Housing, Shelter & Basic Infrastructures Resistant to Disasters in Southern Africa

Malawi
Mozambique
Madagascar

EUROPEAN COMMISSION
Humanitarian Aid

Prepared under the European Commission Humanitarian Office (ECHO) through the Disaster Preparedness Programme (DIPECHO)

UN HABITAT
FOR A BETTER URBAN FUTURE

COOPI
COOPERAZIONE INTERNAZIONALE
Miglioriamo il mondo, insieme

FAO
FIAT PANIS

Aknowledgment

Forward

Acronysms and Abbreviations

IN PROGRESS

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Introduction

Methodology

IN PROGRESS

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III.a

Definitions

2009 UNISDR Terminology on Disaster Risk Reduction

Adaptation. The adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.

Building code. A set of ordinances or regulations and associated standards intended to control aspects of the design, construction, materials, alteration and occupancy of structures that are necessary to ensure human safety and welfare, including resistance to collapse and damage.

Capacity Development. The process by which people, organizations and society systematically stimulate and develop their capacities over time to achieve social and economic goals, including through improvement of knowledge, skills, systems, and institutions.

Disaster. A serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources.

Disaster risk management. The systematic process of using administrative directives, organizations, and operational skills and capacities to implement strategies, policies and improved coping capacities in order to lessen the adverse impacts of hazards and the possibility of disaster.

Disaster risk reduction. The concept and practice of reducing disaster risks through systematic efforts to analyse and manage the causal factors of disasters, including through reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events.

Early warning system. The set of capacities needed to generate and disseminate timely and meaningful warning information to enable individuals, communities and organizations threatened by a hazard to prepare and to act appropriately and in sufficient time to reduce the possibility of harm or loss.

El Niño-Southern Oscillation phenomenon. A complex interaction of the tropical Pacific Ocean and the global atmosphere that results in irregularly occurring episodes of changed ocean and weather patterns in many parts of the world, often with significant impacts over many months, such as altered marine habitats, rainfall changes, floods, droughts, and changes in storm patterns.

Emergency management. The organization and management of resources and responsibilities for addressing all aspects of emergencies, in particular preparedness, response and initial recovery steps.

Exposure. People, property, systems, or other elements present in hazard zones that are thereby subject to potential losses.

Land-use planning. The process undertaken by public authorities to identify, evaluate and decide on different options for the use of land, including consideration of long term economic, social and environmental objectives and the implications for different communities and interest groups, and the subsequent formulation and promulgation of plans that describe the permitted or acceptable uses.

Mitigation. The lessening or limitation of the adverse impacts of hazards and related disasters.

Source: 2009 UNISDR Terminology on Disaster Risk Reduction / United Nations International Strategy for Disaster Reduction / Geneva, Switzerland, May 2009
Please Note: Vocabulary mentioned above is only an extract of the complete terminology, selected on the basis of the requirements of this documentation work

III.b

Definitions

2009 UNISDR Terminology on Disaster Risk Reduction

Natural hazard. Natural process or phenomenon that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage.

Preparedness. The knowledge and capacities developed by governments, professional response and recovery organizations, communities and individuals to effectively anticipate, respond to, and recover from, the impacts of likely, imminent or current hazard events or conditions.

Prevention. The outright avoidance of adverse impacts of hazards and related disasters.

Public awareness. The extent of common knowledge about disaster risks, the factors that lead to disasters and the actions that can be taken individually and collectively to reduce exposure and vulnerability to hazards.

Recovery. The restoration, and improvement where appropriate, of facilities, livelihoods and living conditions of disaster-affected communities, including efforts to reduce disaster risk factors.

Resilience. The ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions.

Response. The provision of emergency services and public assistance during or immediately after a disaster in order to save lives, reduce health impacts, ensure public safety and meet the basic subsistence needs of the people affected.

Retrofitting. Reinforcement or upgrading of existing structures to become more resistant and resilient to the damaging effects of hazards.

Risk. The combination of the probability of an event and its negative consequences.

Risk assessment. A methodology to determine the nature and extent of risk by analysing potential hazards and evaluating existing conditions of vulnerability that together could potentially harm exposed people, property, services, livelihoods and the environment on which they depend.

Sustainable development. Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

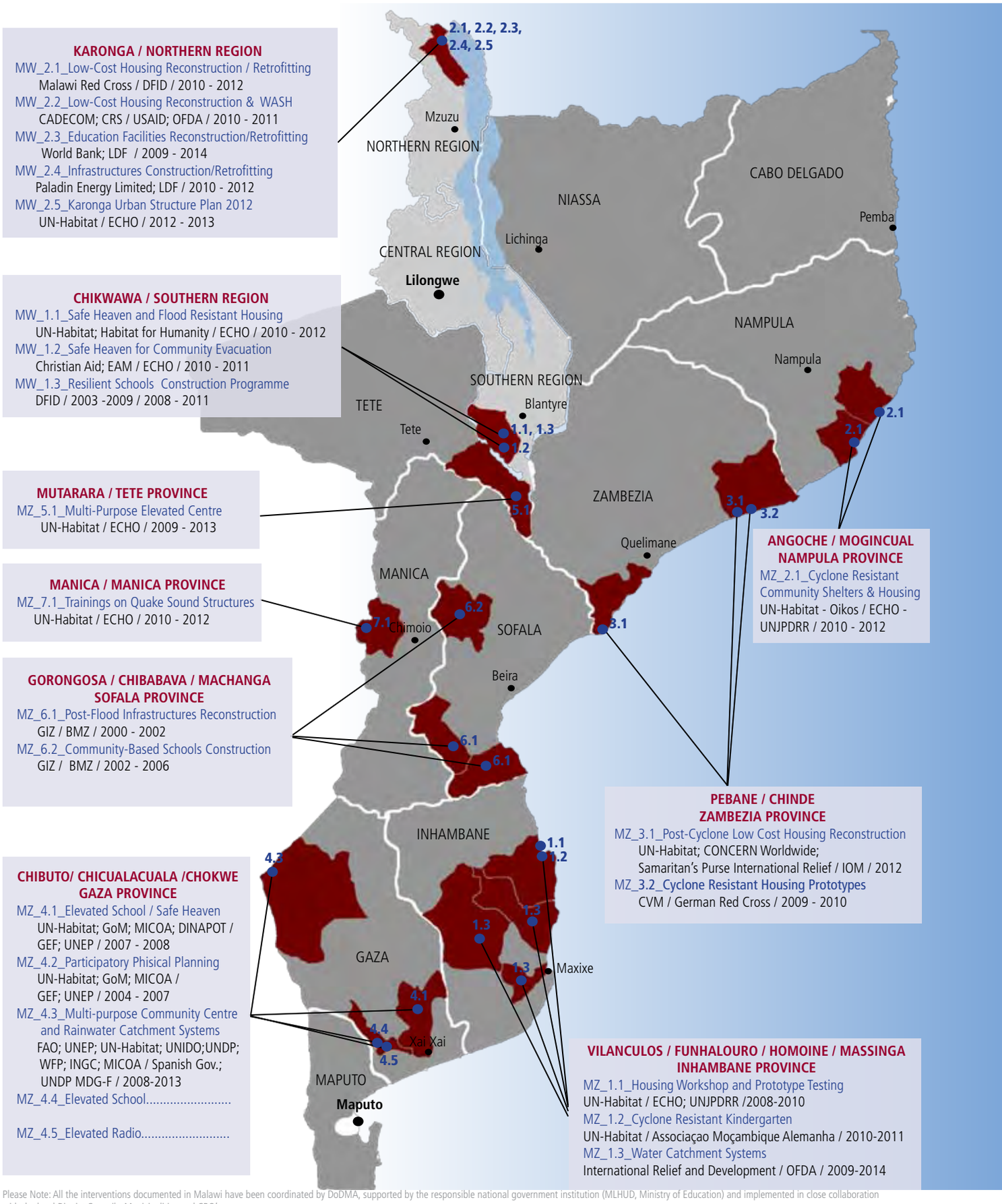
Vulnerability. The characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard.

Source: 2009 UNISDR Terminology on Disaster Risk Reduction / United Nations International Strategy for Disaster Reduction / Geneva, Switzerland, May 2009
Please Note: Vocabulary mentioned above is only an extract of the complete terminology, selected on the basis of the requirements of this documentation work

IV.a

Achievements Map

Adaptive Architecture Interventions Documented in Malawi and Mozambique



KARONGA / NORTHERN REGION
MW_2.1_Low-Cost Housing Reconstruction / Retrofitting
Malawi Red Cross / DFID / 2010 - 2012
MW_2.2_Low-Cost Housing Reconstruction & WASH
CADECOM; CRS / USAID; OFDA / 2010 - 2011
MW_2.3_Education Facilities Reconstruction/Retrofitting
World Bank; LDF / 2009 - 2014
MW_2.4_Infrastructures Construction/Retrofitting
Paladin Energy Limited; LDF / 2010 - 2012
MW_2.5_Karonga Urban Structure Plan 2012
UN-Habitat / ECHO / 2012 - 2013

CHIKWAWA / SOUTHERN REGION
MW_1.1_Safe Heaven and Flood Resistant Housing
UN-Habitat; Habitat for Humanity / ECHO / 2010 - 2012
MW_1.2_Safe Heaven for Community Evacuation
Christian Aid; EAM / ECHO / 2010 - 2011
MW_1.3_Resilient Schools Construction Programme
DFID / 2003 -2009 / 2008 - 2011

MUTARARA / TETE PROVINCE
MZ_5.1_Multi-Purpose Elevated Centre
UN-Habitat / ECHO / 2009 - 2013

MANICA / MANICA PROVINCE
MZ_7.1_Trainings on Quake Sound Structures
UN-Habitat / ECHO / 2010 - 2012

GORONGOSA / CHIBABAVA / MACHANGA SOFALA PROVINCE
MZ_6.1_Post-Flood Infrastructures Reconstruction
GIZ / BMZ / 2000 - 2002
MZ_6.2_Community-Based Schools Construction
GIZ / BMZ / 2002 - 2006

CHIBUTO/ CHICUALACUALA /CHOKWE GAZA PROVINCE
MZ_4.1_Elevated School / Safe Heaven
UN-Habitat; GoM; MICOA; DINAPOT / GEF; UNEP / 2007 - 2008
MZ_4.2_Participatory Phisical Planning
UN-Habitat; GoM; MICOA / GEF; UNEP / 2004 - 2007
MZ_4.3_Multi-purpose Community Centre and Rainwater Catchment Systems
FAO; UNEP; UN-Habitat; UNIDO;UNDP; WFP; INGC; MICOA / Spanish Gov.; UNDP MDG-F / 2008-2013
MZ_4.4_Elevated School.....
MZ_4.5_Elevated Radio.....

ANGOCHE / MOGINCUAL NAMPULA PROVINCE
MZ_2.1_Cyclone Resistant Community Shelters & Housing
UN-Habitat - Oikos / ECHO - UNJPDRR / 2010 - 2012

PEBANE / CHINDE ZAMBEZIA PROVINCE
MZ_3.1_Post-Cyclone Low Cost Housing Reconstruction
UN-Habitat; CONCERN Worldwide; Samaritan's Purse International Relief / IOM / 2012
MZ_3.2_Cyclone Resistant Housing Prototypes
CVM / German Red Cross / 2009 - 2010

VILANCULOS / FUNHALOURO / HOMOINE / MASSINGA INHAMBANE PROVINCE
MZ_1.1_Housing Workshop and Prototype Testing
UN-Habitat / ECHO; UNJPDRR /2008-2010
MZ_1.2_Cyclone Resistant Kindergarten
UN-Habitat / Associaçao Moçambique Alemanha / 2010-2011
MZ_1.3_Water Catchment Systems
International Relief and Development / OFDA / 2009-2014

Please Note: All the interventions documented in Malawi have been coordinated by DoDMA, supported by the responsible national government institution (MLHUD, Ministry of Education) and implemented in close collaboration with the local District Councils, Municipalities and CBO's
Please Note: All the interventions implemented in Mozambique have been coordinated by INGC, supported by the responsible national government institution (MOPH, MINED, MISAU) and implemented in close collaboration with the local District Councils, Municipalities and CBO's

IV.b

Achievements Map

Adaptive Architecture Interventions Documented in Madagascar

MORONDAVA
TOLIARA PROVINCE
MD_1.1_Development of construction tools for adaptive architecture solutions resistant to cyclone and flooding
UN-Habitat / ECHO / .....

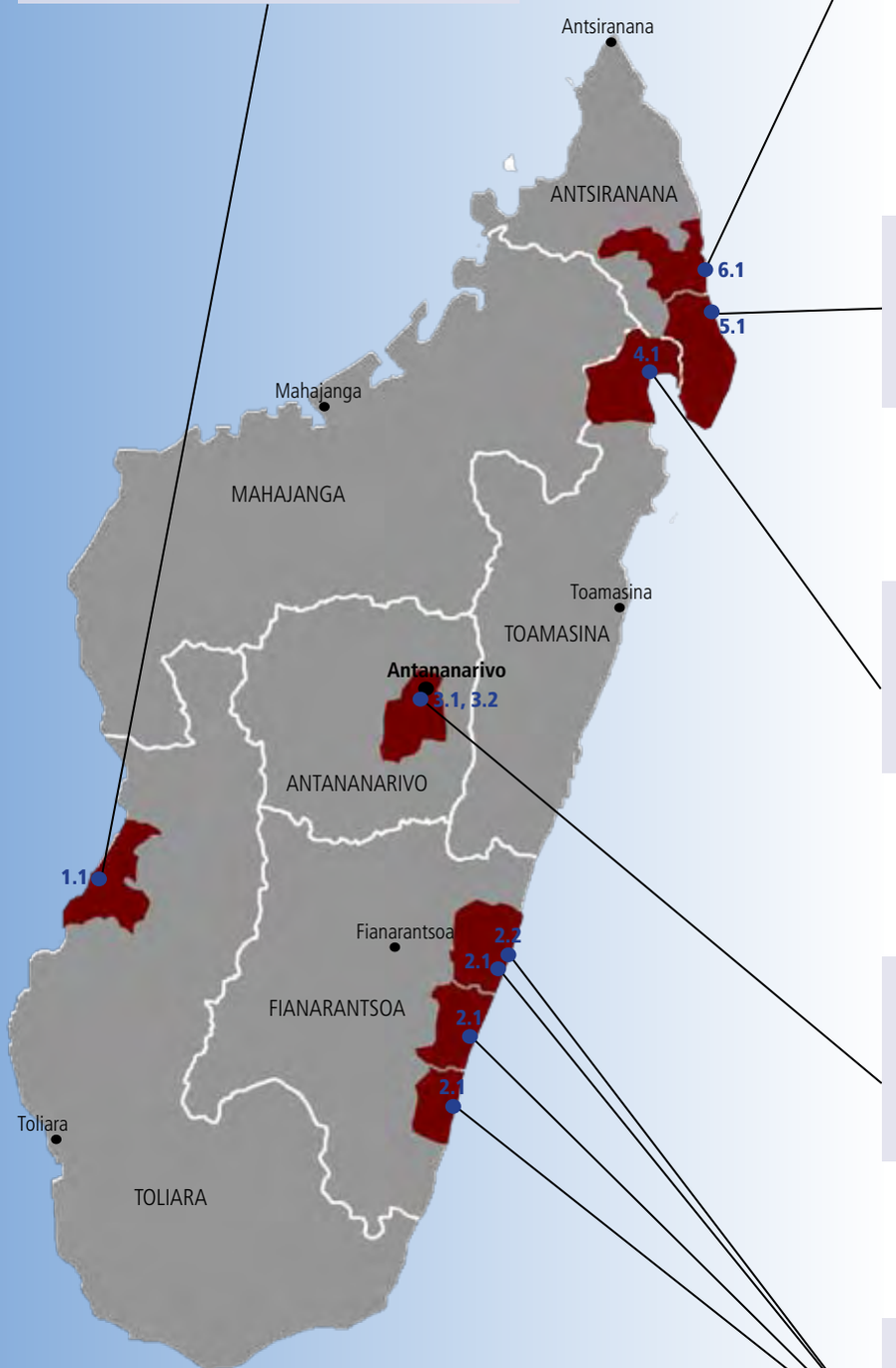
SAMBAVA
ANTSIRANANA PROVINCE
MD_6.1_.....
MDM; UN-Habitat / ECHO / .....

ANTALA
ANTSIRANANA PROVINCE
MD_5.1_.....
CARE; UN-Habitat / ECHO /.....

MAROANTSETRA
TOAMASINA PROVINCE
MD_4.1_.....
MEDAIR; UN-Habitat / ECHO /.....

ANTANANARIVO
ANTANANARIVO PROVINCE
MD_3.1_Development of construction tools for adaptive architecture solutions resistant to cyclone and flooding
UN-Habitat / ECHO / .....
MD_3.2_Public Infrastructures for Solid Waste Recycling
UN-Habitat.....

MANANJARY, VOHIPENO, MANAKARA
FIANARANTSOA PROVINCE
MD_2.1_Development of construction tools for adaptive architecture solutions resistant to cyclone and flooding
UN-Habitat / ECHO / .....
MD_2.2_.....
UN-Habitat; ICCO/SAF FJKM / ECHO.....



Please Note: All the interventions documented in Madagascar have been coordinated by BNGRC, supported by the responsible national government institution (.....) and implemented in close collaboration with the local .....

