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Where to Go? Strategic Modelling of Access to Emergency Shelters in Mozambique

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This paper, through spatial-analysis techniques, examines the accessibility of emergency shelters for vulnerable populations, and outlines the benefits of an extended and permanently established shelter network in central Mozambique. The raster-based modelling approach considers data on land cover, locations of accommodation centres in 2000, settlements and infrastructure. The shelter analysis is a two-step process determining access for vulnerable communities first, followed by a suitability analysis for additional emergency shelter sites. The results indicate the need for both retrofitting existing infrastructure (schools, health posts) to function as shelters during an emergency, and constructing new facilities — at best multi-purpose facilities that can serve as social infrastructure and shelter. Besides assessing the current situation in terms of availability and accessibility of emergency shelters, this paper provides an example of evaluating the effectiveness of humanitarian assistance without conventional mechanisms like food tonnage and number of beneficiaries.

Keywords: Mozambique, emergency shelters, shelter access, access assessment, Geographic Information Systems.

Introduction

The worst floods in over 50 years hit south and central Mozambique in early 2000. The enormous amount of rainfall, dumped by three consecutive cyclones, affected around 4.5 million people, which is one-quarter of the country's population. The floods displaced 400,000 people, and caused at least 700 fatalities (CVM, 2000; UN System Mozambique, 2000b). In 2001, the central provinces faced flooding again, this time affecting 554,000 people (including 220,000 displaced persons), and resulting in 113 deaths (Government of Mozambique, 2001). Two years later (in early 2003), the country faced both a drought and a flood: while struggling with a severe drought in the central and southern parts of the country, the northern provinces of Zambezia and Nampula had 100,000 flood-affected people (OCHA, 2003).

Mozambique, one of the poorest countries in the world as measured by the UN's Human Development Index (ranking 170 out of 173 countries (UNDP, 2002)), does not have the resources to recover from such disasters without development aid. In 2000, for example, external assistance accounted for 23.3 per cent of the country's GDP (UNDP, 2002). Even worse, recurrent disasters (see Table 1) keep the priorities of the government on emergency response rather than shifting towards long-term policies such as hazard mitigation and vulnerability reduction.

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Table 1 The history of Mozambique shows repeated occurrence of floods

Location	*Date*	*Consequences*
Southern Mozambique (Limpopo River, Incomati River)[4]	1975	75K people affected
Southern Mozambique (Limpopo River) [4]	1977	300 casualties, 40K people displaced, 400K affected
Central Mozambique (Zambeze River)[2]	1978	50 casualties, 220K affected
No region given[4]	1981	500K affected
Southern Mozambique (Maputo Province)[4]	1985	500K affected
Southern Mozambique (Gaza Province)[2]	1988	90K people affected
Central and southern Mozambique (Sofala, Zambezia and Maputo provinces)[2]	1988	
Central Mozambique (Pungue River)[1]	1990	12K people displaced
Central Mozambique (Zambeze River)[2]	1991	
Central Mozambique (Pungue River)[2]	1993	
Central and southern Mozambique (Maputo, Zambeze, Incomati, Umbeluzi, Limpopo, Pungue and Búzi rivers)[1]	1996	11 casualties, 200K affected
Central and northern Mozambique (Sofala, Tete, Zambezia, Manica, Nampula and Capo Delgado provinces)[2]	1997	87 casualties, 300K affected (400K affected[4])
Central and southern Mozambique (Sofala, Inhambane, Gaza, Maputo, Nampula, Zambezia provinces)[2, 4]	1998/ 1999	15 casualties, 404.4K affected
Central and southern Mozambique[1]	2000	699 casualties, 100 missing, 650K displaced, 4.5M affected
Central Mozambique (Sofala, Manica, Zambezia provinces)[3]	2001	113 casualties, 220K displaced, 566.5K affected
Central and northern Mozambique (Nampula, Zambezia)	2003	6 casualties, 100K affected

Sources: [1]UN System Mozambique, 2000b; [2]MISAU/WHO, 1994; [3]Government of Mozambique, 2001; [4]CRED, 2003; [5]IFRCRCS, 2003.

Capacity-building programmes such as those sponsored by UNDP and USAID seek to improve the country's emergency response system by setting up information and communication systems, and by establishing a national alert and warning system (UNDP and Government of Mozambique, 2001). These programmes focus on infrastructure resources and their improvement at the national level is essential, although it is a very slow process in comparison to the country's high level of vulnerability to natural hazards and its need for immediate response and mitigation activity. It takes several years before local communities benefit from improvements in training, equipment and forecasting at the national meteorological and hydrological services as well as at the National Institute for Disaster Management (INGC).

