocational training and improving the investment climate are also, perhaps, the two most important ways of improving adaptive capacity. Whether one considers improvement in adaptive capacity to be an adaptation in its own right, or a precondition for adaptation, is a subject of much lively academic debate. These participants, at least, thought the latter. The final item on the list, mainstreaming, simply represents a particular approach to adaptation governance. Many would see this as the best way to begin to address climate concerns across a wide range of sectors, where climate is not the main problem on policy-makers' list of concerns.

CONCLUSIONS FROM THE WORKSHOP TRACK

The workshop track was an extremely useful means of generating intense discussion on the issues of climate

change vulnerability and adaptation in Mozambique, paying particular attention to the issues facing the most vulnerable in society while taking a development-first perspective. The main result from the workshops is to validate previous findings. These are:

- The most vulnerable in society are people lacking the capacity to cope with climate shocks or adapt to changes, and without strong social and family support networks. These include orphans, female-headed households, the elderly, and people with physical or mental handicaps.
- Adaptation options need to address both the specific risks associated with climate change—droughts, floods, and cyclones—with a portfolio of hard and soft options, as well as with the underlying capacity of people to adapt and their resilience in the face of extreme events.
- In the case of the most vulnerable people, their most urgent need is for assistance that will improve their resilience and adaptive capacity, such as education, social support, and programs that allow them to diversify their livelihood strategies.
- Agriculture is the area of economic activity in which the future development is most threatened by climate change impacts. It is essential both to develop specific infrastructure and soft adaptations to protect agricultural producers from extreme weather and climate events, and to enable them to diversify their activities into other income-generating activities.

None of these findings contradicts the main findings either of past adaptation assessment or planning exercises, such as the NAPA, or the findings of the Mozambique sectoral findings in the EACC study.

6. FIELDWORK RESULTS

The primary purpose of the fieldwork in Mozambique was to validate the results from the PSD workshops, in two respects. First, we were interested in the question of differential vulnerability: who were the most vulnerable and what were the effects of climate change on them relative to everyone else. Second, we were interested in the coping and adaptation options identified. Would there be regional variation in the options identified?

To address these tasks, the team gathered data using three methods. The first was a set of institutional interviews: speaking with particularly knowledgeable people in the community, or people with decision-making responsibility. The second was a set of focus-group discussions: speaking with groups of people representing communities covering a range of vulnerability. The third was a household survey: interviewing households in each community, again representing a range of vulnerability profiles, to find out their individual perspectives. The three activities took place in each of the districts where fieldwork was conducted, as shown in Figure 9. In some districts, however, there was not the opportunity to conduct institutional interviews.

RESULTS FROM INSTITUTIONAL INTERVIEWS

All of the institutional interviews followed a common format. The steps in this format were:

- Describe the participants in the interview session. There were usually several participants from the

local government and NGOs operating in the district.

- Identify the main climate risks in the district. These included droughts, floods, cyclones, and in some cases wildfires and coastal erosion. Participants identified past events that had been particularly severe.
- Describe the overall sensitivity of the community to these risks, identifying the groups within the community most vulnerable to these risks.
- Identify options to mitigate and adapt to these risks. The participants went through the list of risks in their district, and suggested adaptation options for each. They divided these into institutional options (what their own organization could do) and options for the community (what the community as a whole could benefit from).
- Identify the main constraints preventing the implementation of these options. In this case, every interview identified financial constraints as the single most important factor. Most also identified the lack of knowledge, information, and skills as an additional constraint.

Overall, the results from each of these interviews were not surprising. The hazards and risks that people identified were in all cases consistent with the results from risk mapping, using national-level data. People were thus well-informed about the risks faced by their community. In general, the results from the other questions were also consistent across interviews, with people listing exactly those adaptation options for each of the risks that had been identified in the PSD workshops. Beyond this, there were several other interesting findings from the interviews. Table 9 lists each of them,

noting the people identified as most vulnerable, and interesting lessons—with respect to risks, sensitivity, or adaptation options—that stood out from their other answers.

It is clear that the people identified as most vulnerable are the same, by and large, as those identified in the PSD workshops. Unfortunately, the institutional interviews did not shed any particular light on the nature of vulnerability among these groups.

RESULTS FROM FOCUS GROUP DISCUSSIONS

The focus group discussions had the same intention: to identify particularly vulnerable social groups, and to brainstorm about potential adaptation options. Unlike the institutional interviews, they were held not with key

decision makers in each community, but rather with people representing a particular social group with medium to high vulnerability. The format that they followed was:

- *Social and demographic characteristics of the group.* Discussions started with those in attendance, and then moved to the members of the same social group in the wider community.
- *Social differentiation.* Participants described the role of the group in the overall structure of the community.
- *Natural disasters.* Discussion then moved on to the major disasters in the region. People described the disasters, when they had occurred with what consequences, and why they believed they happened.
- *Climate hazards and vulnerability.* Discussion moved from natural disasters in general to focus on climate

TABLE 9. INTERESTING LESSONS FROM THE FOCUS GROUP INTERVIEWS

<i>Location</i>	<i>Participants</i>	<i>Especially vulnerable</i>	<i>Interesting lessons</i>
Angoche	1 NGO and government	Subsistence farmers, single mothers, children, elderly	<ul style="list-style-type: none"> • Hazards result from witchcraft • Need to protect forest areas and trees to protect against drought and storm surges • Need to avoid living right at the coast
Chibabava	5 NGOs	None listed	<ul style="list-style-type: none"> • Need to build water storage dams
Chokwe	3 NGOs	Elderly, children, widows, pregnant	<ul style="list-style-type: none"> • Should live on high ground for floods, farm on low ground for droughts • Stay away from the dams, where flooding is more common • Stock surpluses to prepare for drought, sell them in times of drought
Gondola	Government	Not listed	<ul style="list-style-type: none"> • There is no disaster planning
Inhambane	Government	Orphans, elderly, physically handicapped, chronically sick	<ul style="list-style-type: none"> • Trying to resettle people on higher ground • Need better infrastructure • Need better access roads
Mabote	4 NGOs, Government	Elderly, widows, children, pregnant women	<ul style="list-style-type: none"> • Need to conserve soil better
Manhiça	Six NGOs	Elderly and orphans	<ul style="list-style-type: none"> • Need more early warning, more diversification of income • People attribute disasters to ancestors
Massingir	4 NGOs	Elderly, children, handicapped, single women, widows	<ul style="list-style-type: none"> • Need to stock surpluses and sell them • Floods happen when dam sluice gates open, and can be forecast • Need to diversify income • Need to build irrigation systems
Matutuine	Government	Not listed	<ul style="list-style-type: none"> • Need dikes and small dams, and more information
Moatize	Government	Not listed	<ul style="list-style-type: none"> • Need better information
Mopeia	2 NGOs	Not listed	<ul style="list-style-type: none"> • Early warning • Better organization of farmers, for risk management committees and to distribute surpluses more effectively
Xai Xai	2 NGOs	None listed	<ul style="list-style-type: none"> • Need to store surpluses • Build irrigation systems • Stronger houses to protect against cyclones
Zavala	5 NGOs	Widows, single mothers, elderly, handicapped	<ul style="list-style-type: none"> • Farm low-lying areas, live on high ground • Need to build more solid houses because of cyclones

hazards and vulnerability. People described the factors that made them more or less vulnerable, and the reasons why these factors mattered.

- *Adaptive and coping capacities.* Participants described the steps that people have taken to adapt to and cope with climate hazards, and the factors that have helped or hindered them from doing so. In this section, participants identified some of the institutions that have played a key role.
- *Long-term adaptation.* From the discussion on adaptive and coping capacity, participants then moved to discuss possible long-term adaptations. What are they? Who could implement them?
- *Barriers to implementation.* Participants described the factors that could stand in the way of implementing the long-term adaptations they had described.

Table 10 presents results from across all focus groups. It considers six themes, omitting only the characteristics of the particular groups. It presents answers to three questions. First, what were the most common answers and issues identified across all focus group discussions? Second, to what extent did these answers vary according to geographical factors, such as exposure to particular

hazards? Third, to what extent did these answers vary according to different stakeholder groups; that is, did the farmers give the same answers as the fishers and the charcoal collectors?

These results are completely in line with those from the PSD workshops, which in turn were in line with past studies and assessment. The important finding, however, is the general lack of variance in responses, either geographically or across social groups. Also, the respondents were quite clear that the most vulnerable were that way because they lacked the capacity to work.

To supplement the results in Table 10, Annex 1 presents noteworthy comments and observations made in each of the groups. These begin to paint a picture of people's stories of vulnerability.

RESULTS FROM HOUSEHOLD SURVEYS

The final set of data collected during the fieldwork was in the form of the household surveys. The three enumerators interviewed 136 households across all of the districts where fieldwork was conducted. In each district, the intention was to interview households

TABLE 10. AGGREGATE RESULTS FROM FOCUS GROUP DISCUSSIONS

	<i>Most common responses</i>	<i>Geographic heterogeneity</i>	<i>Social heterogeneity</i>
<i>Social differentiation</i>	In most communities subsistence farmers were listed as the major social group, with livelihood diversification into forestry and fishing	Diversification of strategies depended on location, and whether suitable for fishing or forestry	None
<i>Natural disasters</i>	Droughts were the main concern, followed by floods and cyclones	Participants listed hazards according to their exposure, consistent with risk maps	None
<i>Climate hazards and vulnerability</i>	Children, female-headed households, the elderly, and handicapped people are the most vulnerable, because of their limited ability to work	None	None
<i>Adaptive and coping capacities</i>	In most cases people try to cope and adapt, but have very little assistance and support	In some regions there are social support networks, such as farming or fishing cooperatives; these provide help	Fishermen seemed most in need of cyclone early warning; farmers in flood plains needed warning of upstream dam releases
<i>Long-term adaptation</i>	People listed the same set of adaptation options identified in PSD workshops	Areas heavily reliant on fishing and forestry were more likely to list better natural resource management	Subsistence farmers were most likely to mention income diversification
<i>Barriers to implementation</i>	All groups listed the inadequacy of finance and technical support	None	None

representing the range of anticipated vulnerability. In this section, we first present the important raw data in graphical form. We then go on to analyze important relationships. Annex 2 contains a copy of the survey instrument.