SECTION 1
Chapter 1

Disaster Risk Profile of Southern Africa

Malawi
Mozambique
Madagascar

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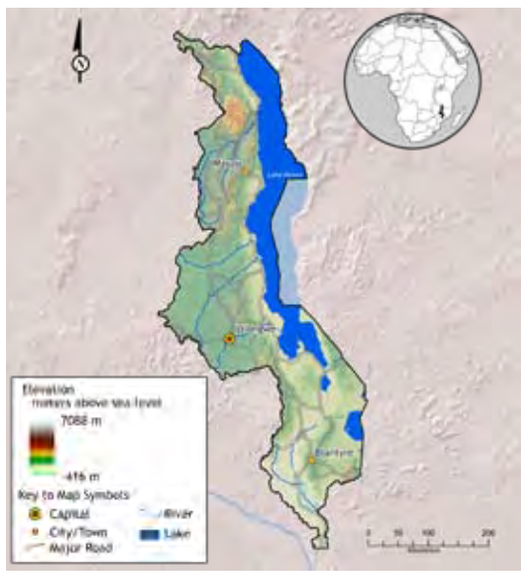
1.1.a

SUB-REGION: fact sheet

Malawi, Mozambique, Madagascar

Malawi at a glance 2011

Area (in km²)	118,480
Population (millions)	15.38
Population growth (annual %)	3.2
Urban population (% of total population)	16
GDP (current US$ billions)	5.62
GDP per capita (current US$)	365
GDP growth (annual %)	4.3
Agriculture (% of GDP)	30
Prevalence of HIV, total (% of population ages 15-49)	10
Improved sanitation facilities, urban (% of urban population with access)	49
Improved water source, urban (% of urban population with access)	95



Mozambique at a glance 2011

Area (in km²)	799,380
Population (millions)	23.93
Population growth (annual %)	2.3
Urban population (% of total population)	31
GDP (current US$ billions)	12.76
GDP per capita (current US$)	533
GDP growth (annual %)	7.1
Agriculture (% of GDP)	30
Prevalence of HIV, total (% of population ages 15-49)	11.3
Improved sanitation facilities, urban (% of urban population with access)	38
Improved water source, urban (% of urban population with access)	77

Madagascar at a glance 2011

Area (in km²)	587,040
Population (millions)	21.31
Population growth (annual %)	2.9
Urban population (% of total population)	33
GDP (current US$ billions)	9.91
GDP per capita (current US$)	465
GDP growth (annual %)	1.0
Agriculture (% of GDP)	-
Prevalence of HIV, total (% of population ages 15-49)	0.3
Improved sanitation facilities, urban (% of urban population with access)	21
Improved water source, urban (% of urban population with access)	74

Data Sources: The World Bank - 2011
Maps: GFDRR - Climate Risk and Adaption Country Profiles / 2011

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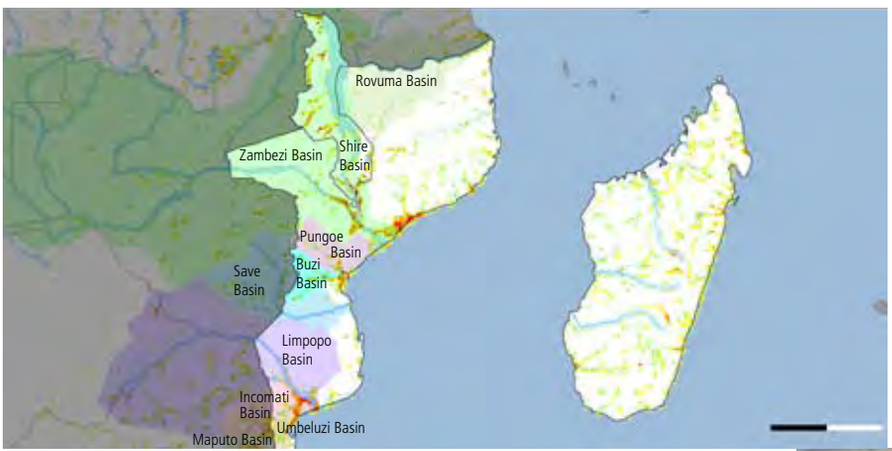
SUB-REGION: Hazards

Floods, Drought



MORTALITY RISK INDEX
FLOOD RISK (Classes)

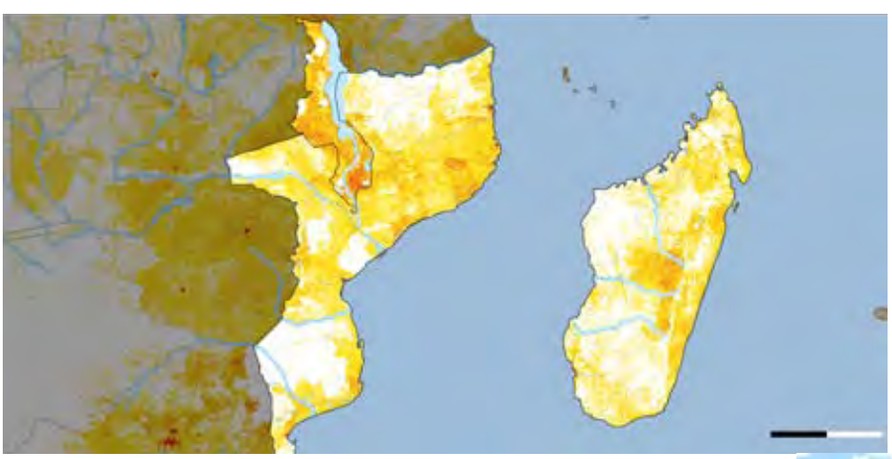
- Extreme
- High
- Medium
- Moderate
- Low

Map: Global Risk Data Platform
© 2012 UNEP / UNISDR

FLOODS

Abnormally high rainfall (for example, due to tropical cyclones) is the primary cause of flooding, occurring along the ten international river basins (see map) and 7.300 Km of coastlines of the sub-region and affecting more than 7.5 million people in the last 20 years[1]. Many human-induced contributory causes concurr to increase communities' vulnerability to floods: land degradation; deforestation of catchment areas; increased population density along riverbanks; poor land use planning, zoning, and control of flood plain development; inadequate drainage, particularly in cities; and inadequate management of discharges from river reservoirs.

Photo: 2000 Floods in Chokwe / Centro de Documentação e Formacão Fotográfica - Mozambique



DROUGHT Population
2010 Exposed (people/year)

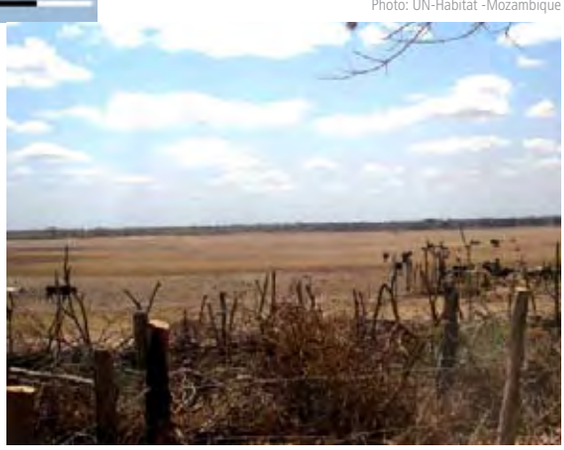
- Less than 10
- 10 - 50
- 50 - 200
- 200 - 1000
- 1000 - 21,057,684

Map: Global Risk Data Platform
© 2012 UNEP / UNISDR

Photo: UN-Habitat -Mozambique

DROUGHT

Droughts are not sudden events but chronic natural disasters affecting the entire sub-region. Linked to climatic phenomena (like El Niño–Southern Oscillation - ENSO)[2], these disasters are the end result of long-term degradation of the environment due to deforestation, poor land use and irrational exploitation of natural resources. They occurr every three to four years, increasing dramatically the vulnerability of an already poor population, concerning food security and livelihoods. Droughts affected globally more than 35 millions people in the three countries during 20 years[3]. Only Mozambique registered 100,000 casualties during the 1981 drought[3].



[1] EM-DAT: The OFDA/CRED International Disaster Database / www.em-dat.net - Université Catholique de Louvain - Brussels - Belgium
[2] ICSU Regional Office for Africa / SCIENCE PLAN / Natural and Human-induced Hazards and Disasters in sub-Saharan Africa - September 2007
[3] PreventionWeb.net / UNISDR

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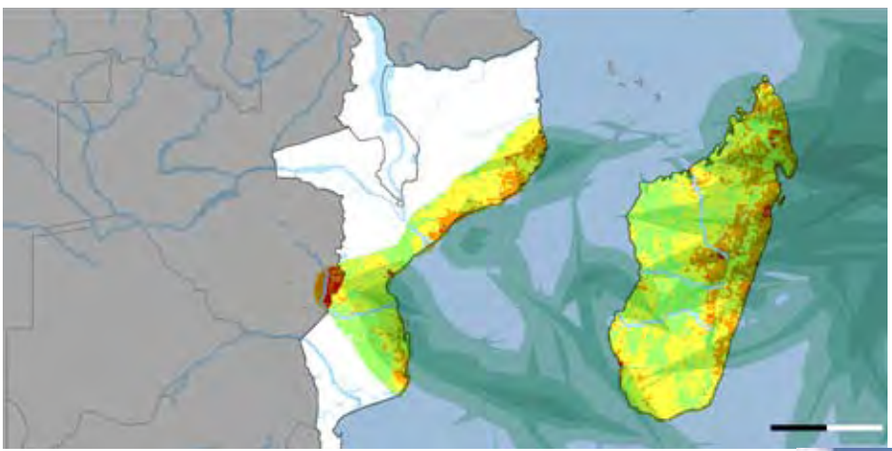
SUB-REGION: Hazards

Cyclones, Earthquakes



MORTALITY RISK INDEX
CYCLONE RISK (Classes)

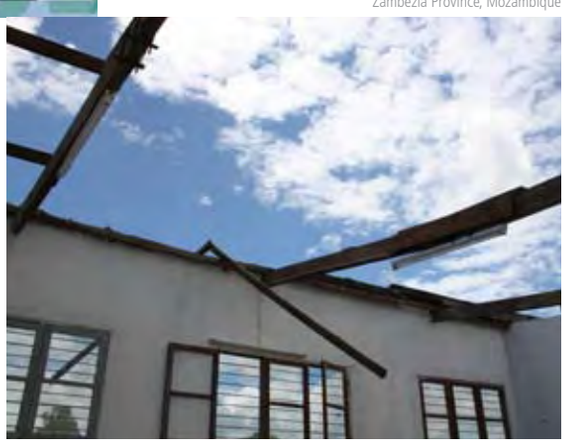
- Extreme
- High
- Medium
- Moderate
- Low

TROPICAL CYCLONES
WIND INTENSITY (SS Cat)

- 1
- 2
- 3
- 4
- 5

Map: Global Risk Data Platform
© 2012 UNEP / UNISDR

Photo: UN-Habitat -
Zambezia Province, Mozambique



CYCLONES AND STRONG WINDS

Typically, 12 cyclones occur annually in the southwestern Indian Ocean[1], generated between latitudes 5° and 20° when sea temperatures are sufficiently warm, and capable of annihilating coastal areas through sustained winds with speeds of 250 km/h or higher, through heavy rainfall and storm surges that cause the ocean level to rise by as much as 10 metres. The coastline of South-East Africa is often affected by these phenomena, being Madagascar the most vulnerable country in the sub-region, followed by Mozambique, with globally more than 1,400 casualties, 7,1 millions people affected and 1,6 billions USD economic damages during the last 20 years[2] in both countries.

EARTHQUAKES
as detected by ANSS (magnitude)

- 5.0 - 6.0
- 6.1 - 7.0
- 7.1 - 8.0
- 8.1 - 9.0

EARTHQUAKES
Footprint (MMI Cat)

- 5 (5 - 7)
- 7 (7 - 8)
- 8 (8 - 9)
- 9 (more than 9)

Map: Global Risk Data Platform
© 2012 UNEP / UNISDR

Photo: UN-Habitat -
Manica Province, Mozambique

EARTHQUAKES

Malawi and Mozambique stretch at south of the Eastern African Rift, the boundary between two plates in separation, thus creating an active fault zone. Devastating earthquakes with magnitudes greater than 6 occur almost annually in the East African Rift[1]. Recent events include the 2006 Mozambican M7.5 earthquake, one of the largest ever recorded in southern Africa, killing 4 people, injuring 27, and damaging more than160 buildings[1]. 1989 Malawian M6.1 earthquake in Salima killed 9 people and affected over 50,000, and the four Karonga earthquakes killed 4 people and affected about 145,436[3].

[1] ICSU Regional Office for Africa / SCIENCE PLAN / Natural and Human-induced Hazards and Disasters in sub-Saharan Africa - September 2007
[2] EM-DAT: The OFDA/CRED International Disaster Database / www.em-dat.net - Université Catholique de Louvain - Brussels - Belgium
[3] Report of the USGS/OFDA Earthquake Disaster Assistance Team (EDAT) "Post-Earthquake Site Visit to Karonga, Malawi" - January 2010

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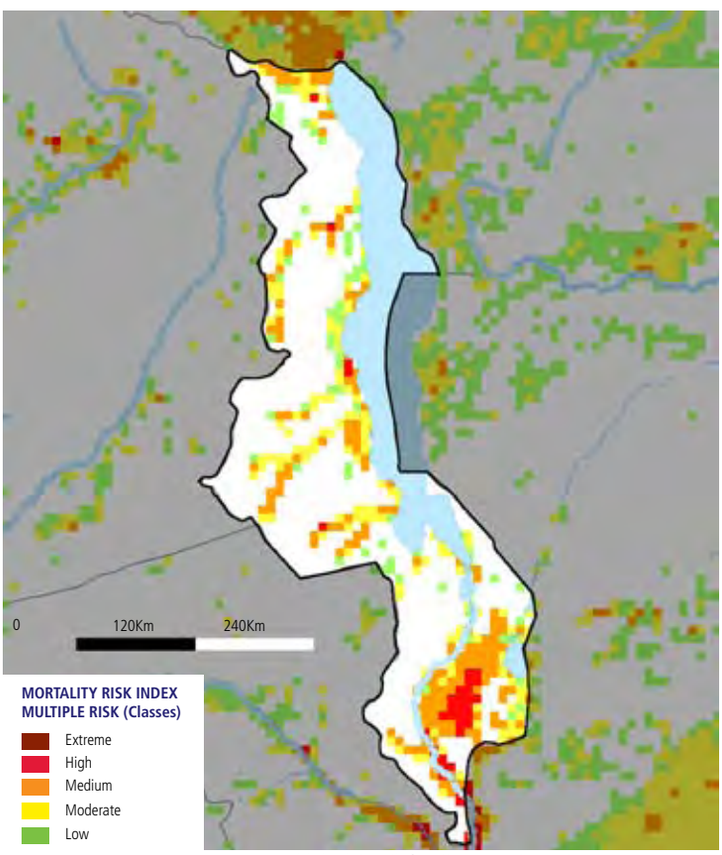
RISK PROFILE - Malawi

Natural Disasters Occurrence, Human and Economical Exposure

Natural Disasters from 1980 - 2010

N° of events:	**47**
N° of people killed:	**2,775**
Average killed per year:	**90**
N° of people affected:	**21,731,581**
Average affected per year:	**701,019**
Economic Damage (US$ X 1,000):	**59,789**
Economic Damage per year (US$ X 1,000):	**1,929**

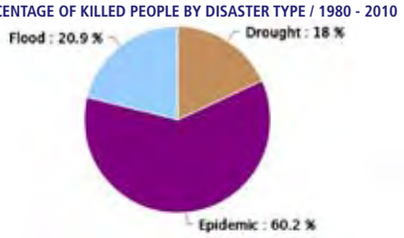
Source: PreventionWeb.net / UNISDR



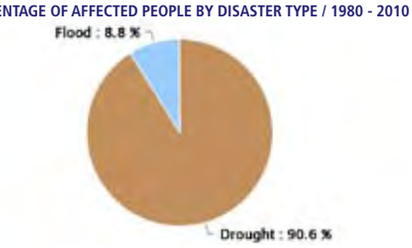
Map: Global Risk Data Platform © 2012 UNEP / UNISDR

NATURAL HAZARDS OCCURRENCE REPORTED / 1980-2010

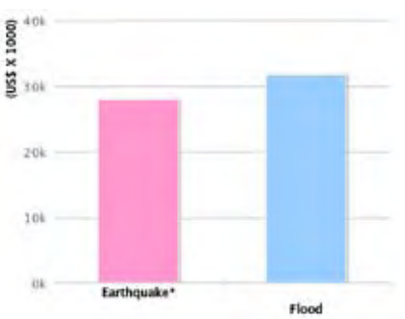
PERCENTAGE OF KILLED PEOPLE BY DISASTER TYPE / 1980 - 2010



PERCENTAGE OF AFFECTED PEOPLE BY DISASTER TYPE / 1980 - 2010



ECONOMICAL LOSSES BY DISASTER TYPE / 1980 - 2010



Source: PreventionWeb.net / UNISDR

Natural Hazards at a glance

Malawi is particularly prone to adverse climate hazards including dry spells, seasonal droughts, intense rainfall, riverine floods, flash floods and earthquakes.

Droughts and dry spells in Malawi cause on average about 1 percent annual GDP loss. The six drought episodes occurring in 29 years (1979-2008) killed about 500 people and affected 19.7 million people[1].

Floods in Malawi cause on average about 0.7 percent annual GDP loss[1].The 23 flooding events occurring in 29 years (1979-2008) killed about 581 people and affected 1.9 million people[1].

Damage from the two earthquakes that occurred over the last 30 years (1979-2009) cost about USD 28 million in Salima (1989), and about USD 13.6 million in Karonga (2009)[2].

Climate variability and climate change will increase the incidence of drought and floods, in frequency, intensity and magnitude over the next twenty years.

[1] "Malawi : Situation Analysis of Disaster Risk Management Programmes and Practice" - Final report - November 2008 – WB/GFDRR Track II/ E. Rowena Hay and M. Alexander.
[2] Report of the USGS/OFDA Earthquake Disaster Assistance Team (EDAT) "Post-Earthquake Site Visit to Karonga, Malawi" - January 2010

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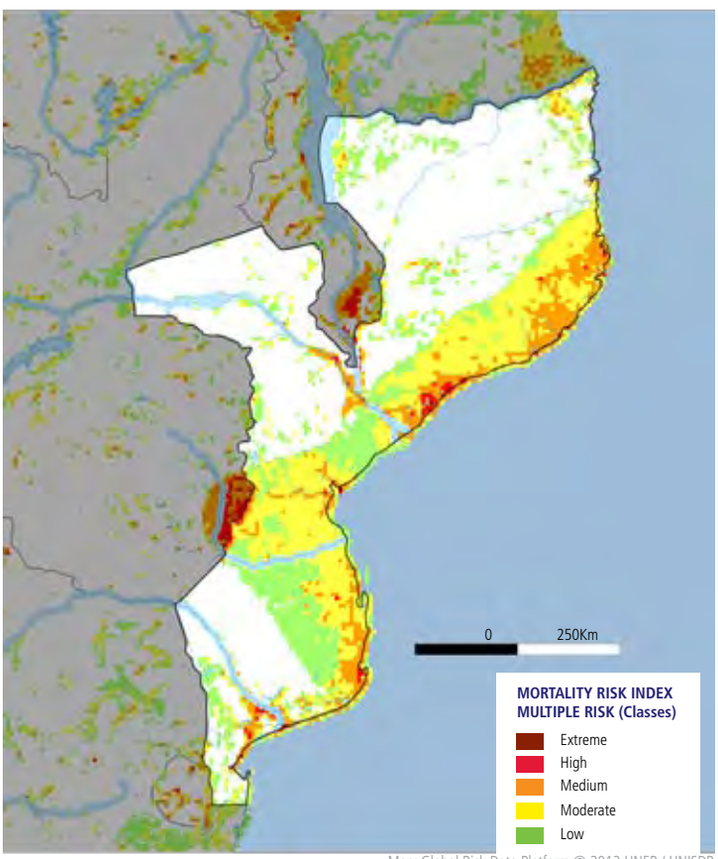
RISK PROFILE - Mozambique

Natural Disasters Occurrence, Human and Economical Exposure

Natural Disasters from 1980 - 2010

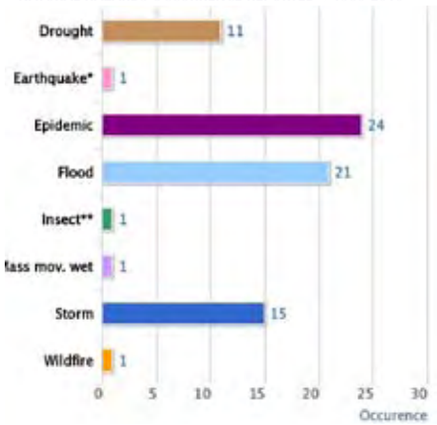
N° of events:	75
N° of people killed:	104,840
Average killed per year:	3,382
N° of people affected:	23,317,164
Average affected per year:	752,167
Economic Damage (US$ X 1,000):	802,650
Economic Damage per year (US$ X 1,000):	25,892

Source: PreventionWeb.net / UNISDR

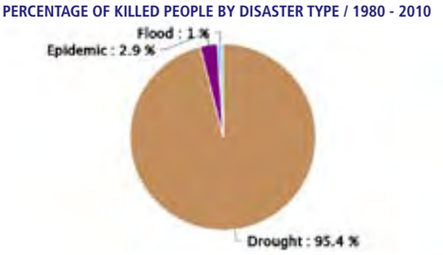


Map: Global Risk Data Platform © 2012 UNEP / UNISDR

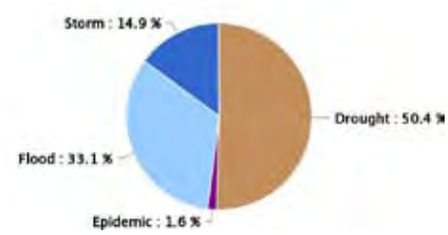
NATURAL HAZARDS OCCURRENCE REPORTED / 1980-2010



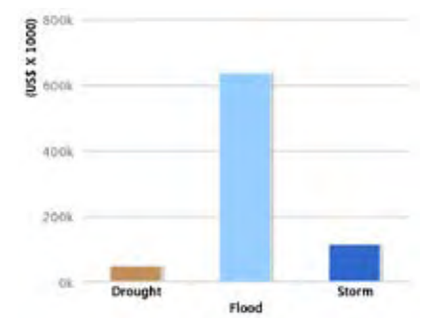
PERCENTAGE OF KILLED PEOPLE BY DISASTER TYPE / 1980 - 2010



PERCENTAGE OF AFFECTED PEOPLE BY DISASTER TYPE / 1980 - 2010



ECONOMICAL LOSSES BY DISASTER TYPE / 1980 - 2010



Source: PreventionWeb.net / UNISDR

Natural Hazards at a glance

Mozambique ranks third amongst the African countries most exposed to risks from multiple weather-related hazards, suffering from periodic floods, cyclones droughts and earthquakes. As much as 25 percent of the population is at risk from natural hazards[1].
Droughts occur primarily in the Southern and Central regions, with a frequency of 7 in 10 and 4 in 10 years, respectively[1].
Floods occur every 2-3 years along major river basins and low coastal plains: the risk is highest in the central and southern region[1].
More than 60 percent of Mozambique's population lives in coastal areas, and is therefore highly vulnerable to cyclones and storms, specially in the central and northern part[1].
Climate change will increase extreme weather patterns: future models predict a 25% increase in magnitude of large flood peaks in the major river basins[1].

