



# Livelihoods at Risk: The Case of The Mphanda Nkuwa Dam



## **COMMUNITY RISK ASSESSMENT FOR THE PROPOSED MPHANDA NKUWA HYDROELECTRIC DAM**

Prepared for **Justiça Ambiental!** by James Morrissey



## **Abstract**

This report examines the risks associated with the construction and operation of The Mphanda Nkuwa Hydroelectric Dam proposed for The Lower Zambezi in Mozambique. The study focussed on two *bairros* in the vicinity of the proposed dam site and made use of participatory methodologies in a livelihoods framework. This generated a rich context for understanding the manner in which local livelihoods might respond to the enormous physical and social changes that are a likely result of both the dam's construction and its operation. The report examines how livelihoods have historically responded to other socio-environment shocks and stresses (these include those stresses recorded from the construction and operation of Cahorra Bassa Dam), as well as looking to secondary literature to expand on how individuals living further downstream may be impacted by the dam.

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## **List of Abbreviations**

<b>AIDS</b>	<b>Acquired Immunodeficiency Syndrome</b>
<b>CIA</b>	<b>Central Intelligence Agency of the United States of America</b>
<b>CMCE</b>	<b>Controlling Maximum Credible Earthquake</b>
<b>DiMP</b>	<b>Disaster Mitigation for Sustainable Livelihoods Programme</b>
<b>FIVAS</b>	<b>Foreningen for Internasjonale Vannstudier</b>
<b>FRELIMO</b>	<b>Front for the Liberation of Mozambique</b>
<b>GGF</b>	<b>Global Greengrants Fund</b>
<b>HIV</b>	<b>Human Immunodeficiency Virus</b>
<b>JA!</b>	<b>Justiça Ambiental!</b>
<b>km</b>	<b>kilometre</b>
<b>KPA</b>	<b>Kariba Publicity Association</b>
<b>kV</b>	<b>kilovolt</b>
<b>MCE</b>	<b>Maximum Credible Earthquake</b>
<b>MDE</b>	<b>Maximum Design Earthquake</b>
<b>MW</b>	<b>Mega Watt</b>
<b>NEPAD</b>	<b>New Economic Partnership for Africa's Development</b>
<b>PRA</b>	<b>Participatory Rural Assessment</b>
<b>RENAMO</b>	<b>Resistencia Nacional de Mozambique</b>
<b>RTE</b>	<b>Reservoir Triggered Earthquake</b>
<b>SAPP</b>	<b>South African Power Pool</b>
<b>UTIP</b>	<b>Unidade Técnica de Implementação dos Projectos Hidroeléctricos</b>
<b>UCT</b>	<b>University of Cape Town</b>
<b>WCD</b>	<b>World Commission on Dams</b>
<b>WFP</b>	<b>World Food Programme</b>

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## **Chapter 1: Introductory Chapter**

This first chapter is meant to act as a guide to what is contained in each chapter and has been provided in the hope that it will make the document more accessible. The reader can thus still gain relevant understanding by reading selected chapters, as opposed to the entire document. However this document has been written with the intention of being read in full. This is due primarily to the fact that the rich context gained from the participatory approach adds great value to the discussion of expected impacts and associated risks. Thus, it is suggested that when using this document, the reader should examine chapters 4 and 5 in conjunction with any other chapters.

This introductory chapter includes the following information:

- An introduction to the proposed Mphanda Nkuwa Dam, detailing issues such as location, cost, financial agreements, reservoir size, dam wall height etc.
- A discussion of the motivations for this study, in terms of the World Commission on Dams suggestion of taking a rights and risks approach to dam building.
- A brief description of what is contained in each chapter as well as the motivations for their inclusion.

### **1.1 The Mphanda Nkuwa Dam**

The Mphanda Nkuwa hydroelectric dam is a hydro-electric scheme proposed for construction on lower Zambezi. It is to be located midway between the city of Tete and the existing Cahorra Bassa Dam wall ( $\pm 140$ km apart), both of which are situated in Tete Province, Mozambique. Its reservoir will inundate an approximate area of  $100\text{km}^2$  and will reach upstream as far as the existing wall at Cahorra Bassa. The area to be inundated is fairly mountainous and thus not densely populated, but it does sustain an abundance of wild game.

The inundation of the reservoir will result in the forced resettlement of approximately 1400 people (UTIP 2001), while the total project is expected to cost in the region of US\$2.165 billion (NEPAD 2003). The power to be produced by this project (1300 MW) is intended to supply the Southern African Power Pool (SAPP) via Maputo, and is not intended for rural electrification. Thus the project will also involve the construction of approximately 1 540km

of 400kV high voltage power lines to transmit power from the dam to Maputo. It has also been proposed that some of the power be used to supply local energy-intensive industry such as aluminium smelting, steel milling and coal mining.

Proponents of the dam argue that Africa's economic, and thus general, development is reliant upon an available source of electricity. They argue that with the SAPP reaching a point where demand will outstrip supply, Mphanda Nkuwa represents both a key generator of foreign exchange for Mozambique and a source of clean energy for the region<sup>1</sup>. Dam proponents further argue that the people of Mozambique will benefit from economic development as a result of a better balance of payments - and from the injection of cash into the economy through the creation of temporary and permanent paid employment at both the dam site and in associated industry.

Those opposing the dam argue that the rapid industrialisation of the Zambezi Valley is taking place at a rate that social change and adaptation cannot match. They are concerned about the deleterious social and environmental consequences that construction of such magnitude will produce, especially in an environment that is virtually without formal social or physical infrastructure. There are further concerns that the much touted "trickle-down-effects" will fail to materialise, especially amongst those individuals who are to be disenfranchised by the dam's construction and operation. These individuals, they argue, will in fact be underdeveloped to such an extent that the whole project will only serve to entrench poverty, rather than alleviate it. Other concerns exist around further lending to already highly indebted country, as well as governmental responsibility and capacity to mitigate deleterious effects.

## **1.2 Rights, risks and the World Commission on Dams**

The World Commission on Dams (WCD) convened in 1998 as a result of global, civil outrage surrounding a multitude of problematic, large dams, and subsequent unsatisfactory investigations into these dams (Imhof et al. 2002). The WCD's final report was released in 2000, based on the following: a review of eleven case studies in five regions, seventeen

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<sup>1</sup> There has been recent debate over whether or not hydroelectric dams are in fact clean energy sources, as the manner in which they contribute to climatic change is not yet well understood.

thematic reviews of social, environmental and economic impacts as well as other issues, and a cross check survey of one hundred and twenty five dams in fifty six countries. The final report proposed that “in order to achieve better outcomes, an approach based on ‘recognition of rights’ and ‘assessment of risks’ be developed as a tool for guiding future planning and decision making (Dams and Development, 2000:16). It is in light of this recommendation, and due to the fact that Mozambique currently has no formal position on the WCD, that this study was undertaken with money from independent funders.

### **1.3 What is contained in this document**

This work has used a livelihoods assessment to understand existing livelihoods strategies currently employed in the area. As local livelihoods respond to social and physical changes in their immediate environment – resulting from the impacts and concurrent risks associated with the dam’s construction and operation – this report has tried to generate a multi-dimensional context in which to understand how the dam is likely to affect the area.

This has been achieved through an investigation of how livelihoods have historically responded to other socio-environmental shocks and stresses.

Chapters 3 through 5 detail this multi-dimensional context, with each subsequent chapter describing the context on a finer scale. Chapters 6 and 7 look at how shocks and stresses have historically impacted on the existing livelihood strategies and finally, Chapter 8 examines the manner in which the proposed dam is likely to impact upon the area.

#### **Chapter 2: *Methodology, ethical considerations and limitations of the study***

Details the methods used in the study as well as some of the limitations and ethical considerations of the research.

#### **Chapter 3: *Context: Mozambique and the Zambezi valley***

Details the broader context in Mozambique with an overview of Mozambique’s geography, as well as a brief economic and social history. It also provides a brief description of the Zambezi River and its basin.

#### **Chapter 4: *Context: Description of the study sites***

Describes in detail the geography of the study sites as well as a description of the dominant livelihood strategies employed by the local inhabitants

**Chapter 5: *Wealth, access and power***

Examines the social forces which generate differential risk profiles at the level of the individual in the *bairro*.

**Chapter 6: *The impact of large dams: contextualising Cahora Bassa***

Details how dams interact with complex riverine systems, and specifically how the construction and operation of Cahora Bassa has already impacted on the people of the Zambezi. This chapter also contains some discussion of dam safety, specifically dealing with the seismic potential of the area and the possible impacts associated with a changing climate.

**Chapter 7: *Priority threats and common responses***

This chapter details the priority threats to which the people of the Zambezi consider themselves to be exposed.

**Chapter 8: *Mphanda Nkuwa: Impacts and risks***

This chapter examines how the construction and operation of the Mphanda Nkuwa Dam will impact on the environment and people of the Zambezi, regarding risk generation.

**Chapter 9: *Discussion and conclusion***

This chapter contains a discussion of the results of the study. It also concludes the document with reference to the research procedure as a whole.

## **Chapter 2: Methodology, ethical considerations and limitations of the study**

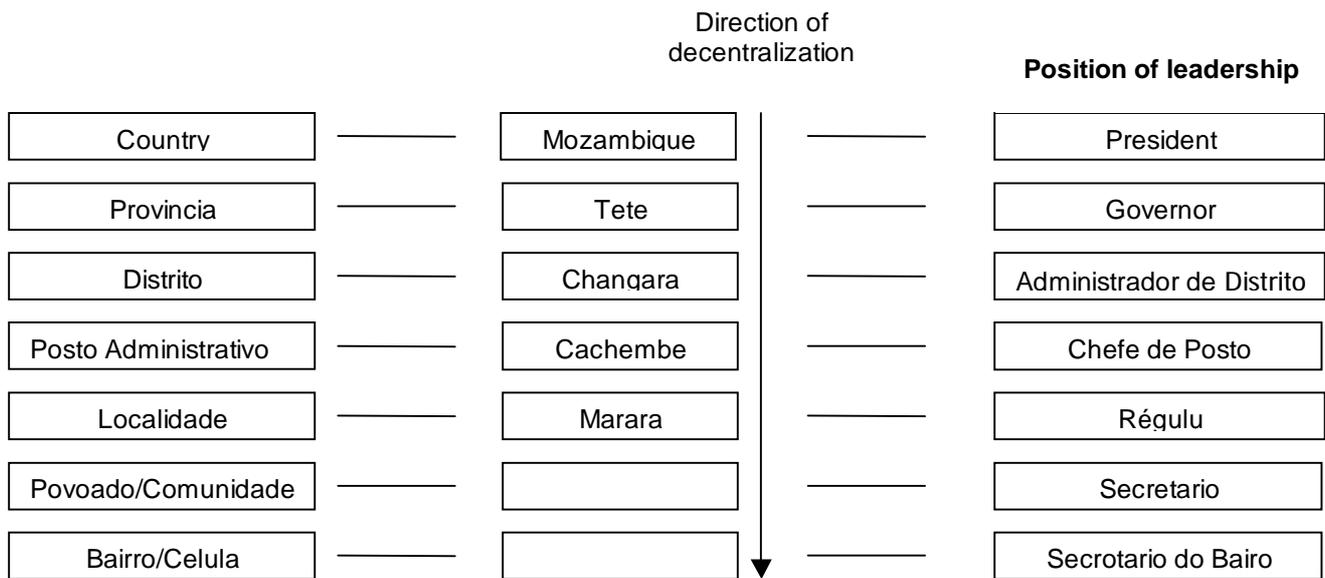
This chapter expounds upon the methods used in this study. It justifies and contextualises some of the findings from the study and attempts to provide some insight into the research environment.

This chapter includes the following sections:

- Methodology:
  - Rationale for site selection
  - List of the research methods used while in the field
  - List of the meetings held as part of the research
- Limitations of the study.
- Ethical considerations.

### **2.1 Methodology**

The study made use of two case studies to examine the risks associated with the construction and operation of the proposed dam at Mphanda Nkuwa. Case studies were conducted at the level of the *bairro* – Mozambique’s smallest administrative level (see Figure 2.1.). These case studies were used to explore the feasibility of participatory rural appraisal tools in generating an understanding of risk-generating processes. They were also used as a means of generating an in-depth understanding of the manner in which risk will be manifest as a result of the dam’s impact on the local social and environmental systems.



**Figure 2.1** Organogram showing Mozambique’s different administrative levels and positions of leadership. Note the *Comunidade* and *Bairro* of the study area have been left out in the interest of anonymity (personal communication: Feliciano de Acibo – *Chefe de Posto*, Marara)

### **2.1.1 Rationale for site selection**

In order to select field sites, the researcher undertook a scoping exercise. This involved driving the length of the river from Caia to Cahorra Bassa and interviewing individuals at random about their relationship to the river. As a result of this scoping exercise, it was decided to undertake research in two *bairros* located in close proximity to the proposed dam wall. These sites were chosen primarily on the basis that the study wished to capture the risk to both potential resettles and the people living downstream of the proposed dam site. This focus was chosen due to the contentious nature of resettlement programmes in general and due to the large numbers of people living downstream who will also be impacted by the dam (and according to the existing dam proposal will receive no compensation). In making the decision as to exactly which *bairros* would be used for case study purposes, the researchers consulted with individuals from the dam site and its surrounds. The first site was chosen due to its close proximity to the proposed dam wall, which meant that it would be heavily impacted by changes in river flow, resulting from the dam’s operation. The people of second *bairro* would have to be resettled due to the inundation of their houses.

Both *bairros* were reasonably small and distinct, they both ran along the length of the river and both had contact with villages on the other side of the river. Thus they were thought to be both heavily reliant on the river, and of a manageable size so as to make research feasible.

Finally, a strong connection had been formed between JA! and an individual living in close proximity to the potentially resettled *bairro*. This individual was involved with work which resulted in knowledge of people from both *bairros*, and as he was to act as a guide to the research team, *bairros* with which he was familiar were preferred.

### ***2.1.2 Methods used***

The study focussed primarily on community-level field research and made extensive use of participatory rural assessment (PRA) tools. This work was supported by numerous meetings with institutions working in the area and by a review of available reports and literature on the area. In order to speak generically about the risk pertaining to individuals living further downstream of the dam wall and in the delta, secondary literature on the impacts of the existing Cahora Bassa Dam was consulted.

The community-level field research took an ethnographic approach: it involved living in the field for two periods totalling around three weeks. Given the intrusive nature of the research, the team held community meetings as part of their first day in the field. These meetings were coordinated by the *Secretario do Bairro*, with food and drink being supplied by the research team. These meetings served as an ice-breaker, and generated a significant amount of trust



**Figure 2.2** showing a community mapping exercise

between the researchers and the people of the *bairro*. These introductory meetings also created a space in which to undertake some of the exercises which would require extensive community involvement and consensus. These included:

#### ***2.1.2.1 Community, and resource, mapping***

Community members were asked to draw a map of the *bairro* in the sand (see figure

2.2). Initially, participants had some difficulty in representing a two-dimensional reality in one dimension. This problem was overcome by encouraging participants to make use of their surrounding environment. This involved using props such as piles of sand, rocks and plant matter to represent features such as mountains, houses and fields. In terms of this map, the community then described resources (well points, mango trees etc), vulnerable groups (child/women headed households etc) and places of significance (burial sites, places of spiritual worship etc). The exercise was as participatory as possible, with the maps being drawn entirely by the participants and verified by all in attendance. These maps were later transferred, by the researcher, onto a piece of A3 paper and were again verified by all in attendance.

#### *2.1.2.2 Threat listing and ranking*

In the threat listing and ranking exercise, participants listed what they considered to be threats to their livelihood security. These threats were then represented by drawings on pieces of paper. Afterwards, the group collectively placed these pieces of paper in descending order of concern. Once this was complete the group discussed the nature of the threats, justifying why they had ranked them as such (see Figure 2.3).



**Figure 2.3** Showing participatory ranking of threats to livelihood security

#### *2.1.2.3 Seasonal calendars*

Participants were asked to construct a seasonal calendar which listed social and environmental events as well as livelihood activities and strategies. They also described the period in the year during which such events occurred. The listing of events was undertaken by the participants but was often prompted by the researcher.

As part of the field work the research team also undertook the following exercises:

#### 2.1.2.4 Semi-structured interviews

Semi-structured interviews accounted for the majority of the time spent in the field. Such interviews were preferred to questionnaires, due to the following: low literacy rates in the area, the confusing nature of the research and the open-ended nature of semi-structured interviews, which allowed for the exploration of points of interest (see Figure 2.4). Each



**Figure 2.4** Showing semi-structured interview/focus group with elderly women

interview lasted an average of one and a quarter hours, and in total 27 interviews were conducted across both *bairros*. The research team tried to capture households from a range of well-being categories, with access to a range of environments; the community mapping exercise was used as a key aid in achieving these goals.

#### 2.1.2.5 Transect walks

Transect walks were undertaken either alone or while accompanied by a guide or member of the *bairro*. The research team often had to walk the length of the *bairro* in order to conduct interviews and these walks were often used as part of transect walks. Much information was gained about local livelihoods practices during these walks.

Due to the ethnographic nature of the research and the fact that the research team was living in the field, extensive use was made of observational study and informal discussions (see Figure 2.4). Such observation and discussion provided powerful insight into the functioning of the *bairro* as a social system. However, it also often resulted in more questions than it did answers, and thus focus group discussions were used to gain clarity on perplexing issues. Every attempt was made to ensure that these focus group sessions were as representative as possible, but numerous barriers presented themselves (see limitations of the study below).