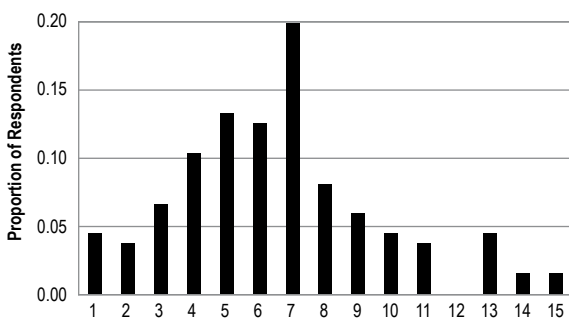
Household Size, Resource Access, and Self-Sufficiency

The first way of describing the data is in terms of household size and the access to resources. Figure 14 shows the distribution of household sizes. The largest households had fifteen members, while the majority of households were between four and seven people, with seven being the most frequent household size.

The next data are the household's access to farmland, and the sufficiency of the farmland to meet the household's needs. Figure 15 shows the distribution of field sizes in highland and lowland areas. Field sizes tend to be somewhat smaller in lowland areas, where close to 10 percent of respondents had less than 1 ha of land to farm. In highland areas, the majority of people had between 1 ha and 5 ha of land to farm. Figure 16 shows the pattern of people bringing their harvest to market. Almost all respondents kept at least 40 percent of their harvest for household consumption. A quarter of respondents took 20 percent or less of their harvest to market. Finally, Figure 17 shows how long the harvests kept for the household typically would last. The

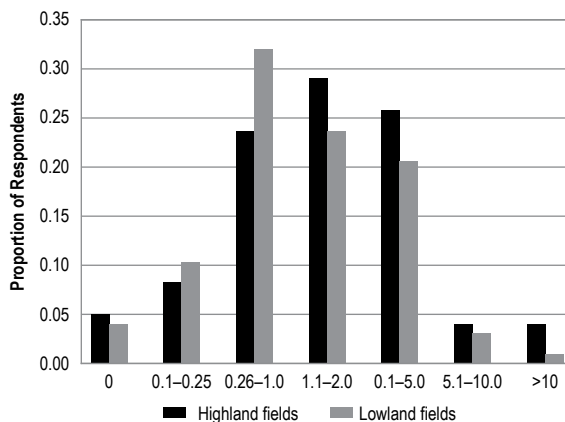
majority of households reported the stocks lasting between three and six months. Only about 10 percent reported their stocks lasting throughout the entire year. The picture that emerges is of households that have many mouths to feed, and in general do not grow enough grain on their own to do so. Most households keep the majority of their harvest for their own consumption, and yet in only a few cases does that harvest last the entire year.

FIGURE 14. DISTRIBUTION OF HOUSEHOLD SIZES



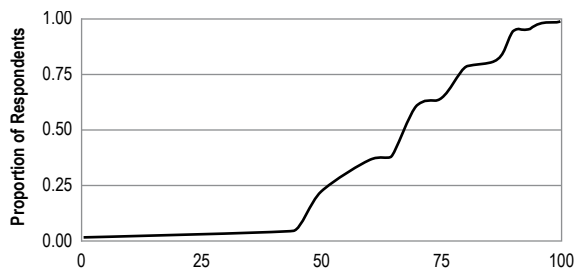
Note: n = 136.

FIGURE 15. PROPORTION OF FIELD SIZES IN HIGH AND LOWLAND AREAS



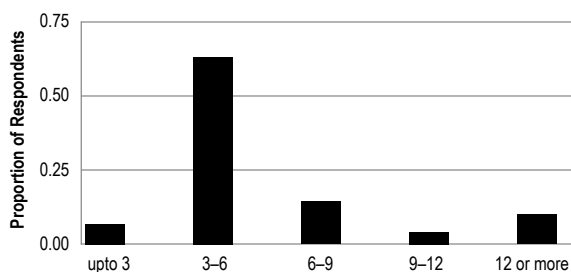
Note: n = 136.

FIGURE 16. CUMULATIVE DISTRIBUTION OF CROPS KEPT FOR HOUSEHOLD CONSUMPTION



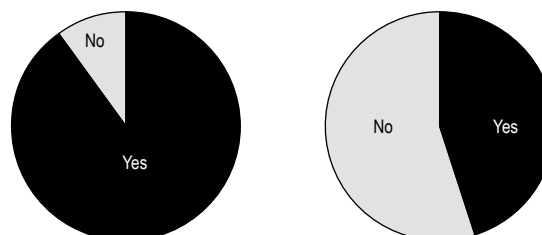
Note: n = 117.

FIGURE 17. NUMBER OF MONTHS THAT HOUSEHOLD GRAIN STOCKS FROM OWN HARVEST LAST



Note: n = 117.

FIGURE 18. PROPORTIONS AFFECTED BY CLIMATIC HAZARDS AND RECEIVING EARLY WARNING OF THESE



Note: The left-hand circle represents the relative numbers of respondents saying they have been affected by a climatic hazard. The right-hand circle represents the numbers who have received early warning of those hazards. n = 117.

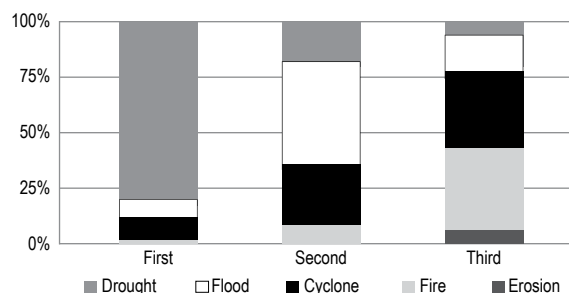
Experience with Climate Hazards

The next data pertain to the climate hazards that people face. As Figure 18 shows, almost all respondents reported being negatively affected by one or more climate hazards. About half of them had received prior warnings about these, while half of them were caught relatively unaware. Figure 19 suggests which hazards they view as the most severe for them. Over three-quarters of respondents listed droughts as the most important climate-related hazard they face, with smaller numbers listing floods and cyclones as the most severe. Half of the respondents list floods as either the most or second-most important hazard they face. A large number list fire and erosion—indirect climate impacts—as the third most important threat they face. These results are consistent with what was learned during the PSD workshops, and indeed is common wisdom about Mozambique’s vulnerability to climate change.

Respondents listed the ways they had been affected by these hazards, and in an open-ended question listed the effects they were most concerned about. These were:

- Destruction and loss of property (56 respondents)
- Hunger and lack of food (20 respondents)
- Low agricultural production (15 respondents)
- Degraded condition of the fields (10 respondents)

FIGURE 19. RANKING OF HAZARDS BY RESIDENTS



Note: Proportion of respondents ranking particular hazards as the first, second, and third most important. n = 117

- Lack of water in the wells (eight respondents)
- Lack of rain (seven respondents)
- Being left exposed to the elements (six respondents)
- Panic and suffering (five respondents)
- Death and physical damage (four respondents)
- Forced relocation (one respondent)
- Limited fishing activity (one respondent)

The next question on the survey asked respondents whether there was variation in the effects that different

households in the community had suffered as a result of climate hazards; 80 percent responded that there is variation. When asked to identify the factors influencing such differences, their answers were:

- House construction, i.e., traditional versus conventional materials (44 respondents)
- Income level of household (28 respondents)
- Being a member of an especially vulnerable group, e.g., elderly, children, female-headed households, handicapped (11 respondents)
- Diversification into other economic activities (nine respondents)
- Geographic factors, such as location of farm on highlands or lowlands (two respondents)

Respondents then were asked if their own household had suffered differently from most other households in the community from climate hazards. Again, 80 percent of the respondents said yes, they had suffered differently from other households in the community. In this case, the reasons most commonly listed were:

- Their own income level, compared to that of the community (34 respondents)
- Their prevention efforts against climate hazards (23 respondents)
- Their income diversification (eight respondents)
- The quality of their roof (eight respondents)
- Being a member of a vulnerable group (five respondents)

What can we learn from examining these two sets of answers? The first is that two sets of factors are the most important determinants of vulnerability: people's level and diversity of income, and the extent to which they have prepared themselves for extreme weather, such as through the quality of their houses. When viewing the matter in the abstract, people were more likely to list preparations as more important. When thinking about it in terms of their own personal experiences, they were more likely to list income as the most important factor. This could reflect an unwillingness to take personal responsibility for having suffered more than other households because of the failure to take precautionary measures. In terms of whom they have gone to for assistance after climate hazards, 39 percent of respondents indicated that they turned to the local

government authorities, 32 percent to the traditional leaders and authorities, and 29 percent to other organizations, including INGC and NGOs.

Past Adaptation and Coping Practices

The heart of the survey investigated households' adaptation coping practices. Two open-ended questions asked respondents to list their primary coping strategies for a range of climatic hazards. Figure 20 shows the results, in terms of the strategies identified most frequently to prepare for hazards and to cope with hazards during and after their occurrence.