[1] Global Facility for Disaster Reduction and Recovery - GFDRR Secretariat - Disaster Risk Management Programs for Priority Countries /Summary 2009

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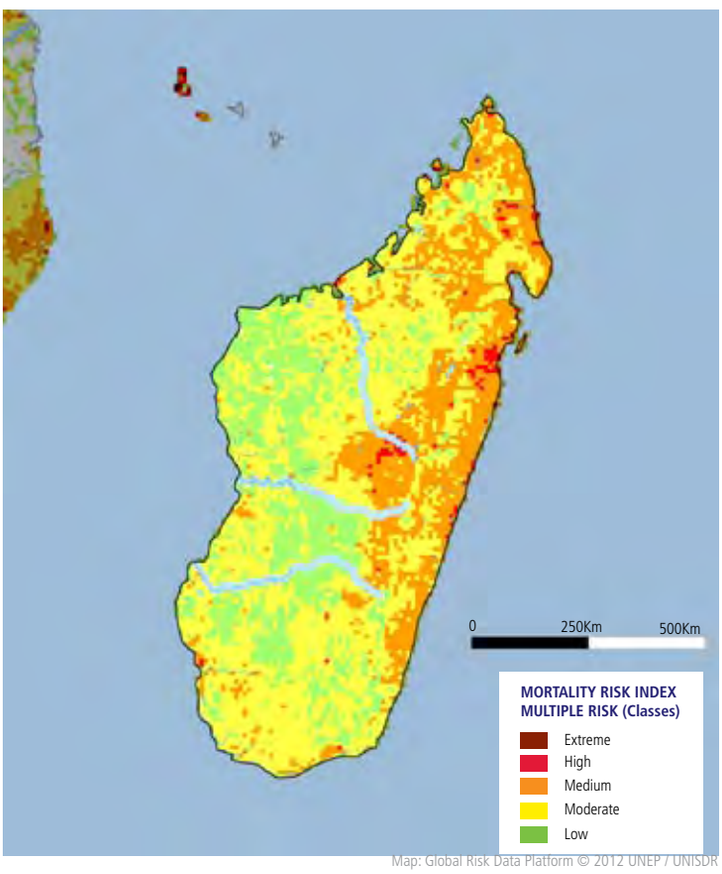
RISK PROFILE - Madagascar

Natural Disasters Occurrence, Human and Economical Exposure

Natural Disasters from 1980 - 2010

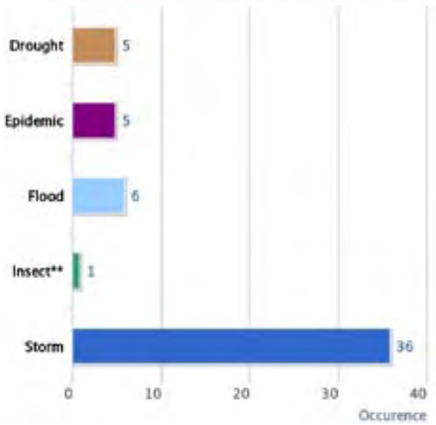
N° of events:	53
N° of people killed:	3,887
Average killed per year:	125
N° of people affected:	8,855,003
Average affected per year:	285,645
Economic Damage (US$ X 1,000):	1,702,881
Economic Damage per year (US$ X 1,000):	54,932

Source: PreventionWeb.net / UNISDR

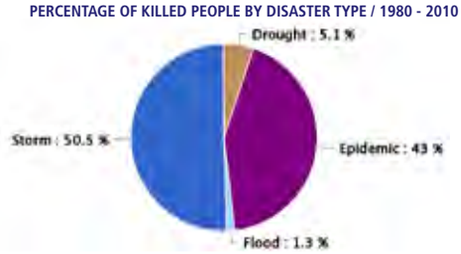


Map: Global Risk Data Platform © 2012 UNEP / UNISDR

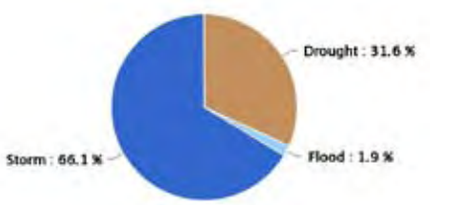
NATURAL HAZARDS OCCURRENCE REPORTED / 1980-2010



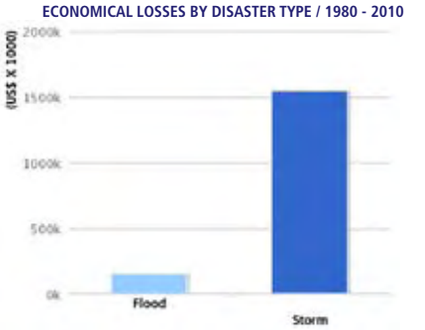
PERCENTAGE OF KILLED PEOPLE BY DISASTER TYPE / 1980 - 2010



PERCENTAGE OF AFFECTED PEOPLE BY DISASTER TYPE / 1980 - 2010



ECONOMICAL LOSSES BY DISASTER TYPE / 1980 - 2010



Source: PreventionWeb.net / UNISDR

Natural Hazards at a glance

From 1980 to 2010, 53 natural hazards - including, droughts, earthquakes, epidemics, floods, cyclones, and extreme temperatures - affected Madagascar and caused economic damages of over 1 billion USD[1].

Cyclones: Madagascar has one of the highest cyclone risks among African countries, with an average of 3-4 cyclones affecting the country every year[1], specially in the northeastern and southwestern coastlines.

Between 1980 and 2009,5 major droughts occurred with large implications on agriculture and food security[1].

Floods and Storms: Over 30 floods or heavy rainfall events affected Madagascar in the past 30 years[1], killing hundreds of people and affecting thousands.

Sea level rise: coastal erosion caused by sea level rise was measured in 1997 between 5.71 and 6.54 meters, and is projected to increase exponentially by 2100[1].

[1] Madagascar: Climate Risk and Adaptation Country Profile - April 2011/ GFDRR

Photo: 2000 Floods in Chokwe / Centro de Documentação e Formacão Fotográfica - Mozambique

SECTION 1
Chapter 2

Architectural Evolution Profile of Southern Africa

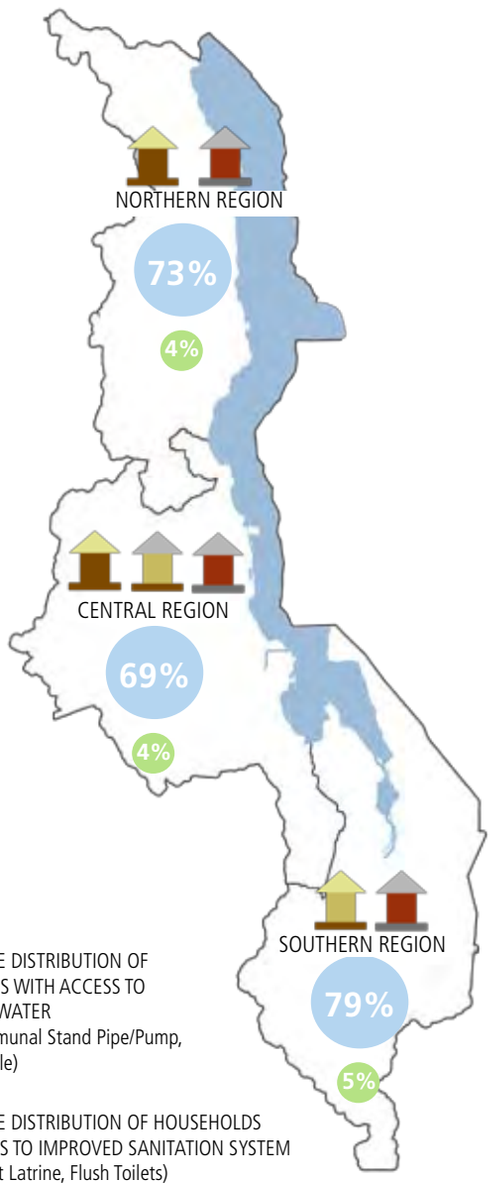
Malawi
Mozambique
Madagascar

R 1.2.a

Habitat - Malawi

FACT SHEET: Building Environment / Water, Sanitation & Hygiene

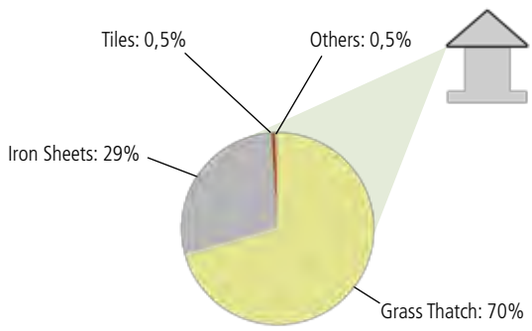
HABITAT CONDITIONS AT NATIONAL LEVEL



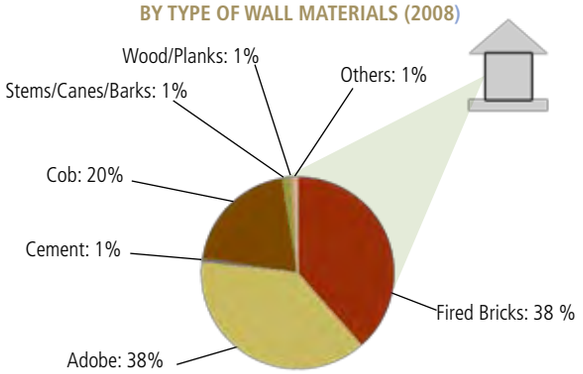
% PERCENTAGE DISTRIBUTION OF HOUSEHOLDS WITH ACCESS TO IMPROVED WATER (Piped, Communal Stand Pipe/Pump, Well, Borehole)

% PERCENTAGE DISTRIBUTION OF HOUSEHOLDS WITH ACCESS TO IMPROVED SANITATION SYSTEM (Improved Pit Latrine, Flush Toilets)

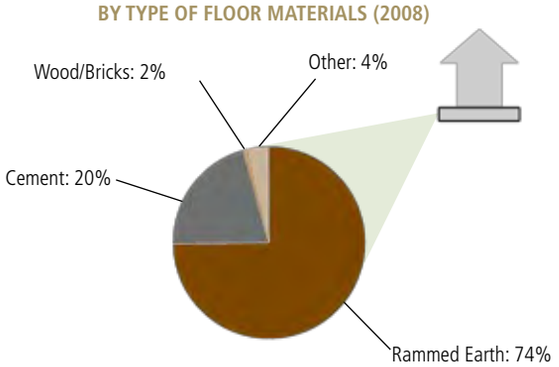
PERCENTAGE DISTRIBUTION AT NATIONAL LEVEL OF DWELLING UNITS BY TYPE OF ROOFING MATERIALS (2008)



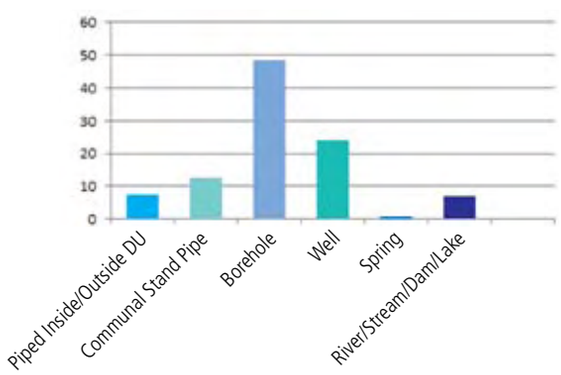
PERCENTAGE DISTRIBUTION AT NATIONAL LEVEL OF DWELLING UNITS BY TYPE OF WALL MATERIALS (2008)



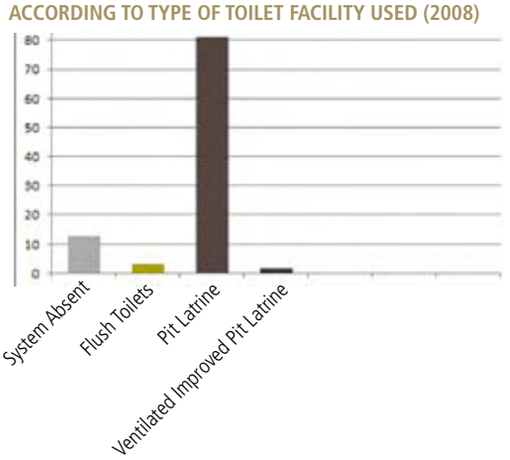
PERCENTAGE DISTRIBUTION AT NATIONAL LEVEL OF DWELLING UNITS BY TYPE OF FLOOR MATERIALS (2008)



PERCENTAGE DISTRIBUTION OF HOUSEHOLDS ACCORDING TO MAIN SOURCE OF DRINKING WATER (2008)



PERCENTAGE DISTRIBUTION OF HOUSEHOLDS ACCORDING TO TYPE OF TOILET FACILITY USED (2008)



Data Source: Malawi National Statistical Office - 2008 Population and Housing Census

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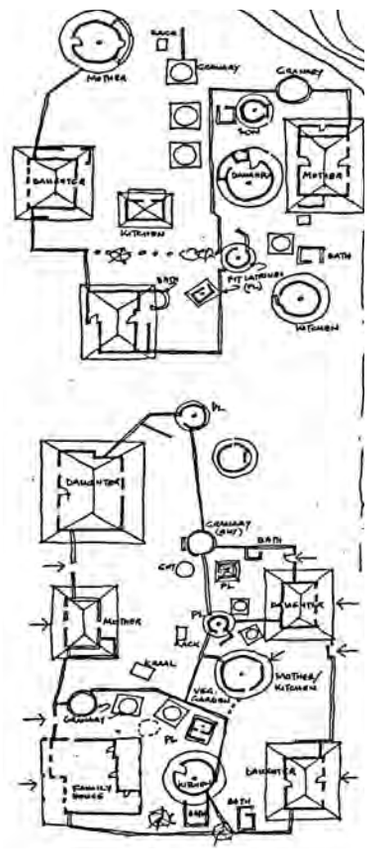
Habitat - Malawi

Transition In Rural Settlements Planning

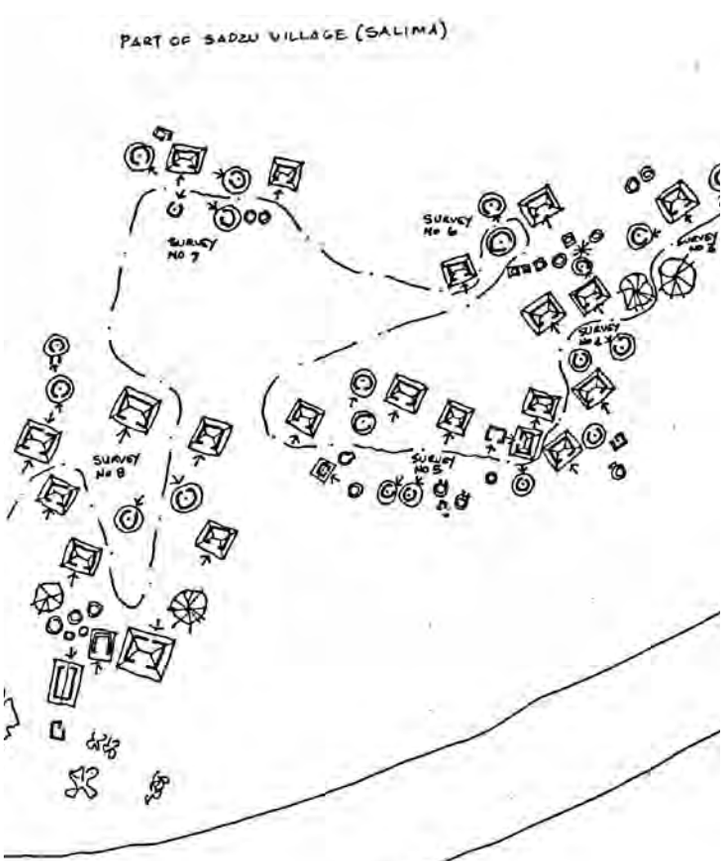


Drawing: Njolomole Village / Mike Polela

Drawing: Evolution of Housing Models / Mike Polela

THE VILLAGE PATTERN

In rural areas, extended families live together, mainyl outdoor, in a compound of several huts, typically thatch-roofed, mud-brick dwellings with one or two rooms. A compound also includes a kitchen hut, a borehole or well, a nkhokwe (a structure for storing grain), and perhaps an enclosure for livestock. The family's fields are located nearby. The houses look clustered in a linear way along the main foot or vehicle paths.
Housing vernacular round shape with conical roof has been replaced by square/rectangular shapes, result of colonial influence. In most rural areas, round shaped structures are now relegated to kitchens and pit latrines. The evolution affected house shapes, house usage - hence design and materials usage.



Drawing: Part of Sadzu Village, Salima / Mike Polela

Drawing Source: Southern Arica Regional Conference on Construction for Development / The Malawi Board of Architects and Quantity Surveyor

Average household size in the Northern Region is 5.2, Central Region 4.7 and Southern Region 4.4. Concerning housing dwellings size, about four out of five of the dwelling units had only one room used for sleeping, specially in rural areas.
The 2008 Popoulation and Housing Census classified a housing unit as **traditional** if it is built with both thatched roof and mud walls. On the other hand, a house is classified as **permanent** if the house or block is generally built using modern or durable facilities. A **semi-permanent** house is the one that has generally been built using modern and partial lasting materials. The percentage distribution of dwelling units by state of permanency has changed considerably since1998 to 2008: traditional houses decreased from 65.8% to 44.4% while permanent ones increasing from 15.8% to 21.4% and semi-permanent from 18.4% to 34.8%. This means that over 20 years 20% of the building environment has substituted mud floor and walls with cement screed and fired bricks masonry, replacing the thatch roof with metal panels coating. Almost half of the households in Malawi (48.3%) used borehole as a main source drinking water in 2008 while only 13.4% used the same source in 1987. Concerning sanitation systems, Traditional pit latrine is still the main toilet facility used in Malawi. The use of the facility has increased from 64 percent in 1998 to 81 percent in 2008. Traditional pit latrine is the most common type of toilet facility used by both rural and urban areas[1].

[1]Malawi National Statistical Office - 2008 Population and Housing Census

R 1.2.c

Habitat - Malawi

Housing - Building Types Evolution

Photo: UN-Habitat / Vernacular House, Karonga District, Northern Region

Photo: Colonial Building, Livingstonia

Photo: UN/Habitat / Contemporary Urban Housing Models, Karonga District, Northern Region

FROM VERNACULAR BUILDINGS....

Traditional houses are generally of wattle and dub dwellings, widespread throughout Malawi. The buidling materials are: soil, obtained from the building site; wooden poles in different sizes depending in areas of use – for uprights or for bracing; where bamboos are available, they are used for bracing; ropes from special twigs or from sisal; grass for thatch roof. The main vulnerability resides in the shallow foundation and the roof slope which is not compatible with the grass roofing material, allowing rain water to stagnate and penetrate in the almost flat thatched roof. While lacking durability, these dwellings, being light and flexible were largely undamaged by 2009 Karonga earthquake.