### ***2.1.2.6 Institutional meetings***

The researcher held meetings with numerous influential partners from outside of the *bairro*. Meetings were held with partners at local, provincial and national levels. These included:

Meeting with Feliciano de Acibo – *Chefe do Posto*, Marara

Meeting with Henrique Silva - HCB, Songo

Meeting with Hitesh Kanakrai - WFP, Tete

Meeting with Joseph Kamara - World Vision, Tete

Meeting with Julia Vasconcelos and Nadia Vaz - WFP, Maputo.

\*Meeting with local level leadership

\*Meeting with a local school teacher

Meeting with Sergio Elisio – UTIP

\*Meeting with a World Vision food monitor

- *Individuals with a '\*' did not wish to be mentioned by name*

Not all these meetings were successful as not all parties were willing to share information; such problems will be elaborated on the section 'Limitations to the study' described below.

## **2.2 Limitations of the study**

Working in Rural Mozambique presents numerous challenges which constrain work of this nature. Such challenges centre primarily on access to information and geographical constraints.

Information is not easily available in Mozambique, even regarding documents which are supposed to be public. The researcher encountered difficulty in trying to gain access to the Environmental and Social Impact Assessments for the project. These documents were held in Parliament in Maputo and were not available for photocopy. Further, access to parliament was limited to individuals who were able to meet a certain dress code. Meetings with officials from both Mozambican government and HCB were often fruitless, as officials refused to provide information about potential funders for Mphanda Nkuwa and management practices at Cahorra Bassa respectively.

In the field the extensive use of the local dialect (Nyungue) made translation necessary. This, in some cases, led to three-way translation (Nyungue-Portuguese-English). Translation affects research in numerous ways, with information often being lost in the process. Further, it also has a detrimental effect on the manner and level in which the researcher is able to engage with the interviewee. Difficulties in the field were also linked to participation. Although women's participation was encouraged to the point of some meetings and interviews being conducted exclusively with women, the patriarchal society meant that it was often difficult to get women and children from the area to participate in *group* discussions. Also, some subjects were deemed taboo by the research team - thus certain questions were omitted from the interviews.

A general lack of formal information sources severely constrained the research, with few reports and little data being characteristic of the area. This further constrained the researchers' ability to upscale findings from this section of the river to generic statements about the risk pertaining to peoples living along the length of the river.

The great length of the river, its distance from Maputo (where the lead researcher was based), and the poor state of transport infrastructure in the country meant that access to field sites was often difficult. This problem was apparent even at the level of the *bairro*, where the researchers often found themselves having to undertake day-long excursions to interview inhabitants living at the far end of the *bairro*. Having to walk such great distances to undertake interviews meant that much time was lost in the field.

During the research, the area was being affected by a drought. This meant that food reserves were depleted and many people – the WFP's 'at risk populations' (the elderly, the young and the sick) – were reliant on food aid. Under such circumstances it is quite possible that drought and food (in)security are threats which would have been foremost in the participants' minds, possibly leading them to overstate the impacts of these hazards while understating the impact of others.

### **2.3 Ethical considerations**

Given that the research was of an ethnographic nature, taking place in a rural context with little access to cash and the fact that the research pertained to a potential 2.3 billion dollar

(US) investment (with interests vested in numerous parties from all over the world), it is unsurprising that the research team encountered numerous ethical concerns regarding the project.

Projects of this magnitude are likely to induce change in the *bairro* regardless of whether they are approved or not. This is a result of speculative behaviour which accompanies many mega-projects – especially those involving resettlement. Examples of such speculative behaviour include the potentially resettled peoples halting further inputs to their land as land tenure is perceived as less secure, or migrants coming to the area in the hope of receiving compensation or preferential treatment in employment during the construction phase of the project. Potential impacts of such speculative behaviour are thought to be proportional to the magnitude and interest shown in a project. Thus site selection posed ethical considerations as this study in itself was a display of greater interest in the dam and thus may inadvertently result in or encourage speculative behaviour amongst local inhabitants. The study was conducted at the proposed dam site regardless of these concerns, as it was found that individuals living further down river were in many instances unaware of the proposed construction at Mphanda Nkuwa. Research in these areas might generate speculative behaviour, as opposed to simply enhancing perceptions already present at the proposed sites. The areas closer to the dam site were also favoured due to the reasons elaborated upon in the section on site selection. Finally, it was thought that the undocumented potential exacerbation of risk due to the dam's construction and operation itself constituted a greater risk to the people of the area than the risk of inducing speculative behaviour.

Further, as was stated above, certain subjects were omitted from the interviews as they were thought to be taboo. Such topics include questions pertaining to divorce or death. In such instances the advice of the translator, or guide, was used to try and gauge whether the question was suitable - given the interviewee's tone and demeanour. As in some instances the translator was from a surrounding area and had experience in interviewing people on sensitive topics, his experience was used to determine the suitability of questions.

### **Chapter 3: Context: Mozambique and the Zambezi Valley**

This chapter details the broader context for this study. It has been provided to situate the case studies in the broader context of Mozambique and the rest of the Zambezi Valley Basin. The chapter overviews Mozambique's geography as well as its economic and social history. It then continues to discuss, in brief, the profile of the Zambezi River Basin.

This chapter contains the following sections:

- Overview of Mozambique:
  - Social and economic history
- Profile of the Zambezi River Basin:
  - Dams on the Zambezi

#### **3.1 Overview**

Mozambique is located on the East coast of Southern Africa and occupies a total area of 801 590km<sup>2</sup> (CIA Fact book 2005). It is bounded to the east by the warm Indian Ocean, while its landward neighbours include South Africa and Swaziland to the south, Zimbabwe and Zambia to the west, and Malawi and Tanzania to the North (see figure 3.1). The predominant landscape in Mozambique comprises of coastal lowlands with uplands in the centre, high plateaus in the northwest and mountains in the west.



**Figure 3.1** Map showing the location of Mozambique, the Zambezi and Mphanda Nkuwa

The country has a population of around 19.5 million people, of which the majority currently live in rural environments. Mozambique has experienced varied patterns of migration associated with periods of colonialism, independence, civil conflict and subsequent peace. All of these periods have had marked influences on the economic and demographic profiles of the country.

### ***3.1.1 Economic and social history***

As stated briefly above, the most notable events in Mozambique's recent history are the end of colonialism, the shift to socialism (and the accompanying civil conflict), and the implementation of structural adjustment and brokering of peace.

Mozambican society was heavily disrupted by the colonial regime which was officially recognized in 1884, when Mozambique was made a Portuguese colony. However, the Portuguese had been extracting resources from the area since about the 1500's, primarily through the sale of labour (Oxfam 2003). Years of forced labour, land expropriation and extractive trade implemented under a brutal and authoritarian Portuguese Government

resulted in the growth of a resistance movement among the indigenous peoples of Mozambique. This culminated in a protracted war of independence between The Front for the Liberation of Mozambique (Frelimo) and the Portuguese colonial authority. This war ended in 1974 with a left-wing coup in Lisbon, which overthrew Portugal's dictatorial President – Marcello Caetano – and resulted in independence being granted to Mozambique on 25 June 1975 (Institute for Security Studies 2005).

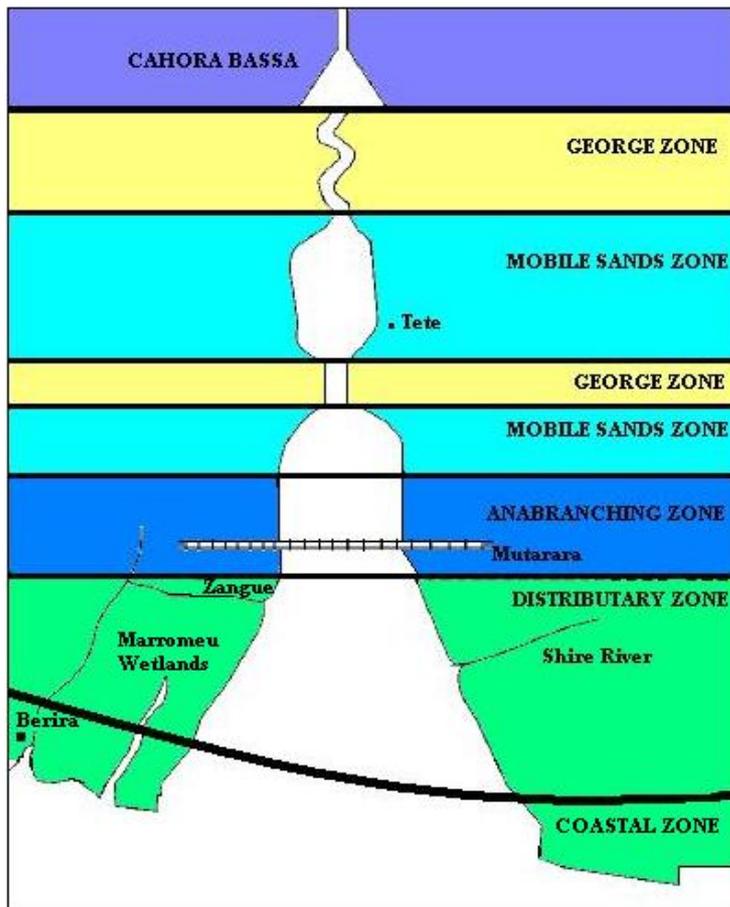
With independence and the election of Samora Machel as President, Mozambique experienced a mass exodus of skilled Portuguese labor back to Portugal. It also led to Mozambique becoming entangled in the violent liberation of its neighbours. Mozambique's adoption of a socialist regime, the closure of its border with Rhodesia (current day Zimbabwe) and its support of liberation movements in both South Africa and Rhodesia resulted in raids by commando units from the armies of both South Africa and Rhodesia. These same countries encouraged the formation of Resistencia Nacional de Mozambique (Renamo) who became the formal face of antagonism during what is often referred to as Mozambique's civil war (Institute for Security Studies 2005). The protracted civilian conflict in Mozambique resulted in significant human displacements. At national and international levels, people sought either the safety of the urban areas or official refugee status in neighbouring countries. However, as will be discussed later in this report, a variety of impacts at the local level have led to conditions which persist today.

Regime change in the international and regional arena resulted in significant changes in the political fabric of Mozambique. Constitutional reforms, international monetary assistance and the end of formal commitments to a Marxist-Leninist, one-party system in Mozambique were a direct result of the collapse of Eastern European political regimes, and the opening of political dialogue in South Africa.

Such circumstances paved the way for the signing of a General Peace Agreement between Renamo and Frelimo in Rome in 1992, bringing to an end the protracted civilian conflict which had destroyed much of the countryside and the economy. With peace, as with war, there came another significant human displacement as refugees and migrants returned to take up their land.

With reforms in Mozambique came debt relief, accompanied by structural adjustment and shifts towards privatization. Thus Mozambique entered the global market as an indebted country not accustomed to centralized, liberal democracy, with its economy and infrastructure in tatters. It also carried with it a history of conflict which had effectively destroyed the country's social fabric. However, since 1992 Mozambique has shown positive signs, with economic growth increasing and inflation dropping. Despite this, the country remains reliant on external aid and although overall growth figures look positive, many people attest to the fact that they are worse off now than they were previously. There have also been ominous incidents of corruption, (especially during the period of privatization), reports of political intimidation and no reconciliation process for addressing war time atrocities has been introduced.

### 3.2 The Zambezi Basin



The Zambezi River is the fourth largest river in Africa and its basin comprises of seven countries: Zambia, Congo, Angola, Namibia, Botswana, Zimbabwe and Mozambique. The river, with its source in Zambia, drains eastward through Mozambique, eventually entering the Indian Ocean. The population of the entire river valley is estimated at 32 million people, about 80% of which are dependent on subsistence agriculture and fishing (Wikipedia 2005).

**Figure 3.2** Schematic river zonation of the lower Zambezi (Figure from Davies et al 2000)

The river is divided into three segments: 'upper', running from the source to Victoria Falls, 'middle', from Victoria Falls to Cahorra Bassa, and 'lower', from Cahorra Bassa to the coast. The lower channel, for which Mphanda Nkuwa is proposed, comprises of a complex physical system made up of four macro-scale, river-floodplain zones: narrow gorges, mobile sand-braided and anabranching reaches and a coastal distributary zone. Such complexity is attributable to variations in regional geomorphology which results in a series of distinct valley-floor-trough and river-floodplain associations (see Figure 3.2) (Davies et al. 2000). The river enters the sea through the Zambezi Delta, which forms a complex network of river channels and extensive low-lying flood plains.

The lower Zambezi Valley experiences varied rainfall, ranging from 600 – 700mm per year in the semi-arid Tete region, to 1000 – 1200mm annually in the coastal delta. The section of the river running through Mozambique is located in the south of the Shire trough, which is in an active state of subsidence. This is also an area which has historically experienced significant tectonic instability (Hartnady 2002).

As with most large rivers, the basin supports a variety of animal life. This varies from Kapenta in lakes Cahorra Bassa and Kariba, to large terrestrial mammals along remote stretches of the river, and prawns at the coast. Many of the communities living along the length of the river and at its mouth are reliant on these sources of natural capital for supplementing their subsistence farming livelihoods.

### **3.3 Dams on the river**

The Zambezi River's flow has been severely interrupted at two points up-stream of the proposed Mphanda Nkuwa Site. These sites refer to the two hydroelectric colossuses: Kariba Dam in Zimbabwe and Cahorra Bassa Dam in Mozambique.

Construction on Kariba – at the time the largest man-made lake in the world – began in 1956 and was completed in 1960 after numerous setbacks caused by riverine flooding (KPA, no date provided). The dam's reservoir is now the third largest storage area in the world (Davies et al, 2000) and power from the dam supplies both Zimbabwe and Zambia. Kariba,

along with the Kafue Gorge Dam in Zambia, have significantly reduced the flows entering Cahora Bassa Gorge (ibid.).

Lake Cahora Bassa is the world's twelfth largest storage area (see figure 3.3). It is held back by a dam wall of 171m. Construction of the dam was completed in 1974 by the Portuguese colonials, who at the time of research still owned the dam<sup>2</sup>. The power generated from the dam is primarily sold to South Africa's utilities parastatal, Eskom.



**Figure 3.3** Showing the Cahora Bassa Dam Wall

The impounding of these three reservoirs has significantly altered the river downstream of Cahora Bassa. A declining trend of water flowing into Cahora Bassa Gorge has been observed since 1975, and the Cahora Bassa Dam itself has had a massive impact on the downstream river ecology, predominantly through flood attenuation and sediment capture.

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<sup>2</sup> Cahora Bassa Dam has very recently changed hands and is now owned by the Mozambican government however while the research team were in the field the dam was controlled and administered by Portugal.

## **Chapter 4: Context: Description of the study sites**

### **Introduction**

This chapter provides a detailed description of the geography of the *bairros* in which the field work was conducted. It also provides a detailed description of the livelihoods strategies employed by the people living in the vicinity of the dam site. Essentially, the chapter is used to contextualize the risk(s) which will be manifest at the level of the *bairro*. As this document is fundamentally an analysis of how people's livelihoods are likely to be impacted by the construction and operation of the dam, this, along with the following, chapter provides some of the most useful context for the study.

This chapter contains the following:

- A description of the geography in the immediate vicinity of the *bairros*
- A description of the livelihood strategies employed by the people of the *bairros*(s)
- A discussion of the explicit differences between the field study sites

### **4.1 Geography**

The study took place in two *bairros* situated within 15km of one another. Thus, statements regarding terrain, climate etc. can be assumed to be generic. Where this is not the case, mention will be made of the relative differences.

The study sites were located in the semi-arid region of the Zambezi River which receives between 600 and 700mm of rainfall annually (Isaacman and Sneddon 2002). Daytime temperatures are often well above 35°C and in summer, they frequently exceed 40°C. The area has a well-defined summer rainfall season with rains falling between November and March. Rainfall is variable in the area, resulting in very arid conditions during times of drought.

The study sites were both very remote and located along the river. Both are situated about 25km from the nearest tarred road which runs between Tete and Songo – a small, dormitory town for Cahora Bassa. There is no transport between the village and this road, leaving locals with a 25km walk and subsequent 70km minibus taxi ride to Tete. The only other

form of transport is a one or two day (depending on your orientation) connection to Tete via dugout canoe.

The terrain in the area is hilly, becoming mountainous and less densely populated as one approaches the dam site. The hills hold a number of tributaries which feed into the Zambezi. Many of these streams are considered perennial; however, in times of severe drought they too run dry.

#### 4.2 Livelihood strategies:

The *bairro* comprises of numerous clusters of houses, or homesteads (Figure 4.1). Each homestead usually houses immediate family members and occasionally their spouses. Homesteads are surrounded by the fields to which the family has access. This results in homesteads being very much dispersed from one another. Such dispersal is suspected to be a



Figure 4.1 Showing a typical homestead

result of the civil war, during which time people separated themselves from one another so as to make the ransacking of villages more difficult. In one of the *bairros* people had constructed their homesteads on the hilltops; this was done in order to allow people to spot approaching forces.

Livelihoods in the *bairro* are virtually self-sustaining. They predominantly make use of farming, but supplement this strategy with a diversity of strategies ranging from livestocking to fishing, to basketry and pottery. The *bairro* does, however, require goods and services that cannot be produced internally. These include: salt, soap, clothes, medicines, pots and pans, transport and formal medical treatment. In order to obtain such goods, people of the *bairro* are reliant on cash.