To prepare for drought, about a quarter of the people did not identify any coping strategy they had implemented in advance. Since almost all respondents listed drought as a major concern, this could simply indicate that they did not see options available. Among strategies, the most common were planting crops in the wetter (and sometimes irrigated) lowlands, planting shorter-season (i.e., more drought tolerant) crop varieties, and improving their buildings. The point about improving their buildings does not make obvious sense, but could include the construction of granaries in order to store more surplus harvest. An additional ten different strategies were mentioned, but in each case by only one or two respondents: these constitute "other." These included preparing for fires, hunting rats, engaging in more weeding, and engaging in religious practices. During and after droughts, the three most common strategies were to plant any new crops in the wetter lowlands, to manage forest resources carefully in order to obtain income from those forests as a safety net, and to manage past surplus harvests and cash receipts carefully. The majority of respondents, however, suggested that they did nothing. The "other" strategies again included a wide variety of measures, including spending more time in the shade.

A larger fraction of respondents do not prepare for floods, likely because many of them do not face a flood risk in their district. Of those who do prepare, the most common preparations were to plant in the highlands, to fortify their houses, and to plant short-season varieties. Why short-season varieties? On the one hand, these would be more appropriate for highland farming. On the other hand, in the floodplain these would be more likely to be harvested before the flood hits. During and after a

flood, most people listed nothing that they can do. The only common strategy listed was to plant in the highlands, while a number of other strategies enlisted the support of only one or two respondents. These included building canoes and keeping belongings in safe places.

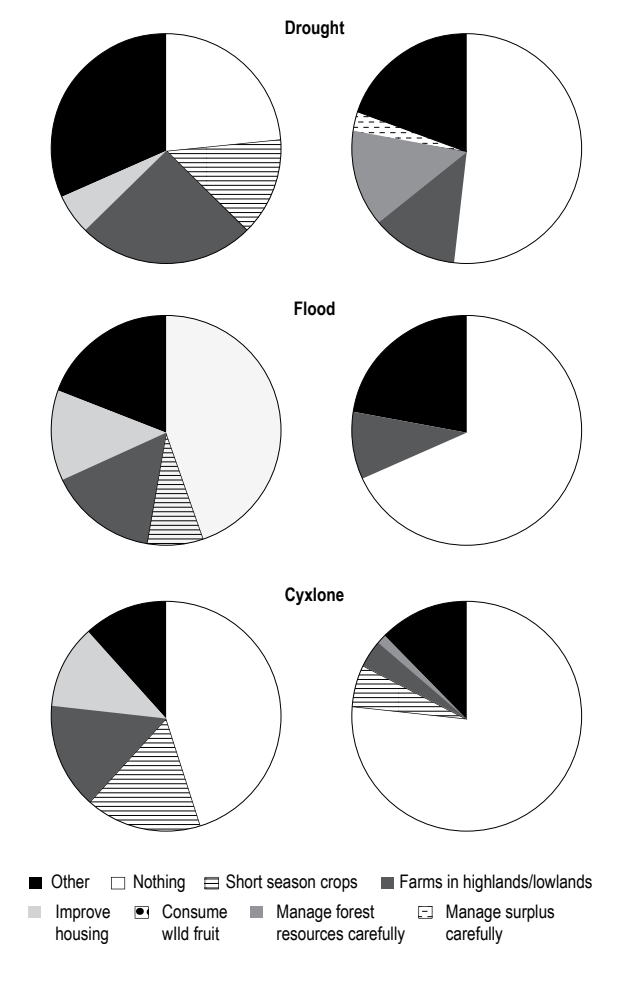
The pattern of preparation for cyclones was very similar to that for floods, albeit with fewer additional strategies covered by the “other” category, and more people listing the planting of shorter season crop varieties, in order to improve the chances of gathering a rainy season harvest

before the cyclone hits. Over three quarters of respondents listed nothing to do during and immediately after a cyclone. The three most frequently listed strategies were to plant short-season crops in the highlands, and to gather wild fruits to make up for the lack of a harvest.

One important question is whether the propensity, or ability, to carry out these adaptation and coping strategies correlates with income or other resources. The final section of the survey asked participants to list whether a member of their household worked either for payment in cash or in kind (61 percent of respondents answered “yes”) and whether the household had any monetary savings to pay for special emergencies (55 percent answered “yes”). We examined whether the answers to either of these two questions significantly correlated with the six sets of results presented in Figure 20. Using a X^2 test, we found no significant correlations ($p > 0.10$ in all cases). In all cases, similar proportions of those with and without employment income, or with and without savings, engaged in adaptations, and the adaptations in which they engaged were similar.

We repeated this analysis using not income or the presence of cash reserves as an indicator of income or resources, but rather other factors. First, we looked at the productivity of the farm. Figure 17 indicated the number of months that households’ harvests lasted; we assumed that those households where the harvest lasted less than four months had low productivity, those where the harvest lasted between five and eight months medium productivity, and those lasting nine or more months high productivity. Again, using a X^2 test, we found no significant correlations between this and the adaptation strategies that households reported making ($p > 0.10$ in all cases). Second we looked at the education level of the household head, coding them as being without schooling, having completed only some primary school, and having completed all of primary school or more. Again, there were no significant correlations. Third, we repeated the test based on household size as a measure of income: perhaps larger households would have more hands available to engage in the adaptations. In this case, we did find one marginally significant relationship ($p = 0.09$), namely between household size and flood preparations. Households with more than seven members were twice as likely as smaller ones to engage in some sort of adaptation; at the same time, there was a

FIGURE 20. COPING MECHANISMS BEFORE, DURING, AND IMMEDIATELY AFTER CLIMATIC HAZARDS



difference in the favored adaptation strategies, among those who did adapt. Larger households were much less likely to move their farming operations to the highlands, and much more likely to engage in all of the other adaptation strategies listed. Presumably, it is hard to move a very big household. All other relationships were insignificant ($p > 0.10$ in all cases).

Planned Adaptation and Strategies

The survey asked people what, if anything, they would do if the climate hazards in their regions were to become significantly more severe. The most common answers were:

- Nothing (70 respondents)
- Move to a safer or more productive area (23 respondents)
- Seek help from others (nine respondents)
- Raise and sell animals (seven respondents)
- Improve the durability of the house (six respondents)
- Practice drought-resistant cultivation (five respondents)

Other ideas, given by three or fewer respondents each, included seeking employment, hunting, and eating less. These results suggest that most respondents do not have a clear picture of what they would do to adapt to climate change, and of those who do, the most frequently listed option was migration.

When asked whether they felt that their household was more or less able to engage in longer-term adaptations, compared to other households in the community, 48 percent thought they were more able, 27 percent thought they were equally able, and 25 percent thought they were less able. This result—only 25 percent thinking they are less able than average to adapt—is broadly consistent with findings of overconfidence in the psychological literature, such as the fact that 90 percent of people think that they are above-average drivers. There was no significant correlation between the belief of being more or less able to adapt to climate change with any of the previously considered indicators of adaptive capacity: household size, number of months the harvest would last, education of the household head, paid employment, or cash savings for emergencies ($p > 0.10$ in all cases, X^2 test).

Who Should Help?

Respondents gave their opinion on which organizations currently play the more important role in helping to mitigate natural disasters. Forty-six percent of respondents suggested that it was agencies of the national government, such as INGC or INAS, while 31 percent thought it was local government or traditional authorities, and 23 percent thought that it was an NGO, such as the Red Cross or World Vision. These organizations are providing assistance such as direct support (food, clothes, money), early warning, and education. What do people need more of from these organizations? The most common response (from 39 percent of respondents) was more direct support, followed by early warning (13 percent of respondents), awareness-raising (7 percent), and improved provision of basic services, such as schools, roads, and hospitals (5 percent).

Synthesis of Quantitative Findings from Household Survey

The household survey offered results in most ways broadly consistent with the results from the PSD workshops, and from the institutional interviews and focus group discussions. People in general were worried about the same climate-related hazards, viewing droughts, floods, and cyclones as the most severe threats to their livelihoods, in that order. They were engaging in a variety of coping mechanisms, the same coping mechanisms identified earlier: cultivating shorter season varieties of crops, switching their cultivation between highlands and lowlands depending on the relative threat of flooding and drought, reinforcing their buildings, and managing their other resources more wisely. Very few, interestingly, listed working more for money as a strategy they were engaging in, perhaps because there are so few such jobs. In all cases, there seemed to be more options available to more people to prepare for a hazard ahead of time, rather than during or after. This would suggest the need for improved early warning, something identified in the PSD workshop as important, and by the survey respondents as something they would like more of. Of course what they really need and want is money, food, and clothing; this is consistent with a lack of resources being the greatest obstacle to coping and adaptation.

What the survey did not show was a significant relationship between the hypothesized—and in the literature, previously identified—determinants of adaptive capacity, and people's propensity to have engaged in adaptation or coping options, or their perceived ability to engage in such options in the future. Only one relationship was marginally significant, between household size and coping measures, with larger households showing a different pattern than smaller ones. But given 35 relationships investigated, chance alone could account for one of these appearing to be significant at the 10 percent confidence level. It is certainly not a strong finding. The lack of significance could be because the sample size was too small, because the survey was not ideally designed or poorly administered, or simply because differences in the determinants of adaptive capacity within the communities surveyed simply do not matter very much.

Finally, the survey paints a fairly bleak picture of future adaptation at the household level. The majority of households do not have any idea of how they would adapt to more severe climate hazards, and one of the most common strategies identified by those who did have an idea—asking others in the community for help—would probably not work very well given that everyone in the community would be suffering. The most common strategy identified was migration. This is consistent with the literature on adaptation, and yet it is a highly disruptive act for any household.