The purpose of this paper is to present an option for reducing vulnerability at the community level. It is argued that access to shelters is of key importance for vulnerability reduction in Mozambique because shelters serve dual purposes: accommodation provision and a venue for aid distribution. They ensure basic assistance by providing survival necessities to homeless and affected people, who may then remain in their home area. In contrast to their importance for the local population, accommodation centres/shelters are not pre-planned facilities and are generally established ad hoc in district capitals and surrounding areas only. This means campsites are selected during an emergency depending on their accessibility for relief agencies, which are under tremendous time pressure to provide shelters. Without access to these ad-hoc shelters, affected people are cut off from any kind of humanitarian assistance. In rural areas, remote from district capitals, people are left to cope with the disastrous situation on their own (Government of Mozambique, 2001).

The floods of 2000 highlighted the inadequate assistance to rural areas and the affected people's insufficient access to shelters. Thus in Mozambique, additional temporary shelters are required that are located in remote areas, host people for a few weeks up to two or three months and support aid distribution to surrounding areas.

This paper examines which communities in central Mozambique (see Figure 1) had access to accommodation centres through spatial modelling. In addition to the spatial analysis, the paper outlines the benefits of an extended and permanently established shelter network — a measure propagated by several stakeholders such as the Mozambican Red Cross, UN agencies and other experts (Christie and Hanlon, 2001; CVM/DRC, 2000). Similar to the successful implementation of multi-purpose cyclone shelters in Bangladesh, where schools, community and health centres serve the double purpose of social service and shelter infrastructure (PPIAF, 2000), it is hypothesised that an expanded and permanent shelter network offers the disaster-prone (especially rural) population opportunities to develop self-help strategies that would result in more successful evacuations and participation in relief assistance. On a broader level, such a system would also allow the national response system to reduce the costly rescue activities, speed up relief operations, improve relief goods distribution and involve communities in the development of response strategies.

A seven-month work assignment with the Catholic University of Mozambique at Beira from March 2000 through August 2001 triggered this research. The initial project (Geoinformation for Rapid Flood Assessment and Hazard Mitigation in Central Mozambique, FLAME) assessed the environmental flood damage and was funded by the Austrian government under the framework of emergency aid for the mitigation of

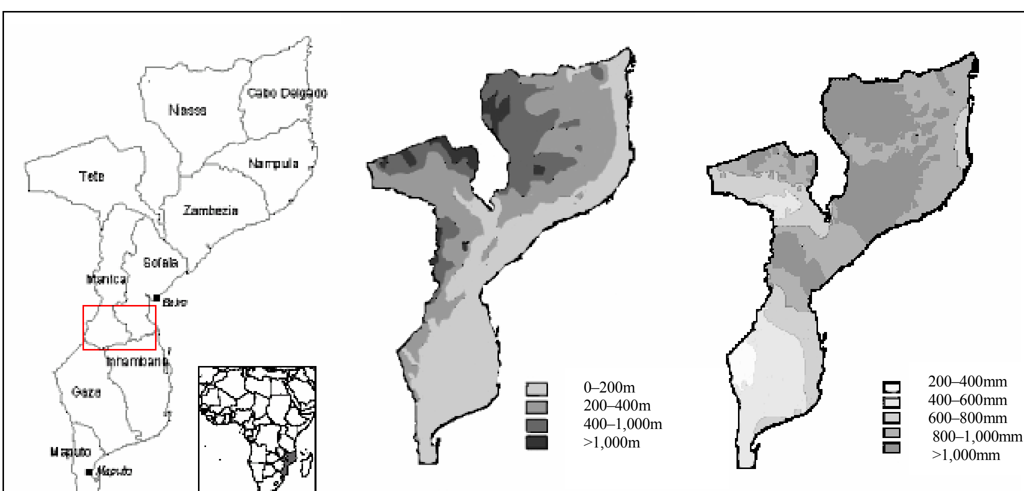

Figure 1 Spatial distribution of elevation and seasonal rainfall (Nov–Apr), based on maps of the World Food Programme (www.unsystemmoz.org)

flood-induced calamities in the central provinces of Mozambique. Insufficient information on the effectiveness of humanitarian assistance, missing post-event evaluations and interviews with community leaders instigated the idea on strategic modelling of access to emergency shelters.

Background

The context, within which mitigation actions are developed and implemented, is important (Mitchell et al., 1989; Rayner, 1992). In Mozambique's case, measures for vulnerability reduction must be considered against the background of two wars: the independence war from 1962 to 1974, and the following civil war from 1976 to 1992, both resulting in thousands of deaths, millions of refugees and a devastated economy and infrastructure.