#### 4.2.1 Farming

Every household in the *bairro* is reliant to some extent on subsistence farming. Farming activities can be divided into two dominant types: (i) farming of the local staple (see Figure 4.2) and (ii) vegetable farming. Staples are grown during the rainy season – planting takes place from October to January and harvesting from March to around mid-May. The main staples include sorghum and millet, with maize being grown in small quantities. Vegetable farming is also undertaken seasonally, but individuals with access to perennial water sources are able to grow vegetables all year round. Due to the arid climate maize cannot be supported by rainfall alone. Thus it is grown in a similar fashion to vegetables. Perennial water sources primarily take the form of the Zambezi River, but include some of its tributaries. However, in years of drought the tributaries of the Zambezi have run dry. Those individuals with access to perennial water sources are of vital importance to the rest of the *bairro* and even to the *administrivo* at large. They ensure a constant supply of vital fresh vegetable produce to the area. During the rainy season vegetables are farmed in vegetable gardens located in upland fields. However, in the dry season these vegetable gardens are moved down to the river beds. Vegetables cultivated include: maize, cove, tomatoes, pumpkin, rice, cabbage, lettuce, bananas and a variety of beans.



Figure 4.2 Showing a farmer with the local staple

Fields are owned by individual families and are delineated by acacia fences. These fences thus show ownership and also act as some form of barrier to the cattle which, if allowed, would consume much of the crop before it is harvested.

#### *4.2.2 Livestocking*

Cattle stocks were largely wiped out during the civil war and only since 1992 have they begun to recover. This recovery has again been halted by recurrent and prolonged drought which has forced individuals to either consume or sell their cattle. Despite being the purview of the wealthy; livestocking (and more so cattle rearing) represents an essential activity to the *bairra*. It is through the sale of cattle that cash is generated, and which later circulates throughout the settlement through the exchange of locally available goods and services. Cattle is used for labour and also represents a vital source of protein. Livestock is used for draught power (see Figure 4.3) and also plays an important role in community maintenance through its consumption during feasts, ceremonies and celebrations.



**Figure 4.3** Showing the use of draught power in the *bairra*

Outside of the growing season livestock is left to roam freely. During the growing season, however, cattle have to be tended (usually by a young boy, employed to this end) to ensure that they do not graze on cropped land – the consumption of crops by cattle is an offence which would require compensation on the part of the cattle owner for crops consumed. Cattle are identified by sight and graze on communal lands which are not regulated by any institution. At night, during the

growing season, cattle are kept in kraals which are located in close proximity to the homesteads.

Given the importance that cattle sales represent to the people of *bairra*, the role of the cattle vendor is a vital one. These individuals represent the primary mechanism by which money

leaves and enters the *bairro*. Further, as their time is spent trading cattle and commuting between the *bairro* and the market, cattle vendors have to buy much of the produce that they require for subsistence. Such purchasing represents a further injection of cash into the *bairro* economy. Cattle is bought in the surrounding *bairros* and sold at the local market to middlemen who have access to transport infrastructure. Due to the lack of price regulation or protectionist measures for farmers, cattle prices can vary substantially: farmers are forced to sell cattle at extremely low prices during times of drought, while plentiful food harvests cause the cattle price to rise substantially.

#### 4.2.3 Fishing and Hunting

Fishing and hunting provide another vital source of protein to the inhabitants of the *bairro*. Fishing is undertaken using both nets and lines but is most effective when undertaken using



**Figure 4.4** Showing a fisherman with the nets used for catching fish during the rainy season

nets (see Figure 4.4). However, such practice is confined to the rainy season as the murkier water means the fish are unable to see the nets. Fishing by line is undertaken in the dry season where the clear water precludes the use of nets. Rods are made out of bamboo with nets, lines and hooks having to be purchased in Tete. There has been a recent lack of supply of quality nets and this has resulted in the smuggling of nets across the border from Malawi. Capenta or prawns are used as bait. Both net and line fishing is undertaken from a dugout canoe and fishing skills are mainly learnt by children who watch and help the older fishermen.

Women sometimes fish using their *capolanas*. This involves wading in the shallows and herding the fish into a corner where they are then scooped up in the *capolana*. This is not a particularly effective means of fishing with crocodiles serving as a significant deterrent.

Hunting takes place in the bush surrounding the *bairro* and is usually confined to trapping, which is only undertaken by those individuals who have access to trapping tools. One form of hunting which is readily practiced is the hunting of birds by slingshot. Hunting is practiced far more widely in the *bairro* closer to the dam site, where the uninhabited mountainous areas provide habitat for game as large as elephant.

#### *4.2.4 Wild Fruit and Honey Collection*

Wild fruits are collected throughout the area and form a major component of the local diet, especially in times of hardship. Such wild fruits include: Mangos, Baobab and the 'little apple'. The fruits of a tree are considered to be owned by the person upon whose land the tree is growing. Should trees be growing in the wild, their fruits can be picked by anyone.

Honey is collected only by those individuals able and willing to put up with the dangers of bee-stings. There is no practice of honey cultivation or bee keeping and wild honey is harvested in an unsustainable manner. This is largely because of a lack of equipment for protecting the collector from stings. Honey is collected by smashing open a tree in which bees are known to have a hive, throwing a smoking stick at the tree, waiting a short period and then pulling all of the comb from the tree and exiting as fast as possible. No precautions are taken to prevent stings and the job is described as one which "requires courage".

If honey is collected from a tree located on land which is not owned by anyone, the honey becomes the property of the honey collector. If the bees are in a tree on land belonging to someone who is not willing to collect the honey themselves, a honey collector is called and an agreement is reached between the land owner and the honey collector as to how much honey each will walk away with.

#### *4.2.5 Brewing of Alcohol*

Alcohol is brewed primarily by women, from sorghum and millet, in large metal drums (see Figure 4.5). As in all societies the role of alcohol is tenuous. It plays a fundamental role in community maintenance through its consumption at celebrations and other social events (including casual drinking sessions), but its abuse is expected to be apparent in the *bairro*

Alcohol also plays a significant role in maintaining the labour relationships between different households in the *bairro* (see the section on *bairro* economics – chapter 5).

#### **4.2.6 Basketry and Pottery**

Basketry and weaving are undertaken by numerous individuals in the *bairro*. Weaving skills are used to make rope, mats and baskets. These occupations are undertaken primarily in the hope of selling the outputs.

Pottery is also undertaken with the hope of retail. Pots are used in the *bairro* primarily to keep drinking water cool, but also to store items. Both these strategies use local materials for their construction and skills are passed along family lines.

#### **4.2.7 Basic Carpentry**

Carpentry plays a vital role in the community as it is through the rudimentary tools produced by the local carpenter that local farmers are able to keep the land productive. Wood for carpentry is obtained from wild trees in the area. This wood is free if found on land that is common. However, should the trees be located on cultivated land, permission to fell needs to be sought, and payment for the wood is necessary. Metal, required for most of the tools, has to be purchased in Tete. Carpentry skills are learnt through apprenticeship.

Carpentry is another means by which spending power is generated in the *bairro*. The carpenter will not be able to farm as much, as his<sup>3</sup> time is occupied with activities pertaining to carpentry - thus he is forced to buy much of his food from others in the *bairro*.



**Figure 4.5** Showing how alcohol is brewed in large metal drums

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<sup>3</sup> No mention is made of female carpenters as this was not apparent in the *bairro* and is considered to be highly unlikely in similar social systems. See the section on gender for more in this point.

#### ***4.2.8 Spiritual and Medicinal guidance***

Spiritual and informal medical treatments are fundamentally important to the people of the area. It is often these practitioners who are the first resort for people suffering ailments. Spiritual healers pass their skills along family lines, while informal medical practitioners either pass their skills through families, or receive their training through dreams. It is also through these dreams that both practitioners are 'chosen' as medicine-men/women. Both practices require the use of the natural capital, in that they require sacred places and/or medicinal plants.

#### ***4.2.9 Employment***

The role of migrant labour will be discussed later in this paper, but it is not the only form of employment apparent in the *bairro*. Due to the fact that distribution and quality of land varies between individuals in the *bairro*, many people find themselves in some form of remunerative labour agreement. Such people often work on the land of individuals who have too much land to cultivate by themselves, or work other people's land when their own has been exhausted. Such work is conducted in return for a various goods, cash, and alcohol. At this point it is worth mentioning that the *bairro* has very little cash in circulation.

### **4.3 Differences between the *bairros***

It has been stated above that it is possible to make generic statements about the two *bairros* due to their close proximity to one another. This is true to some degree and the above discussion of livelihoods practices is applicable as a generic. However, important differences in the two areas do exist. These differences, it is hypothesised, are intimately linked to the differential manner in which the *bairros* were affected by the civil war. This resulted in significantly different degrees of inequality in land ownership between the two *bairros*. In order to elaborate on this point a short discussion of the relevant human movements associated with the Mozambican civil war follows.

Literature discussing migrants from Mozambique's civil war tend to focus on the macro-factors, looking at how people either sought refuge in the urban areas, or sought international refugee status in neighbouring countries. Most of these discussions simply examine the manner in which people fled the rural areas, discussing these movements in

terms of their impact on urban growth, and the resultant impacts of the eventual return of refugees which occurred with the signing of the peace agreement in 1992. All this is true and relevant to the country as a whole. However, there is also much movement which happened at the micro level and it is this movement which is pertinent to this study.

The first of the two *bairros* had Frelimo militia stationed there during the war. This meant that many people flocked to this village seeking protection from the Renamo forces which were terrorising the countryside. Further, villages controlled by Frelimo soldiers were very unwelcoming to farmers who came from the bush, often accusing them of being spies and thus torturing, and/or killing them – as an example to others. Thus farmers preferred to congregate in this, and other, small villages that had militia - as opposed to living out in the bush.

With the end of the conflict, people moved off the now very degraded land and moved back to their original farms. Such a flux of people, in an unstable, unregulated and politically intimidatory environment had enormous implications for landownership in the *bairro*. The research team heard reports of land grabs at the time of peace, where people were forced from their land. The implications of this persist in the *bairro*, where much of the land (especially the good land) is held in the hands of just a few individuals. These individuals usually held influential positions during the conflict (such as police officers and army militia).

The second of the two *bairros* was far more remote during the war, and thus had no Frelimo militia stationed with them. Many people arrived at this *bairro* during the war to get away from the Renamo and Frelimo fighting. The logic in this instance was one of trying to be so removed that you would not draw any attention to your area. Under these circumstances, there was not a sudden flux in occupation and the land is distributed much more equitably amongst the inhabitants. The second *bairro* also appears to have experienced far less of the war in comparison to the first. This has left an apparently more stable and equitable society.

Thus the first of the *bairros* appears to be less cohesive than the second. It is hypothesised that this has (in part) resulted in problems for the first *bairro*, such as ineffective distribution of food aid - evidenced by certain at-risk individuals who claimed to be receiving no aid

whatsoever. It has also resulted in power being more equally distributed in the second *bairro*, as people find themselves less likely to be in labour relationships which are reliant on, and thus vest power in, their neighbours. It is thought that such equitable power sharing in the second *bairro* serves to significantly reduce its vulnerability and makes risk reduction and developmental initiatives far more feasible.

#### **4.4 Conclusion**

Livelihoods in the *bairro(s)* are characterised by their remote nature, a general lack of access to cash, reliance on their environment and relatively inequitable distribution of resources and power. It is clear that the people living on the Zambezi are intimately linked to the state of the environment. They rely on the environment for numerous resources including food, medicines, places of remembrance, nutritional supplements, firewood, construction materials, washing and potable water, crafts, and grazing for animals. Thus the state of the environment is intimately connected to their health, ability to work and spiritual well-being (Basson, 2004).

Further, the *bairros* differ significantly in the degrees to which they can be considered a community. This is intimately linked to the manner in which the war created discrepancies in wealth, and disrupted the social fabric of the area.

All this has created a situation in which individuals in the *bairro* do not have equal access to resources. In the rural, cash-strapped *bairro*, assets such as land, cattle and social influence (determinates of wealth) are not equally distributed. Thus power is vested in certain individuals, these individuals have the power to shape the *bairro* and can go a long way to determining the sustainability of livelihoods. Further, there are certain mechanisms which limit mobility in wealth, access and power categories. These mechanisms are vested in the *status quo* and thus they too stand to be affected by the dam's construction. Thus we need to examine the manner in which wealth, access and power interact in order to understand livelihood sustainability and how this could change in the face of construction of a mega dam. Such an understanding is also powerful in that it allows us to examine the manner in which risk will be manifest at the level of the individual, and not simply at the level of the community.

## Chapter 5: Social Control as Wealth, Access and Power

The previous chapter has created a context for us to gain some preliminary understanding of the impacts and risks associated with the construction of the dam, and how they will manifest at the level of the *bairro*. However, as mentioned in the conclusion of the previous chapter, this is not sufficient. Risk will manifest differentially at the level of the individual as a result of a number of social forces apparent in the *bairro*. Thus this chapter details some of the social forces which generate differential risk profiles at the level of the individual.

This chapter includes the following:

- A motivation for understanding differences in risk at the level of the individual.
- The role and importance of land in differentiating risk and the ways in which land is acquired and accessed.
- The role and importance of livestock in differentiating risk as well the means by which livestock is acquired, accessed and transferred.
- The rules by which economic exchanges take place in the *bairro*
  - The role of the family in redistributing wealth
- A description of the means by which law and order is maintained in the *bairro*
- A discussion of the *bairro's* local-level politics.
- An examination of the manner in which these social systems generate groups which should be considered most at risk:
  - Women
  - Children and the elderly

### 5.1 Wealth, access and power

Recognising and understanding differences in wealth are fundamental to generating a comprehensive understanding of the risk profile in the *bairro*. Such knowledge is important, as assuming a generic risk profile for the whole community can be misleading. Often it is those who are most at risk that are, and will continue to be, disproportionately affected by shocks and stresses. Such knowledge is intimately related to the social systems operating in

the *bairro*, which themselves often act to exacerbate the risk(s) to which certain individuals are exposed.

In order to make sense of the differences in wealth it is important to understand the rules that govern the way in which resources are acquired, owned and transferred. For the vast majority of residents, the economy is founded on subsistence agriculture and the sale of cattle. Thus it is useful to know and understand the common practices surrounding ownership, transfer and management of both land and cattle. The following section explores and details such issues.

## 5.2 Land

It would be useful, at this point, to describe the rules and practices by which land is acquired, transferred and accessed in the *bairro*. But as far as hard and fast rules go, there are very few. On this point, ownership of land (as used in this report and by the study participants) certainly does not denote formalised deed of ownership<sup>4</sup>; rather, it represents who the community considers to be the owner. This is reliant largely on people's ability and willingness to remember, and whether or not the land is currently under cultivation. For this reason exceptions appear to be more common than rules, and the processes described below simply represent common practices - making them more guidelines than they are rules. However, they are still indicative of the workings of society and thus important in building a context for understanding the impacts the proposed dam construction and operation may have.

Land is acquired in three main ways. The first involves a migrant coming to the *bairro* in search of land. This individual would have to approach the secretary of the *bairro* who, if there is land available, can distribute it at his own discretion. Should no land be available, the potential migrant could ask existing land owner(s) if they would cede some land to him/her (both women and men can own land in the *bairro*) and the decision then becomes the prerogative of the incumbent land owner. The secession of land to a migrant may occur for a number of reasons, with the decision to cede land usually being based on the productivity of

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<sup>4</sup> There is in fact no individual land ownership in Mozambique - all formal ownership is maintained on a 99 year lease basis.

the land and the productive capacity of the owner. Unsurprisingly the new migrant is likely to find that they have been given reasonably unproductive land which was unused for that exact reason. The migrant could also receive land as a result of changing personal circumstances of the owner. Such circumstances would include the death of a family member or the loss of a head of cattle.

Should a person who has grown up in the *bairro* wish to branch out of their household and take up ownership in a *bairro* where there is no land available, they would have to ask either a family member or friend to cede land to them. Land is also passed through families as inheritance which does not always favour the eldest son. The distribution of land at death is something which is not undertaken by strict rules of tradition. Rather, the recipient of the land is something which is decided by the family. Decisions are based on criteria such as who needs the land the most, with obvious preference given to individuals who would be willing to work the land. Whether or not an individual would be willing to work the land has become a significant consideration in the context of continuing urbanisation.

Marriage appears to be the primary process by which land is transferred and acquired. Marriages appear to take place in what can best be described as 'out of community of property'. What is meant by this is that at marriage, the wife-to-be's family is expected to provide the couple with land. Again this is not a hard and fast rule but more of a custom, if anything. Further on this point, the land given by the wife's family is given to their daughter. Should separation or divorce occur (which is possible), the land (and any other assets accumulated to the individual prior to the marriage) remains the property of that individual. Often, though, it is the husband-to-be's family who provides the land, and in such cases the land is considered to be given to their son. Interestingly, when respondents answered questions dealing with who gave them their land, women nearly always expressed that their land had come from their mothers, while men stated that their land had come from their fathers. Thus it appears that there is some form of a gendered transfer of land (see the section on access below). Whether or not the land remains in separate gendered pools or whether there is just a perception of economic transfer from mother to daughter and father to son was not determined by the researcher. At marriage it is customary for the couple to live with the family of the husband for one year prior to taking up the land that would likely

have been provided by the wife's family. This is in order to support the couple during their land's first growing season. As marriage often takes place across *bairros*, households can find themselves in control of land in more than one *bairro*

### **5.3 Cattle ownership and control**

Cattle are of great value, both as a source of cash and labour. Thus the rules which govern its transfer and ownership are of great interest.