SYNTHESIS OF FIELDWORK RESULTS

Put together, the three sets of data from the fieldwork validate the results from the PSD workshops, which was their primary intention. There were a few additional new findings:

- The institutional interviews and focus group discussions both revealed very little regional heterogeneity, and the focus group discussions revealed very little heterogeneity according to social group.
- The household surveys revealed no significant differential vulnerability, on the basis of commonly used indicators, such as household assets, education, or income.
- The household surveys revealed a very low awareness on the part of most people of how they would adapt to future climate change, should that bring with it an increase in the frequency or severity of natural hazards.

The last of these points is consistent with an important conclusion from the PSD workshops, namely that there is an urgent need for awareness raising and education about climate change, and options for adapting to climate change, among subsistence farmers.

7. SYNTHESIS AND DISCUSSION

This section consists of three steps. First, we discuss the main adaptation options gleaned from this research, comparing them with options that were suggested before, such as in the NAPAs. In so doing, we address the first question: Does a development-first assessment process result in different findings from a more traditional impacts approach? We also compare these conclusions with the general conclusions from the economic track of the EACC study. Second, we look at the issue of differential vulnerability. Who are the most vulnerable, why, and what interventions can best assist them? Third, we evaluate some of the weaknesses and limitations in this study, and the extent to which our results on either of the first two questions may be sensitive to these weaknesses. Finally, we offer policy recommendations.

ADAPTATION OPTIONS

The PSD workshops generated a list of adaptation options, described in Table 8. The fieldwork generated new results that in most cases left this list of options intact, but in some cases changed them. Table 11 presents the revised list.

As with Table 8, the options in plain text respond directly to climate hazards, while those in italics represent measures to increase the adaptive capacity of the population, or to make them more resilient to shocks to their livelihoods in general. Changes from Table 8 to Table 11 include the addition of wells for drinking water, the construction of hospitals and schools, better

sensitivity to how farmers can hedge their risks by farming both highland and lowland fields, and the importance of wild fruits as a natural resource in times of stress.

All of the options in the left-hand column, being centralized, represent potential government interventions. The right-hand column, by contrast, represents measures that people can undertake on their own. The literature on adaptation often characterizes such actions as “autonomous” (Patt et al. in press and Aaheim et al. 2007), as if they took place on their own without any particular agency. This may be a misnomer in a country like Mozambique. First, there is a great deal of intentionality behind any of these actions. Second, and more importantly, many of these represent actions that people do not have the resources or skills to undertake on their own. This is particularly the case with the hard options: they take money. The people who have the money have already undertaken them, in particular making their buildings more robust. But any of the soft options are also difficult without the right economic enabling environment. Many, for example, would like to diversify their incomes, but there are simply no opportunities to do so. Direct government intervention, in the form of rural economic development, may be necessary.

None of these options are inconsistent with the NAPAs and previous planning efforts. What they do accomplish, however, is to suggest a number of specific ways of improving the capacities of farmers to cope with increasingly adverse weather. They also highlight the fact that some of the most important adaptation options are in fact those that commonly would be labeled

TABLE 11. KEY ADAPTATION OPTIONS FROM FIELDWORK

	<i>Centralized</i>	<i>Distributed</i>
Hard	<ul style="list-style-type: none"> • Flood control dikes and levies • Coastal flood control gates • Dams and irrigation channels • <i>Improved roadways</i> • <i>Improved communication infrastructure</i> • <i>Improved hospitals and schools</i> 	<ul style="list-style-type: none"> • More robust buildings • Farm-scale water storage facilities • Deep wells to provide drinking water for people and animals • <i>Grain storage facilities</i> • <i>Improved food processing equipment</i>
Soft	<ul style="list-style-type: none"> • Improved early warning of climatic hazards, and of dam releases • Better planning and management of forest, fish, and other natural resources • Resettlement of populations to lower risk zones • <i>More credit and financial services for small businesses and rural development</i> • <i>Better education and information for rural areas</i> • <i>Improved health care, social services, and social support for all people</i> 	<ul style="list-style-type: none"> • Better utilization of short-season and drought-resistant crops to prepare for drought, floods, and cyclones • Diversification of flood and drought risk by maintaining fields in both highland and lowland areas • Better household and community management and use of natural resources, including wild fruits • Practice of soil conservation agriculture • Migration to lower risk areas • <i>Diversification of livelihoods away from agriculture</i> • <i>Better planning of how much grain to save for personal consumption, and how much to sell for income generation</i>

development, such as improved finance in rural areas and the provision of social services.

They are also consistent with the economic track results of the EACC study. That part made several recommendations for adaptation strategies:

- *Development.* The main result of the economic study was that the most important means of overcoming the challenge of climate change was through the development of human capital (for example, education) and the growth of well-functioning institutions.
- *Regional river basin management.* Mozambique is a downstream country, and it needs to cooperate more closely with upstream countries to ensure the best use of runoff.
- *Agriculture research and extension.* Mozambique's crop yields are due to decline given a continuation of current practices, but could increase significantly with better utilization of existing technologies, based on an evaluation of suitability.
- *Rural roads.* Roads are necessary for rural development, and unpaved roads will be washed out more frequently by the expected increase in extreme precipitation events.
- *Zoning and land-use planning.* Given the economic growth that is projected for Mozambique, it is important to plan carefully so that the growth occurs in low-risk areas.

- *Careful, and limited, use of hard adaptation options.* Hard adaptation options are an enticing way of protecting against extreme events. The study found that often the costs of these options far exceeded their benefits, in particular for coastal protection.

The social component arrived at remarkably consistent findings. There were only three inconsistencies. First, the social component did not identify regional river basin management as a key priority. This was mentioned in one focus group discussion—farmers complained that they were uninformed about upstream dam releases that caused flooding for them—but was not highlighted in other areas. Second, the social component did not consider the costs of hard adaptation options, and so did not reach a conclusion that they are often inefficient. Third, the social component highlighted the importance of improving social safety nets. This potentially falls under the category of development institutions, but was not explicitly mentioned in the economic study.

DIFFERENTIAL VULNERABILITY

In all three PSD workshops, and in every institutional interview and focus group discussion, people identified the elderly, children, single women and female-headed households, and the physically handicapped as being the most vulnerable. This is because they lack the ability to work and thus to earn a sufficient income, the skills necessary to engage in self-protective action, and the

assets to withstand extreme weather events. What these people need more than anything is an improved social safety net, so that they do not use their productive assets simply to survive. Several interviewees mentioned that the existing level of social support—approximately \$4 per month—is tragically low.

It also emerged that the agriculture sector is far more vulnerable than alternative livelihoods. Farmers lose their crops from droughts most of all, and then from floods and cyclones. The effects of natural hazards on the agricultural sector then trickle through into the other livelihood strategies. They place additional pressure on forests and fisheries to feed people when the crops fail, and they slow down the flow of money and goods in trade.

Differential vulnerability failed to show up as expected in the household survey. While many people in the survey claimed—as had the participants in the other activities—that those with fewer resources were unable to engage in self-protective behavior, there were no significant correlations between the indicators of household assets and reported past self-protective behavior. It could be that the sample size was too small, or the survey design inappropriate, or the sampling of households too narrow, to capture a differential vulnerability effect. Or, it may simply be that the effects of differential vulnerability are in fact small. It is worth mentioning that other studies have also found that income or assets are not good predictors of adaptive behavior, except when they lead to households acquiring additional information or skills (Phillips 2003; Pratt et al. 2005; Grothmann and Reusswig 2006; and Grothmann and Patt 2005)

Addressing differential vulnerability—if indeed it is a major problem—needs to be part of the development agenda, simply because that agenda needs to focus on interventions that benefit the poorest of the poor. In fact, the last few years have witnessed this focus taking hold among development agencies (Gupta et al. 2009). Hard adaptation options will not achieve this, but social development, including strong safety nets, will.

LIMITATIONS OF THE STUDY

There are some important limitations to this study, as well as lessons learned about how to—and not to—conduct a country case study such as this.

First, there has been an insufficient review of the current institutional context of adaptation research and planning in Mozambique. While this report has reviewed the NAPAs, it has omitted detailed descriptions of some other important programs under way. SETSAN and FEWS.NET, for example, are engaged in a great deal of vulnerability and livelihood mapping, with the intention of using this information to reduce food insecurity in the face of increasing climate hazards. Originally it had been envisioned to interview national-level stakeholders, and to analyze these programs in greater depth. Given unforeseen delays in the study process, this did not take place. Since this review of the institutional context was not seen as a critical element of this report—it describes features unique to Mozambique and is difficult to generalize to other countries—resources were redirected to the more participatory areas of the project. As a result, this component of the report is underdeveloped.

Second, there were inconsistent approaches taken during the PSD workshops. These had a valid justification, namely to observe whether variance in the PSD workshop design led to a difference in substantive outcome. To a large extent these changes in format were the result of post-workshop team discussions, in order to “tweak” the workshop design for the next one. However, the Xai Xai format—a longer workshop, with discussions centered on activities and not geographical regions—generated the greatest depth of discussion. Thus, some of the most interesting findings are from a single workshop, not well-corroborated by the other workshops.

Third, the quality of some of the data is questionable. In the case of the PSD workshops, arguably the most important single workshop was that held in Maputo, with national-level stakeholders. In fact, challenges with timing meant that very few high-level stakeholders from the national government attended the Maputo workshop. The majority of attendees were representatives of NGOs operating in Maputo, some of them with very limited knowledge of adaptation policies and priorities. In the case of the institutional interviews and focus group discussions, the field notes that served as the basis of this report omitted a great deal of detail of the discussions. For example, the local consultant’s field report (Annex 3) suggests that participants engaged in

wealth-ranking exercises to identify the links between social groups and adaptive capacity. The field notes stated that such wealth-ranking exercises took place, but did not provide information about the results. In the case of the household survey, the sample size was too small to observe significant statistical relationships. Adding to this, there were many apparent problems in data collection and entry. This consultant simply dropped the unexplained answers from the statistical analysis, but if the unexplained answers correlated with other variables, then this would have introduced bias into the results.