...THROUGH COLONIAL INFLUENCES...

British colonialism has introduced in Malawi the use of fired red bricks, used as main structure for walls masonry. In contemporary urban environment, the 44% of building walls are made in fired bricks, while the 53% use unburnt bricks. Only the 20% of the built asset is still using mud, and mainly in the rural areas. The colonial houses and missionary buildings were characterized by rectangular or square structures, often double storeys. Regular and paced windows and doors were reinforced by concrete lintels. The high pitch roofs were covered with corrugated iron sheets. On the high plateau of Zomba town, in the Southern Region, it is still possible to admire a wide repertoire of original British architecture.

...TO CONTEMPORARY LOCAL HOUSING MODELS

The introduction of brick-making, tinned roofs and the associated building tools changed the vernacular dwelling construction process to a "modern" building process. The vernacular round shape that was suitable to fight strong winds was given up to the square/rectangular shapes that required proper orientation to fight the strong winds. At the low-income end of brick construction chain, houses are built with un-burnt molded bricks (zidina) and mud mortar. Where there are sufficient resources, bricks are burnt using locally sourced firewood: this increases deforestation if construction activities are not accompanied by replanting programs. Houses are generally constructed over a period of time, as families gain the resources to purchase the required materials.Generally, to economise on the use of bricks, single brick thick walls are often built, with weak bonds at corners and no reinforcement of ring beams. The position and size of windows and doors, weak sections of the structure, doesn't take into account seismic resistance or winds performances. The foundations are not enough deeply laid under the ground level, to increase mechanical stability, and not enough elevated above that level, to protect the house from dump rising and water flooding. The roof structure is not reinforced with bracing systems and the two-slopes are not enough inclined to guarantee rain water outflowing and wind resistance: hence, tarpaulin 'damp' proof membranes, instead of being used for foundations, now find their-way in thatched roofs of square or rectangular houses.

R 1.2.d

Habitat - Malawi

Public Facilities - Building Types

Photo: UN-Habitat, Mlodza School, Lilongwe

EDUCATION INFRASTRUCTURES

The education sector is actually regulated in Malawi by the National Education Sector Plan (2008-2017) and the Education Sector Implementation Plan (2009-2013). School structures welcome an average of 500 pupils, and are composed by a series of 2/3 classrooms blocks with concrete floor, fired bricks, cement blocks or stabilized blocks masonry, wooden roof structure and corrugated metal sheets coating. A common problem is overcrowding.DFID has been supporting the Malawi Ministry of Education since 1995 to transform conditions at hundred of schools as part of its support to the education sector (ESSP)[1]. Construction has been carried out by small and medium sized local contractors, taking into account natural environment risks factors.

Photo: UN-Habitat, Mlodza School, Lilongwe

Photo: UN-Habitat, Makhira Health Centre, Chikwawa District / Staff House built with Stabilized Soil Blocks

HEALTH INFRASTRUCTURES

Accessibility and lack of electricity in remote areas are the major problems in terms of health services in Malawi, 60% of which are under the Ministry of Health, 37% under the Christian Health Association in Malawi (CHAM), while the remaining 3% is owned by private institutions. The Health Sector Strategic Plan (2011-2016) 1st objective is to increase coverage of Essential Health Package interventions, by constructing health facilities to allow the majority of Malawians to live within an 8 kilometres radius of a health facility[2]. One of the implementation strategies mentioned in the plan is to strengthen the response to disasters and emergencies specifically related to water, sanitation and hygiene.

Photo: UN-Habitat, Makhira Health Centre, Chikwawa District

[1]Ibid: MW 1.3 / Resilient Schools / Education Sector Support Programmme
[2]Malawi Health Sector Strategic Plan 2011- 2016 / Ministry of Health / Malawi Government;

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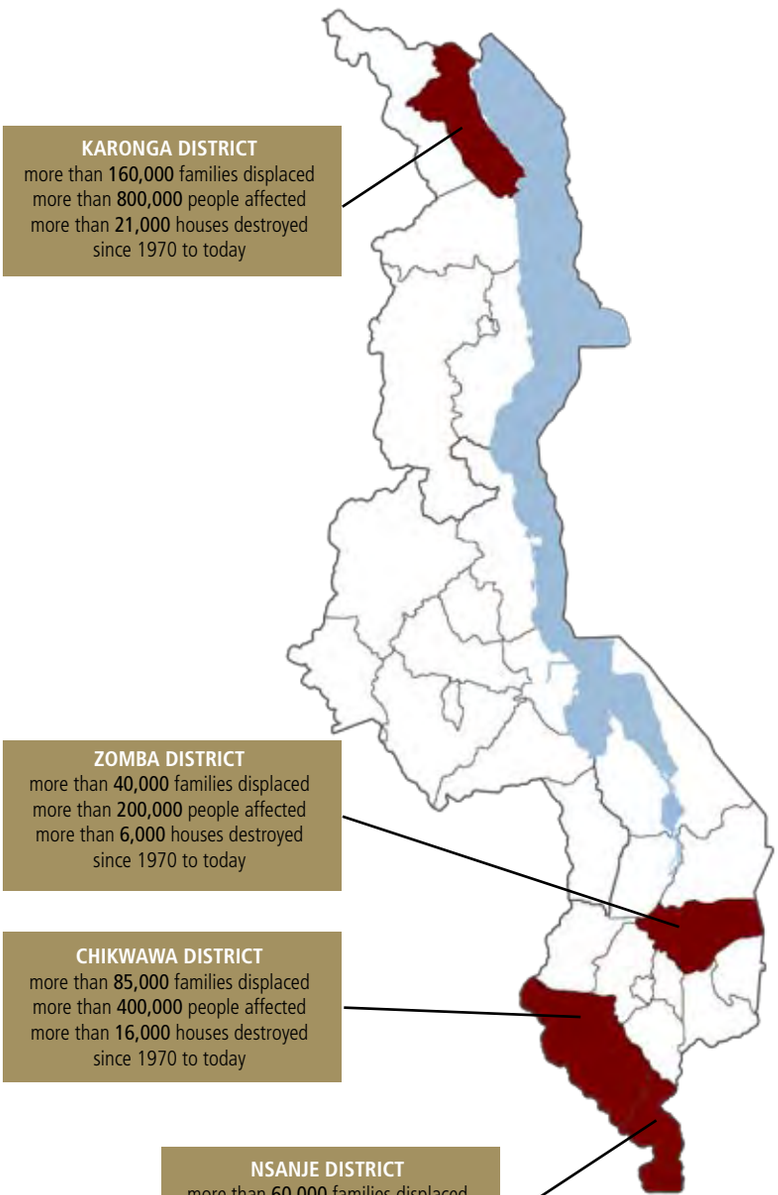
Habitat - Malawi

Built Environment Vulnerability



KARONGA DISTRICT
more than **160,000** families displaced
more than **800,000** people affected
more than **21,000** houses destroyed
since 1970 to today

ZOMBA DISTRICT
more than **40,000** families displaced
more than **200,000** people affected
more than **6,000** houses destroyed
since 1970 to today

CHIKWAWA DISTRICT
more than **85,000** families displaced
more than **400,000** people affected
more than **16,000** houses destroyed
since 1970 to today

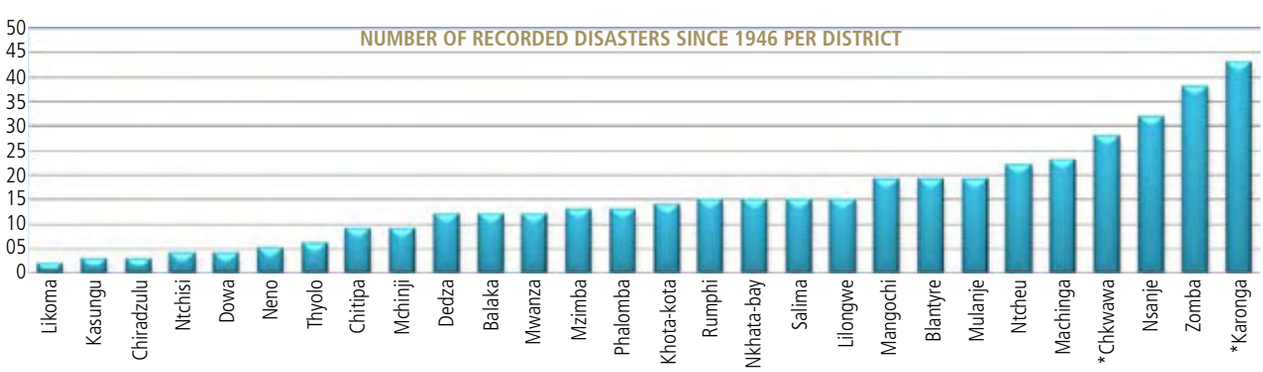
NSANJE DISTRICT
more than **60,000** families displaced
more than **300,000** people affected
more than **15,000** houses destroyed
since 1970 to today

Data Source: National Profile of Disasters in Malawi / DoDMA

RELEVANT DEFECTS IN CONSTRUCTION TECHNIQUES INCREASING VULNERABILITY TO NATURAL DISASTERS:

- Site selection regardless of environmental risk factors
- Building orientation regardless of prevailing winds exposition
- Ractangular/squared building shape not aerodynamic
- Foundation depth insufficient to reach a firm bearing ground
- Absence of proper reinforced foundation system (plynth beam)
- Insufficient elevation of foundation system
- Absence of damp proof solutions for foundation system
- Absence of stabilization for unburnt bricks
- Absence of retaining systems (bracing) for walls
- Absence of reinforcing framework (lintels) for openings
- Frail connections between roof structure and walls
- Asence of ring beams at wall plate level
- Absence of bracing elements for roof
- Reduced wooden element connections for roof structure
- Bad quality wood used for primary/ secondary roof structure
- Reduced roof covering thickness and bad assembling
- Absence of eaves to protect underlying walls
- Bad performing roof shape (2 slopes)
- Bad performing roof inclination (less than 30°)

Photo: 2009 Karonga Earthquake damaged dyke lets in flood water / DoDMA



FREQUENCY (*= Districts including adaptive architecture interventions documented in this publication)

Data Source: DoDMA

Photo: UN-Habitat, Bridge Inundated even in normal times, Chikwawa District

Photo: UN-Habitat, Community constructed drain, Jana Village

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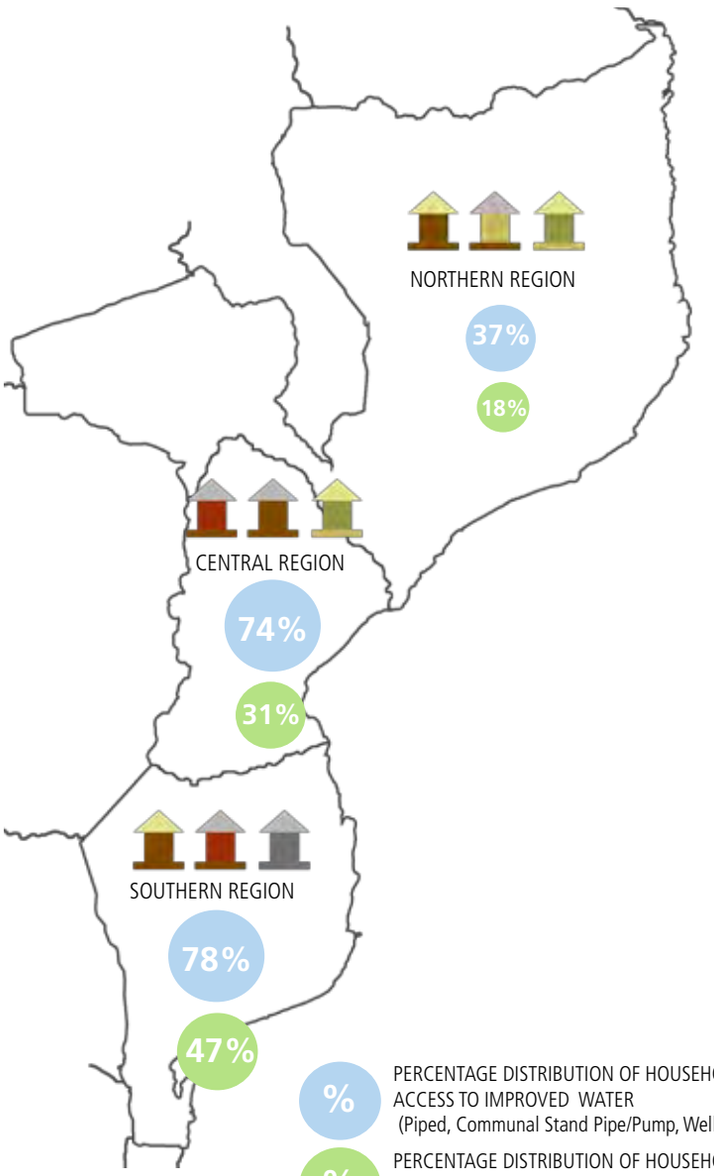
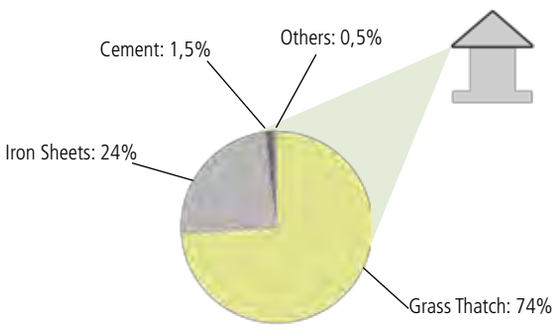
Habitat - Mozambique

FACT SHEET: Building Environment / Water, Sanitation & Hygiene

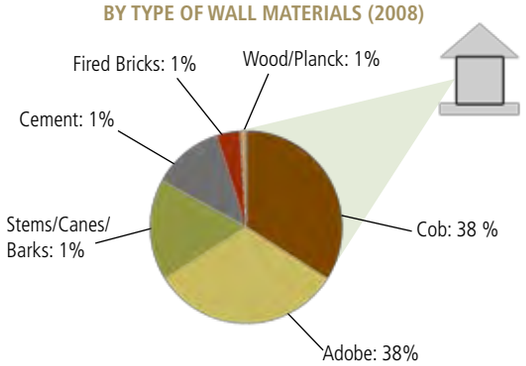
HABITAT CONDITIONS AT NATIONAL LEVEL



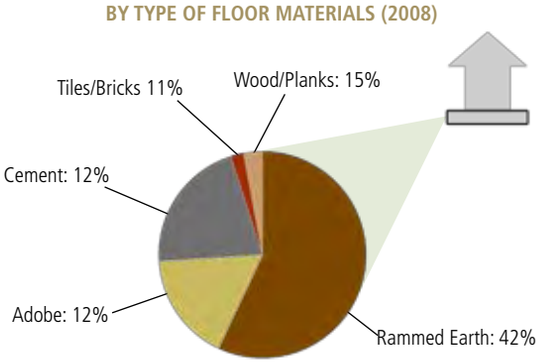
PERCENTAGE DISTRIBUTION AT NATIONAL LEVEL OF DWELLING UNITS BY TYPE OF ROOFING MATERIALS (2008)



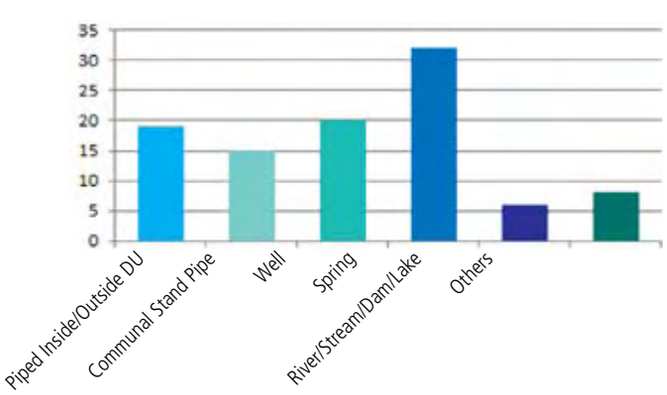
PERCENTAGE DISTRIBUTION AT NATIONAL LEVEL OF DWELLING UNITS BY TYPE OF WALL MATERIALS (2008)



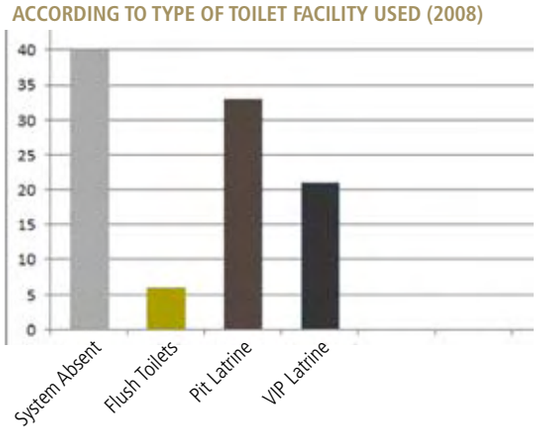
PERCENTAGE DISTRIBUTION AT NATIONAL LEVEL OF DWELLING UNITS BY TYPE OF FLOOR MATERIALS (2008)



PERCENTAGE DISTRIBUTION OF HOUSEHOLDS ACCORDING TO MAIN SOURCE OF DRINKING WATER (2008)



PERCENTAGE DISTRIBUTION OF HOUSEHOLDS ACCORDING TO TYPE OF TOILET FACILITY USED (2008)



Data Source: INE (2007). Resultados definitivos do censo 2007; INE/MISAU - MOÇAMBIQUE: Inquérito Demográfico e de Saúde 2011

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Habitat - Mozambique

Housing - Building Types

Photo: UN-Habitat, Vernacular Houses, Manica Province

Photo: UN-Habitat, Swahili House Model, Pebane District, Zambezia Province

Photo: Colonial Building, Beira, Sofala Province

Photo: Urban Model House, Manica Province

FROM "PALHOTAS" TO "CANIÇO HOUSES"...

The portugese/mozambican word "palhota"refers to the traditional cylindrical house made with wooden poles structure covered with earth and vegetal conic roof. In the Southern Mozambique, this vernacular model has been substituted, in colonial times, by rectangular houses, whose walls and roofs were made by bandles of reeds ("caniço" in portoguese). The "caniço house", easier and even cheaper to realize than the round palhotas, has been, up to recent times, not the only but surely the most diffused housing model in the urban suburbs. Composed by one unique space, with shallow foundations and frail vegetal connectionthis vegetal house is spontaneously implemented by the family itself, with no help by skilled manlabor.

...AND SWAHILI TRADITIONAL DWELLINGS...

In the northern regions of Mozambique, the cylindrical houses have been replaced, starting from the mid-nineteenth century, by rectangular houses with hipped roof derived from Swahili traditions, originally confined to few towns along the coast. It's based on an articulated squared plan, with a sorrounding varanda, bouded by wooden posts, constituting the main support for the roof structure. The palm leaves roof coating is very typical. It is a well-characterized constructive model, which, because of its shape and the placement on the outside of the plot toward the street, it is very well adapted to the urban environment, so that up to now it's the most diffused housing type in the towns of the north.

...THROUGH COLONIAL MODELS...

If it is true that in the long run the models and construction techniques derived by European architecture influenced the local construction techniques in Mozambique, at the beginning of the twentieth century was instead the colonial architecture to be influenced deliberately or unconsciously by the traditional African architecture. Thus, in Mozambican coastal towns like Beira it is possible to find many examples of colonial buildings, which demonstrate the influence of the swahili housing models as concerns the planimetric and spatial distribution, but that, at the same time, use materials, technology and decorations clearly deriving from the European heritage.

...TO CONTEMPORARY URBAN HOUSING

Today the traditional "caniço" house has been replaced almost everywhere by constructions made ofmasonry walls (fired bricks or concrete blocks), covered with metal sheets, implemented by small and micro informal building companies. In some cases, the masonry infill is supported by a concrete structure made of beams and pillars. The volumetric complexity of the different house spaces, each identified with a distinct roof slope, is the ever-recurring element in these new types and can be justified undoubtedly for reasons of construction easiness: anyway it probably also refers to an ancient African conception to which the wealth and importance of the house owner was identified by the number of building spaces, formerly separated, that composed it.