Due to the war, during which time large amounts of cattle were killed or stolen, most individuals in the area have built up their own herds from scratch. However, cattle can be accumulated through inheritance. The building of a herd requires some form of investment; this appears to occur in two primary ways. Either people leave for the cities in order to work and generate enough money to buy some cattle from which they would breed an entire herd, or people receive some livestock as a gift. It appears that the most common way to build up a herd is to acquire a piglet, raise this piglet and sell it, generating enough money to buy some cattle.

A reasonable understanding of the manner in which valuable resources in the *bairro* are owned, acquired and transferred is not sufficient for understanding the manner in which wealth and degrees of livelihood sustainability are distributed amongst the *bairro*. It has been stated that resources are not common, ownership is recognised, and that wealth is unequal; thus it becomes important to understand the accompanying systems of exchange. Making sense of the rules and patterns of exchange will provide us with some insight into how resources are accessed, how access is constrained and what barriers exist to generating wealth and thus livelihood sustainability.

### **5.4 Bairro economics**

Given the inequalities in wealth described above and the reliance on subsistence agriculture in the area, it is quite possible that some individuals may be unable to sustain themselves. Further, the research showed that although not every household has access to cattle, there appears to be cash needs/wants throughout the village. Cash expenditures include: transport, clothing, soap, salt, school books, tax, party fees, medical expenses etc. As people without

cattle have little or no access to cash, individuals are often left with no choice but to engage in paid labour, with those individuals whose vast tracks of land and cattle give them access to cash.

Due to this, the livelihood strategy of many residents comprises of subsisting on their own crops when they can and after that, looking for work on other people's land, in order to acquire food and cash. Such work involves tending cattle, harvesting and sorting sorghum, ploughing, sowing and other related activities. These individuals cannot be seen as subsistence farmers, because although they are reliant on the subsistence economy, they are not themselves subsisting. This distinction may seem trivial; but such a shift in thinking is vital if we are to fully understand the manner in which risk is manifest at the level of the individual. It is also important when examining how changing social relations (resulting from the dam's construction and operation) are to impact upon the livelihoods of people in *bairros*

The poor in the *bairro* are reliant on the wealthy. This reliance is exacerbated in times of stress (such as during droughts or floods) when food becomes scarce, and only those with the most land can generate enough food. What is important to note here is that the wealthy do not simply hire the poor, regardless of whether they need their labour. Instead they only make use of that labour when they need it. Thus the notion of community and the common ownership of all the goods is inappropriate here. Instead, we need to think of a functioning capitalist economic system in which people attempt to generate and accumulate wealth, not distribute it amongst all the people. Thus although all members of the village are involved in subsistence farming at some stage in the year, many are also essentially casual farm labourers, reliant on a system of paid labour for much of the year.

#### 5.4.1 *The role of the family in redistributing wealth*

Above it is argued that the system of exchange at the community level in the *bairro* resembles a capitalist economic system of exchange more than it does a system of community networks and reciprocity. However, it would be simplistic to view the *bairros* as individuals competing for access to, and control of, resources with no means by which absolute gains from the land can be passed onto those with limited access to land, and no other mechanism for

redistribution - save for paid labour. The role of the household and extended family in the system of exchange sheds some light on the reality of the situation.

It appears that resources are shared freely between household and extended family members, representing an important risk management strategy. Cattle are lent for the purpose of breeding, land is lent to those who are in need, equipment is shared, skills are transferred and credit is often extended. There are also numerous other ways in which families and households pool their resources in order to make them a more sustainable unit. These include unpaid labour, urban remittances and 'political' protection to name a few. These processes of social redistribution within the household and among the extended family interfere with the free market type economics described previously. Thus a better way to understand the system of exchange may be to view households and extended families as competing for access and control of resources with other households and families. This competition between households may be enhanced by their geographic isolation from one another - a result of Mozambique's civilian conflict (see the section on 'Livelihood Strategies' in Section 4.2). This understanding of inter-family competition - as opposed to competition between individuals - is vital in understanding risk. Such competition gives rise to unique risks and risk management strategies through the generation of a type of class system, which is a strong determinant of vulnerability.

Thus far the vulnerability context has been detailed through a description of people's different livelihood strategies. It has described the manner in which vital resources for these livelihoods are acquired, owned and transferred. This provides information about the vulnerability at the sub-community level by examining the manner in which resource ownership and control is unequal throughout the settlement. This research has stated before that hard and fast rules for social conduct are themselves more the exception than they are the rule. It has also been mentioned that the society and its interactions are governed largely by norms and customs, with little connection to the formal institutions of the state. Thus our understanding of vulnerability in the *bairro* would be incomplete without knowledge of the systems and institutions which regulate the behaviour of the society and how they link to the formal structures of the state. Knowledge of these processes will tell us much in that those with power to change the 'rules' and rule on the 'rules' are less vulnerable than those who

can't. Such norms and customs are determined by what the society deems to be just, fair and correct. Thus knowledge of this system will provide us with some insight into vulnerability at the sub-household level - the level of the individual.

### **5.5 Systems of rule and justice – the role of ‘grey’ social control**

As the state's mechanisms for dealing with breaches in the law are often unavailable to those living in the *bairros*, and given that these mechanisms are reported to be largely inefficient, disputes in the village have to be dealt with internally. The following is a description of such processes.

Disputes in the village are dealt with in the following general<sup>5</sup> manner. Should a dispute arise in the village (such a dispute may pertain to compensation for crops eaten by another person's cattle, or trees being chopped down which were on land belonging to another person), a first attempt is made by the two parties concerned to come to some form of agreement. Should they be unable to resolve the issue they will approach the secretary of the *bairro*. The secretary will then act as a mediator and attempt to resolve the issue. Should the parties fail to agree on such a judgement or procedure, the secretary will either consult with or refer the issue to what can best be described as a form of justice tribunal or advisory board, usually comprising of elderly and/or respected members of the village. The research was unable to determine how this 'tribunal' was elected – it is thought to be up to the discretion of the *Secretario do Bairro* – however, it was found to contain both men and women and was representative of people from numerous wealth/wellbeing categories. This tribunal will then hear the case of both parties and rule on how it feels the issue should be addressed. If the complainants refuse to accept this ruling, the issue will be passed on, via the secretary, to the state. This is an undesirable outcome for the *Secretario do bairro* who is expected to deal with domestic problems internally. Thus, significant pressure will be placed on individuals to succumb to the ruling of the tribunal. There are exceptions to this procedure, and such exceptions would be cases such as murder, where the suspected perpetrator will bypass the local justice systems and be passed straight to the state authorities.

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<sup>5</sup> The term general is used here as, again it would be incorrect to view the processes as a set of hard and fast rules.

As the role of the secretary of the *bairro* is central to this system, it is worth elaborating on how such an individual is elected. The secretary of the *bairro* is elected by the people of the *bairro*. The secretary has two assistants, which he does not choose and who are nominated and voted on solely by the people of the *bairro*. The position of secretary is voluntary and the person receives no monetary compensation for their time and energy. It appears that people from the *bairro* can express their discontent with the secretary directly to the *regulu* (see Figure 2.1 for a description of Mozambique positions of leadership). It is not uncommon for assistants to the secretary to later become the secretary.

As it is the people from the *bairro* who make up the institutions for enforcing justice, the local notions of equity, fairness and right and wrong are the main tools for regulating the manner in which society is maintained.

Democracy is often seen as a vehicle for affecting justice and bringing about social change. Thus it is necessary at this point, in a discussion of the vulnerability context, to discuss the manner in which democracy is applied and understood in the *bairro*.

### **5.6 Power and a discussion of democracy in the *bairro***

Democracy is a complex ideal which can arguably be described as a system by which an individual's voice is heard and respected, allowing for a space in which individuals can affect the societies they live in via formal channels. Utopian as these ideals may seem, it would be simplistic to assume that such a system practically exists. A system by which democracy can operate is not easy to put in place and thus varying types of democracy can be said to exist.

It has been mentioned already that during the Renamo conflict, political intimidation was common and led to certain individuals attaining greater access to resources than others. The reports of such political intimidation were in some instances shocking and they have no doubt left a mark on people, even in this time of so-called democracy. Thus to view people as rational beings who will vote for an individual who will best represent their interests or value system may be very much misleading. It may also provide some explanation as to why an area in which the ruling party holds a strong majority can still be so neglected by the state.

Reports of political influence and intimidation came out in the research. The most blatant example of this was made apparent when people described their cash expenses. Many individuals stated that they had to pay a compulsory party fee. This sounded absurd and the researchers immediately probed the point enquiring as to how they were forced to pay party fees. Respondents replied by telling us that all the names of registered party members were made available to the public. Should you fail to pay your party fees, or even fail to attend party meetings, your failure would become public knowledge and you could find yourself excluded from social networks. Such exclusion could be exceptionally damaging in light of the economic system (described above) in which people are reliant on others (the wealthy) for employment, credit and thus sustenance. There were also reports of aid going only to party members as aid agencies often worked through local political institutions.

Such a form of democracy is not indicative of rational choice, and may represent more of a pledged or coerced allegiance to political structures.

This sort of democracy has far reaching implications for vulnerability. Firstly, it means that many people are removed from the position of determining or influencing their own development as they are unable to translate their knowledge of what they need into a political body which can meet that need. Secondly, it means that those most vulnerable, the poor, who are unable to pay their party fees stand only to be plunged further into poverty and vulnerability.

As it would be misleading to view risk only at the level of the community, it would again be misleading to stop our analysis at the level of the household. Certain individuals such as women, children and the elderly are more vulnerable and thus at greater risk than the rest of society. Their risk is different due to the different manner in which they interact with their physical environment, and due to the accepted rules and norms described above. The next section examines how issues of access influence the wealth, and thus risk, of such particularly vulnerable individuals.

## **5.7 Individuals at risk: women, children and the aged**

Women and children often form groups exposed to differential risk due to their socially enforced 'roles' (Moser 1993) and limited capacity (physical and, in the case of children, cognitive). Such roles often exclude them from cash-generating activities and thus limit their access to resources. As a result of this, women, children and the elderly access their resources through numerous social strategies. Reliance on such strategies often places them at greater risk, because not only are their resources an element at risk, but so too is their social network.

### **5.7.1 *Women and gender***

Literature has shown that women consistently comprise a population sub-group exposed to significantly greater risk due to the manner in which they relate, and are related to by their social and physical environments. While it was difficult, during the research, to attain hard and fast rules about the exact manner in which men and women are viewed and view themselves, there were characteristics which were revealed during the fieldwork which lend us some understanding of how women and men are perceived.

Despite the fact that women and men can both own land and cattle and that women can retain their land in the case of divorce or separation, experiences in the field still indicated that the terms upon which men and women interact are not equal. The first indication of this was the manner in which men and women interacted with the researchers. In meetings, women's participation was very much limited. Meetings were persistently dominated by men – this made the finding of women on the 'justice tribunal' all the more surprising. However, it is important to note that the women in the village were not the picture of a people trying to be heard and being excluded from the process. Rather, women appeared loath to participate even in the face of encouragement from both researchers and resident men. It appears that women's voices are not as valued as are men's, even by the women themselves. Such voicelessness stands to exacerbate vulnerability, as women's concerns are less likely to be heard. This is even more concerning in an environment which is regulated by local understandings of justice and equity. In such an environment, women's voicelessness removes from them the ability to alter the self-same understandings of justice and equity which undermine them in the first place.

Women's and men's roles in the village and household are also distinctly different and serve to provide us with further insight into the manner in which gender is manifest in the village. Reproductive work such as caring for the children, preparing and cooking food and fetching water is almost the sole responsibility of women whose voiclessness in community maintenance structures adds to their vulnerability. Men are dominant in community maintenance roles and both men and women are heavily involved in productive work such as working in the fields. However, women's assumed (and in fact obligatory) double burden of both 'reproductive' and 'productive' roles often precludes them from partaking in cash earning occupations and limits their access to decision-making structures.

The act of marriage is intimately linked to the institution of gender in the *bairro*. As marriage has been found to be central in the acquisition of land – which has been shown to be a most important factor in determining vulnerability – and since the household (of which marriage is a fundamental institution) has been shown to be an important means for redistributing wealth, marriage has a great bearing on how risk is manifest at the level of the household. The interactions between husband and wife, and the capacity in which both individuals enter into marriage says a lot about the manner in which risk is manifest at the sub-household level. For these reasons the norms and customs governing the institution will be elaborated upon below.

### 5.7.2 *Marriage*

Before discussing the act of marriage, it is important to be wary of reducing the act of getting married to a set of rational decisions, based on capitals and positive and negative feedbacks to the livelihood of an individual. Marriage represents more than simply the rational decision which will be represented below, for the act of marriage is bound up in a suite of human emotions which go well beyond the scope of this paper.

Men tend to enter into marriage at around age eighteen while women are married by around age sixteen. There is a custom of gift giving at the time of marriage, but this practice is not compulsory. The wife-to-be's family provides a gift of land to the couple, while the husband-to-be pays some form of Labolla to his fiancé's family.

Men and women appear to enter marriage for different reasons. It was reported that for women there is little other way to leave the household of her parents apart from the institution of marriage. Men, on the other hand, seem to get married in part for the status it provides them. On this point: polygamy is practiced in the *bairros* and the number of wives a man has is related to the number of wives he can support. This implies that the perceived role of the husband in a relationship appears to be that of provider. On this point, while polygamy is widely practiced, promiscuity amongst women is heavily frowned upon, and is an action that would very likely lead to social exclusion. As land is transferred during marriage, numerous marriages represent one way by which a man may increase his access to land - although he would not technically own that land. In polygamous marriages, the resources of each household are not shared between different wives.

It is important to note here that like most things in the village, the union of marriage is not a formal institution, enshrined in either law or church. Rather it is an agreement between a man and a women, where consensual sex is considered constitutive of marriage (on this point the concept of rape was acknowledged and understood, however the intricacies of what constitutes 'consensual' could not be determined (given the status of women's rights it is thought that coercion and bullying into sex, and thus marriage, could be a problem).

It has been mentioned before that wealth tends to travel along gendered lines (see the section on land) and thus men's ability to accumulate wealth due to their access to cash generating mechanisms (see below). As such, men are more likely to inherit greater quantities of resources from their fathers. An example of where this is applicable is when cattle is passed on through inheritance. As the purchase of cattle is likely to be a financial decision, cattle is likely to accrue to the male in the house, rather than the female for two reasons. The first is that should a family send a member to the city to earn money in order to purchase cattle, this is likely to be the man. The women's obligatory reproductive and productive role means that she will be more likely to be left to tend to the fields and family while her husband is in the city. She will likely tend her husband's land which will remain his possession for the duration he is away. However, the money earned in the city will be the man's and will be under his control upon his return to the *bairra*. Due to this, any cattle purchased with such money will become the property of the man. Should the man divorce

his wife, he will maintain his cattle and should he die, his cattle will likely be passed onto his son(s). Further, any sale of the cattle in his possession will generate cash that will become his, allowing him to purchase more cattle that will also belong to him. Added to this is the fact that men in the *bairro* tended to undervalue the reproductive role of women in the *bairro*. This has implications in situations such as divorce, during which men would consider their productive contribution to the household as being of greater importance than women's reproductive contribution.

It is important to note that women can own cattle and livestock. In wealthy households it is quite common for a wife to be given (by her husband) some livestock of her own. Such livestock is hers, to be sold, or mated at her own discretion and cannot be touched by her husband without her permission. This is, however, often the privilege of the very wealthy and represents little more than tokenism, in that the money allows women to purchase the luxuries that they desire.

Although the control of cash does appear to remain in the realm of men, women do have an element of decision-making power. This is due to the fact that reproductive activities form one of the largest cash needs in the household. This finding was made apparent when, in interviews, women tended to focus on the cost of reproductive materials such as clothing, soap and food, while men focussed more on community maintenance activities such as taxes and party fees. Thus the fact that reproductive activities are big cash consumers gives women a measure of decision-making power regarding how household cash is spent.

Albeit that women's control of reproductive labour allows them cash decisions, the notion that reproductive roles are the sole responsibility of women appears to be a leading cause of their constrained access to resources. At no time is this more pronounced than when women head households alone as a result of separation or divorce. During a separation or divorce women are almost always left with the children. This places an enormous burden on the new female-headed household, who now have one less labourer, and only a marginalised and isolated voice. Under such conditions household resources are often stretched to the point that a woman has to approach her parents in order to cope.

Single women have their access to resources even further curtailed as they often find that they are unable (should they be able to spare the time) to undertake the physical labour required to build a house and kraal – required to keep livestock. As livestock are primary cash generators, it appears that women’s obligatory reproductive role (the result of the gendering of roles from a very young age) reduces their access to cash-earning activities. Evidence of this appeared in that while young boys spent their time learning to fish, tending cattle and wielding an axe, young girls practiced washing clothes on a stone by the river and were left to help with household chores and tend to their siblings. On this point there did not appear to be any preference in sending either boys or girls to school. Decisions about which child to send to school appeared to be based more on financial status at the time that a child would attend school and the motivation of the child to attend school. It must be noted here that preconceived notions of girls’ and boys’ roles (productive vs. community maintenance) may influence a child’s motivation to attend or not attend school, thus possibly indirectly privileging boys in school attendance.

### *5.7.3 Children and the elderly*

Children and the elderly represent two very vulnerable groups in a society such as rural Tete. Both often lack the physical ability to subsist on their own, making them reliant on others. Such reliance makes them vulnerable as their risk profile is not only a function of their own well-being but also that of their carers - a situation that has special relevance in the context of HIV/AIDS.