Fourth, the depth of analysis of the field data is not as great as it should be. Delays in the scheduling of the workshops and the fieldwork led to very little time being available for the analysis of the data generated there.

How serious are these limitations? Not very; indeed, there is good reason to believe the core findings of this study would be the same even if each of the problems had been resolved. This is because they are so consistent with past assessments, and with other results within the EACC study. This agreement provides reason to believe that improvements in data and analysis would not likely have led to qualitatively different findings.

CONCLUSIONS

Finally, it is useful to condense the many findings into a core set of key conclusions. These are:

1. ***Rainfed agriculture takes the hardest direct hit from climate hazards.*** Across the focus group discussions, institutional interviews, and workshops, participants mentioned climate impacts affecting a variety of livelihood activities, including agriculture, fishing, forestry, and charcoal production. But in all cases, the most frequent and severe impacts were listed for rain-fed agriculture because of droughts. The most frequently mentioned way of reducing these impacts was the construction of irrigation systems. The most frequently listed barrier to this was the lack of finance. Likewise the least vulnerable were those households that had managed to diversify their income away from just agriculture, such as through informal trade or the receipt of remittances from family members living in urban areas or in South Africa. But diversification isn't easy: many people suggested that the recipients of micro-finance ended up using that money just to buy food, because the opportunities for small businesses succeeding were not very good. This suggests that attention to integrating rural areas into markets—including a great deal of attention to improving transportation and communication infrastructure—will be an important activity.
2. ***Subsistence farmers and the economically and socially marginalized are the worst off.*** Across all focus group discussions, institutional interviews, and workshops, participants identified subsistence farmers—and among them the economically and socially marginalized individuals—as the most vulnerable and having the fewest resources available to adapt. Economically and socially marginalized individuals include the elderly, orphans, widows and female heads of households, and the physically handicapped. Most communities are lacking support networks for these people, either formally through the government or informally through well-functioning social networks. The government assistance that the particularly needy receive is inadequate to help them make it through adverse weather events. Social safety nets need to be improved.
3. ***Policies and institutions should enforce sustainable resource management and wise land-use planning.*** In many cases, participants in the discussions and workshops suggested that the harvesting of forest resources—such as wood for charcoal production—as well as fishing were important income-generating activities, which often helped to buffer shocks to agricultural productivity. But these activities are suffering due to deforestation and overfishing. Better management is needed. This can include the enforcement of existing laws and government policies, as well as improving the capacity of community associations to manage local resources effectively. Planning is also needed to make sure that activities gradually move from those areas of high risk to areas of lower risk.
4. ***Knowledge is needed across the board.*** Lack of knowledge is a problem in several respects. First, there appeared to be a great deal of confusion about the causes of natural disasters and whether they would increase or decrease in the future.

Education is needed so that people can expect disasters to be a constant feature in the future. Second, people need technical assistance concerning better land management, such as conservation agriculture. Third, people need access to real-time weather forecasts—effective early warning—to mitigate their losses to floods and cyclones. In some cases, they also need information about when

dam operators upstream will be releasing water, so that they can prepare for the local flooding this causes. Fourth, and most importantly, people need more education in general, if they are to diversify their livelihoods away from agriculture and toward high value-added activities that can enhance their well-being and provide them the resources to withstand extreme weather.

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APPENDIXES

APPENDIX 1. INTERESTING RESULTS FROM INDIVIDUAL FOCUS GROUP DISCUSSIONS

<i>Location</i>	<i>Participants</i>	<i>Interesting lessons on social differentiation and income</i>	<i>Interesting lessons on vulnerability and adaptation</i>
Angoche	Elderly and handicapped	The poorest group comprise 11 percent of population Government support to them of 100 Metecaix (\$4) a month is totally inadequate Social protection network exists	People with more diversified incomes are in a better position There is one guy with a really strong house, and people go to him when cyclones come; more such houses are needed
Angoche	Fishermen with boats	Fish are no longer available in large quantities People use mosquito nets for fishing, which deplete fish stocks People help each other to reconstruct after a storm	Need to establish a fishing association to manage the resource better Cyclones and strong winds are the big threat, because of the destruction to houses, boats, and coconut trees No forecasts of adverse weather Men and young people are better at adapting Need to stop cutting the mangroves
Angoche	Subsistence farmers	Fishing and agriculture are main sources of income Elderly, single women, widows suffer most	Cyclones are biggest hazard, destroying houses and boats Wealthier people have built stronger houses that can withstand storms Need cash to build better homes
Angoche	Fishermen	Fishing and selling fish are the main income activities	Cyclones lead to hunger and disease Maybe need to move to a safer area
Buzi	Subsistence farmers	Associations exist in the community Widows are the most vulnerable group Increasing hardship over last 10 years	Drought happens annually; locust plague was a recent problem
Buzi	Charcoal producers	Access to trees to fell is determined by relevant permits	Nobody can adapt to cyclones
Chibabava	Subsistence farmers	No cooperatives Agriculture and labor are main income sources Need better inputs for agriculture (tractors, etc.)	Natural disasters would become less common if they could hold more traditional ceremonies Need to build dams and irrigation, better homes, and homes on higher ground

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APPENDIX 1. INTERESTING RESULTS FROM INDIVIDUAL FOCUS GROUP DISCUSSIONS (*continued*)

<i>Location</i>	<i>Participants</i>	<i>Interesting lessons on social differentiation and income</i>	<i>Interesting lessons on vulnerability and adaptation</i>
Chibabava	Small business people	No social protection network or association exists in the community This group works in beekeeping Subsistence farmers, elderly, orphans are the most vulnerable	Need to get access to 7 billion People can stock up on food to prepare for drought, using money obtained from selling charcoal Working age people have the greatest adaptive capacity Climate hazards occurring because of rapid deforestation
Chibabava	Subsistence farmers	No social protection network or associations exist in the community Agriculture and charcoal production are the main sources of income	Need to build better houses to prepare for floods and cyclones
Chibabava	Subsistence farmers	No social protection network exists There are activist associations Community controls the firewood resource	Repairing broken water pumps would be a good adaptation Tree planting is needed Future well-being will either get worse or better, nobody can predict
Chibuto	Widows and single mothers	No cooperatives in community No paid work Agriculture and lake fishing are main income sources, also charcoal production	Desperately need alternative sources of income
Chibuto	Community leaders	Agriculture and livestock are main activities. Also fishing and selling rush matting	Problems are lack of health post, electricity, and paved roads Believe that deforestation is causing the natural disasters Believe that climate conditions will improve over next 10 years Need early warning
Chókwe	Widows	An association exists for wood harvesting and baking Charcoal is the main source of income Orphans and elderly are the most vulnerable Widows represent 30 percent of population	Microcredit to help people start small businesses and diversify income, but small businesses are also tough to work, and loaned money is often used to buy food Technical assistance is needed
Chókwe	Elderly men	Young men go to South Africa for work, leaving women behind to run the farm Remittances from South Africa are important Widows represent 30 percent of population	Forecast of drought and flood has not been forthcoming Unassisted elderly people have the hardest time adapting
Mabote	Farmers	Agricultural production, including beekeeping, is the biggest activity	Drought is biggest threat People have pulled together after disasters
Mabote	Elderly	Agriculture, ranching, and forestry are the main income activities The elderly are the only ones who cannot adapt	Drought is caused by climate change, which is caused by deforestation There isn't even enough drinking water
Mabote	Old women and widows	Agriculture and charcoal production are the main income-generating activities	They suffer from a lack of mobile telephone coverage Water shortages are so severe that there is no water for people and cattle to drink. Better storage of grain would help smooth out the hard times

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APPENDIX 1. INTERESTING RESULTS FROM INDIVIDUAL FOCUS GROUP DISCUSSIONS (*continued*)

<i>Location</i>	<i>Participants</i>	<i>Interesting lessons on social differentiation and income</i>	<i>Interesting lessons on vulnerability and adaptation</i>
Mabote	Leaders	A savings association exists that supports elderly and orphans The young people often leave to seek work elsewhere Elderly subsistence farmers are the most vulnerable	Main problems are a lack of wells, lack of health care, and lack of roads Tree planting for charcoal production is needed
Manhiça	Elderly women and widows	Little solidarity Lots of people go to South Africa Farming, charcoal, and cattle are biggest income sources	Droughts dry up the wells, leaving even no water for drinking You can't adapt if there isn't any water Need to diversify income
Manhiça	Leaders	No social protection People travel to South Africa Farming, charcoal, and hunting are main income sources; also beekeeping	Planting trees to increase charcoal production Deforestation is a big problem, and seen as causing droughts and flooding
Massingir	Charcoal producers	Association for tree felling and charcoal production exists Lack of social services is a key problem, especially a health post	Lack of water even for human consumption, as well as for cattle, because the wells have dried up Without enough water, no adaptation is possible
Massingir	Needy women	No social protection network	People travel to South Africa to escape the lack of water at home Constructing a dam would be good Not entirely convinced that hazards result from failure to observe traditional ceremonies
Matutuine	Leaders	Forestry and farming are main activities Elderly and orphans are most vulnerable The worst affected is the entire population	Lack of electricity is a problem Flooding is annual when dams upstream opens its sluice gates. The dam in South Africa sometimes informs them in advance, the one in Swaziland does not Need more traditional ceremonies to ward off drought
Matutuine	Widows and single mothers	No social protection for the elderly New association formed to share in farming work Main income is working in South Africa and Swaziland, farming, and forestry	Poor access roads and lack of facilities to buy basic products No differentiation in terms of adaptive capacity Need more dams, irrigation, and technical assistance
Moatize	Subsistence farmers	Agriculture and fishing are main income sources	Big problem is being eaten by crocodiles when farming low-lying land Need to build irrigation canals, and avoid cutting down trees for charcoal
Moatize	Subsistence farmers	Cooperatives of small businesses and fishermen exist Agriculture and fishing are main sources of income	Need better road access, a health center, and police People do receive weather forecasts over the radio, and suffer less than in the past Need tools, and motor-driven pumps for irrigation No differences between groups in terms of adaptive capacity
Moatize	Subsistence farmers	Subsistence farmers are the most vulnerable, because they go hungry with drought	People try traditional ceremonies to avoid droughts, but these don't seem to work Burnings are a big problem
Mopeia	Subsistence farmers	Going to cities to work has increased standard of living – the young can do this No associations in the community Small business owners have highest incomes, subsistence farmers the lowest	Flooding is the main hazard Canoes are being built Farming should be in the lowland during drought periods