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1.2.h

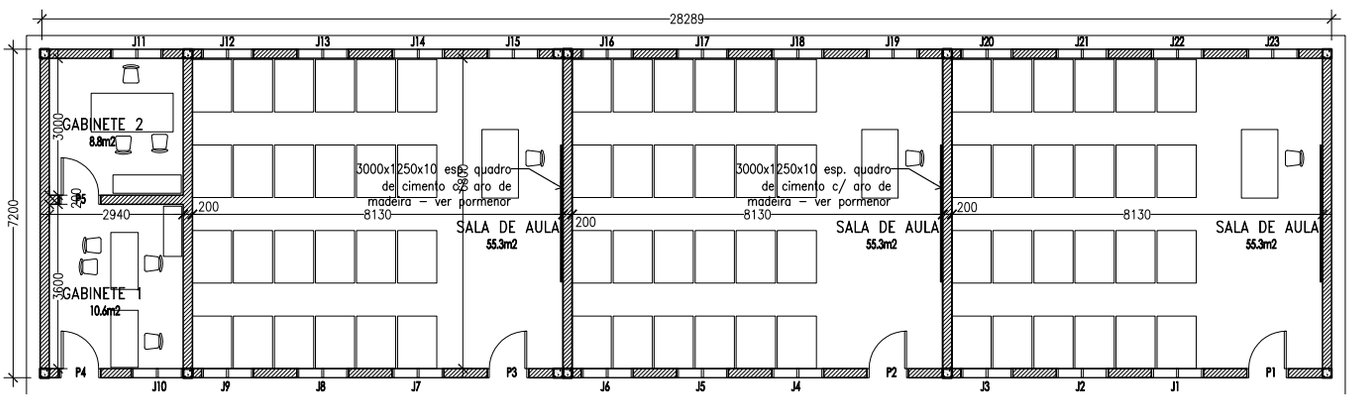
Habitat - Mozambique

Education Infrastrctures - Building Types

Photo: UN/Habitat / Students of primary school, Pebane District, Zambezia Province

CONVENTIONAL, INFORMAL, IMPROVED

In Mozambique there are three types of education infrastructures: conventional schools, informal spontaneous schools and the so called "improved constructions". The conventional schools are built by the Government, specifically it's the Directorate of Planning and Cooperation of the Ministry of Education (DIPLAC / MINED) to be responsible for the designing and construction supervising of the education infrastructures. Conventional schools are built using mostly reinforced concrete pillar-beam structures, cement blocks for the walls infill, cement screed for the floor and wooden roof structure covered with metal corrugated panels. They generally don't include any reinforment measures for natural disasters vulnerbility reduction.



Drawing: MINED - Ministry of Education / Conventional School Block: three classrooms and administration block

Photo: UN/Habitat / Conventional School Model, Pebane District, Zambezia Province

Photo: UN-Habitat / Informal school block built by the community with local materials, Pebane District, Zambezia Province

Conventional schools are generally composed by one or more two/three classrooms buildings, latrines blocks, administration block, and sometimes by few teacher houses. Given the insufficient number of conventional schools and the overcrowding of the classrooms, the local communities generally join their efforts to collect enough local construction materials to build one or two informal spontaneous classrooms: these structures are made with wattle and dub walls and a wooden roof, covered with thatch. Almost every conventional school is accompanied by an informal block on its side, sharing the same external yard: anyway spontaneous constructions in Mozambique are only dedicated to primary level instruction, while all the secondary level infrastructures are only conventional and heavily insufficient in number.

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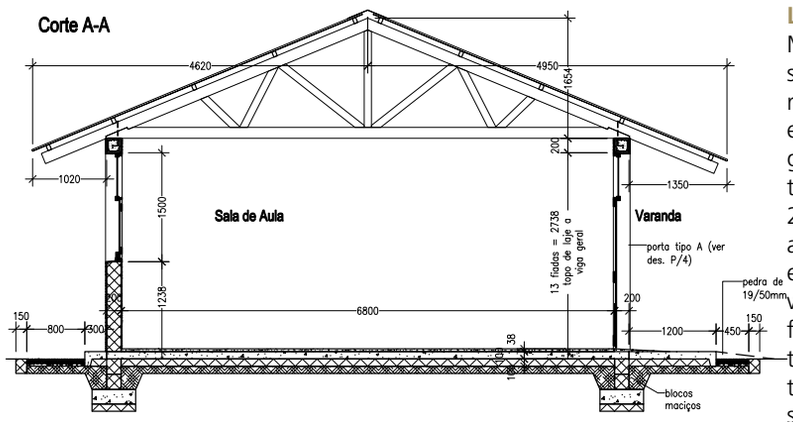
Habitat - Mozambique

Education Infrastructures - Coverage and Access



LAST TEN YEARS DEVELOPMENT

Mozambique greatly expanded its education system since joining EFA FTI in 2003 with primary school enrolment soaring from 3.3 million to 5.3 million[1]. The existing regulatory system at that time was the Strategical Plan for Culture and Education (PEEC 1999/2005), that, as the following editions 2006/2011 and actual 2012/2016, had the primary objective to increase the access of population to all levels of education: building education infrastructures was one strategy. In 2005 it was launched the fast-track construction programme for low-cost schools built with community participations (Programa de construção acelerada de infra-estruturas escolares de baixo custo: so called "improved schools", see previous page).

Photo: UN-Habitat / School built under the Fast-Track Construction Initiative , Pebane District, Zambezia Province

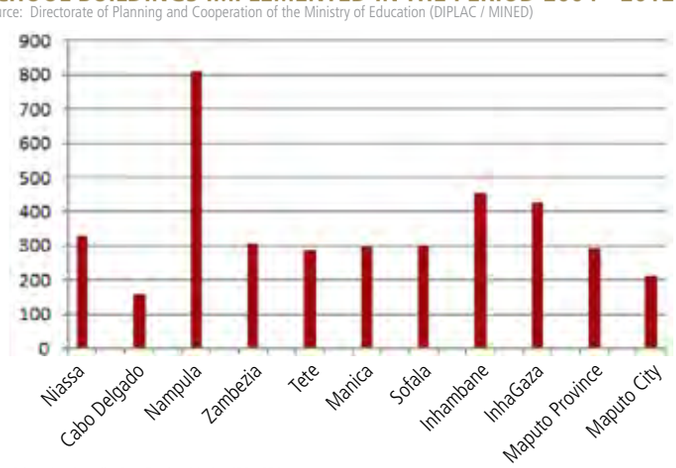
EVOLUTION OF SCHOLAR INFRASTRUCTURES DISTRIBUTION / EDUCATION LEVEL:

Source: Plano Estratégico da Educação 2012-2016 / MINED)

	NUMBER OF SCHOOLS			GROWTH
EDUCATION LEVEL	2004	2007	2011	2004/2011
PRIMARY (age: 6 -10 / 11 - 12)	9806	11470	14644	150%
SECUNDARY (age: 13 - 15/ 16 - 18)	296	492	789	260%
TECHNICAL/PROFESSIONAL (age: 11 - 12 / 13 - 15 / 16 - 18)	55	73	145	263%
SUPERIOR (age: after 18)	17	-	38	223%

SCHOOL BUILDINGS IMPLEMENTED IN THE PERIOD 2004 - 2012

Source: Directorate of Planning and Cooperation of the Ministry of Education (DIPLAC / MINED)



Since 2005 to 2010, under this programme, 4,601 classrooms have been built, including administrative blocks and 773 teachers houses[2]. Mozambique qualified for a grant of US$ 90 million to build more classrooms, earmark direct support to schools and provide many more text books. The new FTI financing for Mozambique will be pooled among bilateral donors and includes a US$ 41 million credit from the World Bank's International Development Association (IDA)[1]. According with the National Coordinator of the Fast-Track Construction Programme more 1070 classrooms will be built. UN-Habitat is working with the World Bank and Ministry of Education in a project named Safer Schools: the main goal is to revise the actual building regulation to integrate it by including adaptive architecture measures aimed to reduce school buildings vulnerability to natural disasters.

[1] The Education for All - Fast Track Initiative (EFA FTI);
[2] UNICEF: Pobreza Infantil e Disparidades, Chapter 4;

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Habitat - Mozambique

Health Infrastructures - Assistance Level and Coverage

Photo: GIZ / Health Post in Tronga, Sofala Province

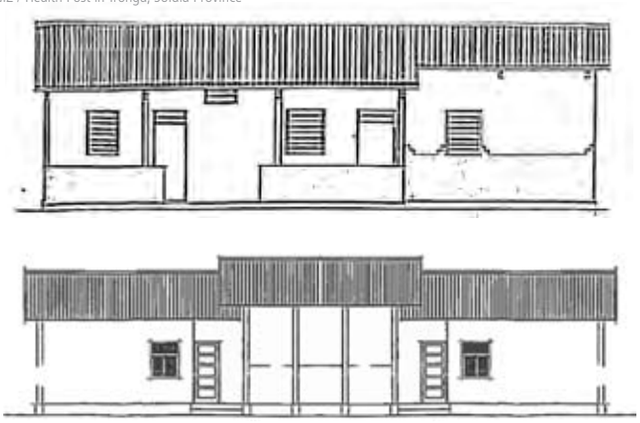

Photo: MISAU / Health Posts Drawing Models

LAST TEN YEARS DEVELOPMENT

The health sector in Mozambique started to be regulated in 2000 with the first Strategic Plan for the Health Sector (PESS I / 2000 - 2005): the first, as the second (PESS II / 2006 - 2012) and the actual edition (PESS III / 2013 - 2018) of the plan aim to gradually imrpove the health state of the population, by facilitating, among others, the geographical access of communities to health infrastructures. The national helath system is organized according with 4 different levels. The primary level includes the Health Posts at urban and rural level and provide basic medical assistance: these infrastructures represent the first contact between population and health services provision. The secondary level in represented by the Rural and General District Hospitals, assisting the patients that couldn't be helped at primary level. The tertiary level is composed by the Province Hospitals, being the reference for the patients not curable at secondary level. The Central National Specialized Hospitals constitute the quaternary level, most important reference for patients in severe conditions. In 2004 the geographic distribution of health infrastructures consisted in 1,210 units. In 2011 the National Health System can count 1,392 public health infrastructures. This data reports just 11% growth in the number of health infrastructures during 6 years, almost all of them beloning to the primary level The Ministry of Health estimates that in 2010 less than 60% of the population had access to basic health services and lived in a radius of 10km from the nearest health post[1].

GEOGRAPHIC DISTRIBUTION OF HEALTH UNITS / HEALTH SERVICE LEVEL

Source: Relatório Da Revisão Do Sector De Saúde / DIPLAC, USAID, Health System 2, Confederazione Svizzera, WHO, World Bank, September 2012

HEALTH SERVICE LEVEL	PROVINCES											
	Niassa	C. Delgado	Nampula	Zambezia	Tete	Manica	Sofala	Inhambane	InhaGaza	Maputo P.	Maputo C.	Total
3° - 4°	1	1	1	1	1	1	1	1	1	0	1	10
2°	1	3	8	10	5	5	8	8	8	6	4	66
1° (Rural)	142	107	197	200	97	90	147	106	118	78	32	1314
Other	0	0	1	0	0	0	0	0	0	0	1	2
Total	144	111	207	211	103	96	156	115	127	84	38	1,392

Photo: GIZ / Health Post in Mucheve, Sofala Province

Up to today the highest number of Health Units per capita is observed in Maputo, and almost all the available bed of the entire health sector are located in the two major hospitals of Maputo and Beira. The most populated Provinces of Nampula and Zambezia have the lowest number of Health Units[1]. The main barrier for improvement of population health state in Mozambique is still the difficult access due to long distances between health services and communities. The responsible for health units project designing and construction supervision is the Directorate of Planning and Cooperation of the Ministry of Health: at the moment the only measure adopted to reduce buildings vulnerability to natural disasters is to operate an approapriate site selection for the building location.

[1]Relatório Da Revisão Do Sector De Saúde / DIPLAC, USAID, Health System 2, Confederazione Svizzera, WHO, World Bank / September 2012

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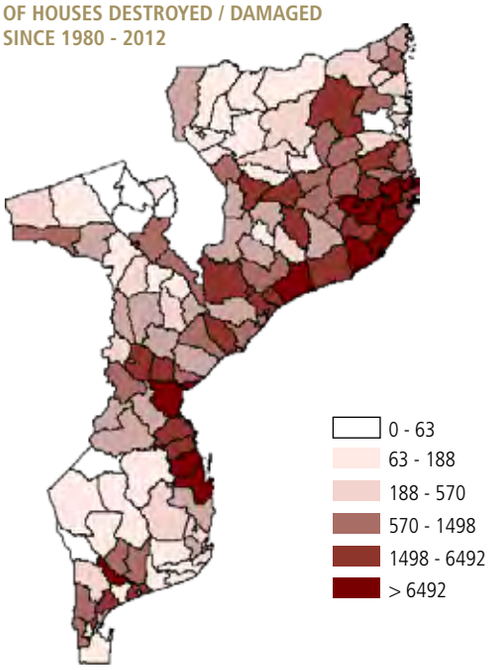
Habitat - Mozambique

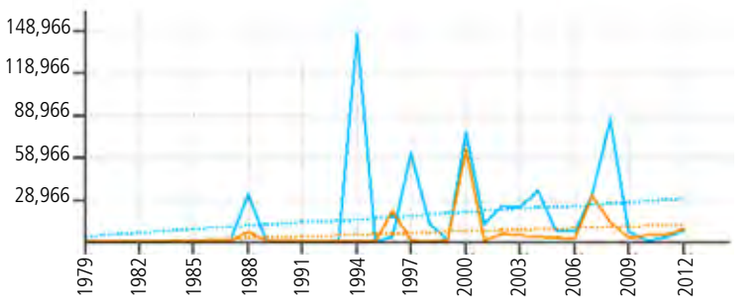
Building Environment Vulnerability

SPATIAL DISTRIBUTION PER DISTRICT OF HOUSES DESTROYED / DAMAGED SINCE 1980 - 2012

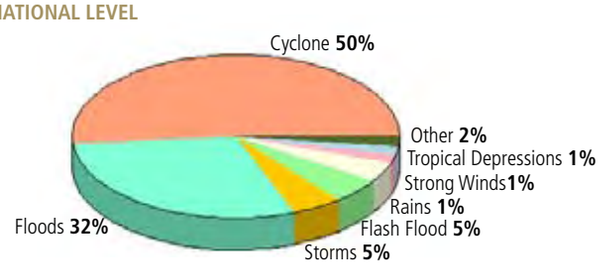


Data Source: DESINVENTAR - Natural Disasters Database / UNHCR, UNDP, INGC

DISTRIBUTION IN TIME (1980 - 2012) OF HOUSES DESTROYED / DAMAGED AT NATIONAL LEVEL



DISTRIBUTION PER DISASTER OF HOUSES DESTROYED / DAMAGED AT NATIONAL LEVEL



RELEVANT DEFECTS IN CONSTRUCTION TECHNIQUES INCREASING VULNERABILITY TO:	FLOODS	CYCLONES	EARTHQUAKES
Absence of proper reinforced foundation system	✓	✓	✓
Absence of stabilization or compaction for wall filling materials	✓		
Absence of retaining systems (bracing) for walls		✓	✓
No closing systems or reinforcing framework (lintels) for openings		✓	✓
Bad mixture soil components for adobe blocks/rammed earth walls	✓		✓
Frail connections between roof structure and walls		✓	✓
Reduced wooden element dimensions / connections for roof structure		✓	
Bad quality wooden elements used for primary/ secondary roof structure	✓	✓	✓
No drying system for wooden elements	✓	✓	✓
Absence of bracing elements for roof		✓	✓
Reduced roof covering thickness and bad assembling	✓	✓	
Absence of eaves to protect underlying walls	✓	✓	
Bad performing roof shape (2 slopes)		✓	✓

Building regulations in Mozambique refer only to conventional construction technologies: traditional buildings, made in local vegetal materials, being the vast majority of the human settlements , are not ruled by any building regulation.

Photo: UN-Habitat - Zambezia Province, Mozambique

Photo: UN-Habitat - Zambezia Province, Mozambique

R
1.2.f

Habitat - Madagascar

FACT SHEET: Building Environment / Water, Sanitation & Hygiene

IN PROGRESS

Pag. 33-39

SECTION 1
Chapter 3

Actual DRR Institutional Framework: Existing Policy and Main Actors

Malawi
Mozambique
Madagascar

R 1.3.a

DRR Framework - Global / Regional /National

GLOBAL FRAMEWORK

The **HFA**, adopted in 2005 in Japan, provides a global strategic roadmap to disaster risk reduction. The HFA is a global blueprint for disaster risk reduction with the goal to substantially reduce disaster losses in lives, and in the social, economic, and environmental assets of communities and countries by 2015. The framework offers guiding principles, priorities for action, and practical means for achieving disaster resilience for vulnerable communities. It clearly emphasizes that concerted international cooperation is required to provide the knowledge, capacities and incentives for DRR (UNISDR, 2007).
The **GFDRR** is a partnership of the World Bank, United Nations International Strategy for Disaster Reduction (UNISDR), and international donors to support the implementation of the HFA. The World Bank on behalf of the participating donors and other partnering stakeholders manages GFDRR. It provides technical and financial assistance to highrisk, low- and middle-income countries to mainstream disaster reduction in national development strategies. It offers technical assistance in disaster response, recovery, and reconstruction. GFDRR further anchors a broad knowledge source and provides technical expertise and specialists to various topics from risk financing to PDNAs. In Sub-Saharan Africa, GFDRR has funded various initiatives under three financing tracks: i) **Track I** supports UNISDR regional processes to leverage resources to implement the HFA; ii) **Track II** supports the mainstreaming of disaster risk reduction into national policy and strategy development, including pilot national and subnational initiatives; **Track III** supports damage and loss assessment as well as recovery from disasters.
UNISDR is the UN agency facilitating the implementation of the HFA and fostering policy dialogues on DRR and recovery. UNISDR aims to build disaster resilient communities by promoting increased awareness of the importance of disaster reduction as an integral component of sustainable development, with the goal of reducing human, social, economic, and environmental losses due to natural hazards and related technological and environmental disasters. It fosters international cooperation and programs DRR and has launched several global campaigns such as the Making Cities Resilient. UNISDR has a regional program for Africa that coordinates disaster risk reduction activities across the continent. It strengthens policy dialogues with national governments, the AU, and other regional institutions[1].