The Front for the Liberation of Mozambique (FRELIMO), which took over power after independence from Portugal, enforced a Marxist policy that resulted in 'villagisation' and pressed rural people to live in larger, more centralised, villages (Bowen, 2000). This was the opposite of the traditional dispersed settlement patterns that were prevalent prior to independence. The villagisation programme added to the later cruelties of civil strife and the eradication of community life. During the civil war, the Mozambique National Resistance Movement (RENAMO) opposed FRELIMO. RENAMO's targets of destruction were public-service infrastructure (roads, schools, etc.) and their demolition paralysed public services and community life for years to come (Bowen, 2000; Lubkemann, 2001).

Concerted efforts by the international donor community sought to improve public and economic infrastructure through reconstruction efforts. The imprints of war on Mozambique's society, however, are complex and much more difficult to overcome than the reconstruction of infrastructure. According to several studies (UN System Mozambique, 2000a; Cossa et al., 2001; Bowen, 2000), a culture of mistrust and isolation is still prevalent and significantly interferes with the encouragement of civil society in dialogue and participation — a prerequisite for the success of many mitigation measures (Lubkemann, 2001). Cossa et al. (2001) found in their assessments for the Mozambican Red Cross that networking or collective work is still absent in Mozambican community life. Oliver-Smith (1982, 1996) and Read (1996) explain such phenomena as the traumatic consequences of displacement — the aftermath of the disaster event deprives people of their network, social relationships, identification, history and context.

Today, the level of public services and the capacity for policy implementation are still very low (UN System Mozambique, 2000a). In the context of disaster mitigation, this leads to a failure of vulnerability-reduction measures among those who require state intervention of any kind. Resettlement efforts, in particular, are prone to failure due to the absence of implementation and control capacity of the state as well as the desire of affected people to return to their homes (Oliver-Smith, 1982). Additionally, the absence of all-hazard risk assessments hampers the long-term success of resettlement programmes in Mozambique. There is a lack of knowledge as to whether people moved from hazardous areas to regions with even higher risk potential of other disasters such as drought or cyclones. This is a clear violation of the all-hazards approach as propagated by various agencies and researchers (ISDR, 2002; FEMA, 1997; Mitchell et al., 1989; Cutter et al., 2000).

In Búzi, for instance, after the floods of 2000, the Austrian Development Corporation provided houses to affected people outside flood-prone areas, although the local government waited too long to assign farmland to its new residents, forcing the relocated population to abandon their new houses and move back into the floodplain to their old farms. On the other hand, in Bandua, south of Búzi, the temporary ad-hoc shelter turned into a resettlement area because farmland was quickly available to the displaced peasants, however, aggravating the host community's insufficient access to potable water. The Ministry of the Environment is in charge of keeping track of such voluntary resettlements. It is actually supposed to perform vulnerability assessments beforehand, although insufficient resources prohibit such. Therefore, resettlement may be a common adjustment to floods in urban areas and in developed countries, but in view of Mozambique's history and its current lack of enforcement capacities, planned resettlement is definitely not an option for vulnerability reduction in rural areas.

As resettlement has to be excluded as a powerful vulnerability reduction option, the question is what other possibilities are available for local improvements? In terms of research, little has been done on community and household-level risk-management strategies in Mozambique. Only a few descriptive studies are available, which investigate vulnerability and local coping strategies, although they do not offer any suggestions as to how these strategies could be integrated into the national emergency and response system (Cossa et al., 2001; CVM, 2001; CVM/DRC, 2000; Steinbruch, 2003).

More general studies on the socio-economic aspects of Mozambique's rural population (Arndt and Tarp, 2001; Sperling and Longley, 2002; Longley et al., 2002) point out the importance of access to relief goods and the need to plan interventions earlier than presently (Green, 2000). They remain, however, on a fairly theoretical level and do not provide any recommendations about how this could be accomplished.

A feasible approach to increase access to humanitarian assistance and to improve targeting is the proposition of multi-purpose emergency shelters as seen in the case of Bangladesh. There, schools, community centres, mosques and medical centres serve as cyclone shelters, counter-balancing the limited number of newly constructed shelters. As a result, people incorporate the facilities into their everyday lives and view them as resource and service centres instead of ignoring them (Akhand, 1996). Another beneficial side-effect is the possible avoidance of common traps like inadequate shelter management and maintenance, missing awareness by local communities and difficult access for the latter. In Bangladesh, the combination of such prescribed shelters, and community-based as well as national preparedness measures (early warning systems, evacuation plans) resulted in a drastic drop in the number of casualties (Macks, 1996; PPIAF, 2000). In Mozambique, a similar intervention is required to promote community participation, enhance voluntary evacuation as well as to improve access to and targeting of emergency assistance.