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APPENDIX 1. INTERESTING RESULTS FROM INDIVIDUAL FOCUS GROUP DISCUSSIONS (*continued*)

<i>Location</i>	<i>Participants</i>	<i>Interesting lessons on social differentiation and income</i>	<i>Interesting lessons on vulnerability and adaptation</i>
Mopeia	Subsistence farmers	No social protection networks Associations to market food have been successful at getting people income and raising standards of living	Lack of market and access roads are major concern; there are no people to buy their products Hazards occur because of witchcraft Problems from natural hazards will improve in next 10 years
Morrumbala	Subsistence farmers	Association exists Agriculture and casual labor are primary sources of income, with fishing as well	Hazards occur because of failures of ancestors Frequent floods and droughts To protect against drought, farm in the lowlands, to protect against flood, farm in the highland CVM has provided the most assistance
Morrumbala	Subsistence farmers	Subsistence farmers the most vulnerable	Want to construct dikes to protect against floods. Flooding is the most frequent event, followed by drought Need to have two machambas, one high and one low
Morrumbala	Subsistence farmers	No social protection network in the community Most people are subsistence farmers, who are the most vulnerable People living in stronger built houses do not suffer as much	Hippos have reduced agricultural production, along with floods Floods destroy all their property Situation would improve if the climate would change to have fewer natural disasters Cyclones and drought also a problem
Vilanculo	Farmers	No associations or cooperatives Most vulnerable are elderly, single mothers, and children Fraud has led to unequal distribution of food aid	Main problems are lack of information and transportation Drought is main hazard Hazards have increased because of failure to follow local customs Do not receive radio weather forecasts
Vilanculo	Community leaders	Community has suffered a loss of social and moral values No associations in community Children suffer most	Illegal tree felling is a problem Lack of organization is the main barrier to community adaptation Food for work program is mentioned many times as important
Zavala	Community leaders	No cooperatives Elderly and children are most vulnerable	Planting fruit trees helps No formal forecasts available, but traditional indicators Women most able to adapt Need to focus more on raising and selling animals
Zavala	Subsistence farmers	People here don't travel Lots of conflicts between families Agriculture and ranching the main income sources	Need to increase the area under cultivation Need more organization and knowledge Cyclones are worst hazard, along with drought
Zavala	Widows and elderly farmers	People here don't travel No social solidarity or cooperatives Agriculture is biggest income source	Need more water pumps Lack of rain because have failed to do the traditional ceremonies Need early warning Families that receive remittances are most able to adapt Better employment opportunities are needed

SECÇÃO 2: CHOQUES E ESTRATÉGIAS (salmon)							
2.1 O seu AF sofreu alguma situação fora do comum, que afectou a sua capacidade de se manter, comer normalmente, ou reter os seus bens nos últimos 12 meses?		1 Sim		2 Não → Vá para Secção 5			
2.2 Se Sim, que problemas o seu agregado sofreu? Pergunte qual foi o pior e siga insistindo se houve outros problemas que afectaram o AF. Não leia as opções mas insista: "O seu AF sofreu algum outro problema que lhe afectou?"							
<input type="checkbox"/>	A. Seca/Falta de chuvas/chuvas irregulares	<input type="checkbox"/>	B. Enchentes/cheias	<input type="checkbox"/>	C. Erosão	<input type="checkbox"/>	D. Níveis acima do normal de peles ou doença da lavoura
<input type="checkbox"/>	E. Epidemias de doença em animais	<input type="checkbox"/>	F. Epidemias de doença agudas em pessoas (ex. Cólera, malária, diarreia)	<input type="checkbox"/>	G. Doença crónica e séria de membro (s)	<input type="checkbox"/>	H. Aumento de preços dos produtos agrícolas (sementes, pesticidas etc)
<input type="checkbox"/>	I. Perca ou redução de empregos de membros do AF	<input type="checkbox"/>	J. Perca ou redução de dinheiro de membros do AF	<input type="checkbox"/>	K. Aumento de preços dos alimentos	<input type="checkbox"/>	L. Morte do Chefe do AF
<input type="checkbox"/>	M. Morte de um membro do AF	<input type="checkbox"/>	N. Roubo ou perda de bens e recursos	<input type="checkbox"/>	O. Insegurança/ violência	<input type="checkbox"/>	P. Chuva de gelo
<input type="checkbox"/>	Q. Ciclonas	<input type="checkbox"/>	R. Terremoto				
Indicar até 4 choques.							
2.3 - [Choque]	2.4 O [choque] criou decréscimo/perca de receitas em dinheiro ou em espécie? (1. =SIM 2= NÃO)	2.5 O [choque] criou um decréscimo/perca de bens? (1. =SIM 2=NÃO)	2.6 O [choque] criou redução na produção de alimentos? (1. =SIM 2=NÃO)	2.7 Quais foram os principais mecanismos que seu AF usou para minimizar o impacto do [choque]? Vide código	2.8 - O seu AF já se recuperou das perdas? 0 = NÃO 1.=SIM 2.=PARCIALMENTE		
1. L. _	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	A. _ B. _ C. _	<input type="checkbox"/>		
2. L. _	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	A. _ B. _ C. _	<input type="checkbox"/>		
3. L. _	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	A. _ B. _ C. _	<input type="checkbox"/>		
4. L. _	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	A. _ B. _ C. _	<input type="checkbox"/>		
01 = Mudou dieta para alimentos mais baratos e menos preferidos 02 = Pedu comida emprestada 03 = Comprou comida em crédito 04 = Consumiu maior quantidade de frutos silvestres/comida de fome 05 = Consumiu reservas de sementes da próxima campanha 06 = Diminuiu a quantidade de comida para todos os membros 07 = Adultos comeram menos para deixar as crianças comerem 08 = Reduziu o número de refeições 09 = Passou dias sem comer nada 10 = Alguns membros migraram temporariamente (menos de 6 meses) 11 = Alguns(s) membros migraram por mais de 6 meses 12 = Diminuiu gastos em educação 13 = Trouxeram criança da escola 14 = Diminuiu gastos em saúde 15 = Pegou dinheiro emprestado ou em crédito de familiares/amigos 16 = Pegou dinheiro em crédito de penhoristas 17 = Vendeu materiais agrícolas 18 = Vendeu materiais de construção 19 = Vendeu mais animais pequenos 20 = Vendeu mais animais grandes (bois, vacas) 21 = Vendeu bens/móveis do AF 22 = Trocou produtos agrícolas 23 = Cedeu terra 24 = Trabalhou por comida 25 = Mudou de casa 26 = Trabalhou por mais horas/intensificou trabalho 27 = Mandou filhos trabalharem para outros AF 28 = Gastou poupança 29 = Cozinhava antes do tempo (por exemplo, milho verde). 30 = Cozinhava antes do tempo (por exemplo, milho verde).							

SECÇÃO 3: Mudanças Climáticas, Vulnerabilidade, e Adaptação (pink)			
Exposição aos Riscos e Mecanismos de Alerta			
3.01	Nos últimos 10 anos o AF foi afectado por quaisquer eventos climáticos	1=sim 2=não	[]
3.02	Se sim, que tipo de eventos?	Códigos abaixo	A B C
	1 Seca 7 Estiagem		
	2 Cheia 8 Outros (especificar _____)		
	3 Ciclone		
	4 Erosão		
	5 Queimadas Descontrolada		
	6 Sismos		
3.03	Recebeu alerta em relação a quaisquer desses eventos	1=sim 2=não	[]
3.04	Se sim, com quanto tempo de antecedência?	Códigos abaixo	A B C
	Quem avisou o AF?		A B C
	Como avisou?		A B C
	Tempo de Aviso	Quem avisou	Como avisou
	1 Um hora	1 = Oficial de INGC	1 Rádio
	2 Um dia	2= administrador	2 Porta a porta
	3 Mais de um dia	3= autoridade tradicional	3 Reunião Pública
	4 Uma semana	4= vizinhos	4 TV
3.05	De todos esses eventos quais deles e de maior preocupação para o AF?		
3.071	Porquê?		
3.08	Qual é o evento que mais afectou o AF? Descreva as circunstâncias:		
3.09	Existe alguma variação sobre o grau de afectação entre AFS dentro da comunidade?	1 = Sim ()	2 = Não ()
3.10	Se sim, como?		
3.11	Existe alguma razão para justificar o porquê do seu AF ter sido (ou não ter sido) afectado por esse fenómeno em comparação com o resto da comunidade?	1 = Sim ()	2 = Não ()
3.12	Se sim, quais as razões?		
3.13	Quando afectado a que instituição recorrer o seu AF para assistência? ()	1= administrador	2= autoridade tradicional 3= ONGs 4= INGC
3.141	Como é que o seu AF previne contra cada um dos eventos?		
3.142	Ciclone:		
3.143	Cheias:		
	Seca:		
	Erosão:		
	Queimadas descontrolada:		
	Sismos:		
	Terramoto:		
3.151	Que medidas adopta quando evento ocorre para minimizar as perdas durante e pós a ocorrência?		
3.152	Ciclone:		
3.153	Cheias:		
	Seca:		
	Erosão:		
	Queimadas descontrolada:		
	Sismos:		
	Terramoto:		
3.16	Se os eventos tornarem-se bastante severo, que medidas extrema passaria a adoptar para ultrapassar a situação?		
3.17	Que factores limita a habilidade da comunidade em precaver antecipadamente contra os eventos?		
3.18	Pensa que os AFs das comunidade estão em: melhores () na mesma () ou piores condições () para precaver contra desastres naturais em comparação com o seu AF?		
3.181	Porquê?		
3.19	Que tipo de organização/instituição tem tido um papel importante na prevenção contra desastre natural?		
3.20	Que tipo de serviços essas organizações tem oferecido ao seu AF e a sua comunidade?		
3.21	Que tipo de serviços pensa que ainda está a faltar?		
3.151	Se as calamidades naturais tornarem-se mais severo, que tipo de serviço deve ser adoptado na comunidade para mitigar os problemas?		
3.152	A Curto	Medio	Longo Prazo
3.153	Ciclone:		
	Cheias:		
	Seca:		
	Erosão		
	Queimadas Descontroladas		
	Terramoto		