THE HYOGO FRAME OF ACTION[1]

Three strategic goals:

1) More effective integration of disaster risk consideration into sustainable development **policies**, planning and programming at all levels, with a special emphasis on disaster prevention, mitigation, preparedness and vulnerability reduction;
2) Development and strengthening of institutions, mechanisms and **capacities** at all levels, in particular at the community level, to methodically contribute to building resilience to hazards;
3) Systematic incorporation of risk reduction approaches into the design and **implementation** of emergency preparedness, response and recovery programs in the reconstruction of affected communities;

Five priorities for action:

HFA 1: Ensure that DRR is a national and local priority with a strong institutional basis for implementation

HFA 2: Identify, assess and monitor disaster risks and enhance early warning

HFA 3: Use knowledge, innovation and education to build a culture of safety and resilience at all levels

HFA 4: Reduce the underlying risk factors

HFA 5: Strengthen disaster preparedness for effective response at all levels

REGIONAL INITIATIVES AND COOPERATION

The **AU** (African Union) is the intergovernmental organization that represents all African countries, except Morocco. The AU's New Partnership for Africa's Development (NEPAD), an economic development program adopted in 2001, recognizes that natural and human induced disasters put development at large at risk. The AU has recognized that institutional frameworks, risk identification, knowledge ma agement, governance, and emergency response are critical to the DRR agenda (African Union, 2004). The AU established an overarching **Africa Regional Strategy for Disaster Risk Reduction** to address these issues. The objectives of the strategy are guided towards facilitating dialogues and fostering political commitment to DRR. The strategy has the following core objectives for DRR:
1.Increase political commitment to DRR/ 2.Improve identification and assessment of disaster risks/ 3.Enhance knowledge management/ 4.Increase public awareness/ 5.Improve governance of DRR institutions/ 6.Integrate DRR into emergency response management.
Moving forward with this strategy, a Programme of Action for the Implementation of the Africa Regional Strategy for DRR was launched at the first and second regional platform meetings. The AU and UNISDR twice organized these regional platform consultations on DRR in preparation for the Global Platform on Disaster Risk Reduction in 2007 and 2009. The Programme of Action provides a matrix of action for national governments, RECs, and the AU, as well as specialized agencies and civil society organizations. It was agreed to provide bi-annual reports to measure the progress made with respect to the strategy and HFA (African Union/UNISDR, 2009).
Africa's **RECs** (Regional Economic Communities) are key partners for the implementation of the strategy[1]. Among them: the **Indian Ocean Commission (IOC)**, including the Union of Comoros, France (Réunion), Madagascar, Maurice, and Seychelles, works toward objectives such as institutional reinforcement, knowledge improvement, capacity building, rebuilding and rehabilitating solutions, increasingly taking into account Disaster Preparadness and Disaster Risk Reduction; the **Southern Africa Development Community (SADC),** recognizing the importance of DRR, has taken concrete steps to ensure that it is effectively mainstreamed into national policies by establishing a DRR Unit in July 2008, within the SADC Directorate of the Organ on Politics, Defense and Security Affairs. The decision was endorsed during the SADC Summit Heads of State and Governments in August 2008 and acknowledged for implementation and resource allocation in January 2009. The SADC DRR Unit, supported by SADC DRR Technical Committee, has the responsibility to coordinate and provide regional leadership on disaster risk reduction, mitigation, preparedness and related management activities[2].

[1] Report on the status of Disaster Risk Reduction in Sub-Saharan Africa / November 2010 / World Bank - GFDRR
[2] ACP-EU Natural Disaster Risk Reduction Program / Support the Establishment of a Technical Center for Disaster Risk Reduction and Climate Change Adaptation for Southern Africa / EU, ACP, GFDRR

Regarding the **UN** system and the humanitarian partners such as international NGOs, a Regional Inter-Agency Coordination and Support Office (**RIACSO**) was established in 2002 in Johannesburg covering southern Africa, and is chaired by **UNOCHA**. The RIACSO provides support to strategic planning, assessment and monitoring of crisis situations and coordination for emergency response. It has a functional partnership with the SADC, in particular by playing an important role in the strengthening of networks such as the Famine Early Warning System Network (FEWSNET) and the Southern Africa Regional Climate Outlook Forum (SARCOF). Hence the standard modus operandi of the RIACSO is mainly on supporting preparedness and early warning across the region through annual plans which match the yearly meteorological cycles[1]. **UN-Habitat** is in the process to facilitate the establishment of a Sub-Regional Technical Centre for Disaster Risk Reduction and Climate Change Adaptation for Southern Africa (**DIMSUR**) with the financial support of the European Commission Directorate-General for Humanitarian Aid and Civil Protection (**ECHO**) through its disaster preparedness programme. This centre should initially provide support to the countries of the southeastern region of Africa to build the resilience of communities to disasters and to the effects of climate change through a number of activities, maximising the use of existing technical capacities and learning from existing practices and on-going actions in the region[2]. The **World Bank**'s activities in DRR in Sub-Saharan Africa focus on the following areas: 1.Facilitate disaster risk and vulnerability assessments across sectors; strengthen early warning and monitoring systems/ 2.Foster awareness, and support policy, and institutional building for DRM/ 3.Invest in risk mitigation and reduction of underlying risk factors/ 4.Support new preparedness, contingency, and catastrophic risk financing instruments/ 5.Improve emergency response and preparedness; assist in post-disaster situations[3]. The Southern African region is vibrant with initiatives from the **Academic sector**: among them, the Disaster Mitigation for Sustainable Communities and Livelihoods Programme implemented by the University of Cape Town (now transferred to the University of Stellenbosch), South Africa, also acts as a facilitator for the inter-university Peri Peri U project which supports ten universities throughout Africa (two of which are respectively in Mozambique and Madagascar) to promote a DRR agenda. In Madagascar, the disaster management course (supported by UNDP) graduates 40 students a year, including members of the national institutions of disaster prevention and management. The African Centre for Disaster Studies, in the North-West University at Potchefstroom (SA) focuses on the development of knowledge tools and offers postgraduate education courses[1].

OVERVIEW OF GFDRR PROJECTS IN THE SUB-REGION AND THEIR PRIMARY (P) FOCUS AND SECONDARY (S) FOCUS OF ACTIVITY[3]


Photo: UN-Habitat

	Economic Vulnerability to Disasters	Floods , Coastal Hazards in Urban Areas	Water Resources Management	Drought and Food Security	Adaptation to Coastal Surges, Marine Environment	Capacity Building
MALAWI Mainstreaming Disaster Reduction for Sustainable Poverty Reduction	P	S	S			S
MOZAMBIQUE Mainstreaming Disaster Reduction for Sustainable Poverty Reduction	S	P	S			S
MADAGASCAR Mainstreaming CCA and DRM into Economic Development	S			S	P	S

NATIONAL INITIATIVES AND PLATFORMS

National governments and national disaster risk management authorities are central to implementing DRR in the broader development agenda. In recent years a number of countries have strengthened their national DRM authorities and formulated national policies, strategies and action plans. The institutional arrangements of DRR agencies are very diverse across the Sub-Saharan Africa region. National authorities are typically established under various ministries, including the ministries of the interior, defense, agriculture, and local government. DRM policies and frameworks are increasingly being revised to shift from an ex-post paradigm to an ex-ante approach to DRR. The institutional framework of the DRM agencies can often determine how strong national authorities are in coordinating between national ministries, UN organizations, international development partners, and NGOs. Multi-stakeholder platforms of several ministries, UN agencies, and NGOs to enhance cooperation in DRR had already been established in several countries before the launch of National Platforms for Disaster Risk Reduction. Since 2007, several more have been initiated with the support of UNISDR. National platforms are a useful instrument to foster cooperation among ministries, agencies, donors, NGOs, and civil society organizations. A National Platform for DRR should be the coordination mechanism for mainstreaming DRR into development policies, planning and programs in line with the implementation of the HFA. In some countries national platforms have not yet been established due to lack of resources, limited capacities, institutional structures or legal foundation[3]. While in Malawi a DRM national platform has been just launched this year, in Mozambique civil society organizations, national finance and planning institutions, key economic and development sector organizations are represented in the national platform. In Madagascar the National Platform, composed of 7 commissions (Health, Logistics/Infrastructure, Information, Education, Communication, Agriculture, Science) takes part in the development of all matters concerning DRR

[1] ACP-EU Natural Disaster Risk Reduction Program / Support the Establishment of a Technical Center for Disaster Risk Reduction and Climate Change Adaptation for Southern Africa / EU, ACP, GFDRR
[2] Focus on Mozambique: a decade experimenting disaster and risk reduction strategies in Mozambique / UN-Habitat / 2012
[3] Report on the status of Disaster Risk Reduction in Sub-Saharan Africa / November 2010 / World Bank - GFDRR

MW 1.3.b

DRR Framework - Malawi

institutional Framework

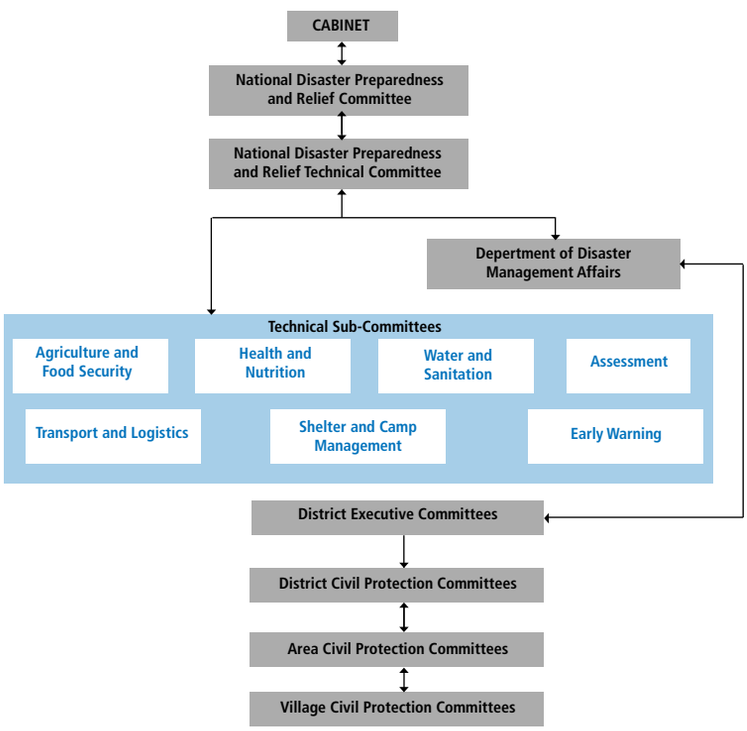
DRM INTO POLICY PAPERS: NATIONAL LEGISLATION[1]

Disaster Preparedness and Relief Act / 1991: it was passed in consequence of the Phalombe flash flood and included i) the creation of Office of Commissioner for Disaster Preparedness, Relief and Rehabilitation, ii) the institution of the National Disaster Preparedness and Relief Committee, iii) the outlining of the process by which the president can declare a state of disaster, iv) the establishment of a fund for disaster preparedness, v) the establishment of a local disaster response mechanism creating a regional and community level disaster response system.

A **National Disaster Management Plan** exists since **1997** and a **National Disaster Management Policy** is actually under preparation.

The Malawi Growth and Development Plan / 2006-2011 included disaster risk management and climate change adaptation under Theme 2.

National Adaptation Plan of Action (NAPA) / 2006 : is the main guiding document that Malawi Government has developed on Climate Change, under the leadership of the Ministry of Mines, Natural Resources and Environment, and launched by the State President in 2008. The NAPA identified five priority activities to address Malawi's urgent adaptation needs to climate change and extreme weather events for vulnerable communities.



Line Of Communication To All Drm Structures From Village To Cabinet Level And The President

Source: Phiri et al. 2008 / Malawi DRR Situation Analysis

STRATEGIES

The 2009-2011 HFA progress report for Malawi has noticed an increased knowledge, coordination and communication concerning DRR among government and non-governmental organizations personnel and communities. In fact, the Department of Disaster Management Affairs (DoDMA), established at the level of the Office of the President, has been conducting DRR capacity building-programs for personnel in key line ministries and district assemblies through training sessions and workshops[1]. UNDP-Malawi and the Government of Malawi have co-signed an action plan known as the **2008-2011 Country Programme Action Plan (CPAP)**, in which they address the enhancement of disaster risk reduction programs and emergency management systems and practices in Malawi. Pending the development of this DRM Policy, Government of Malawi through DoDMA developed a **National Disaster Risk Reduction Framework (DRRF)** for 2010-2015 and an **Operational Guideline (OG)** for DRM were designed in 2009, providing common strategic direction to government and non-government stakeholders[2]. Although disaster risk reduction is a stated priority for Malawi, comprehensive implementation of major initiatives remains limited. The main weaknesses are due to the lack of a systematic and comprehensive DRR strategy, the weakness of technical leadership for DRR, and finally the lack of resources to support implementation[1].

REGULATORY FRAMEWORK: NATIONAL INSTITUTIONAL PLATFORM

The National Disaster Preparedness and Relief Committee (NDPRC), attached to the Office of the President and Cabinet, is the highest-level decision-making body for directing and coordinating DRM in Malawi. It is chaired by the Chief Secretary, comprising Principal Secretaries of line Ministries, and is responsible for: providing recommendations on disaster declarations; formulating and updating the national disaster risk management policy and mobilizing resources for its implementation; submitting reports to the President on disaster risk reduction (DRR) and post-disaster activities; and managing recovery initiatives.

Established through the Disaster Preparedness and Relief Act of 1991, **Department of Disaster Management Affairs (DoDMA)** is the Government of Malawi's agency responsible for coordinating and directing the implementation of disaster risk management programmes in the country in order to improve and safeguard the quality of life of vulnerable communities affected by disasters. Although DoDMA was initially formed to focus on disaster response and preparedness, its mandate now covers the entire DRM cycle, including DRR. DoDMA is responsible for ensuring that al stakeholders adhere to DRR principles; coordinating resource mobilization for DRR programmes; overseeing early recovery needs assessment and recovery, rehabilitation and reconstruction activities; and coordinating action at and between national and district Levels[3].

Technical Committees were established to provide support to DoDMA for the coordination of DRM activities. DRM structures are also decentralized and include district, area and village **Civil Protection Committees (CPC)**. A DRM National Platform has been just launched in 2013 and it is actually operational[2].

[1] ACP-EU Natural Disaster Risk Reduction Program / Support the Establishment of a Technical Center for Disaster Risk Reduction and Climate Change Adaptation for Southern Africa / EU, ACP, GFDRR
[2] Disaster Risk Management in Malawi - Country Note 2010 / Country Program Update 2013 / GFDRR
[3] Draft Operational Guidelines for Disaster Risk Management" – August 2009 – DoDMA/UNDP

MW 1.3.c

DRR Framework - Malawi

Main Actors and Synergies

NATIONAL DISASTER RISK REDUCTION FRAMEWORK (DRRF) / 2010-2015[1]:

1) DRR is **mainstreamed** into policy, strategy, programme and annual planning and their implementation at all levels
2) An effective system in place to identify, monitor and **assess risk** (national and cross-boundary)
3) An effective and national **early warning** system is strengthened.
4) **Underlying risk** factors are systematically identified and addressed
5) Disaster **preparedness** capacity strengthened for effective response
6) **Knowledge, education and innovation** are used to promote culture of safety and exploration of resilient technologies

Photo: UN-Habitat, Vernacular Houses, Manica Province

TOWARDS SAFER HUMAN SETTLEMENTS: UN-Habitat

UN-Habitat is supporting the Government of Malawi, local authorities and other partners in working towards safer and resilient human settlements. With funding from ECHO and the ONE UN Fund, UN-Habitat is promoting the "living with floods" approach: it consists of reinforcing disaster preparedness capacities of local communities and authorities and implementing small-scale adaptation solutions through the adaptive architecture and construction of dwelling houses and public buildings which could serve as a refuge in case of floods and as a social facility in normal times. The approach has been actually endorsed in the Sustainable Shire River Basin Management Programme (funded by WB). UN-Habitat has also supported the Government of Malawi to elaborate and disseminate the "Safe House Construction Guidelines" developed as a key component of of the shelter recovery programme in the aftermath of the Karonga earthquake. This has been done in partnership with the Malawi Red Cross Society, TEVETA, Malawi Institution of Engineers, CCOODE, and the World Bank. Also as part of the recovery efforts, UN-Habitat has supported the formulation of a new urban structure plan for Karonga that has been developed to guide the development of Karonga town in the next 10 years, cognisant of the disaster risk management challenges the town faces. UN-Habita is also working with urban local authorities and urban planners through the Malawi Institute of Physical Planners (MIPP) in strenghtening capacities for mainstreaming disasters risk management in urban planning.

KEY PARTNERS AND COORDINATION

GLOBAL: Global DRR Platform / Global Facility for Disaster Reduction and Recovery (GFDRR) / Global Environment Facility (GEF);
REGIONAL: the African Union (AU); African Development Bank (AfDB); SADC DRR Platform;
NATIONAL: DODMA, Ministy of Land, Habitation and Urban Development (MLHUD), Ministry of Agriculture and Food Security; Civil Protection;
INTERNATIONAL: UNDP; FAO; WFP; UNICEF; WHO, World Bank, UN-Habitat, IFRC, UNISDR, The United Nations Development Assistance Framework (UNDAF);

Local Faith Based Organisations (Fbos):
Blantyre Synod Development Commission; Church Action In Relief And Development; Christian Aid Of Malawi; Catholic Relief Services (Crs); Evangelical Association Of Malawi (EAM); CADECOM;

Local Non Governmental Organisation:
NASFAM; Malawi Enterprise Zones Association; the Association For Rural Community Development (Arcod);

International Non Governmental Organisations:
World Vision, Action Aid, CARE Malawi; CONCERN Universal/Worldwide; COOPI; Oxfam; Malawi Red Cross Society; Action Aid; GOAL Malawi; Plan international; Save the Children; World Vision; Council for Nongovernmental Organizations in Malawi (CONGOMA);

International donor organisations: DFID; Irish Aid; Norwegian Embassy; USAID; DIPECHO; Global Facility for Disaster Reduction and Recovery (GFDRR); World Bank;

SYNERGIES BETWEEN STAKEHOLDERS[2]

UNDP	Assists the Government in: developing national DRM policies, mainstreaming disaster risk reduction planning processes, capacity building for DRM and response, risk assessment and EWS
Ireland, Norway and UK (DFID)	Through the Enhancing Community Resilience program, the three countries support: (i) small-scale river level monitoring systems; (ii) community-based early warning systems; (iii) small-scale flood mitigation measures; (iv) catchment improvement; and (v) community grain banks.
EU (ECHO)	The following activities are being implemented: (i) community-based EWS; (ii) small-scale flood mitigation measures; (iii) catchment improvement; and (iv) activities focusing on livelihoods.
AfDB	The AfDB supports the Global Environment Facility (GEF), the Least Developed Countries Fund (LDCF) in its funding for Climate Adaptation for Rural Livelihoods and Agriculture.
WFP	The World Food Programme (WFP) provides assistance to people suffering from the effects of natural disasters, HIV and AIDS.
World Bank	The Shire River Basin Management Program, the National Water Development Project, Social Action Fund 3 Project, Agricultural Development Project, Malawi Education Infrastructure Project are just some of the activities the WB is developing to reduce vulnerability in Malawi

[1]MALAWI DISASTER RISK REDUCTION AND CLIMATE ADAPTATION RESEARCH FOR CORDAID - Final Report / Llongwe / 2010
[2]MALAWI: Country Programme Update 2013 / GFDRR

MW 1.3.d

DRR Framework - Malawi

Completed / On-going Projects

COUNTRY PROGRAMMING AND FINANCING

DRR programmes in Malawi have been aligned to the HFA, following six priority areas: 1) Mainstreaming disaster risk management into sustainable development; 2) Establishment of a comprehensive system for disaster risk identification, assessment and monitoring; 3) Development and strengthening of a people-centred early warning system; 4) Promotion of a culture of safety and adoption of resilience-enhancing interventions; 5) Reduction of underlying risks; 6) Strengthening preparedness capacity for effective response and recovery. A number of projects on DRR have been implemented with support from cooperating partners, including: (i) a post-floods early recovery initiative which aimed at building resilience of affected households; (ii) a DRR mainstreaming project which targeted flood mitigation; and (iii) the DRR policy project which aims at strengthening capacity for effective coordination and implementation of DRR. Malawi is being increasingly involved in DRR regional initiatives, as demonstrated with its continued support in establishing a DRR and CCA Technical Centre in Southern Africa, the Shire-Zambezi River Basin Project and the Songwe River Basin Project.