Study area and methodology

The Save and Buzi river basins, located in the southern part of the provinces of Sofala and Manica, delineate the study area (250 x 300km; see Figure 1). Both provinces comprise a population of about 2.5 million, which is 15 per cent of the total population (UNDP, 2000). The study area's rural population is concentrated along the coast and main river valleys. There are no urban areas within the study area.

A pattern of declining economic performance and public service with increasing distance from the capital is characteristic of Mozambique. This means that the study area has a much lower level of socio-economic development than the southern provinces (see Table 2). Hence, without significant employment opportunities in the region, the population relies heavily on rain-fed subsistence farming, fisheries and livestock as sources of income.

The region's vulnerability to hazards is determined by its location in a tropical/subtropical climate zone and its exposure to cyclones originating in the Indian Ocean. There are two distinct rainfall patterns in the study area: the hot and humid season with rainfalls from November to March, and the cool season with showers from April to October. The average annual rainfall ranges from 350mm at Pafuri in Gaza to more than 2,348mm at Tacuane in Upper Zambezia, Alto Molucue District (see Figure 1). The intensity of the rain increases from the south to the north of the country, although the frequency of the occurrence of intensive rainy periods peaks in the country's centre (MISAU/WHO, 1994). A large variability in rainfall (Todd et al., 2003) makes the country prone to both floods and droughts, sometimes appearing at the same time in different parts of the country as seen in 2003.

Access to the study area is limited. The only year-round road (EN1) goes north/south in direction, while the dirt roads that provide access to the coastal and western areas are often impassable during the rainy season. This lack of access aggravates the collection of real-time data during an emergency, distribution of relief goods, and also the acquisition of in-situ data afterwards, a problem encountered in this study as well.

The data used in this study originate from various sources: food distribution figures and locations of accommodation centres in 2000 derived from INGC reports or digital files by the World Food Programme (see Figure 2); digital infrastructure information acquired from the National Cartographic Service (DINAGECA) and

Table 2 Economic development indicators, 1999

Indicator	*Total*	*Sofala*	*Manica*	*Maputo City*
Human development index	0.300	0.313	0.299	0.600
Real GDP per capita in US$	205	244	161	1,189
GDP percentage structure				
Agriculture	24.8	16.6	36.6	10.1
Commerce	22.7	31.8	19.3	31.1
Manufacturing industry	11.4	10.0	13.7	18.9
GDP growth rate (%)*	9.0			
Inflation rate (%)*	4.8			
Employment	*Rural*			
Agriculture	88.6	95.1		
Commerce and services	3.9	1.4		
Public services	2.9	1.2		
Industry and mines	2.9	1.6		
Construction	1.0	0.5		
Transport and communication	0.8	0.2		

Sources: Employment information derived from 18,444 interviewees aged seven and older (UNDP, 2000). *UNDP and Government of Mozambique, 2001.