Secao 4: Factores de Producao, Porudcao e Gestao (Blue)		
4.1	Nos ultimos 10 anos quantas machambas tinha nas terras altas?	[] Número
4.2	Quantos hectares tinha o total dessas machambas nas terras altas?	1=menos de 0.25 hec 2= 0.26 a 1.0 hec 3=1.1 a 2.0 hec 4=2.1 a 5 hec 5=5.1 a 10 hec 6=10.1 a 50 hec 7=Mais de 50 hec []
4.3	Na ultima campanha quantas machambas foram cultivadas nas terras altas?	[] Número
4.4	Quantos hectares tem as machambas presentemente cultivadas nas terras altas ?	1= menos de 0.25 hec 2= 0.26 a 1.0 hec 3=1.1 a 2.0 hec 4=2.1 a 5 hec 5=5.1 a 10 hec 6=mais de 10 hec []
4.5	Nos ultimos 10 anos quantas machambas tinha nas terras baixas/regadio?	1= menos de 0.25 hec 2= 0.26 a 1.0 hec 3=1.1 a 2.0 hec 4=2.1 a 5 hec 5=5.1 a 10 hec 6=mais de 10 hec []
4.6	Quantos hectares tem as machambas presentemente cultivadas nas terras baixas/regadio?	1= menos de 0.25 hec 2= 0.26 a 1.0 hec 3=1.1 a 2.0 hec 4=2.1 a 5 hec 5=5.1 a 10 hec 6=mais de 10 hec []
Codigos das Areas		Codigos
4.5	Se areas de ultimos 10 anos for menor que a actual, quais as razoes: _____	1= Cedeu a pessoas da familias 2= Cedeu pessoas fora da comunidade 3= Cedeu a vizinho 3= Abandonou falta de forca 4= Falta de recursos 5= Problema de erosao 5= Efeitos de desastres naturais [] [] []

Destino e Gestao da producao	
Após a producao, como e que divide as partes?	
Parte para consumo _____ Reserva de Sementes _____ Mercado _____	
4.6	Quantos meses no total tem durado as suas colheitas de base (cereais, mandioca, feijao, mapira)? 1=menos de 1 mês; 2=até 2 meses 3= até 3 meses; 4=até 4 meses 5=até 5 meses; 6=até 6 meses 7=até 7 meses 8=até 8 meses 9=até 9 meses 10=até 10 meses 11=até 11 meses 12= 12 ou mais meses []
4.8	Em que meses Costuma vender o seu produto: Muita _____ Regular _____ Pouca _____ Aonde normalmente vende os seus produtos? Codigos: 1= noutra vila; 2= no mercado na vizinhanca; 3= grossistas 4= comerciante informal 5= lojistas
4.9	Em que meses normalmente compra produtos para consumo: Muita _____ Regular _____ Pouca _____ Quando não produz o suficiente (milho, arroz, amendoim, etc), como faz para obter esses produtos?
4.10	Como armazena os seus produtos? Em quanto estima a sua perda pós-colheita?
Em comparacao com os ultimos anos a sua producao Aumentou _____ Estána mesma _____ Reduziu _____ Porquê? Codigos	

4.11	Tem árvores fruteiras em Produção?		1=sim 2=não	<input type="checkbox"/>	<input type="checkbox"/>
	2.21 Se sim, qual tipos?	2.22 Número aproximado de árvores 1=1 a 10; 2=11 a 50; 3=mais de 50			
	A				
	B				
	C				
	D				
	E				
	F				
	Códigos das Fruteiras				
	1 Bananeira	5 Limoeiro	10 Jambalueiro		
	2 Mangueira	6 Abacateiro	11 Malurreira		
	3 Larangeira	7 Goiabeira	12 Coqueiro		
	4 Papoera	8 Tangerineira	13 Cajueiro		
		9 Ananazeiro	14 Canhoero		

SECÇÃO 5: RECEITAS DO AF (green)					
5.1	Algum membro do AF recebeu remessas em dinheiro nos últimos 12 meses?		1=sim 2=não	<input type="checkbox"/>	<input type="checkbox"/>
5.2	Algum membro do AF transferiu dinheiro nos últimos 12 meses?		1=sim 2=não	<input type="checkbox"/>	<input type="checkbox"/>
5.3	Algum membro do AF recebeu alimentos ou espécies nos últimos 12 meses?		1=sim 2=não	<input type="checkbox"/>	<input type="checkbox"/>
5.4	Algum membro do AF transferiu alimentos ou espécies nos últimos 12 meses?		1=sim 2=não	<input type="checkbox"/>	<input type="checkbox"/>
Principais Fontes de Rendimento					
5.51	Qual é a principal fonte de rendimento do seu AF?		Ver código abaixo	<input type="checkbox"/>	<input type="checkbox"/>
5.52	Qual é a Segunda principal fonte de rendimento do seu AF?		Ver código abaixo	<input type="checkbox"/>	<input type="checkbox"/>
5.53	Qual é a Terceira principal fonte de rendimento do seu AF?		Ver código abaixo	<input type="checkbox"/>	<input type="checkbox"/>
1	Produção/Venda de culturas alimentares básicas	6 Trabalho Informal/Ganho-ganho	11	Venda de lenha/carvão	15 Materiais de Construção
2					
3	Produção/Venda de culturas de rendimento	7 Pesca (venda de peixe)	12	Fabrico/venda bebidas	16 Aluguer de tracção animal
4					
5	Produção/Venda de hortícolas	8 Pecuária (venda de animal/produtos animais)	13	Transporte	17 Pensão Mensal (velhice)
	Produção/Venda de frutas	9 Comércio informal/formal	14	Emprego Formal	88 Não tem
	Prod. de Colheita/caça/canico	10 Remessa			
5.6	Nos últimos 12 meses, alguém do seu AF trabalhou por pagamento em espécie?		1=sim 2=não	<input type="checkbox"/>	<input type="checkbox"/>
5.7	Nos últimos 12 meses, alguém do seu AF trocou bens ou produtos agrícolas por outras necessidades como roupa, comida, medicamentos?		1=sim 2=não	<input type="checkbox"/>	<input type="checkbox"/>
5.8	O seu AF tem alguma poupança de dinheiro que poderia ser usada para emergências maiores?		1=sim 2=não	<input type="checkbox"/>	<input type="checkbox"/>

APPENDIX 3. FIELD REPORT SUBMITTED OCTOBER 5, 2009, BY RAUL VARELA

BACKGROUND

The purpose of the study was to create an environment for understanding economic adaptation to climatic changes and to generate recommendations for subsequent actions leading to better interventions to mitigate and adapt to the effects of this phenomenon. Particular concerns are with fragile livelihood groups, mainly those households and communities with high exposure to natural hazards.

In order to address such concerns, it becomes important that a consistent criteria be adopted in the selection process to visualize geographical zones that allow us to grasp, confidently, representatives of all livelihood groups followed by an in-depth analysis of their level of adaptation to the effects of climatic changes, formal and traditional interventions, level of resilience, intervention gaps and cost benefit analysis of additional actions to overcome the problem in a short, mid and long term perspectives.

The WB recommendation is that the geographical zones-hotspots be defined based on the combination of three factors: agro-ecologic zones (geographical patterns defined based on combinations of soil characteristic, rainfall pattern, vegetations, agriculture potential and environmental conditions)¹; physical aspects (key natural events that may expose households and communities

at risk of natural hazard)²; social or socioeconomic aspects (key elements at disposal and affecting household's wellbeing that can be translated as combined factors influencing household levels of wealth, food security and nutrition, health and sanitation)³.

In order to address the above concerns and instruction provided by the World Bank and by taking into account that adaptation to climatic changes is intrinsically linked to anthropogenic multi-factors, a framework was laid out to capture the cause-effect relationship among anthropogenic factors integrating **agro-ecologic** factors with **physical** and **social** aspects. As a result of this, it was possible to identify six zones as well as physical hotspot with respect to climatic changes. In addition, elements related to food security and nutrition, poverty indicators as well issues related to health were integrated for a final definition of geographical hotspot.

With this background, the study was conducted in three stages:

- Definition of hotspots
- Three workshops (two regional and one national)
- Fieldwork at representative geographical zones
- Analyses and presentation of overall trends

1 IIAM had set up 10 agro-ecologic zones

2 For Mozambican context, drought, cyclone, flood and sea level rise are the most common hazards

3 For the purpose of this study, food security, health and nutrition, HIV-AIDS and poverty should be the most relevant socioeconomic factors.