Orphaned children, and children in general are also unlikely to have access to structures which allow their voices to be heard, and although orphans may gain access to land and livestock through inheritance, they are less likely (than an adult) to have either the physical ability or technical knowledge to use such resources in a sustainable manner.

The elderly do have access to community maintenance structures and often their voices are highly valued - evidence of this was found in the make-up of the ‘justice tribunal’ described above. However, more and more so the elderly are experiencing feelings of isolation due processes of modernisation which they consider to be eroding social values, thereby lessening the role and influence elderly people have in society.

Not surprisingly, orphaned children and isolated elderly people are most vulnerable. Both are highly susceptible to disease and are less likely to be able to ensure their own food security. Ironically, these two vulnerable groups tend to be linked to one another as elderly people are often left to care for orphaned children.

From the above it is quite apparent that the vulnerability and thus risk of individuals varies across the *bairros*. Numerous factors act to increase this vulnerability and certain combinations of such factors (such as disability) can result in cases of extreme vulnerability.

## **Chapter 6: The impact of large dams: contextualising Cahora Bassa**

The following chapter details how dams interact with the complex riverine environment, and specifically how the construction and operation of Cahora Bassa has already impacted on both the people of the two *bairros* and those individuals living further downstream. This chapter has been included to provide some physical explanation of the mechanisms by which large dams impact on river ecology. It has also been included in order to add to the already documented, rich context of the study as it appreciates that the people of the Zambezi are already dam-affected. In order to fully generate such a context, this chapter also discusses some of the implications of climate change and seismic shocks for the area.

This chapter contains the following:

- A brief discussion of river dynamics and the manner in which dams change these and thus the ecology of the entire river.
- A consolidated report of the numerous studies which document the impact that Cahorra Bassa has already had on the Zambezi River.
- A discussion of dam safety regarding earthquake stress and overtopping. The latter of these two is discussed in the context of a changing climate.

### **6.1 How dams impact on the environment**

All parts of a river ecosystem are interconnected. Thus, a disturbance in one part will create a greater or lesser response over much of the system (Basson 2004). Dams alter the rivers on which they are built via two primary disturbances: (i) changes in the sediment load as a result of sediment capture in the reservoir and (ii) changes in the flow regime as a result of flood attenuation. These characteristics are the main determinants of the down-stream ecology of the river, and are thus the cause and impacts of both will be discussed below.

#### ***(i) Sediment capture***

Sediment is vitally important to healthy productive ecosystems. It serves numerous purposes ranging from nourishing organisms at the base of the food chain, to fertilising the land on which it is deposited. A river's capacity to carry sediment is a function of the flow rate of the river. So when a river enters a large, slow-moving reservoir (the sea, a reservoir, a lake etc.)

the water slows down, thus reducing its ability to transport sediment. That sediment is then deposited in the reservoir, effectively reducing both the sediment load of the river and the volume of the reservoir. Upon leaving the reservoir, the low-sediment-load-water's velocity increases, giving the water very high erosive capabilities. This results in extensive vertical and horizontal erosion of the stream channel immediately downstream of the dam wall.

*(ii) Flood attenuation:*

The defining feature of most rivers' ecology is the flow regime (the different amounts of water found in a river at different times of year). Hydro-electric dams alter the flow regime of a river in the following way: as dam levels need to be kept full in order to maximise power generation, dam managers release water at the end of the dry season so that they have storage capacity for catching the wet season high flow. This prevents the wet season high flow from occurring downstream and instead releases unexpected and inappropriate smaller floods towards the end of the dry season. This has numerous impacts on the ecosystem downstream as it essentially creates river flow which fluctuates both at unusual times and to a far lesser degree than it would under pre-impoundment conditions.

The changed flow regime then impacts the river in the following fashion:

- With reduced flooding and sediment, land downstream becomes less fertile as the rich alluvial sediments are not deposited on the banks as they would be during flood events.
- Many fish species spawn in response to flood events. The removal of these events can reduce fish spawning activities, while a change in the timing of such events can have dramatic impacts on the survival rates of juveniles.
- Some fish species are also reliant on the shallow waters of the flood plain in order to breed. A reduction in flood events means that the flood plain will be flooded less often and thus fish species (often those in the lower reaches of the food chain) will become less successful breeders.
- An unimpounded river deposits sediments in the delta where the river gradient, and thus flow speed decreases. This sediment forms mobile sand bars and river channels which are washed out by the larger flooding events. The removal of these flooding

events serves to generate increased deposition downstream which in turn stabilizes once dynamic wetland/estuary zones.

- Coastal fisheries can be reliant on wet season high flows to facilitate spawning and growth cycles at river mouths. A reduction in flood events reduces the productivity of coastal fisheries.
- The lack of flooding means that permanent human settlements tend to encroach on the river. Flooding no longer appears to pose a threat and water levels have decreased (making the journey from high-lying areas to water sources more arduous). When large floods (those of a magnitude which exceed the storage capacity of the dam) inevitably occur, the consequences of changed settlement patterns can be disastrous, as people's 'flood memory' has been lost.

<b>Flow component</b>	<b>Importance</b>
Low flows	The low flows are the daily flows that occur outside of high-flow peaks. They define the basic seasonality of the river: its dry and wet seasons, and degree of perenniality. The different magnitudes of low-flow in the dry and wet seasons create more or less wetted habitat and different hydraulic and water-quality conditions, which directly influence the balance of species at any time of the year.
Small floods	Small floods are usually of great ecological importance in semi-arid areas in the dry season. They stimulate spawning in fish, flush out poor-quality water, mobilise smaller sediments and contribute to flow variability. They re-set a wide spectrum of conditions in the river, triggering and synchronising activities as varied as upstream migrations of fish and germination of riparian seedlings.
Large floods	Large floods trigger many of the same responses as the small ones, but additionally provide scouring flows that influence the form of the channel. They mobilise coarse sediments, and deposit silt, nutrients, eggs and seeds on floodplains. They inundate backwaters and secondary channels, and trigger bursts of growth in many species. They re-charge soil moisture levels in the banks, inundate floodplains, and scour estuaries thereby maintaining links with the sea.
Flow variability	Fluctuating discharges constantly change conditions through each day and season, creating mosaics of areas inundated and exposed for different lengths of time. The resulting physical heterogeneity determines the local distribution of species: higher physical diversity enhances biodiversity.

**Table 6.1** Different kinds of river flow, and their importance for a healthy river (King 2002).

## 6.2 A changed flow regime: Cahorra Bassa

As the Zambezi is described by Jackson (1986) as a 'sandbank river' with pronounced flood (January-April) and dry season (June-October) flows, dam construction (and the accompanying flood attenuation) has significantly altered the ecology of the river downstream of the dam wall(s). As formal documentation of these changes is not readily available and there is no study detailing the pre- and post- impoundment sediment loads of the river, this section of this report draws largely on the life and oral history interviews from the fieldwork, and on Issacman and Sneddon's (2002) work.

Respondents claimed that the physical state of the river has changed drastically since the impoundment of Cahorra Bassa – an event marked by a virtual drying up of the river downstream of the dam as the reservoir was filled in just one season (Isacman 2002). Respondents reported a significant reduction in the fertility of the soil, the following quote – made with reference to the land at the top of the river bank – describes this:

“We used to just have to drop a seed in to the soil here and it would grow into a tree, now look...nothing will grow here.” - Manuel Escudo<sup>6</sup>

Isacman also makes reference to this reduced fertility, which one of his respondents refers to as the “rich dark *makande* soils of the floodplains”. Another respondent remarks “...[the *makande* land located near the banks of the river always gave us good production” (Isacman 2002:8-9). These *makande* soils have been lost since the construction of Cahorra Bassa and it is hypothesised that this reduction in fertility is attributable, in part, to sediment capture in the reservoir, but more so to flood attenuation. This is thought to be the case as respondents claimed that years in which they experienced (what have now become relatively rare) floods were always followed by remarkably productive years. This is expressed in the following quote which was made in response to a question regarding problems of food insecurity following a flood event:

“You should have seen it... (laughing) everything grew here that year...bananas, sugar cane...” - Dino Marco<sup>7</sup>

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<sup>6</sup> Names have been changed to protect anonymity

<sup>7</sup> Names have been changed to protect anonymity.

Such a reduction in fertility has significantly impacted upon the drought situation in the area, where even in times of 'normal' rainfall the stresses induced by agricultural drought have been experienced. The impacts of meteorological drought have thus been exacerbated in this context. Under such conditions of reduced fertility, the impact of a changing climate is expected to be increased substantially (see section 6.3.1).

This reduction in fertility has been accompanied by significant erosion and degradation of the riverbank downstream of the dam wall. Respondents from the field sites and those living further down the river (as far as Tete) claimed that the banks of the river have been severely degraded (see Figure 6.1).



**Figure 6.1** Showing erosion of the stream channel downstream of Cahorra Bassa



**Figure 6.2** Showing vegetables being grown down on the river bed (in the *baixa*)— a response to increased erosion and reduced fertility

This is thought to be a result of the combined effects of increased erosive capabilities of the river (due to sediment capture) and the less vegetated banks as a result of reduced fertility of the surrounding soils. The consequence of such erosion is that people have been forced to move their vegetable gardens down into the river bed in what is locally called the *baixa* (see figure

6.2). This has generated stresses associated with hydrological drought as access to water has been reduced. Such impacts have been furthered by the reduced flooding which acts to replenish well supply points located on the flood plain (Personal communication: Richard Belfius).

Fish catches are reported to have declined in the river channel. It is unclear if, in the area upstream of Tete, this can be attributed to Cahorra Bassa as people only reported a

reduction in fishing from around 1997. Thus, this is not likely to be attributable to the dam unless there has been some unknown change in management, or some delayed effect. Further downstream, however, coastal fisheries have experienced a 60% decline in prawn catch rates for the period 1978 – 1995. This correlates directly with the decreasing runoff to the offshore Sofala Bank from the Zambezi (Hoguane 1997). Disruption of the main channel in the delta (see below) has had severe consequences for subsistence fishing.

The effects of flood attenuation have impacted heavily on the Zambezi Delta, where the morphological responses to flow regulation and the subsequent reductions in sediment loads have resulted in marked reductions in the magnitude and frequency of floodplain inundations. This has resulted in a dominance of one main channel, whereas previously there were several active channels (Basson 2004). Further, many secondary channels have become isolated from the main channel due to the silting of entrance points. All this has led to widespread encroachment by woody savanna onto the herbaceous floodplain which has choked meander trains and oxbows. Accompanying such encroachment has been the invasion of alien plants, *Azolla* and *Eichhornia* (ibid.). Bird and mammal life is now virtually non-existent compared to the 1970's – the once enormous populations of Cape buffalo, (over 70 000 head) have virtually disappeared. But although altered flooding and sediment depletion could be cited for the loss of wildlife, enhanced human access (as a result of wetland stabilization), the civil war, and poaching are more likely causes (ibid.). This disruption of the main channel has resulted in severe consequences for local, subsistence fisheries and avifauna. Aerial surveys indicated a 40% loss of mangrove while coastal erosion was also obvious (ibid.). In total the delta has decreased in size from a width of 600 km to only 150 km since construction of Cahora Bassa Dam (ibid.).

The change in the flow regime of the river has altered the river ecology, which has indirectly impacted on the livelihoods of those individuals who depend on the river for their subsistence. The effects of the dam's construction and subsequent (mis)management has impacted people directly by changing the flood risk to which they are exposed. As stated above, when the dam's capacity to absorb floods is inevitably exceeded, the magnitude of flood impacts is significantly increased as permanent human settlements have encroached on the flood plain. Unscheduled and un-communicated releases from the dam also serve to

flood out peoples' vegetable gardens that are more at risk as they have now been forced down onto the river bed. Such 'small scale' flooding events can have dramatic impacts on the food security situation in the river, as they often take place late in the dry season, when food stocks are almost at their lowest.

As a result of these impacts which are described as being "little short of catastrophic" (Basson 2004:10), there has been a push from leading scientists to change the management of Cahora Bassa so as to mimic the natural flooding regime by releasing appropriate amounts of water at appropriate times of the year. Studies have shown this to be both beneficial and feasible without requiring too great a reduction in power output from Cahora Bassa (Beilfuss 2005). This work, although promising, still requires a great deal more research regarding the following:

- The manner in which inhabitants of now permanent settlements in the flood plain would be informed of, and respond to, another change in flow regime.
- The manner in which the changed flows will impact on the stream channel, given that these flows would now be without sediment and thus highly erosive, especially at flood velocities (Personal communication: Brian Davies).
- Whether or not the proposed flood volumes would be sufficient to breach the now degraded stream channel and thus flood the surrounding flood plain (Personal communication: Paul Funston).

It is important to note here that as promising as this work is, such a change in river flow would be occurring in the face of thirty years of altered ecosystem activity. Such abrupt change could impact significantly on the livelihoods of individuals living downstream.

### **6.3 Dam Safety**

The primary concerns regarding dam safety pertains to two events: (i) dam wall failure – attributable primarily to seismic activity and (ii) dam over-topping (when flood waters exceed the reservoir's storage capacity and water runs over the dam wall – this in itself can also cause dam wall failure). As such this section on dam safety pertains to both existing and future dams on the Zambezi. For this reason this section will discuss the seismic activity in the area and the monitoring thereof. The discussion of the actual seismic risk attributable to The Mphanda Nkuwa Dam will be covered in Chapter 8 as part of the

discussion of risks associated with dam operation. The risk of dam over-topping will be discussed with reference to both climate change and the structural integrity of existing dams in the area.

### ***6.3.1 Dam failure and seismic risk:***

Dam failure on any of the dams (Kariba, Cahorra Bassa and potentially Mphanda Nkuwa) on the Zambezi would be catastrophic, given the number and nature of human settlements located downstream which include: the large cities of Tete and Quilimane, smaller cities such as Marromeu and Mutarare, as well as the large numbers of subsistence farmers living in isolated homesteads.

Mozambique is located in a reasonably active seismic zone as it is in the vicinity of The Nubia-Somalia Boundary. Further, the country as a whole also straddles the highly active fault zone of the Shire Trough which runs southward down the country from the southern point of Malawi almost all the way to Maputo. Despite knowledge of the fact that Mozambique is in a seismically active zone which frequently experiences earthquakes, poor record-keeping in the area has made prediction of potentially large earthquakes exceptionally problematic. This in turn makes providing appropriate building specifications for future dams impossible and also generates concern over existing dams whose construction must have been based on very poor data.

Further, there is concern that the area is actually undergoing an increase in seismic activity. Such activity has the potential to load stress on surrounding plates which could generate very large earthquakes (Personal communication: Chris Hartnady). Of still greater concern here is the fact that the team charged with undertaking the EIA for Mphanda Nkuwa were unable to obtain seismic data for the area from the seismic stations located at Cahorra Bassa. This, they were told, was because no such stations were operational. This is concerning as it is in breach of international safety regulations pertaining to the operation of large dams.

Given the concerns relating to dam wall failure, there is also concern surrounding dam over-topping. This is obviously related to potential dam wall failure upstream, but is also becoming a real threat a result of a changing climate.

### *6.3.2 Climate change*

Although climate change has been introduced in a discussion of dam safety, it also warrants discussion in the examination of the long-term risks associated with the construction of a large dam. This is because the impacts associated with the dam (reductions in fertility, possible implications for HIV (see sections 7.1.3 & 8.2.1) etc) are likely to be exacerbated under the conditions of a changing climate.

Generally, climate models predict an increase in extreme events to accompany an increase in the global mean temperature. This is likely to mean an increase in the frequency of both extreme rainfall and drought events. It is also quite possible that a changed climate would result in changed onset times for the rainy season. These general shifts could have large impacts for both the dam and people living in the vicinity of the dam. Increased droughts and increased extreme rainfall events could very well result in changes in catchment erosion and thus the sediment loads in the river – which in turn could have impacts for the life expectancy of the dam. Thus increased extreme rainfall events may place the dam under structural pressures, while a more varied and volatile climate will at the same time erode and undermine existing livelihood strategies.

It is also worth noting that changes in the frequency and intensity of extreme weather events is likely to compromise water security and reduce the agricultural capacity of land upon which people are currently subsisting. Chapter 7 details the manner in which shocks and stresses interact to generate livelihood insecurity and when reading the subsequent chapter, it is imperative to keep in mind the cumulative impacts of increased climate stress when reading about the manner in which dam construction may further stress local livelihoods.

## **Chapter 7: Priority threats and common responses**

This chapter details the priority threats to which the people of the Zambezi consider themselves to be exposed. It has been included as it compliments chapter 5 by examining livelihoods as dynamic processes of response. This is achieved by examining each hazard as well as the manner in which threats to individual livelihoods impact upon the local population, and the strategies employed either in response to or in preparation for such threats. The chapter has also taken an holistic approach by discussing the manner in which threats interact (as opposed to viewing them in simple isolation) to generate food and, more generally, livelihood insecurity.

This chapter includes the following sections:

- Motivations for examining the manner in which people respond to threats to their livelihood security.
- A threat ranking and discussion of the manner in which these threats impact upon the local population as well as response and mitigation strategies to these threats.
- An examination of the manner in which food security generates risk and common responses to food insecurity.
- A discussion of the manner in which food insecurity, water quality and peoples' health interact to generate vulnerability.