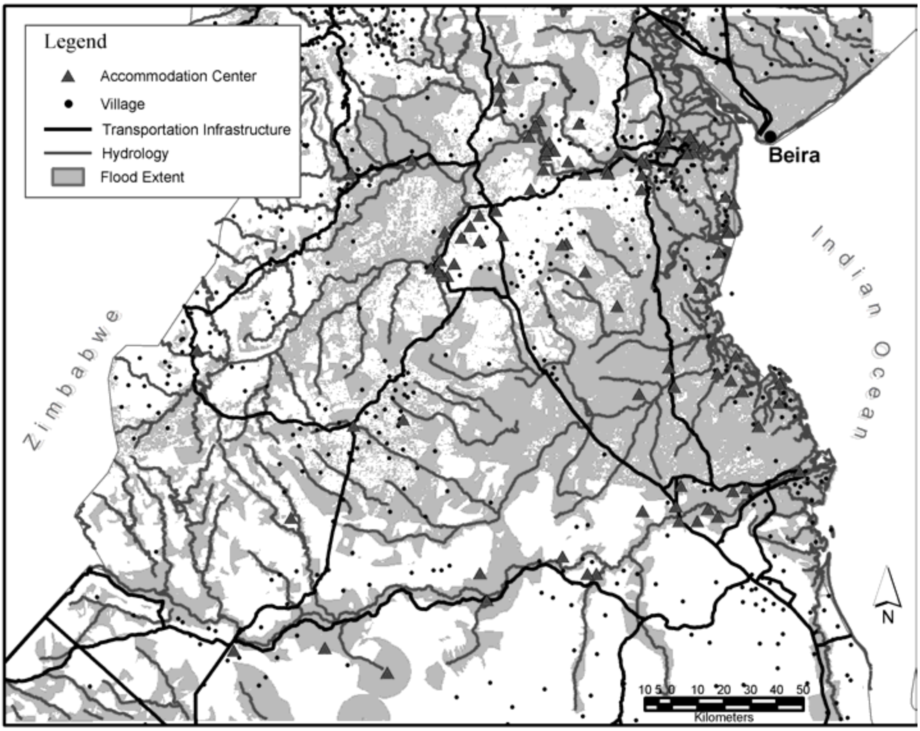

Figure 2 Flood extent and distribution of accommodation centres in 2000. The flood extent is a combined product of simulation and satellite-image interpretation. Note that the areas north of Beira have not been affected in 2000, but appear as potential flood areas in the simulation

USAID dating from 1997 and 2000; digital land-cover information compiled by DINGECA in 1997; flood-extent information delineated from LANDSAT 7 ETM+ satellite imagery dating from April 2000 and compiled by the GIS unit of the Catholic University of Mozambique at Beira; population information provided by USAID — unfortunately no detailed metadata was available, but it is assumed that data were collected by an aerial survey in 2000 or later; and in-situ data (GPS measurements, interviews) collected in May/June 2001 to verify, update and complement the existing data sets.

The shelter analysis in the Save and Buzi river basins is a two-step (raster-based) process. First, all elements conflicting with the location of new shelter sites are determined. These elements, so-called constraints, are: areas with sufficient access to emergency shelters; areas with inappropriate land cover such as aquatic meadows or dense forest; and flood-prone areas. Flood simulations and satellite-imagery analyses aided in the delineation of areas vulnerable to flooding. Logically, the subsequent suitability model excludes all those improper areas. Second, the suitability analysis incorporates factors enhancing the suitability of a site such as the proximity to major roads or the existence of schools and hospitals — so-called host-infrastructure (see Figure 3).

Determining accessibility

For this research, accessibility refers to the physical ease of access to shelter sites by vulnerable populations. This definition also implies the shelter's outreach capacity in terms of assistance to people who remain in surrounding communities instead of evacuating. To determine accessibility to emergency shelters, certain assumptions are necessary: as experienced in the 2000 floods, it is assumed that people tend to ignore warnings and leave their homes very late. Consequently, even small rivers cannot be crossed on foot because of high water or because dirt bridges are washed away. Thus, in this model, rivers are regarded as significant natural barriers. Furthermore, it is presumed that people mainly walk cross-country to accommodation centres because settlements are remote and dispersed, the roads are impassible in periods of extended rainfall and public or private transport is unavailable.

These assumptions are translated into friction values (see Table 3). The coded land use/land cover data set captures the effort of walking cross-country, and differentiates between the movements over bare soil or through woodland. Generally speaking, the denser the vegetation, the more energy-intensive it is for people to cross this land-cover type, and the longer the journey will take. For instance, crossing meadows has no friction value assigned to it, so the resulting friction score equals simple Euclidean distance: crossing 200 metres of meadow (which equals two pixels, with a spatial resolution of 100m each) results in a friction score of 2.0.

The outcome is a specific catchment area for each accommodation centre depending on distance and land cover. Areas below a friction score of 800 (equals 50km on bare soil) are considered as areas with sufficient access to shelters by vulnerable communities and are excluded from the suitability analysis. Based on experience, this threshold seems reasonable: in 2000, people reached shelters within a walking distance of one to two days or the equivalent of a walking distance of 50km over gentle terrain.

Suitability model

Questionnaires facilitated the determination of factors that enhance the suitability of shelter sites. These questionnaires were distributed among the emergency-management community involved in the rescue and relief phases of the 2000 floods. Out of 75 questionnaires, 43 are valid and entered the analysis. The answers given by the various members of UN agencies, NGOs, public administration and community representatives are fairly homogeneous among certain groups (rescue and relief, rehabilitation, community/administration), though they vary between groups. According to the survey, the factors considered most important for establishing new accommodation centres are: their proximity to vulnerable population; their proximity to roads; their proximity to potential host infrastructure (schools, health posts); their proximity to farmland; and the availability of potable water. The suitability analysis presented here includes all factors except availability of water due to the absence of appropriate data.