The present report specifically addresses only issues related to the fieldwork and it will deal with instruments, geographical coverage, procedures and activities carried out after fieldwork.

FIELDWORK

Fieldwork was initially planned to be conducted by local enumerators under the supervision of three junior university graduates. The proposed approach was to assure high quality work because that way we could use local knowledge, control language constraints and carry out a more in depth survey, particularly with respect to identification and characterization of livelihood groups. However, after various attempts to go to the field, which was postponed for three or four times due to administrative reasons, the decision was that fieldwork was going to be conducted by two junior students under the supervision of the local technical coordinator.

Thus, the approach was as follows:

- In each district, the team recruited one local staff, preferably, one of the participants who attended the regional workshop to be part of the exercise.
- In each administrative post, assistance was also provided by a technical staff who played the role of facilitator as well as translator.

Instruments

The purpose of fieldwork was to cross check information from the desk review as well as to gather insights on climatic changes at local level, particularly with respect to livelihood groups and individual household. Furthermore, it was important to gather perception from different institutions and civil society about exposure to climatic changes, sensitivity, and adaptation, including extreme coping mechanisms, which would complement information already compiled from the three workshops. Therefore, three instruments were developed:

1. Household questionnaire – was divided in 4 sections:
 - Sociodemographic information
 - Agriculture performance and income source
 - Shocks and coping strategies

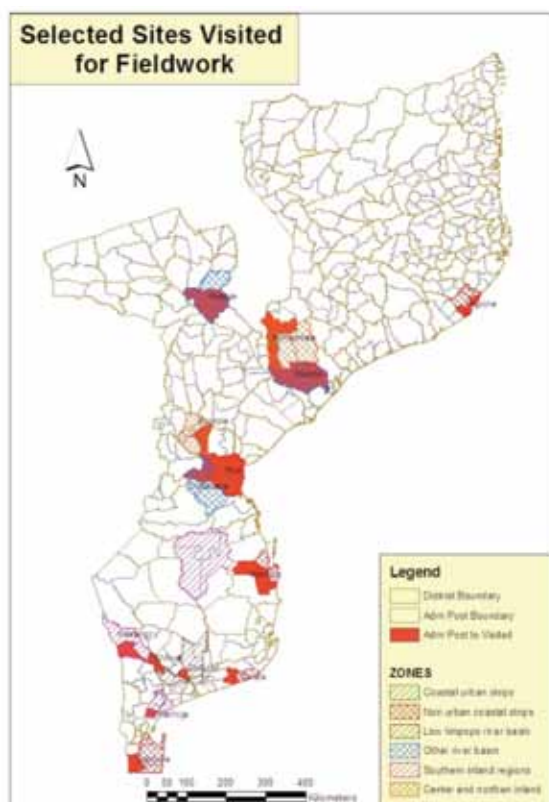
- Climatic Changes and Vulnerability, which include exposure, sensitivity, resilience and adaptation as well as institutional and community's performance and perception about climatic changes.
2. Institutional questionnaire – organized in four parts:
 - Institution profile, which included the identification of area of intervention, group entitlement and partnerships.
 - Institutional perception about risk including identification/recall of past events, the effects on different social groups, likely chance of repetition and lesson learnt.
 - Sensitivity, which deals with perception about events, preventive measures and action for mitigation.
 - Inventory of adaptation (prevention, adaptation and mitigation done by the community and institutions) and constraints.
 3. Focus Groups – This instrument was designed to capture information about various social groups and to understand common perception of groups about climatic changes, variations on adaptation and sense about future events. This included wealth ranking exercise and specific interview with the representative of part of the identified social groups.

Once designed, the instrument was pre-tested and, thereafter, it was adjusted for the final version. It is important to mention that the results of the various workshops were also keen for the final adjustment of the instruments because they were carried out before fieldwork,

Spatial Representation

During the preliminary exercise, six zones sensitive to the climatic changes were identified. Later on, they were combined with the definition of hotspots, which were crucial for the identification of zones for fieldwork. However, such definition had to be done by taking into account administrative boundaries. All zones were covered and regional variations (inland and coastal) as well as population density were taken into account

As per the map, a total of 7 out of 10 provinces were visited of which 2 in the North, 2 in the Center and 3 in the South.



Procedures

The following steps were followed:

- At District Level
 - Upon arrival in each district, the team met with local administrator and his/her staff to explain the purpose of the mission and to gather preliminary background about agenda on climatic changes, past events, and evidences of risks and adaptation.
 - Additionally, the team met with various institutions to fill out the questionnaire about climatic changes. When it was possible, separated interviews were conducted with official institutions and then with NGOs or, otherwise together. Such procedure was intended to control for biases and for crosschecking information about the same issue. Overall, this was a good opportunity to discuss various insights about institutional perception on climatic changes in terms of: exposures;

sensitivity and adaptation; individual action taken to mitigate the problem; perception about outlooks.

- One of the objectives of the above mentioned meetings was to discuss spatial variations about types of climatic change exposures, population density, examples of adaptation and variations on exposure to risk. For a practical purpose, participants usually described the characteristics of various administrative posts⁴.
- After the discussions, the team, consensually, selected two administrative posts to be part of the study. In general, the selection of these posts was done after an in-depth discussion about past events, exposure and sensitivity of each post and, thereafter, the selection was made.
- At Administrative Post
 - Meetings were held with the population of different social strata as well as with traditional authorities.
 - The discussion started with an introduction about the purpose of the mission, its neutrality in addressing the issue and clarification that there were no political, economic gains or even commitments neither from the organization nor for follow up of projects or programs.
 - Following that, discussion about socioeconomy of administrative post linked to climatic changes took place. The combination of these two elements guided the direction of the discussion that was often supported by various techniques of participatory approach and community development.
 - Once again, a clear picture about socioeconomic variation and climatic change exposures at local level were addressed. This was a good opportunity to select the 2 “localidades”⁵ should be visited.

⁴ Geographical/administrative units below districts. In average each district has two to four administrative post and each administrative post has about three “localidades”

⁵ There is wider variation among localidades in terms of livelihood and social organization as well as exposure to the climatic changes. Some localidades were in the very coastal area and typically linked to fishery, while others were in the interior and mainly subject to subsistence agriculture.

- **Wealth Ranking**
 - The meeting at administrative posts was completed with the exercise of wealth ranking to identify and characterize livelihood groups as well as their proportion and distribution within the “localidade”. Typical items (i.e. maize, various types of beans, stones and other local items) were used based on their value/role to characterize livelihood groups. Such exercise was well taken by the populations who embraced it and participated actively; therefore, the team became mere facilitators.
 - As a result, there was a general perception that we could find concentration of various livelihood groups at one “localidade” and, based on that, the team selected two localidades for hh and focus group interviews.
- At localidade

As per table 1, a total of 24 Administrative Posts and 28 localidades were visited. In each localidade, the following took place: 15 HH interviews with representatives of various identified livelihood groups; 3 focus interviews; 1 institutional.

In some cases, purposive interviews were conducted to capture and enhance social variation, despite the fact that they were not identified during the wealth ranking exercise (i.e. gender issue, widows, orphan child as head of HH).

Post-Field Visit

- **Data Cleaning and Post-Coding**

A total of 137 HH questionnaires were completed as well as 18 institutional and 45 focus interviews. Due to the fact that there were close and open questions in the questionnaires, there was a need for the revision and post-coding. This exercise took longer than expected because only two junior collaborators under my supervision were carrying out the task. They spent about six days on that task.

- **Data Entry**

A database had to be designed in order to enter the data. For that, the supervisor worked closely with

technicians to go over each part of the questionnaire to make sure that everything was accordingly. CSPro was the selected software because it will allow data to be entered friendly and can be easily transferred either to SPSS or Excell.

Focus Interviews and Institutional Questionnaires

The post-coding was difficult due to a wide variation of responses, even though, a template was designed for that purpose. To counteract the problem, the option was to write a synthesis, which, at this stage, is all in Portuguese, but if needed, it can be translated.

Lesson Learnt

Overall, the results for all the components of this study were very interesting. However, they could have been much better. Several issues prevented us from getting greater results and they are highlighted below:

- Contrary to what happened in other countries, the study in Mozambique did not have any institutional integration at all. Not only that, but Mozambique lacked a multi-disciplinary core team.
- Theoretically, the study had a national coordinator. Even though we recognize all her effort, she was overloaded with other work and often away from Mozambique and, thus, she could not follow all the day-to-day activities. Furthermore, her relationship with WB was not all clear at all, which often created some difficulties when she needed to draw upon support from the organization.
- The team had also a technical coordinator who was away from the country at both initial phase and fieldwork. If he were here, he could have made a difference and many issues could have been dealt with more profoundly. Thus, this led to some limitations on addressing technical issues.
- There was limited consensus in terms of procedures, methodologies and overall technical aspects. Often, what was produced in the ground was not totally integrated or taken into account. For example, issues on socioeconomic aspects, including poverty and food security and nutrition were not well integrated with climatic changes, even though, some very good materials were produced.

- Resource allocation and very limited support from WB office in Mozambique made it difficult to implement the activities.
- Often, the team was asked to prepare agenda with chronograms, budget and procedures, which were often changed for more than once. Such situation interfered with the consultant's scheduled and made planning difficult. This was particularly aggravated by great delays (i.e. fieldwork) which

made it impossible to carry out the work smoothly and; in some cases, it generated conflicts with respect to the record of number of days on consultancy work.

Overall, this activity was quite an experience and useful to exchange ideas and to shape up methodologies to bring about outstanding results on economic costs of adaptation to climatic changes.



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