### **7.1 Threats to livelihood security and associated responses:**

People live with threats to their livelihood on a daily basis. Some take the form of prolonged low-impact stresses, while others act rapidly to shock and devastate livelihoods. Both shocks and stresses interact to constrain development. Due to the day-to-day nature of the threats which retard peoples' ability to 'develop', an appreciation of the manner in which people manage, and are constrained in their management of, risk to such threats is vitally important. Regarding dam construction, it is important to understand that these dynamic responses are as integral a part of livelihood security as the often-studied asset base. Thus, determining the manner in which dam construction and operation may impact on risk management strategies is as important as understanding the manner in which the dam will impact upon their asset

base. Finally, an understanding of how livelihoods currently respond to stresses will tell us much about how they might respond to stresses induced by the construction and operation of the dam. This chapter aims to provide an account of the threats to livelihood security and the manner in which they interact both with one another and with the surrounding community.

From the exercise in which the communities ranked their priority threats to their livelihood security, the following rankings were attained:

***Bairro 1***

- (i) Drought
- (ii) Crocodiles
- (iii) Health
- (iv) Hippopotami
- (v) Flooding
- (vi) Pests
- (vii) Snakes

***Bairro 2***

- (x) Drought
- (xi) Crocodiles
- (xii) Flooding
- (xiii) Health
- (xiv) Pests
- (xv) Hippopotami
- (xvi) Wind
- (xvii) Cattle sickness
- (xviii) Baboons

There are many similarities between both lists and thus the priority hazards/disasters from the areas will be discussed below.

***7.1.1 Drought:***

Drought represents a conceptually complex disaster, in that drought itself is not a hazard, nor is it a disaster. Rather, drought is a climatic state that generates an emergency when a lack of rainfall results in failed food crops. Drought is also complex as it is not easily definable. Most climatologists would define drought as a period of significantly below average rainfall. Such a description is appropriate, but it is also exceptionally problematic as it begs the questions: what is 'average' and what is to be considered a significant deviation from average? Further, it focuses on rainfall and not food production. These issues can be overcome, by deciding on standard measures of normal etc., but a more dynamic approach is to define drought from a human perspective as a period during which rainfall is not sufficient to sustain local staple crops. From a disaster risk standpoint, the second definition is probably much more useful - however it too has numerous implications. These include the fact that changing human circumstances (poor farming techniques, the planting of

inappropriate crops, anthropogenic environmental degradation) can serve to make 'normal/average' climatic conditions drought conditions, as food crops either fail or are not sufficient.

Regardless of these complexities, drought is a grave concern for the people of the lower Zambezi River. Drought is thought to be one of the most destructive threats. It impacts on food security, which in turn contributes substantially to human vulnerability in a number of ways. Due to the nature and common occurrence of drought, the people of the *bairro* have generated a suit of responses to the event. The main responses include:



**Figure 7.1** showing temporary shelters that have been built on the flood plain

- Foraging in the bush for wild fruits and hunting game.
- At times when/where food aid is available, people access this as a means for sustaining themselves during the drought<sup>8</sup>.

Given the recurrent nature of drought and under what are viewed locally as changing

- The construction of temporary shelters close to the river (well below the flood plain). These allow people to tend, and guard (see below) their vegetable gardens which are irrigated using the water from the river (see figure 7.1).
- Selling cattle in order to generate cash for purchasing staples and other goods which would have been purchased with cash made from selling staples.



**Figure 7.2** Showing extensive maize crops being grown on the riverbed in place of vegetables

<sup>8</sup> At the time of writing; World Vision, who provide and coordinate food aid to the area, were only able to feed their 'at risk populations' (the elderly, the young and the sick) as pressure on resources and prolonged drought had already eaten into budgets allocated for development and not aid.

climatic conditions, some activities have been undertaken which could be considered as drought mitigation strategies. These include:

- Ø Changing patterns of cultivation – this includes strategies like shifting from large area, low labour, low yield crops such as sorghum to small area, labour intensive, high yield crops such as maize. This strategy is most apparent as people start to grow maize in their vegetable gardens at the expense of planting in the upland fields (see figure 7.2).
  
- Ø Extending the planting period to mitigate against variations in the onset of the rainy season by ploughing a certain section of field and then planting that section, before ploughing and planting the next section. It is hypothesised that this staggered planting strategy would serve to mitigate against crop failure as a result of variations in the onset of the rainfall. It must be noted that people of the *bairro* were unaware that this might be a drought mitigation strategy and in fact could not provide an explanation for such a practice, stating simply that this is the manner in which they plant their fields.

### 7.1.2 Crocodiles:

Crocodiles were rated, by both *bairros*, as the second-gravest threat to livelihood security. Crocodiles present a threat in that they are both aggressive and capable of killing humans and livestock. They also damage fishing nets and pose a threat to women collecting water, washing clothes and fishing with their *capolanas*. Crocodile attacks are thought to be more of a problem for humans during the wet season, as water is murkier and crocodiles are thus harder to spot. However, livestock are more susceptible during the dry season as they roam freely and are unsupervised when drinking from the river (see section 4.2.2). Cattle are thought to be more susceptible to crocodile attacks than goats, as they have a tendency to wade deeper into the water in order to drink.

The high ranking of crocodiles as a threat is of interest, in that in spite of the fact that they claim relatively few lives, they rank second in terms of the communities' perception of threats to livelihood security. This may have to do with the fact that peoples' perceptions of risk are not always reflective of rational self-interest. However, people also justified ranking

crocodiles above larger killers (like ill-health), as ill-health tends to affect primarily the elderly, the young and the sick. The loss of this community sub-group is not considered to be as devastating as the loss of an established adult in a crocodile attack. This was explained as people stated that young babies have not yet established friendships in the community, and people are mentally prepared for the loss of the elderly and the sick.. The loss of an established adult, on the other hand, was reported to devastate the community<sup>9</sup>. Thus, it appears that part of the surprisingly high ranking of crocodiles as a threat is explained by the manner in which crocodiles have the capacity to generate stress and deplete valuable social capital.

Despite being ranked equally, crocodiles were considered a significantly greater threat in the second *bairro*, due to the shape of the river channel which was very deep with steep sides. This, according to the respondents, not only facilitated the crocodiles' attack strategy, but also provided them with a more suitable habitat. As a result of this, people in the second of the two *bairros* have established much more sophisticated means for mitigating the threat of crocodile attacks. The following measures are taken as a means for preventing crocodile attacks:

- The creation of fenced areas to act as safe places to wash clothing and collect water (see figure 7.3)

§ This practice was not widespread and although one or two examples of it were found, people were also observed to be washing, unprotected, in the river.



**Figure 7.3** Showing a section of river fenced to protect from crocodile attacks

- Should people be undertaking a quiet activity – such as swimming – people throw stones into the water prior to swimming. Should there be a crocodile in the water it will stir in response to the stones. In this instance, people will postpone their swim. Should people be undertaking a more noisy activity – such

<sup>9</sup> Such an event last occurred in 2004

as washing – they will go to the water in groups in the hope that the mass of people would be able to scare off the crocodile in the event of an attack.

- § People only undertake acts of washing and swimming in areas that they deem to be safe from crocodile attacks.
- Killing the crocodile by either:
  - § Calling the authorities, who respond by sending a hunter to kill the crocodile [People expressed frustration with this approach as the authorities don't always send someone and when they do, the hunter is not always successful in killing the crocodile].
  - § In the second *bairro*, people also 'booby-trapped' dead goats. This was achieved by placing a spiked wooden cross inside a dead goat, which is left by the river. The crocodile then attacks the goat and chokes on the wood.
  - § In the second *bairro*, people do not wash in the river. Rather, they fetch a bucket of water from the river and bucket-shower up on the banks. Further, as children often assist with chores such as washing and fetching water, they are taught from a young age about the dangers posed by crocodiles.

### **7.1.3 Health:**

Ill-health is a major concern to the people of the Zambezi, as it acts in numerous ways to decrease livelihood sustainability. These include inducing stress and causing hardship while at the same time reducing available labour (permanently in the case of a death) and disposable income. Due to the remote nature of the area, costs involved with formal medical treatment are high and thus most people rely on traditional healers as a diagnostic point of call. In many instances, the remote nature of the area and limited access to cash makes treatment simply impossible. The people of the *bairros* prioritised the following diseases and symptoms<sup>10</sup>:

- § **Malaria** is considered the most problematic disease, and was observed to be rife in the area. It is highly problematic as most people cannot afford mosquito nets and the pesticides available in the *bairro* are simply not sufficient to wipe out the mosquitoes.

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<sup>10</sup> People often misdiagnose themselves and perceptions of illness have been shown, by Mull and Mull (2004) to, often, be very different from their biomedical concepts.

Malaria was reported to be worst in the dry season. This strange finding is possibly attributable to changes in behaviour (see the section on hippos below) and the manner in which the rainy season acts to flush pools of stagnant water. The only action people take to combat malaria is to use a limited number of Mosquito nets (their price precludes their widespread use) and to attempt to limit what they consider to be the breeding places for mosquitoes. Unfortunately, these are not considered to be stagnant pools of water, but rather rubbish tips. A significant complication regarding malaria was that mothers with new-born babies are not able to travel the long distances to medical facilities with their babies - and at the same time, are not able to leave their babies unattended. As such, the implication of a young mother catching malaria is that either the mother or the child dies as a result of the disease. Thus malaria may result in the death of an individual, in this case a child, even though they had not actually contracted the disease. This no doubt adds to the already significant underreporting of deaths attributable to malaria.

§ **Cholera/Diarrhoea** is largely a problem of unsafe drinking water and for this reason is most problematic during the rainy season, when contaminants are thought to get washed into the river. Individuals living away from the river are exposed to a greater health risk, as their access to potable water is limited to hand-dug well points. The water from these wells is thought to be less safe than water from the river. The practice of boiling drinking water is limited to times when cholera/diarrhoea is known to be rife. This is due to limited firewood resources and the additional labour associated with boiling water. People were aware of the twenty-four hour<sup>11</sup> extent of cholera and knew how to treat it - but most attested to the fact that someone suffering from cholera was likely to die. Mitigatory measures include: maintaining hygiene through practices such as washing hands and cooking utensils as well as filtering drinking water through *capolanas* in an attempt to remove particulates.

§ **Child birth** is considered a danger for women, as there are few facilities and little expertise for dealing with complications at birth. There are people in the area who have skills as midwives, but should complications arise, women are usually rushed – six hours – by canoe to the nearest mission station at Borroma.

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<sup>11</sup> If a patient with cholera is able to survive for twenty-four hours with the disease, chances of survival are significantly increased

§ **HIV/AIDS** was not mentioned by the community as a priority, but is worth mentioning due to its topical nature, impact on livelihoods and relevance to impacts discussed later in the report. It is also worth mentioning at this point as Tete Province has the highest reported rate of HIV in Mozambique. There was some awareness of HIV/AIDS as a result of health/awareness groups moving through the area, however there were no reports of precautionary measures - save for not sharing blades while administering traditional medicines and remaining faithful to sexual partners - but urban migration and a polygamous culture complicate this. People were aware of testing, however the stigma attached to HIV meant people were hesitant to be tested themselves as they thought a positive test would make their lives worthless - they would simply rather not know. As such, people were loath to encourage testing as they thought people who tested positive would try and infect others as an act of anger. There was no knowledge of anti-retrovirals.

It is important at this point to realise, as with the malaria-child birth complication, that ill-health interacts with numerous other environmental and societal factors to threaten livelihood security and as such the above impacts should not be viewed in isolation.

#### ***7.1.4 Flooding***

The destructive nature of Flooding on the Zambezi is mitigated by the fact that the river is perennial, thus the impacts of events such a flash flooding are reduced. As a result, it was reported that few people die as a direct result of flooding. Despite this, flooding is an extremely destructive event with the capacity to destroy crops and houses. People also reported that flooding causes sickness and often encourages pests which further threaten food security.

People have few means for mitigating flooding, and there is a very poor (if any) early warning system in place. The only facet of early warning was through people receiving radio broadcasts regarding water releases from Kariba – which usually precedes water releases from Cahora Bassa. Unfortunately, upon receiving the warning, people only informed their friends and family and did not necessarily disseminate the information to those individuals in the *bairro* without access to a radio. Thus, in the event of a flood, people's only response is to harvest what they can from their vegetable gardens - should the water rise slowly enough.

### *7.1.5 Hippopotami*

Hippopotamus's, in spite of much literature, are viewed locally as reasonably docile creatures which will not attack humans unless cornered and threatened. In fact, the threat posed by the hippopotamus pertains to food security more than it does to physical injury, as a result of their ability to destroy vegetable gardens. The only other hazard that the hippos pose is to fishermen and people commuting on the river, as the hippos can capsize boats. Since vegetable gardens form a vital component of the drought-time livelihood strategy, hippos pose one of the greatest threats to livelihood security. As a result of this people expend a great deal of energy mitigating against hippos. The primary defence is to guard the vegetable gardens through the night. If a hippo is heard or spotted, people on the bank bang pots and pans together or light fires in an attempt to scare the hippos away. Other more inventive means for scaring hippos are to use slingshots or connect cans and plastic bottles to a piece of rope strung through the vegetable garden. The rope is then tugged, which rattles the cans and bottles, scaring away the hippo. The only precaution people take towards preventing hippos capsizing boats is that they do not cross the river at night (when hippos are most active).

The threat posed by hippos is greater during the dry season, as people are forced to farm on the river bed, which increases the exposure of their gardens to hippopotamus's. In order to protect these gardens, people construct temporary shelters on the river bed. It is thought that this could increase their malaria risk which is reported to be greater in the dry season than the wet season (see section on malaria above) (see Figure 7.4).



**Figure 7.4** Showing a temporary house constructed to defend against Hippo damage. Note the close proximity to standing water

*7.1.6 The remaining threats to livelihood security are not nearly as problematic as the ones already mentioned and thus will only be discussed in brief:*

- **Pests** occur late in the rainy season and are considered a real concern. However they are addressed in a somewhat resigned manner, as people feel that it is simply a matter of luck as to whether or not they will be impacted by pests. People take no precautions in protecting their crops, save for using small amounts of Baygone in their Sorghum and Millet stores to deter mice and rats. They state that pests were not always such a problem as harvests were better. People reported that they were aware of plants that could be grown and used as pesticides, however they felt that they would not be able to grow them in the current climate. Pests represent a direct threat to food security as they have the potential to wipe out people's crops. The effects of pests are reported to be felt locally, with some people in the *bairro* being heavily affected and others not. These pests are likely to refer to caterpillars etc., not swarms of locusts.
- **Wind** presents a problem early in the harvest season (February) as it serves to damage growing crops. The strong winds which blow between June and September can also cause problems for people crossing the river by capsizing their boats. People take no precautions to mitigate against wind damage/loss.
- **Cattle sickness** poses a threat to people's assets and there are no locally available strategies for addressing this threat. Thus people appeal to the authorities to send vets. There is also a non-functional dip tank located in the vicinity but this is reported to have been out of use for the past thirty or so years.
- **Baboons** are more of a problem in the second, more mountainous, of the *bairros*. Baboons pose a threat in that they pillage from people's vegetable gardens. Problems with baboons are exacerbated during periods of drought as a reduced availability of wild foods forces them from the mountains in search of sustenance. People take similar measures to protecting the gardens from baboons as they do hippos.
- **Snakes** are considered a real danger in that a snake bite in such a remote location could very well kill a person. However, snakes are not thought to be aggressive and one is considered very unlucky if by accident one stands on a snake and gets bitten.

The only precaution people take towards snakes is to kill the snake should the opportunity arise. However, very poisonous snakes are largely just avoided.

## **7.2 Focus on food security**

Due to the rural nature of the research and the reliance of the *bairros* on the subsistence economy, a discussion of food security is of paramount importance. This is due to the fact that many hazards interact to threaten food security. Focussing on the response and mitigation strategies to each hazard may simplify the manner in which people respond to impending hunger - which is the result of numerous shocks and stresses.

As the growing season does not last all year, households are in the habit of storing food. Vegetables are dried and stored while the staples are stored in small mud-covered silos. There is some form of refrigeration in the village and people use this to store meat for short periods. Refrigeration is achieved by placing sand and water in a porous clay pot. In times of good harvest the community<sup>12</sup> will store more than it needs for a season. Food insecurity becomes an issue when households realise that they do not have enough food to last them until the next harvest. The food insecurity problem thus becomes chronic when the entire village's resources are not sufficient to meet the consumptive needs of the entire village. In this case, systems such as informal farm labour are not sufficient to redistribute the unequal gains attributable to unequal land ownership. This last scenario is unlikely to occur as the wealthy will shore up their food supplies as a pre-emptive measure for the impending hunger. Thus there may well be a situation where the (relatively) poor are starving and the (relatively) wealthy still have access to food. It must be borne in mind that households have to hold over enough seed to replant in the next season. Such a calculation can be difficult as people start digging into this store in order to meet immediate food needs.

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<sup>12</sup> The term community is used here, as an individual may not have enough land to sustain them for an entire season. These individuals would then never, even with a good harvest, be able to sustain themselves for an entire season. Under such circumstances, these individuals would easily find enough employment which would pay for their consumptive needs. Thus the total land for the village would cover the entire village's (communities) consumptive needs.

It is difficult to try and determine the order in which households<sup>13</sup> change their strategies to adjust for impending food insecurity, as households in different well-being categories will make different decisions based on their access to, and control of, resources. One cannot differentiate households into neat quanta of well-being - rather, well-being is better conceived of as a continuum from (relatively) wealthy to (relatively) poor. Common responses to impending food insecurity can however be observed in that it is common for households with access to cash to first start trying to conserve those cash reserves or exploit their cash-generating opportunities. For households with no access to cash, changing the manner in which resources are consumed is the primary response to food insecurity. The former strategy involves actions such as selling cattle or changing patterns of cash expenditure, while the latter strategy includes changing eating habits (going from three to two meals a day) or foraging for wild foods.