The final suitability information is a sum of weighted factors (see Figure 3). The factor weights reflect the importance of each factor. The factor on proximity to host infrastructure weighs highest, followed by the factors on proximity to roads and on proximity to farmland. Two trade-offs are necessary in terms of weighting: first, the weight for host infrastructure exceeds the weight for secondary roads as the road network in the study area is too coarse to generate meaningful outcomes; second, the

Table 3 Friction values assigned to land use/land cover types

Cultivated land use	*Friction value*
Rainfed cultivation	1.4
Irrigated cultivation	1.4
Non-cultivated land use	
Plantation	1.4
Recreational area	1.0
Urbanised dwelling area	1.0
Semi-urbanised dwelling area	1.0
Non-urbanised dwelling area	1.0
Industrial	1.0
Salt pans	1.0
Land cover with edaphic limitation	
Bare soils	1.0
Meadow	1.0
Aquatic meadow	20.0
Mangrove (locally degraded)	200.0
Steppe	1.0
Land cover with no edaphic limitation	
Grassland	1.3
Shrubland	1.6
Medium thicket	3.0
Tall thicket	4.0
Bushland	1.6
Wooded grassland	2.0
Scrub wooded grassland	4.0
Open woodland	4.0
Woodland	10.0
Evergreen forest	20.0
Water areas	
Ocean	9999
Dam reservoirs	9999
Lakes, lagoons	9999
Wide rivers	9999

factor of proximity to affected population enters the suitability analysis only at the second level which gives the factor a heavier weight than actually assigned by the experts. The issue of availability of farmland was not part of the original questionnaire. Hence, the participants could not assign a weight to it. By requests from the respondents, the suitability analysis includes this factor now.

To summarise, physical constraints excluded from the suitability analysis are: areas flooded in 2000, ineligible land cover (aquatic meadows, woodland areas with a coverage of more than 80 per cent woodlands) and areas with sufficient access to accommodation centres as derived from the accessibility model.

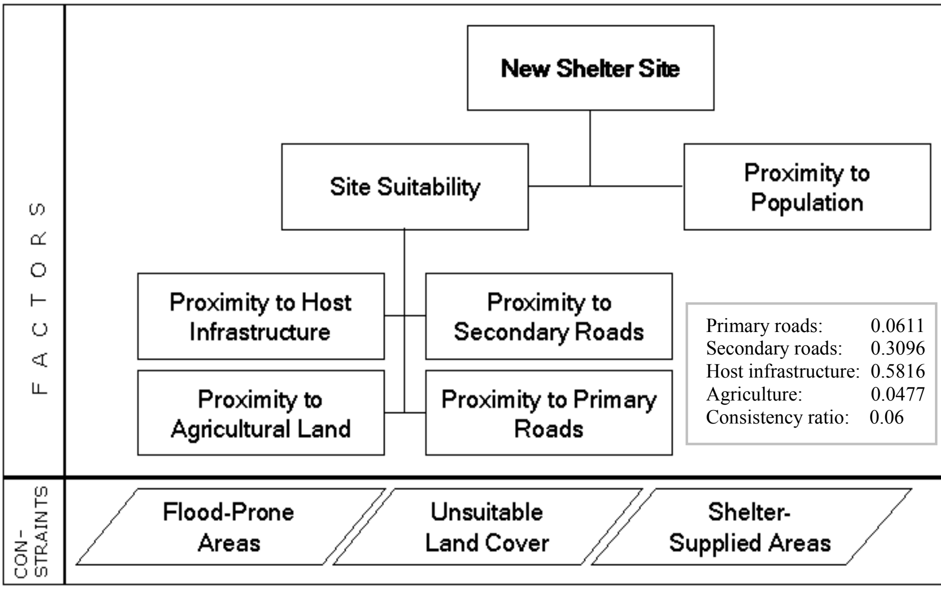

Figure 3 Decision matrix and associated factor weights

At the second level of the analysis, the present information is combined with the factor on proximity to population. Both information layers are weighted similarly denoting equal importance. Since it is more efficient to establish an accommodation centre close to population clusters, rather than farther away, only regions with a population density of 24 people per square kilometre (equivalent to three families/km^2) are considered.

The final outcome is a spatial representation of suitable zones close to rural settlements that are prime sites for new accommodation centres.

Results

From south to north, eight sites meet the defined requirements: Inhassoro and Maimelane (Inhassoro district), Save (Machaze district), south of Espungabera (Mossurize district), Dacata and small patches south of Dombe (Sussundenga district), east of Goonda (Chibabava district) and Macata (Gondola district). Eight suitable sites is a small number considering the size of the study area. This phenomenon is caused by the high weight for the factor of host infrastructure as areas without existing infrastructure are diminishing in importance.