MAJOR COMPLETED / ONGOING PROJECTS BY MULTILATERAL DONOR ORGANIZATIONS IN MALAWI

Project Name	Indicative Budget / Time Frame	Donors / Partners
Mainstreaming Disaster Reduction for Sustainable Poverty Reduction: Malawi	914.000 USD 2006 / 2010	GFDRR (Track II) / Government of Malawi
Disaster Risk Management in Malawi Country Plan - Phase I	1,027,847 USD 2011 - 2012	GFDRR (Track II) / Government of Malawi
Disaster Risk Management in Malawi Country Plan - Phase II	1.000.000 USD 2012 - 2013	GFDRR (Track II) / Government of Malawi
Disaster Risk Management in the Sub-Saharan Africa Region	300.000 USD 2007-active	GFDRR (Track II) / Government of Malawi
Karonga Earthquake Post-Disaster Support	122.901 USD 2008-2011	GFDRR / Government of Malawi / Malawi Red Cross Society / UN-HABITAT
Phase 1 of an Activity to Support National Red Cross and Red Crescent Societies	200.000 USD 2008-2011	(GFDRR Track II) / Government of Malawi
Disaster risk management in Africa - strategic framework, good practice, communication	395,000 2008-active	(GFDRR Track II) / Government of Malawi
Malawi Third Social Action Fund (MASAF 3) APL II (LDF Mechanism)	51 million USD 2008 / 2014	World Bank / Government of Malawi / Ministry of Finance / NGO's / CBO's
II National Water Development Project	198 million USD 2007 / 2012	World Bank / Government of Malawi
The Shire River Basin Management project	70 million USD 2011 / 2016	World Bank / Government of Malawi
Building Community Resilience to Climate Change	3.4 million USD 2011 / 2016	DFID/ Christian Aid - Action Aid - CARE
Community Resilience to Natural Disasters and Climate Risks	10 million USD 4 years	DFID-World Bank- Norway Aid-Irish Aid
DIPECHO's support to Disaster Risk Reduction (through NGOs) – Phase 1,2,	2,551,260 EU 2008-2011	ECHO / UN-Habitat - COOPI - FAO - Habitat for Humanity - Christian Aid - GOAL
Community based Disaster Risk Reduction Projects	2,551,260 EU 2006-2010	DFID - CHASe / Christian Aid, Action Aid/ Tear fund
One UN Disaster Risk Reduction Programme	24.7 million USD 2009-2011	UN (through mainly UNDP, but also WFP/ UNICEF/ UNHabitat/FAO/UNRCO)
Enhancing National and Local Capacity in Disaster Risk Reduction in Malawi	660,250 USD 2008-2011	UNDP
Community-based disaster Mitigation and Preparedness project	431,580 USD 2006-2010	DfID / River of Life Evangelical Church / Tear Fund UK)
Disaster Risk Management project	1.5 million USD 2008-2010	CORDAID/CADECOM
Disaster Management Programme	1.4 million USD 2009-2010	IFRC/ICRC/Finnish Red Cross
Disaster Risk Reduction Project design	125,000 £ 2009-active	DFID / NGOs
Malawi Climate Change Programme	300,000 £ 2009-2011	DFID / NGOs
Support for Victims of Storms and Floods	1.2 million USD 2008-active	DFID / NGOs and emergency aid
Zambezi River Basin Initiative project / Flood Early Warning and Mitigation project	1.5 million USD 2009-active	USAID-OFDA / IFRC / WMO
Drought Mitigation through Irrigation Promotion and Conservation Agriculture Extension Project	1.5 million USD 2009-active	USAID-CARE

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DRR Framework - Mozambique

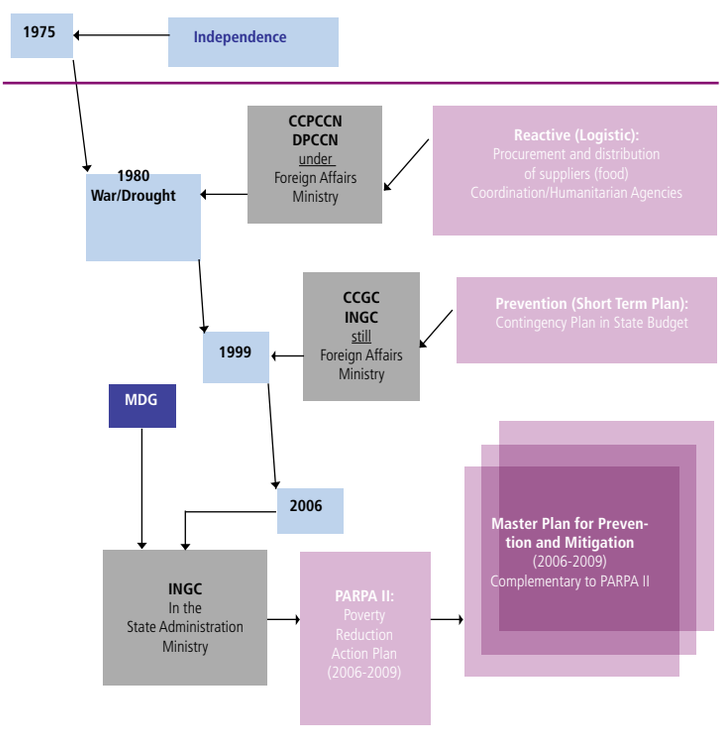
institutional Framework

DRM INTO POLICY PAPERS: NATIONAL LEGISLATION[1]

National Disaster Management Policy/1999: focuses on disaster prevention and preparedness, and seeks for their integration within the overall development framework of the country**;** includes the institution of 588 local committees called Comités Locais de Gestão de Risco de Calamidades (CLGRC) distributed all over the country. It is currently being reformulated into a Disaster Management Law.
5-years Development Plan of the Government (Plano de Acção para a Redução de Pobreza Absoluta- PARPA; I Edition 2001/2005, II Edition 2006/2009): Incorporate DRR making links between poverty, disaster and vulnerability**.**
National Adaptation Plan of Action (NAPA): regarding climate change this plan exists and is regularly updated

"Study on the Impact of Climate Change on Disaster Risk in Mozambique: Synthesis Report"/ INGC / 2009:

The National Institute for Natural Disaster Management, funded by Denmark,UNDP and GTZ, produced in 2008 a major report analyzing the potential impact of climate change on Mozambique over the next 50 years.



Historical Summary of DRM development in Mozambique
Source: www.preventionweb.net

STRATEGIES[1]

Master Plan for Disaster Prevention was produced in **1999** and updated in **2006**, giving specific responsibilities to the different sectors. It focuses on:
1) community participation and self-esteem as the central strategy;
2) the establishment of multi-purpose resource centers (Centros de Recursos de Uso Múltiplo – CERUM) in different locations of the country for information management, technological innovation, disaster monitoring and exchange of experiences;
3) the integration of disaster management concepts into the formal education system;
4) a greater participation of the civil society;
5) a re-defined role of National Disaster Management Institute (Instituto Nacional de Gestão de Calamidades – INGC) with increased competencies to carry out its DRR coordination functions;
Annual Contingency Plans are prepared before each rainy season in a coordinated group effort including Government, United Nations (UN) Agencies and NGOs, to delineate strategies for coping mainly with floods, droughts and cyclones.They make provisions for early warning systems, evacuation routes and temporary accommodation centers, inventory and pre-positioning existing means and additional resources needed for response and mitigation.

REGULATORY FRAMEWORK: NATIONAL INSTITUTIONAL PLATFORM[2]

The National Council for Disaster Management Coordination (Conselho Coordenador de Gestão das Calamidades – CCGC): including several ministries, is the highest political body dealing with disaster-related issues in Mozambique. Its mandate is: to ensure multi-sectoral coordination for disaster prevention, assistance to the victims and rehabilitation of damaged infrastructures;
Technical Council for Disaster Management (Conselho Técnico de Gestão de Calamidades - CTGC): it regroups technical staff from the concerned departments of the different Ministries represented in the CCGC, as well as partners from the UN system. Its mandate is: to assist the CCGC in deciding about strategical measures for prevention, mitigation, response and rehabilitation;
The National Disaster Management Institute (Instituto de Gestão de Calamidades – INGC), under the Ministry of State Administration (Minstério da Administração Estatal – MAE), coordinates the CTGC and reports to the CCGC. Its mandate is: i) to coordinate disaster prevention and mitigation activities; ii) to lead the government's response to emergencies; iii) deal with arid and semi-arid areas, reconstruction and resettlement. It works very much as a knowledge and reference center, providing free access to its products in the web. The structures of INGC go down to the 3 regions (Southern, Central and Northern Mozambique) and 11 Provinces both politically and technically: inter-sectoral technical committees for disaster management organized at the provincial level dealing with CLGRC;
Ministry for Environmental Affairs (MICOA): it is responsible for coordinating action under climate change adaptation and coordination; it oversees the implementation of the National Adaptation Plan.

[1] ACP-EU Natural Disaster Risk Reduction Program / Support the Establishment of a Technical Center for Disaster Risk Reduction and Climate Change Adaptation for Southern Africa / EU, ACP, GFDRR
[2] Disaster Risk Management Programs For Priority Countries / Africa / Mozambique - World Bank

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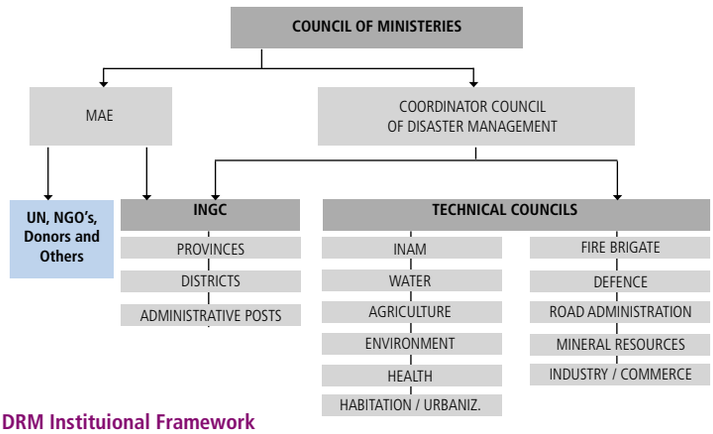
DRR Framework - Mozambique

Main Actors and Synergies



DRM Instituional Framework
Source: Disaster Risk Management Programs For Priority Countries / Africa / Mozambique - World Bank

PREPAREDNESS AND EARLY WARNING: GIZ

166 countries adopted the Hyogo Framework for Action in 2005 which highlights early warning as one of the major elements of disaster risk reduction. For 6 years, the GTZ has been a partner of INGC for DRM projects in Mozambique and has supported a South-South cooperation with Latin-America, where the first early-warning system had already been implemented. In cooperation with Munich Re Foundation, IP-Consult and Ambero, the system has been transferred to Mozambique where strategies have been adapted to the corresponding circumstances. Experiences within the best practice model Búzi, called SIDPABB4, have shown that early warning system on the long term becomes part of local society adaptation strategies to the consequences of climate change. The EWS has been integrated in a national structure of emergency through COEs5, which are Centres of Emergency Operation[1].

EMERGENCY RESPONSE: Mozambican Red Cross / CVM

CVM was established by law in as an institution of public utility (law 87/99 of 23/11/1999) and therefore has an officially recognized auxiliary role to aid the Government of the Republic of Mozambique in the humanitarian field and is considered an integral part of the combined Disaster Management instruments in Mozambique. Through the responsibilities entrusted to us by the GoM, including its Disaster Management and Civil protection agencies, and the trust placed in us by the UN system as Cluster leader and member, CVM is the primary humanitarian actor in emergency response situation and defines its mandate:to improve the living conditions of the most vulnerable population groups, through preventing and alleviating human suffering; to execute its auxiliary role to the utmost throughout the territory of Mozambique; to consolidate and build on its knowledge and experience[2]

KEY PARTNERS AND COORDINATION

GLOBAL: Global DRR Platform / Global Facility for Disaster Reduction and Recovery (GFDRR) / Global Environment Facility (GEF);
REGIONAL: the African Union (AU); African Development Bank (AfDB); SADC DRR Platform;
NATIONAL: INGC / MAE (Ministry of Statal Administration); Ministry of Environmental Affairs (MICOA); Ministry of Habitation and Public Infrastructures (MOPH); Ministry of Education (MINED); Ministry of Health (MISAU); Ministry of Agriculture (MINAG); Civil Protection;
INTERNATIONAL: UNDP; FAO; WFP; UNICEF; WHO; World Bank; UN-Habitat; IFRC; UNISDR; World Meteorological Organization (WMO); The United Nations Development Assistance Framework (UNDAF 2012/2015 to support the Government's Five Years Plan 2010/2014); GIZ (German Cooperation);

Local Non Governmental Organisation: Mozambican Red Cross (CVM);

International Non Governmental Organisations: Oikos; German Agroaction; Concern; Samaritans Purse; ADRA; Save the Children; Oxfam GB and Oxfam Intermon; IFRC;

International donor organisations: DIPECHO; Global Facility for Disaster Reduction and Recovery (GFDRR - funding 5.05 million USD for DRM Programme 2010/2015); World Bank; USAID; DFID; German Federal Ministry for Economic Cooperation and Development (BMZ); International Organization for Migration (IOM); Government of Japan, Spain, Italy, Netherlands, Denmark, Brazil;

SUSTAINABLE DEVELOPMENT: UN-Habitat

UN-HABITAT in Mozambique has been promoting since 2002 the"living with floods" strategy to reduce the vulnerability of communities living in flood prone areas of the country. Different types of didactic and awareness-raising tools were produced, such as the colorful manual associated with a cards game, the "River Game", as well as several posters and a short cartoon animation. These materials provide basic concepts of community-based disaster response, preparedness, mitigation and adaptation solutions, and have been tested and disseminated at the international level. Other illustrated didactic tools were produced for coping with cyclones, drought and (more recently) earthquakes. In addition, still under its DRR agenda, UN-HABITAT in Mozambique has a recognized field experience in carrying out participatory planning at the local level (for which specific guidelines were developed), municipal capacity development activities, risk mapping using Geographic Information Systems (GIS), shelter cluster coordination for floods and cyclones and land management. Several physical interventions have been also carried out through direct community involvement in both urban and rural settlements, with aim at reducing vulnerability to floods, cyclones and drought. For cyclone-prone areas, UN-HABITAT has identified suitable low-cost housing construction techniques and a number of architectural models were designed, built using ferro-cement roofing. Finally, UN-HABITAT has also support a number of DRR assessments and studies which have led to the formulation of sustainable recovery and reconstruction strategies, currently influencing policy-making.

[1] Mozambique: Disaster Risk Reduction as the Basis for Climate Change Adaptation – A Multi-Level Project of German-Mozambican Development Cooperation / GIZ / 2011
[2]Source: CVM

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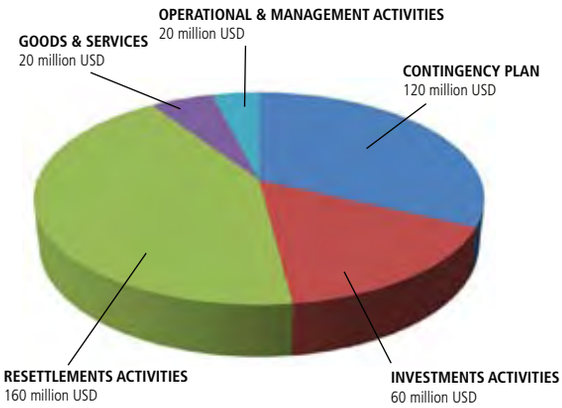
DRR Framework - Mozambique

Completed / On-going Projects

COUNTRY PROGRAMMING AND FINANCING

Due to its levels of vulnerability to various natural hazards, disaster risk assessment and profiling is a continuous activity in Mozambique. It is carried out by different actors such as government entities (especially INGC and MICOA), NGOs, UN Agencies and cooperating partners. The current Economic and Social Plan of Mozambique still does not include DRR as a priority activity since it appears as a cross-cutting issue. However there is an increased financial effort regarding DRM since the allocation for the Contingency Plan (120 million Meticais; 1 USD corresponds to approximately 28 Meticais) which are readily available in case of need. The national budget for 2012 is 163 billion Meticais, of which 60.5% were generated internally and 39.5% come from direct budget support of cooperating partners. The DRR sector will receive this year 375 million Meticais (corresponding to only 0.23% of the national budget) which are distributed as follows[1]:



Percentage Distribution of Funds dedicated to DRM within the National Budget 2012

MAJOR COMPLETED / ONGOING PROJECTS BY MULTILATERAL DONOR ORGANIZATIONS IN MOZAMBIQUE

Project Name	Indicative Budget /Time Frame	Donors / Partners
Slum Upgrading and Vulnerability Reduction in Flood Prone Cities in Mozambique	615.000 USD 2002 / 2004	Cities Alliance / UNDP UN-Habitat
Sustainable Land Use Planning for Integrated Land and Water Management for Disaster Preparedness and Vulnerability Reduction in the Limpopo River Basin (Botswana, Mozambique, South Africa and Zimbabwe)	970.000 USD 2004 / 2007	UNEP/GEF Government of Mozambique, MICOA - DINAPOT, UN-Habitat, CBO's
UN Joint Programme for Strengthening Disaster Risk Reduction and Emergency Preparedness	4,1 million USD 2008 / 2011	UNDP/ UNISDR / One-UN Fund / AustralianAid INGC / MAE / UN-Habitat
Strengthening national capacities and frameworks for disaster risk reduction and climate change adaptation	35 million USD 2012 / 2016	UNDAF 2012-2015 / UNDP Government of Mozambique/ UNHCT
UN Joint Programme on Environment Mainstreaming and Adaptation to Climate Change	7 million USD 2008 / 2010	Spanish Gov. / UNDP MDG-F INGC/MICOA/FAO/UNEP/UN-Habitat/UNIDO/UNDP/WFP
Coping with Drought and Climate Change	1.89 million USD 2008 / 2011	Special Climate Change Fund UNDP / GEF / MICOA
Climate Risk Management Technical Assistance Support Project	2.75 million USD 2008 / 2009	UNDP executed by Asian Disasters Preparedness Center
Mainstreaming Climate Change Adaptation Mechanisms in Policy, Development and Investment Framework in Mozambique	2.98 million USD 2009 / 2011	Government of Japan Africa Adaptation Programme UNDP / INGC / MICOA
Institutionalising Disaster Prevention in Mozambique (PRO-GRC) Institutionalising Disaster Prevention in Mozambique (PRO-GRC II)	3.9 million USD 2007/2009 - 2010/2012	BMZ / Munich Re Foundation GIZ / INGC / IP-Consult and Ambero
Impact of Climate Change on Disaster Risk Study	0.5 million USD 2009	UNDP, Denmark, GIZ INGC
DIPECHO Programmes I / II (Disaster Preparedness ECHO)	3.5 million EU 2008/2010 - 2010/2011	ECHO / UN-Habitat, COOPI, FAO, Oikos,OXFAM, Concern,German Agro Action
Economics of Adaptation to Climate Change (EACC) – Mozambique Case Study	800.000 USD 2010	DFID / Netherlands World Bank (WB)
Cities and Climate Change Project	120 million USD 2012/2018	International Development Association (IDA) World Bank / MAE / MOPH / MICOA / ANAMM / 20 Municipalities / UN-Habitat
Mozambique Strategic Programme under CIFs' Pilot Programme for Climate Resilience (PPCR)	1.5 million USD 2009/2011	World Bank WB/African Development Bank/ International Finance Corporation/ MPD / MICOA
Mainstreaming Disaster Reduction for Sustainable Poverty Reduction	914.000 USD 2006/2011	GFDRR Track II (World Bank) Government of Mozambique / INGC
Disaster Risk Management Program - Phase I	1.5 million USD 2010/2015	GFDRR Track II (World Bank / UNISDR) INGC / MOPH / MICOA / INAM / UNDP / PPCR /
Safe Schools Project	220.000 USD 2010/2015	GFDRR (World Bank) UN-Habitat/MINED

[1] ACP-EU Natural Disaster Risk Reduction Program / Support the Establishment of a Technical Center for Disaster Risk Reduction and Climate Change Adaptation for Southern Africa / EU, ACP, GFDRR