Strategies for mitigating food insecurity are reasonably sophisticated and include some surprisingly complex insurance practices. Regarding vegetable gardens on the river bed, it was reported that an owner had to have enough money stored to buy food, as in one night a hippo or unscheduled release from Cahorra Bassa could wipe out an entire crop. Thus, only individuals with money saved up could afford to invest in a river bed vegetable garden. A similar strategy for sharing risk and ensuring against disaster was the existence of a fund called the *Calamidades* fund which involved a voluntary payment (more of a donation) made by members of the community which would be used to support those individuals in the surrounding *bairros* who had been hit by disasters. Unfortunately respondents claimed that they, despite having been in times of difficulty, had never received any benefit from this fund. Payments for this fund are made to the state.

Other responses to food insecurity include migration and/or reliance on food aid. Migration is a last resort that is only available to those with access to the appropriate capital, such as good health and cash. Regarding food aid, respondents from the first *bairro* claimed that they had not received any aid since 1993. Some “at risk” population groups were receiving food

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<sup>13</sup> The term household is used here as this is the level at which the decision is enacted. This does not imply that all members of the household play an equal part in making the decision. The decision could very well be made by only one member of the household.

aid in the second *bairro*, but people from both *bairros* mentioned how food aid was problematic in that it is open to political abuse and corruption. This was reported to occur as individuals were reported to be pilfering from food aid parcels and using their authority in determining who does, and who does not, qualify for food aid as a means of social coercion.

It has been mentioned above that threats to food, and more generally livelihood, security do not operate in isolation. The discussion below expounds on conceptual tools that can assist in generating an holistic understanding of the manner in which people interact with one another and their environment.

### **7.3 Multiple threats: Food security, water and health**

When examining threats to livelihood security, it is important to realize that these threats do not operate in simple isolation to exacerbate vulnerability and thus generate risk. One needs to appreciate the manner in which hazards and their associated human responses interact to generate vulnerability to continued and/or new shocks and stresses - which in turn act to further food insecurity, or more generally, livelihood insecurity. The shocks and stresses attributable to each threat are compounded by one another and in fact often act to exacerbate other threats both in terms of exposure and impact. This phenomenon has been well described as the ratchet effect. Such an effect describes the dynamic manner in which poverty is reproduced as the impoverishing impacts of shocks on the already vulnerable lessen their ability to plan for and withstand further shocks (Soussan, Blaikie, Springate-Baginski et al. no date provided).

Food security is impacted either directly – such as drought reducing the availability of food – or indirectly – such as ill-health limiting a person’s ability to labour in their fields. In fact, impacts can become a long way removed and cyclic. In such instances, ecosystematic thinking proves a powerful tool for generating an understanding of how environmental conditions (and changes in those conditions) are likely to impact upon local livelihoods. Drought, for example, is likely to reduce crop yields and increase the demands of household labour, while at the same time increasing exposure to health risks through both an increased exposure to vectors – such as poor quality water – and a depleted immune system. Such conditions then generate positive feedbacks as people’s ability to secure food is further

limited. When one considers the manner in which other threats are likely to interact with these positive feedback conditions, one gains an appreciation for the manner in which conditions of chronic vulnerability are generated and maintained.

The number of combinations and permutations of interactions - such as the one above - are numerous and should become evident from the discussion of the nature of hazards undertaken above. For this reason, and to avoid redundancy, they will not be mentioned again here. The point to be noted is that vulnerability can, and often is, cyclic and reinforcing. Those most vulnerable tend to become more vulnerable when placed under the most remote stress. This increased vulnerability then increases their risk, resulting in a spiral of poverty from which they cannot escape without social support.

## **Chapter 8: Mphanda Nkuwa: Impacts and risks**

This chapter examines the manner in which the construction and operation of the Mphanda Nkuwa Dam will impact upon the people of the Zambezi, as well as the risk that will be generated as a result of such impacts. The context for this chapter lies primarily in chapters 4 and 5, however it is strongly recommended that the reader examine chapter 6 as well so as to familiarise oneself with the manner in which dams impact upon river basins.

This chapter includes the following:

- Impacts and risks associated with the construction of Mphanda Nkuwa:
  - Risks associated with migrant labour and resettlement schemes.
- Impacts and risks associated with the management of Mphanda Nkuwa.
- Introduction to, and discussion of, political risk.

### **8.1 The impacts and risks associated with Mphanda Nkuwa**

As discussed in chapter 6, the dam will impact on the existing social and physical environment in a manner of ways. These impacts can be separated into two phases: (i) the construction of the dam and (ii) the operation of the dam. Again it would be simplistic to conceive of these impacts in isolation - they need to be contextualised in the livelihood strategies (which include the response strategies discussed in the previous chapter). Regarding dam management, the construction of the dam needs to be viewed as the context for the manner in which the impacts will be manifest.

### **8.2 Impacts and Risks associated with construction**

The impacts of dam operation on river systems have been discussed in some detail in chapter 6. However, there has been very little discussion of the manner in which construction of the (US) 2.6 billion dollar, 100m dam will impact on the river and its dependent surroundings.

These impacts and the associated risks are best understood in terms of two broad impact-inducing events: (i) the likely impacts and risks associated with the influx of largely migrant

labourers, and (ii) the resettlement of people living in close proximity to the dam wall or in the area to be inundated by the dam's reservoir.

### ***8.2.1 Migrant labour and access to cash***

One of the dam's purported benefits is the boost it will provide to the local economy through the creation of wage employment, which will bring cash to the area and allow people to break out of cyclic or chronic poverty. While this is theoretically conceivable, experience has shown that such circumstances often bring about many unintended impacts, which can serve to undermine the potential gains to be had from the injection of cash into the local economy (Hoover 2001a and Thabane 2000).

Construction of the dam will require the labour of a vast number of people. But experience has shown that many more than the required number of labourers tend to arrive on site in the hope of finding employment (Hoover 2001). A significant contributing factor to this risk would be the large numbers of unskilled and unemployed workers in Mozambique and neighbouring countries. The reality of this risk is evidenced by the fact that the field research revealed people to have already been coming to the area, enquiring as to what was happening regarding the dam's construction.

Due to the local understanding that reproductive work is the purview of women and wage labour the purview of men— a view which extends beyond the *bairro* – it is men who are likely to make up the vast majority of both migrant and local labourers. This is not to say that cash made available by salaried work on the dam will not reach women; rather, women are not likely to be the direct beneficiaries of the project.

Thus the area is likely to experience an influx of a large number of male, migrant labourers. Such an event has the potential to significantly disrupt the social fabric of the currently stable, although admittedly un-utopian, society. This is due to a number of factors, but is largely attributable to the current reliance on 'grey' means of social control (see section 5.5). Such a system would struggle to cope with the influx of people who do not necessarily know or respect the current institutions of power in the *bairro*.

Sinister elements associated with the influx of migrant labourers are likely to evolve as cash-earning migrants enter the agrarian economy, in which access to cash is both limited and unequally distributed. This could fundamentally disrupt the existing power relationships in the *bairro*, further stressing those institutions which currently act to maintain 'law and order'<sup>14</sup>. In turn what is considered acceptable 'law and order' could be challenged, as migrants are likely to have differing value systems and lack respect and understanding for the established institutions. The large numbers of male migrants with disposable income in an area without suitable amenities would likely give rise to significant amounts of substance, especially alcohol, abuse. Such abuse under the aforementioned conditions of strained social control is likely to place vulnerable groups at even greater risk. Women's position in sexual relationships is at risk of being further undermined as the lines between consensual sex, transactional sex and rape become blurred even further (see section 5.7.2). A general lack of legal protection (a result of both the state's virtual non-existence and the stress on existing (local) means for ensuring law and order) is likely to exacerbate the risk of other criminal activities, such as theft and child abuse.

Such circumstances also raise serious concern over the risk of HIV. This is enhanced by the fact that Tete province has the highest HIV infection rate in the country and by the current lack of knowledge surrounding treatment and testing amongst people in the area (see section 7.1.3).

With the potential erosion of existing systems of law and order there is also likely to be an erosion of other traditional practices and institutions in the area. Such practices often form fundamental social support networks which are accessed during times of stress. The most potentially precarious of these is the extended family network which currently acts to redistribute wealth amongst individuals and which supports the sick, women, children and the elderly (see section 5.4.1). The 'family' could be eroded in numerous ways including an increase in prostitution. While prostitution is potentially liberating – providing women with potential access to cash – it is not sustainable (in the context of high HIV infection rates)

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<sup>14</sup> 'Law and order' appears in italics as this is used to refer to what the people of the *bairro* generally consider to be just and fair. This is distinct from Mozambican law which in fact precludes many practices which are condoned in the *bairro* such as informal courts and public beatings.

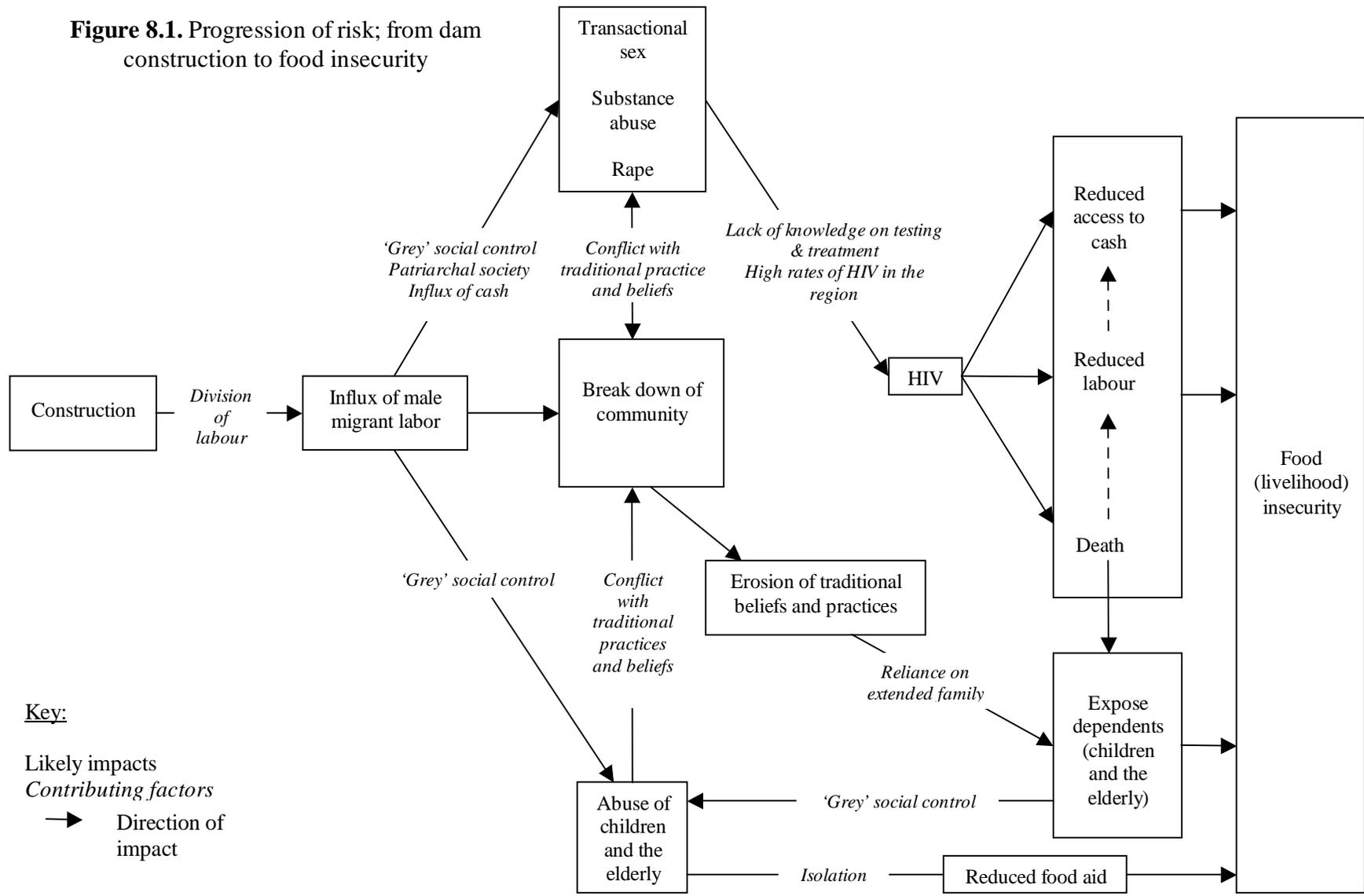
and could, as the act becomes vilified (a likely outcome given the degree to which female promiscuity is deemed socially unacceptable), lead to women's eventual exclusion from society and other social support networks. The erosion of the institution of marriage – fundamental to the institution of the family – could serve to further isolate the elderly, leaving them more open to abuse and neglect (O'Donoghue 2001).

Thus the rapid influx of people is likely to further erode the concept of 'community' in the *bairros*. This is problematic as external support agencies (such as World Vision's food-aid programme) are reliant on community structures for distributing food aid. This provision of food aid is an already arduous task (personal communication: Joseph Kamara), and reports of corrupt leadership pilfering from food parcels and showing favouritism abound. Should any further social disarticulation occur, the success of providing (often vital) food aid could be at even greater risk.

The list of potential impacts discussed above is not exhaustive. It is, however, indicative of the manner in which sinister elements of society will have room to evolve in the context of the cash-strapped, gendered, unregulated and isolated *bairra*. Such sinister elements not only pose a risk in and of themselves (through rape, murder etc.) but also serve to potentially erode the social fabric of the society, leaving people without social support networks and stripping them of their informal safety nets. This is likely to hit those who are already most vulnerable (women, children and the elderly) hardest (see section 5.7.3).

The links between dam construction and increased vulnerability are complex and not always obvious, thus figure 8.1 provides a diagram of the manner in which the dams' construction could serve to increase food insecurity. Note the value of ecosystematic thinking and contributing factors in this schematic.

**Figure 8.1.** Progression of risk; from dam construction to food insecurity



Key:  
 Likely impacts  
 Contributing factors  
 → Direction of impact

### ***8.2.2 Resettlement***

Resettlement schemes, like the influx of migrant workers, represent another abrupt social and environmental change which serves to potentially stress both the host and resettled communities. At the time of writing, the resettlement plan had not yet been made a public document - thus the author has been left to comment generally about the process of resettlement in the area. Resettlement is likely to take place in an area in close geographical proximity to the area that is to be inundated. This means that the social context is likely to be similar to that described above and thus the risks associated with social disarticulation and the general erosion of the social fabric of society are similarly applicable. However, there are other risks present which are related to the nature of resettlement.

Chapter 5 has already elaborated on reports of land grabs which had occurred with the succession of violence - related to the Renamo-Frelimo conflict - as refugees returned to their land. It is hypothesised that such land grabs were connected to the manner in which power is located. This was very likely related to the political nature and roles of individuals during the conflict. As political intimidation was observed to still be very apparent in the area, the threat of land grabs by both the to-be-resettled and host communities is a prominent concern during the resettlement process. The risk of land grabs is heightened by the manner in which women, children and the elderly's access to power is limited.

Resettlement also stands to exacerbate people's level of vulnerability, by interfering with the vital means of social support – the extended family. Moving people in a context in which physical mobility is severely constrained means that social support networks could come under considerable strain as people are moved away from their extended family members. This is of concern as the act of marrying across *bairros* is common and people's social support is often located in areas which will not be resettled, potentially isolating them in their new place of residence. The impact on support networks will not only be felt by the resettled household, but also by those households that are not resettled - their access to social support is also diminished. As support networks are reliant on small contributions from a large network, the act of resettlement could also place strain on those reduced numbers of people who are still in contact with their dependants, as the burden of supporting them stretches resources even further.

### **8.3 Risk associated with dam operation**

The operation of the dam also generates many risks in and of itself and as has already been discussed, these risks are largely confined to those communities living downstream of the proposed dam. These communities are not currently considered as directly affected and (in conflict with the WCD guidelines) stand to receive no compensation for losses they may incur as a result of the dam's operation.

The exact manner in which Mphanda Nkuwa will alter the downstream river morphology and ecology is not yet understood and is also dependent on the operating regime that the dam undertakes. While the exact consequences of differing hydro-electric power production regimes have not been modelled and are not well understood, experiments simulating flows for intermittent (peak) power production yielded unfavourable results (International Rivers Network 2005). This is due to that fact that peak production would involve the generation of twice daily mini-floods, ranging in height from 2.1m at the dam wall to between 0.3m and 0.5m at Tete city. Mini-floods of this magnitude would destroy those river gardens which are located in the river bed and so fundamentally undermine the contemporary dry-season livelihood strategies (see section 4.2.1 & 7.1.1). The undermining of such strategies would also have implications for people living further from the river who are reliant on the supply of vegetables from the river gardens during the dry season.

As has been discussed, the introduction of yet another reservoir will again remove sediment from the water, possibly reducing fertility down stream and increasing erosion. Such impacts are of greater concern as the location of the reservoir will inundate the Luia River which is one of the last unregulated catchments (comprising approximately 28 000km<sup>2</sup> of drainage area (Hillmann and Taredal 2003)) in the Zambezi system (UTIP 2002). The sediment load of this river is currently unknown but the contribution it makes, during the rainy season, to nutrient rich sediment deposits downstream is believed to be highly important. As such the impoundment of this catchment could have severe effects for downstream productivity (ibid.). The impacts of attenuated flooding as a result of Cahorra Bassa (reduced fish stocks, increased flood risk, stabilizing of the delta etc.) have already been discussed and will only be exacerbated by Mphanda Nkuwa.