Areas where the results of the analysis coincide with the documented demand for additional accommodation (compare situation reports from February 2000 to August 2000 at www.mozambique.mz/floods/cheias.htm) are: the region north-east of Goonda, the southern banks of the Lucite River and the area around Save. In these regions, it is possible to transform or expand existing facilities to serve as accommodation centres in the near future. The same is true for the zones around Inhassoro and Maimelane, although these locations require further examination in terms of their vulnerability to cyclones.

The relevance of areas highlighted as suitable sites located in Mude and Dacata is questionable. These regions lie in a mountainous zone and access could be restricted by the topography. In order to account for this factor, digital-elevation models (DEM) with sufficient spatial vertical resolution (<50m) should be incorporated in future studies of shelter accessibility. Unfortunately, such information is currently not available to the public.

Areas, where the demand for accommodation sites exists but no potential sites could be identified, are visualised in dark-gray shades (see Figure 4). In order to improve the situation in these regions, proactive measures such as the construction of hazard-resistant, multi-purpose facilities are vital (as seen in Bangladesh (Macks, 1996)). For instance, west of Dombe (Sussundenga district), an additional facility could accommodate the population living between the Lucite and Mussapa rivers. Most of the year, this area is inaccessible by vehicle since the only bridge was destroyed during the civil war. In times of heavy rainfall, the situation worsens and the region is totally cut off from external assistance. The same is true for the regions between Chuirairue, Save and Mavue, along the Repembe River and the southern bank of the Save River between Zinave and Vila Franco do Save.

The benefits of an extended and permanent shelter network including multi-purpose infrastructure such as schools and health posts as well as the construction of additional facilities in areas where a simple upgrade of schools and other public structures is not possible allows for improvements on several levels. On the local level, accommodation centres reduce physical vulnerability to natural hazards (requiring flood- and cyclone-resistant construction, see the Sphere Project) and assist in a faster recovery from impact through the timely and targeted provision of relief goods, seeds, tools, etc. These benefits are multiplied when the local community develops complementing self-help strategies such as controlled evacuation and pre-stocking of

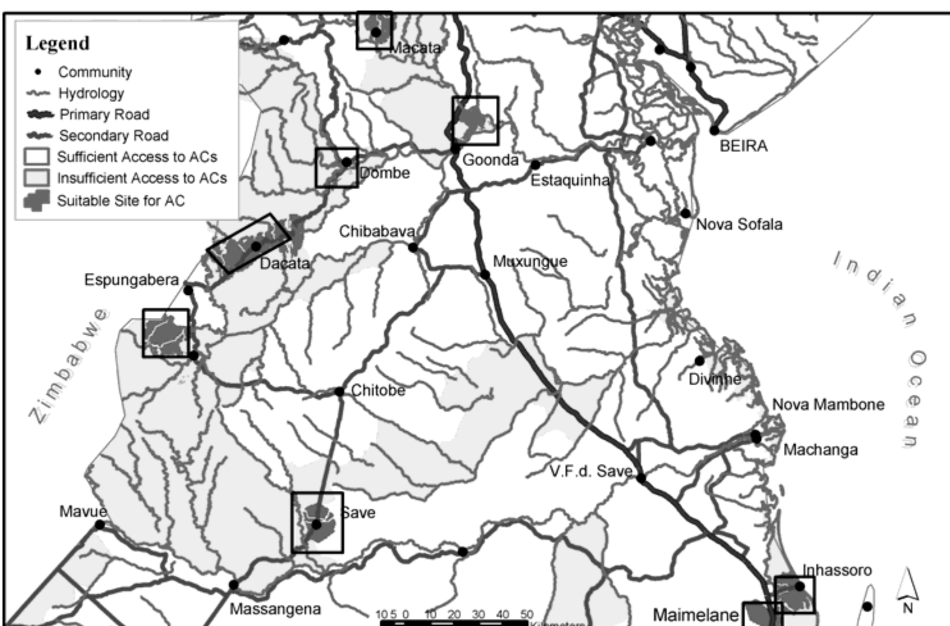

Figure 4 Suitable sites for new accommodation centres and areas requiring proactive shelter measures

accommodation centres with food and water, hereby lessening dependence on external initiatives and reducing the community's vulnerability. Until now, only a few communities in Mozambique have developed successful early warning systems — systems which consider traditional environmental cues like ants moving to higher ground or rising water levels in sidearms and ponds (SEED, 2001).