Seismic risk and the general seismic characteristics of the area have been discussed in Chapter 7; here the report will elaborate on the seismic risk which relates specifically to the Mphanda Nkuwa Dam. It is worth noting that this risk is intimately connected to the state of the existing dams located further upstream.

The proposed dam site is to be located about 200 km from the heart of the Shire Trough fault zone, which is currently known to be active. Due to poor record-keeping in the area, the accurate prediction of potential large earthquakes has become problematic, if not impossible. This is a concern as the existing design specifications for Mphanda Nkuwa were described by experts as alarmingly small, given the seismic potential of the area (Personal communication: Chris Hartnady). Further caution should be exercised as it is hypothesised that the recent seismic activity in the area is indicative of a general trend of increasing activity in the fault zone around the dam (ibid.)

Due to the manner in which the dam will be filled as well as the shape, depth and location of the dams' reservoir, the inundation process predisposes the area to the generation of seismic activity through reservoir triggered earthquakes (RTE's<sup>15</sup>). The dam's location in the South of the African Rift Valley, the recent southerly migration of seismic activity down the Malawi Rift and the lack of recording of the general plate kinematics in the area (Hartnady 2002) raise concerns over the manner in which the maximum credible earthquake (MCE<sup>16</sup>) has been estimated for the Estima Fault. Due to the close proximity of the Estima Fault to the proposed dam wall and the long absence of activity on this fault, it is quite possible that the MCE for the Estima Fault could be the controlling maximum credible earthquake (CMCE<sup>17</sup>) for the project. Currently the MCE for the Estima Fault has been conservatively estimated. As this could be the CMCE for the project it is possible that the maximum design earthquake (MDE<sup>18</sup>) for the project could also have been underestimated.

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<sup>15</sup> RTE: is an earthquake which is triggered by the impoundment of a reservoir.

<sup>16</sup> MCE: is the largest reasonable, conceivable, earthquake for a fault, plate or area that appears possible under the known, or presumed, tectonic framework.

<sup>17</sup> CMCE: is the most critical MCE for a project or area.

<sup>18</sup> MDE: Is the maximum level of earthquake that the dam will be designed to withstand – this is based on the CMCE.

Given the potentially catastrophic consequences associated with the failure of the dam wall – rated as extreme in all categories by the seismic assessment – and the fact that the risk has not yet been properly assessed, it must be assumed that the risk is of a level which is unacceptably high.

#### **8.4 Institutional capacity and political will**

Theoretically, virtually all the risks mentioned above can be mitigated and the resettled community could be neatly integrated into its host community without experiencing any social disarticulation. It is also conceivable that with appropriate interventions from the state, many of the negative impacts associated with dam construction could be guarded against. But this is not to say that such interventions will be easy, nor is it to say that those tasked with resettlement are in possession of the political capacity and/or will required to ensure a successful resettlement and mitigation programme.

The issue of resettlement is exceptionally complex. Most practitioners accept that the problem of being worse off after resettlement can best be mitigated through land-for-land swaps (Madore and Lucas 2001). This is the approach which has been recommended in the social impact assessment. However even with this approach there is a risk that livelihoods will be less sustainable after resettlement than before. This risk is greatly exacerbated as land is often valued in a very conservative manner which is only ever broadened to include, at best, reductionist approaches (such as valuing assets in monetary terms and providing monetary compensation for such assets). In the case of Mphanda Nkuwa it was found that a simple land-for-land approach might actually exacerbate livelihood stress: in the study area, it was found that access to land other than that under direct individual ownership is considered a measure of value. Further, livelihood security is not solely dependent on the amount and quality of land a person has access to – proximity to markets and supply routes, as well as access to the bush and river are also of fundamental importance in determining livelihood security. Finally, 'land quality' needs to consider future quality – which in itself needs to be defined very broadly. Climate change represents a pressing concern regarding future quality of land (see section 6.3.1) and resistance to climate change (e.g. access to perennial water sources) needs to be considered as being a quality which is accounted for when calculating land values.

Meeting such criteria for land resettlement is further complicated, as the more removed a people are from their original place of residence, the more likely they are to experience social disarticulation and social exclusion. This is a result of geographically distinct cultures sharing fewer cultural norms (this is especially problematic in the context of 'grey' social control) and limited physical mobility isolating people from their established social support networks described above. At the same time, the chance of finding land of equal quality in close proximity to their place of previous residence is highly unlikely. Thus in terms of factors contributing to the risk of reduced livelihood sustainability, quality of land and social disarticulation represent the inverse of one another.

Such complexities are very aptly described by Scudder when he comments:

“Within the major dam building countries, I am aware of none, including the United States, China and India, that can document that they have been able even to restore the incomes of a majority of resettlers.”  
(Scudder 2001: 331)

“The problem of resettlement failure and impoverishment is due more to lack of political will on the part of governments and project authorities, poor policies and plans, and inadequate implementation of good plans, than to affected people who time and again have shown their ability to respond to whatever opportunities are available.”  
(Scudder 2001: 337)

According to the existing proposal for the dam, those individuals living downstream will receive no compensation for their losses whatsoever. They are unlikely to benefit from the electricity produced by the dam and are unlikely to receive any of the supposed benefits from the economic growth the project will attract. Due to the expected impacts of the dam's construction and operation, the risk that their livelihoods will be made less sustainable than they are currently is very likely to be realised in some manner.

What these quotes and the above discussion demonstrate is that there is a risk surrounding whether or not the body responsible for mitigating the negative impacts of the dam will be successful. Just as a donor or funder would assess the risk of a project (i.e. the risk that a government might choose to nationalise its assets or default on payments), so too must one examine the risk associated with defaulting on, or being unable to meet, terms spelt out in

compensatory/mitigatory agreements. Such risk is very difficult to quantify; but there needs to be some measure by which it can be said “the risk is of an unacceptably high nature and is now too great to allow the project to go ahead”. This is the only way we can overcome the problem of assuming that with the correct type and timing of interventions, it is possible to mitigate all the negative impacts of a dam.

Regarding the dam at Mphanda Nkuwa, the risk appears to be particularly high. However, as such risk cannot be quantified, this paper suggests some indicators or contributing factors which can be used to try and gauge ‘political risk’:

- Current reliance on land-for-land swaps.
- Current level of state control in the area (local reliance on grey social control).
- Lack of maintenance on existing formal, physical infrastructure in the country.
- Current problems regarding existing dams.
- Lack of provision for compensating downstream communities despite acknowledging that they will be affected.
- The current lack of an explicit resettlement plan.
- Lack of a formal position on the WCD.
- Lack of a compliance plan<sup>19</sup>.
- Reports of political intimidation in the area.
- The currently high level of corruption reported in the country (Transparency International 2005).
- The current lack of formal social safety nets and social services.
- The current level of governmental accountability.

Political risk is a sensitive issue and admittedly, the above may not be the most appropriate indicators for assessing what this paper is terming political risk. However we cannot simply avoid the issue due to its sensitive nature, nor can we hide behind the rhetoric of sovereign democratic states. It is not sufficient to simply argue that in theory the mitigation of risk is possible and absolute. To ignore such risk is to make a mockery of the entire risk and impact

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<sup>19</sup> See Dams and Development 2000 for more on compliance plans.

assessment process, which becomes meaningless if it is not backed by the political capacity and will to mitigate this risk or to prevent its manifestation.

### **8.5 Unexpected Impacts**

Finally, as well as this political risk, there is also the risk that the project will produce numerous unexpected impacts. Such impacts could serve to make people's livelihoods less sustainable in a large number of ways. Such risk cannot be mitigated and flexibility in compensation schemes needs to be incorporated to accommodate this possibility.

### **8.6 Conclusion**

The rural, isolated and unregulated *bairu* although currently stable is exceptionally vulnerable to changes of a magnitude that are likely with the construction (influx of male, migrant labour) and operation (land resettlement and uncompensated livelihoods stresses downstream) of the Mphanda Nkuwa Dam. This vulnerability is primarily related to two factors: the reliance on 'grey' social control in the area, and the intimacy with which people's livelihoods are connected to the state of the environment. The vulnerability is expressed most clearly in the case of women, children and the elderly.

Although, in theory, one could mitigate these negative impacts it is not acceptable to assume both a willingness and capacity on the part of the institution responsible for compensation (in this case the Mozambican Government – especially so when it is this institution who will be bearing the financial burden of the project). As such the political risk of the project also needs to be explored and accounted for. This risk is thought, given the proxy measures mentioned above, to be of an unacceptably high nature. Finally political risk is linked to unexpected impacts of the dam which cannot be conceived of and need to be accounted for by ensuring flexibility of compensation plans.

## **Chapter 9: Discussion and conclusion**

This chapter contains a discussion of the results of the study. It then goes on to conclude the document with reference to the research procedure as a whole and with explicit reference to the Mphanda Nkuwa Project.

The chapter includes the following:

- A discussion of the manner in which risk will be manifest differentially at different scales and the implications of this for development in the area.
- A discussion of the imperative to integrate a rights and risks approach into the livelihoods framework.
- A conclusion on the outcomes of the study in the context of a developing Mozambique.

### **9.1 Winners and losers in the process – an exploration of scale**

It is quite clear that the dam's construction creates numerous potential benefits and potential losses. These benefits and losses are then distributed across geographical and social space. For example, at the national level potential benefits are to accrue to the investors in the aluminium smelter planned for Beira, while the risk of loss is borne by those living in the *bairros* on the river. This is clearly an inequitable position in which those exposed to the risks associated with the dam those stand to gain very little or nothing from its success. In such a process, the social system is imposing a level of risk upon people who in this case have had very little say in what should constitute an acceptable level of risk.

This provides an interesting lens through which to view development, as the risk framework sheds light on how we can determine the degree of justice and equity in 'developmental' initiatives. The risk framework allows us to explore how we can transfer the risk onto those who stand to gain from the project and who have some bearing on its success. For example, the risk of failure of the resettlement plan needs to be carried by those implementing the plan, not by those being forcibly resettled.

It is not enough, however, to simply examine the winners and losers at only one scale. Many dam proponents may argue that the dam will serve to create temporary employment and inject cash into the local economy, providing the mechanism for jump-starting the local economy. This statement would counter the view that people at the dam site are exposed to a significant portion of the risk with no access to potential gains. Not only is this a simplistic understanding of how trickle-down effects are realised, but it is also an homogenisation of the individuals in the community - all individuals in the community are thought to be exposed to the same risks and potential gains. If we examine the community at the level of the individual, we see a remarkable bunch of inequalities in risk exposure. For example, those likely to realise the gains from temporary employment are (due to the prevailing social structure of the community) likely to be men, while those likely to suffer most from, and be exposed to, the greatest risk and impact of HIV, abuse and crime (as well as the associated impacts) are women, children and the elderly.

Thus, by exploring the different scales at which risk is manifest, we are able to determine who is carrying the greatest risk burden. Usually, and as is apparent in the case of Mphanda Nkuwa, it is those groups who already constitute the most vulnerable that end up being exposed to the lion's share of the risk. The risk of such groups is usually furthered as they prove to be the hardest groups to compensate and thus are exposed to a disproportionate political risk as well.

## **9.2 The right to a participatory approach and its role in decision-making models**

The WCD makes reference to a rights and risks approach to decision-making and dams, but what this means exactly is only alluded to. This study has made use of the risk framework, using it at many levels, as a means for making sense of the complex ways in which external influences will affect people's livelihoods. The use of the framework at different levels informs us about different processes in the dam's construction which are generating risk. The participatory approach creates a space in which the concept of a person's right to a life with an acceptable level of risk can be examined and explored. Such a space is created by the in-depth understanding of the likely impacts, made possible by the participatory approach which examines risk and how it is manifest at the level of the individual. The livelihoods framework allows for a temporal examination of risk management strategies, providing a useful understanding of how vulnerability and risk profiles will change in the

face of expected impacts. The approach provides insight into the manner in which such impacts are likely to interact with the social and physical environment and shows who is most vulnerable and who is likely to be most impacted. This complex information can then be effectively synthesised and understood in terms of the broader political context in terms of the risk framework. Such an approach allows a liberal understanding of risk that explores who will be most burdened with the risk, how great is that risk, and whether or not that risk is of an acceptable level.

Regarding decision-making and dams, should we wish to shift dams from poverty-creating and entrenching to development enhancing, we need to take a rights-based approach. Should a dam's current development plan infringe upon the rights of the individual, then either the decision not to build the dam needs to be taken, or the project plan needs to be amended so that risk is not disproportionately carried by certain members of society. The level of risk a person can be exposed to needs to be defined, either internationally or participatorally (preferably both, so that acceptable risk is internationally defined as being locally relevant). This risk has to account for political risk.

### **9.3 Conclusion**

There is no doubt that dams can have both positive and negative impacts on the lives of humans. The power they provide is invaluable in generating economic development in the system of exchange which is currently dominating the planet. However, at the same time the social and environmental costs of such large-scale and rapid change can leave those individuals living in the immediate vicinity of the dam far worse off than they were before the dam was built. Too often the decision of whether or not to build a dam is simply made by examining whether or not the simplistic gains outweigh the simplistic losses. Even when this framework is expanded (through reductionist measures of quantification) to include potential social and environmental losses, scant attention is paid to who wins and who loses. Herein lies the problem, as too often it is those who so dearly need the potential gains from the dam who end up losing - entrenching poverty and deepening the divide between rich and poor. Such circumstances only serve to further exclude the poor from both free market and interventionist mechanisms for social redistribution.

In the case of the Mphanda Nkuwa Hydroelectric Dam, the risk of project failure is being borne disproportionately by those individuals who have the least power in determining the success of the project. It has failed to make provision for the rectification of the unequal distribution of benefits and losses attributable to the project and in terms of seismic risk, it has not been able to suitably gauge the risk (which therefore must be assumed to be of an unacceptable level). Thus this study and methodology makes apparent that given the current compensation plan, the apparent indicators of political risk and level of local participation, this project (in its current form and context) represents a developmental initiative which is neither just in terms of the level of risk it will generate nor equitable in terms of its likely distribution of potential gains and losses.

A participatory livelihoods approach provides decision makers with the tools for exploring, at the level of the individual, who is likely to win and who is likely to lose during the dam's construction and operation. This allows us to go beyond the simple utilitarian approach of cost-benefit analysis, by viewing the mechanisms by which individuals are likely to win and lose at all levels. In terms of a risk framework, decision-makers are able to determine who is carrying the risk, and whether or not this risk is of an acceptable level - given the potential gains that could accrue to the individual should the project go ahead, and the role of the individual in determining the success or failure of the project. This can highlight mechanisms by which risk can be transferred, so that the risks of winning and losing are more fairly distributed and can help ensure that the project represents a just and equitable development.

## APPENDICES

### Appendix I

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## Appendix II

### Livelihoods Interviews

Name?

Age?

Sex?

Place of birth?

Did you attend school?

Where else have you lived?

What did you do while living there?

Why did you come to this bairro?

Time in Village?

Number of people in Household?

Relationship to head of the household?

Number (and ages) of children in the household?

How long has each member lived in the house?

Time in Village?

Do you have family members in any other bairro?

How do you generate wealth in your household?

- subsistence farming
- cash cropping
- cash remittances
  - o Do you have any access to a cash income?
  - o Who controls cash incomes?

What things do you spend money on?

- When do you buy those things (time of year)
- Where do you buy these things?
- Who decides what you buy and when?

What assets does your household own/have access to?

- How does/did your household get its land?
  - o Is some land more valuable than other land?
  - o How much land do you have access to?
- How many head of cattle does your household own/have access to?
- How did you get your cattle?
- What do you do with your cattle?
- Why do you only have these types of cattle?
- What are the other ways to get cattle?

What do you do in an average day?

- how do actions change during different times of year

Number of meals a day?

- What sorts of food do you eat?
- How do the number of meals and their content change over the year?

What facilities (school, clinic, agricultural extension officer) are available to the village?

What crops do you grow?

- Why do you grow those crops?

What stresses shocks have you experienced recently?

- how have you changed your activities so as to deal with these shocks/stresses?

Has the household been better or worse off in the past?

- What caused the household to move between the levels of well being?

What do you do in times of drought?

What do you do when it floods?

What do you do when you get sick?

Do you like living in this bairro?

## **Appendix III**

### **Life Histories Interview:**

Name?

Age?

Sex?

Place of Birth?

Number of people living in your household?

Relationship with the rest of the household?

How long have you lived in the village?

Where did you live before you live here?

When did you move?

Why did you move?

Where else have you lived?

How did you generate wealth in your previous places of residence?

What was it like growing up in the village?

What activities were children meant to perform?

What activities were women meant to perform?

How many people lived in your household when you were growing up?

How is life different for people living in the village today compared to when you were growing up?

What dangers/problems did you face when growing up?

How do you think these dangers have changed?

Why do you think the dangers have changed?

What did you used to do to protect yourself from such dangers?

What was the impact of forced labour?

Where did you live during the struggle for independence?

Did you live differently during this struggle?

How did Mozambique getting its independence affect your life?

What was the effect of the local committees that were formed to restart industry and farming?

What were the impacts of FRELIMO's attempts to liberate women, remove polygamy and alienate traditional healers?

Where did you live during the civil war?

Did you have any connections with South Africa or Zimbabwe during the civil war – how did those connections change?

How was life different during the war?

What did you do to generate wealth during the war?

Did droughts used to be this bad?

Were they as frequent?

What did you used to do for food/money during droughts?

How has the weather changed?

Has the river always been like this?  
How has it changed?  
Why do you think it has changed?  
When did it change?  
How often did it used to flood?