A permanent network of shelters also enhances the performance of local administrations and aid organisations. Sheltering in place and timely evacuations minimise expensive airlift operations for search-and-rescue and relief food distributions. Relief operations are more effectively targeted as the network of accommodation centres ensures the channelling and distribution of survival items into affected regions. Thus, freed up financial sources can be invested into sustainable reconstruction and preparedness efforts rather than in short-term rescue efforts. Table 4 highlights the current inequalities in the distribution of external assistance: in 2000, external assistance reached over 70 per cent of the people in Gaza and Maputo provinces, however, the number dropped from 60 per cent in Sofala to 40 per cent in Manica and Inhambane provinces. Simultaneously, the number of people that received help through accommodation centres was lowest in Manica and Inhambane provinces as well, remaining below 30 per cent. Even more alarming is the fact that in Sofala and Manica province all of the affected people were reported as needy indicating the populations' high degree of vulnerability.

Besides serving as a school or health post, for instance, emergency shelters should also be used as storage facilities year round to boost the devastated agricultural system of Mozambique. As no local storage and production facilities exist, the population stores parts of the harvest locally at their homes with a high probability of rotting or sells surplus immediately to merchants. The latter involves the risk of being forced to re-buy food at higher prices at a later date. Current studies (Arndt and Tarp, 2001; Sperling and Longley, 2002; Longley et al., 2002) prove that storing and producing food locally could significantly reduce high transport costs and the risk of buying overpriced food. Hence, this may be a promising approach for both poverty eradication and vulnerability reduction for the rural population of Mozambique.

Conclusion

The results show that a spatial post-assessment of the accessibiliy to shelter facilities provides useful information for various groups involved in vulnerablity reduction in Mozambique. With reference to NGOs and various UN agencies, it is desirable to incorporate spatial analyses as an evaluation and planning tool. This helps to gear the evaluation of food distribution projects away from the number of recipients and distributed tons and more towards effective and equitable distribution.

Furthermore, it is argued that a bottom-up process, namely improving the situation locally by creating a reliable network of (multi-purpose) shelters, triggers improved performances at a higher level (e.g. speed-up relief operations, effective and efficient humanitarian assistance). Of course, it is recognised that capacity-building projects on the national level are as important as local measures, although the delay in generating tangible benefits at the local level is tremendous. Thus, in an environment where financial and human resources are limited, spatial analyses should be incorporated in disaster-management procedures of both the Mozambican government

Table 4 External assistance in 2000. N.B. different figures given by INGC

Province	*Affected districts*	*No. of ACs*		*Accommodated/ displaced people*[1]			*Affected‡*	*In need‡*	*Benefi-ciaries‡*
		CVM	*INGC*	*CVM*	*INGC†*	*INGC‡*			
Sofala	Búzi Machanga* Chibabava	12	2	62K	45K	95K	197K	197K	123K
Manica	Mossurize Machaze Sussundenga Gondola‡ Manica‡	0	3	25K	15K	17K	62K	62K	27K
Gaza	Caniçado† Chókwe Guijá Chibuto Massangena† Xai-Xai Bilene-Macia Chicualacuala‡ Mabalane‡ Massingir‡ Chigubo‡	33	49	180K	252K	252K	743K	398K	313K
Inhambane	Govuro Inhassoro* Vilanculos* Cidades de Maxixe e de Inhambane* Mabote‡ Funhalouro‡	7	8	8K	7K	26K	138K	101K	40K
Maputo	Manhiça Moamba Marracuene Boane Magude Matola Matutuine† Namaacha†	28	30	27K	83K	101K	871K	250K	184K
	Cidade de Maputo e de Matola	16	14	12K	11K				
Total		96	106	313K	412K	491K	2,010K	1,009K	663K

Sources: *CVM, 2000; †Government of Mozambique, 2000: Annex 8; ‡Government of Mozambique, 2000: Annex 4; no star or symbol indicates information listed in CVM and governmental reports.

Note 1: The figures derived from GoM/Annex 4 refer to accommodated people only. The reference for the figures presented in GoM/Annex 8 is unclear: numbers can potentially refer to the total number of displaced people per province instead of accommodated people.

and development agencies to decrease the vulnerability of the country's population, especially in rural and remote regions.

In order to integrate spatial analyses it is essential, however, that the Mozambican government and its agencies (INGC, DINAGECA, CENACARTA), NGOs, UN agencies (WFP's Vulnerability Analysis and Mapping Unit) and others, keep up, or better, increase the compilation of spatially referenced data sets and share them as well. Future project planning and evaluation could significantly benefit from detailed, accurate and complete data sets that allow for comprehensive vulnerability assessments and cross-checks of existing findings at the national and subnational level.

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