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DRR Framework - Madagascar

institutional Framework

DRM INTO POLICY PAPERS: NATIONAL LEGISLATION

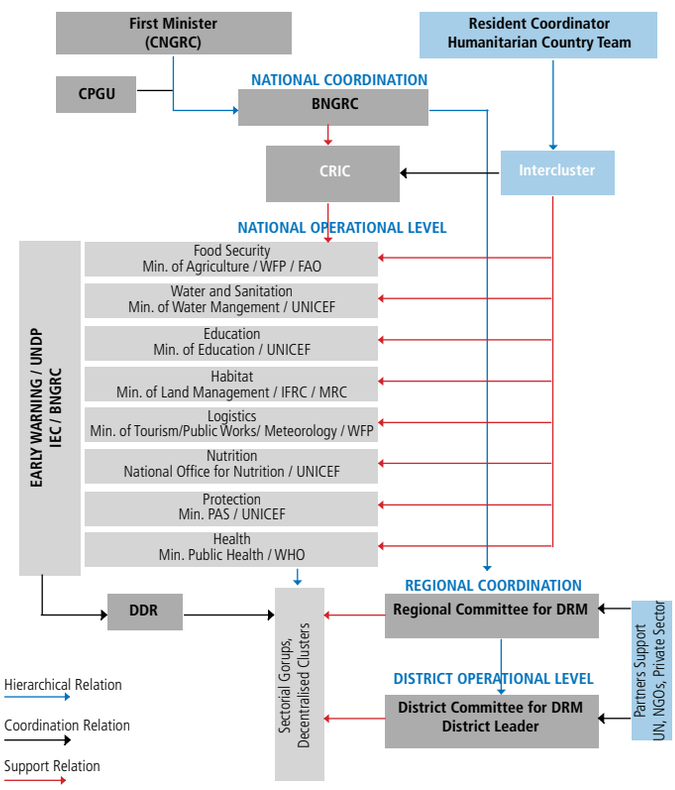
National Development Plan approved / 2008: it mentions of disaster risk reduction as priority nr. 8 and witnesses the serious steps the country is taking towards the integration –if not a shift– of prevention of disasters and reduction of risks;

The National Action Plan for Adaptation - NAPA / 2006 (written by the Government of Madagascar with technical and financial support by the Global Environment Facility - GEF - at the World Bank): it aims to empower the country to adopt urgent and immediate adaptation measures, addressing the adverse effects of climate change[1];

The National Environmental Action Plan - NEAP / 1989: this long-term investment program divided in three phases (1991-1997, 1997-2003, 2003-2008) aims to improve human living conditions through protection areas and better management of natural resources, promote environmental education, improve policy and management, and establish mechanisms for monitoring of the environment;

The Poverty Reduction Strategy Paper / PRSP: describes the country's macroeconomic, structural, and social policies and programs over a three-year or longer horizon to promote broad-based growth and reduce poverty;

The Madagascar Action Plan - MAP / 2006: was produced by the Government of Madagascar and incorporates risk reduction and disaster management (DRR). It is a bold, five-year plan that establishes direction and priorities for the nation from 2007 to 2012[2];



Coordination Structure Applied to Natural Disasters Management

Source: PLAN DE CONTINGENCE NATIONAL / CYCLONES ET INONDATIONS / MINISTERE DE L'INTERIEUR - BUREAU NATIONAL DE GESTION DES RISQUES ET DES CATASTROPHES

STRATEGIES

A **National Strategy for Disaster Management** exists since **2003**, which was prepared by an expert of Asian Disaster Preparedness Center (ADPC) through the support of the United Nations Development Program (UNDP), provides an effective and sustainable institutional structure and a strategic plan that will indicate Madagascar's priorities for disaster risk management for a period of three to seven years. A **National Disaster Contingency Plan** is prepared on a yearly basis in collaboration with UNOCHA. With a GFDRR grant of US$1.2 million the country designed cyclone-resistant codes, which were adopted by a **Government Decree** signed by all 31 Ministries on **April 20, 2010.27** These codes are being applied as climate-proof norms for roads, irrigation systems, schools, public health centers, and agriculture in areas highly vulnerable to cyclones, droughts, and other climatic shocks. Of the 7,000 schools built recently following the newly established codes, less than 2% were damaged during cyclones in the latest years. Meanwhile, in 2011, the Malagasy authorities suggested the following priorities to SADC for the regional DRR strategy: (i) agreed common standards across the region; (ii) strengthening contingency plans; (iii) established operations centers; (iv) reviving local committees; (v) development of an integrated early warning system[1].

REGULATORY FRAMEWORK: NATIONAL INSTITUTIONAL PLATFORM

The Emergency Prevention and Management Unit (Cellule de Prévention et Gestion des Urgences - CPGU): is a technical unit within the Prime Minister's office managing DRR and prevention projects with the support of UNISDR and the World Bank. Its mandate concerns: (i) to elaborate and update the national strategy for DRR; (ii) to assess and control the implementation of national policy of disaster risk management and reduction; (iii) to support the sector for the implementation of prevention activities; (iv) to assist the Prime Minister in decision making regarding DRR. The flagship intervention of the CPGU is the work developed on building norms and codes in areas prone to cyclones.

The National Disaster and Risk Management Office (Bureau National pour la Gestion des Risques et des Catastrophes-BNGRC) : was established by the Government of Madagascar in 2006. It supports the **Council for National Risk and Disaster Management (CNGRC)** under the Ministry of Interior and provides disaster prevention, organization and management in case of emergency. The BNGRC replaces the Council for National Security (CNS), which was created by a first decree in 1972 to ensure the coordination of disaster-related activities across the country.

Stakeholders Committee for Reflection on Disaster (Comité de Réflexion des Intervenants en Catastrophes – CRIC): was established by the Government of Madagascar in 1999 initially as a think tank to discuss disaster-related matters and, subsequently, in 2003 as a national platform for disaster risk reduction. **SNAP:** the National Early Warning System reports on all indicators of vulnerability of a population (social, economic, physical, environmental, infrastructure, etc.)[2].

[1] ACP-EU Natural Disaster Risk Reduction Program / Support the Establishment of a Technical Center for Disaster Risk Reduction and Climate Change Adaptation for Southern Africa / EU, ACP, GFDRR
[2] Madagascar: Climate Risk and Adaptation Country Profile / World Bank

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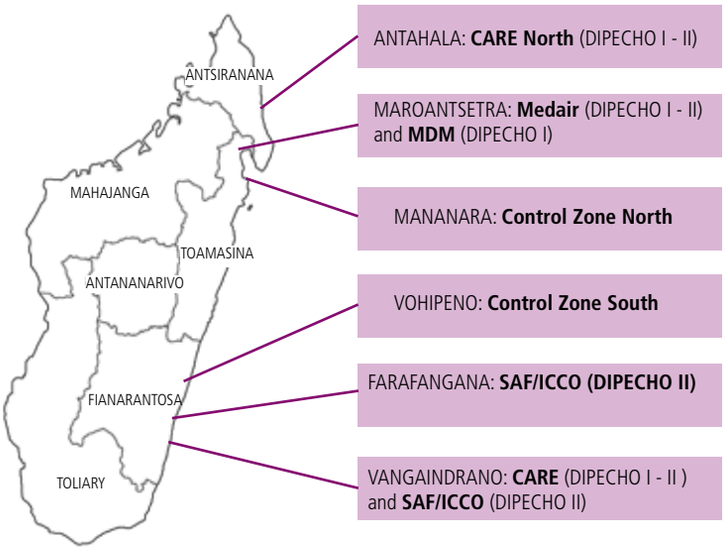
DRR Framework - Madagascar

Main Actors and Synergies



Source: CARE Madagascar

KEY PARTNERS AND COORDINATION

GLOBAL: Global DRR Platform / Global Facility for Disaster Reduction and Recovery (GFDRR) / Global Environment Facility (GEF);
REGIONAL: the African Union (AU); African Development Bank (AfDB); African Region DRR Platform; SADC DRR Platform; the Indian Ocean Commission;
NATIONAL: CPGU, CNGRC, BNGRC, CRIC, Government of Madagascar;

INTERNATIONAL: UNDP; FAO; WFP; UNICEF; WHO, World Bank, UN-Habitat, IFRC, UNISDR, The United Nations Development Assistance Framework (UNDAF); United Nations Office for Coordination of Humanitarian Affairs (UNOCHA);

International Non Governmental Organisations: COOPI; CARE international; MDM; Medair; ICCO/SAF; ICCO

International donor organisations: European Commission's Directorate General for Humanitarian Aid (ECHO); Global Facility for Disaster Reduction and Recovery (GFDRR); World Bank; USAID; UNDP; UNOCHA;

OPERATIONS IN THE FIELD: The Role Of The Ngos

The role of the non-governmental organizations (NGOs) in Madagascar regarding DRR is extremely important. Some NGOs were in recent years supported by the European Commission's Directorate General for Humanitarian Aid (ECHO) through its Disaster Preparedness Program called DIPECHO, and developed a solid body of practices in areas such as community resilience, food security and hazard-resistant buildings. The informal exchanges during DIPECHO 1 (for example, the CARE shelter model used by MdM, the construction of a Medair pump in MdM's shelter in Ambodivoanio and the joint production of film by Medair and ICCO/SAF-FJKM, etc.) were followed in DIPECHO 2 by the creation of a coordination body (ICPM) charged with coordinating the DRR network formed by CARE, Medair, ICCO/SAF-FJKM and Médecins du Monde. This body's role is to formalise idea-sharing, best practice and lessons learnt and to publish a joint bulletin. The NGOs are helping to promote the transition from a "disaster culture" to a "risk culture", also contributing, through their programmes to no-regret strategies which ensure benefits for the population even in the absence of a natural disaster (food security : varieties of short-cycle rice whose productivity is higher than that of the varieties used previously and crop diversification; access to water and healthcare infrastructures; Dual use of shelters which otherwise serve as schools or village halls; Improvements in epidemiological surveillance; Protection of the environment (replanting of trees, protection of the mangrove). The NGO's programmes have enabled local risk governance by activating Local and Municipal DRM Committees (CLGRC and CCGRC). As a result, the alert and preparedness phases are now better structured.The alert is now effectively transmitted between the different levels of Committees: the District DRM Committees (CDGRC) have set up a formal relay system in the Communes and Fokontanies (villages). Radio works effectively as an awareness raising tool for emergency preparedeness. The infrastructures implemented by the NGO's remained virtually undamaged after Bingiza Cyclone: In the majority of cases, the shelters were well used, the conditions were good and families brought in stocks of food. The concrete involvement of the communities in realising multi-purpose infrastructures, preferably that can otherwise be used for commercial purposes as an alternative to offering donations, reduces the risk of simply adding to the "archaeological remains" of past humanitarian projects[1].

TECHNICAL EXPERTISE: UN-Habitat

UN-Habitat in Madagascar has played a key role in the development of the DIMSUR/DIPECHOII Programme (Strenghtening Local Capacities and Providing Technical Expertise for Durable Reconstruction within the areas Recently or Frequently Affected by Floods and Cyclones in Madagascar) through essentially two kind of activities: i) cevelopment of construction tools (guidelines, architectural blueprint) to implement adaptive architecture solutions resistant to cyclone and flooding (Mananjary, Vohipeno, Manakara, Morondava); ii) provision of technical assistance for construction implementation to DIPECHO Partners (MDM, Médair, ICCO-SaFFjkm, Care) in Antalaha, Sambava , Fenerive-Est, Maroantsetra, et Mananjary. The first component has been developed through: elaboration of one construction guide, carrying out of assessments in the areas of intervention targeting the applied building codes, design of blueprints for constructing public shelters, development and delivering of Training modules and elaboration of a manual regarding the vulgarisation of norms and guidelines with specific recommendations for Madagascar. UN-Habitat has also contributed to the elaboration of small-scale development plans for land management (PALOS / Plan D'Amenagement Local Simplifié) including measures to strengthen the resilience of the community facing a hazard.

[1]A comparative survey of DIPECHO programmes in the wake of cyclone Bingiza / MDM, EU / 2011

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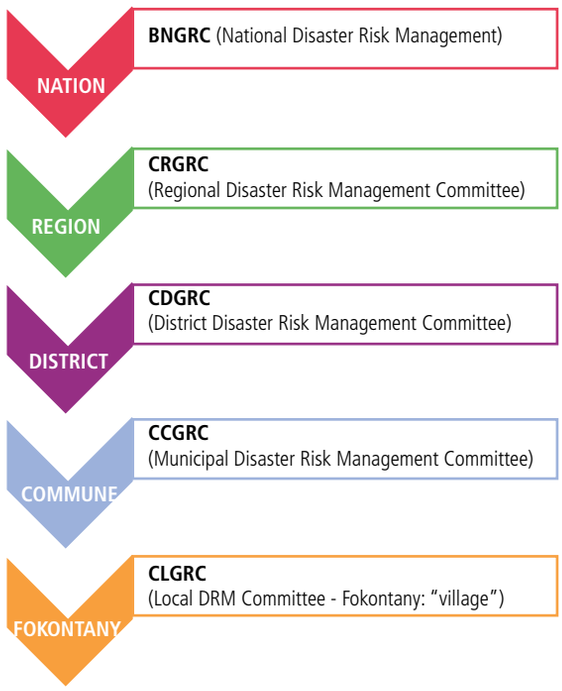
DRR Framework - Madagascar

Completed / On-going Projects

COUNTRY PROGRAMMING AND FINANCING

A **Risk Atlas** is currently being prepared by the CPGU with the support of the World Bank which will provide a vulnerability analysis of in 4 regions (Sofia, Sava, Atsimo Andrefana and Atsimo Atsinanana) by focusing on five sectors: agriculture, housing, roads, health/nutrition and education. Meanwhile, UNDP is currently analyzing the **DRR institutional capacity and risk profile** in collaboration with the Capacity for Disaster Reduction Initiative (CADRI) and within the framework of the UNDP Global Risk Identification Program (GRIP) for other 4 regions, namely: Alaotra Mangoro, Atsinanana, Menabe and Analanjirofo. UN-Habitat within the framework of the UN Joint Program funded through the Human Security Trust Fund is advocating and raising awareness of the different stakeholders regarding the importance of elaborating an urban multi-risk contingency plan for Antananarivo, the capital city, including an assessment of the existing DRR capacities at the municipal level. The national budget merely supports the functioning of the BNGRC and of the CPGU. For the time being there is still no systematic financing mechanisms for DRR in Madagascar. In addition to a specific budget for emergency response. CPGU affirms that approximately 33% of the Public Investment Program is related to DRR. Within the framework of the elaboration of the **UN Development Assistance Framework (UNDAF) 2014-2018** the different sectors were requested to include DRR and CCA projects and activities. Due to the current political crisis in Madagascar, bilateral donors have not allocated any budgetary support; hence current activities related to DRR are implemented through unspent financial resources and humanitarian projects[1].



Institutional DRM Levels In Madagascar

MAJOR COMPLETED / ONGOING PROJECTS BY MULTILATERAL DONOR ORGANIZATIONS IN MADAGASCAR

Project Name	Indicative Budget /Time Frame	Donors / Partners
Cyclone Emergency Social Fund III Supplemental	18.1 million USD 2000	World Bank
Post-Cyclone Emergency Supplemental to SAC 2	20.1 million USD 2000	World Bank
Mainstreaming CCA and DRM into Economic Development	1.2 million USD 2008 / 2012	GFDRR / Government of Madagascar / CPGU
Assessment of Socioeconomic Impact and Recovery and Reconstruction Needs following Cyclone Faine and Ivan	167.614 USD 2008 / 2012	GFDRR / Government of Madagascar / CPGU
DIPECHO Programmes I / II (Disaster Preparedness ECHO)	6.2 million EU 2008 / 2011	ECHO / UN-Habitat , COOPI, FAO, CARE Int., ICCO-SAF, MDM, Medair, ICCO
Emergency Infrastructure Preservation and Vulnerability Reduction Project	102.0 million USD 2012 / 2017	World Bank / Ministry of Finance, CPGU
Emergency Food Security and Reconstruction Project	40.0 million USD 2008 / 2013	World Bank / Government of Malawi
Appuì des Institutions Nationales en Charge de la GRC	670.694 USD 2013 / 2014	UNOCHA - Central Emergency Response Fund / UNDP
Gestion de Risques et Catastrophes	1.7 million USD 2011 / 2012	UNDP / BNGRC, CPGU

[1] ACP-EU Natural Disaster Risk Reduction Program / Support the Establishment of a Technical Center for Disaster Risk Reduction and Climate Change Adaptation for Southern Africa / EU, ACP, GFDRR

SECTION 2
Chapter 1

Principles and Cases of Adaptive Architecture

Malawi

1_MW 1 Chikwawa District

Situation Overview

CHIKWAWA DISTRICT - CASES STUDIES LOCALIZATION

FACT SHEET

Disaster: Floods

Disaster Date: 2001/2003/2005/2007/2008/2013

Deaths: 15

People Injured: -

People Left Homeless: more than 80,000

Nr of Households Affected: more than 40,000

Nr of Houses Completely Collapsed or Partially Destroyed: more than 12,000

Documented Disaster Prevention/Mitigation Programmes - Target Population: more than 8,000 beneficiaries

Building Types:
New Built Houses - 30-40 m2
New Built Safe Heavens/Community Centres-200m2
New Built Schools

Material Cost per Building:
House Construction (including labour): approx. 3,000 USD / House
Safe Heaven Construction (including labour): approx. 28,000 USD
School Construction (including labour): approx. 30,000 USD per block

CASE STUDIES:

1.1_Safe Heaven for Community Evacuation at Nankapa Village and Flood Resistant Housing in eight other villages in TA Makhwira
UN-Habitat ; Habitat for Humanity / ECHO; One-UN Fund

1.2_Safe Heaven for Community Evacuation at T.A. Ngowe
Christian Aid; Evangelical Association of Malawi / ECHO

1.3_Resilient Schools / Education Sector Support Programme
Department of International Development - UK Gov.

Disasters Data: Global Register of Major Flood Events - Dartmouth Flood Observatory; Disasters - National Profile, DoDMA; IFRC Appeals;

VULNERABILITY OF CHIKWAWA DISTRICT

Chikhwawa is one of the 34 District Councils in Malawi, is located in the Southern Region, and lies in the Shire River Basin and in the Great East African Rift Valley. It is vulnerable to earthquakes, storms and floods. The most common disaster in the District is floods. Floods do occur every rain season. Government is often called upon to assist with alleviating the suffering of the affected citizens.

The events become more and more predictable year after year: in most cases there is loss of assets including shelter and domestic animals. Farming and other businesses get interrupted; school going pupils get affected by flooded rivers which they cannot cross; their school blocks become rescue centres; social group activities are curtailed or disturbed during the flood period; people hurriedly evacuate from their houses and start temporarily to live in rescue houses, tents, classrooms, with fellow victims of the floods from other villages and usually under community supervision. Such a life under a 'camping' atmosphere with mixed sexes, age groups, with mixed behavioural trends does lead subsequently to other social pressures requiring further resources to contain them.

Relocating away from endangered location described above and move to a safe residential location doesn't represent a viable alternative for communities that have rooted their agriculture production in origin area and would imply availability of land in the receiving area. Unfortunately, land usage is generally competitive. Chikhwawa District with its neighbouring district of Nsanje has an additional competitor in land use in form of Forest Reserves, Wild-life Reserves and Illovo Sugar Plantations[1].

Photo: UN-Habitat - Houses and Community Infrastructures damaged by the floods

Photo: MalawiLive - Chikwawa Floods

LIVING WITH FLOODS

The approach of Living with Floods consists of reinforcing disaster preparedness capacities of local communities and authorities and implementing small-scale adaptation solutions through the architectural design and construction of housing dwellings and public buildings which could serve as a refuge in case of floods and as a social facility in normal times. Living with floods is a complex issue, related to how the structure is constructed. It is a technical calling on how a building should be constructed to fight rising water, water gushing downhill, hitting the walls and entering the buildings through doors. It is also how to stop roofs leaking and how the roads should be constructed to avoid turning them into water ways. Above all it is about awareness, knowledge and skills to survive living in flood prone areas. Floods, in most cases, are beyond human control. The worst results affecting human beings occur where settlements and infrastructure has not been engineered using a multi-disciplinary approach involving technical experts such as Planners, Engineers and Architects as well as natural environmentalists, to give a concerted safe design solution. Scientific solutions may have to be called upon and merged with traditional methods of construction where possible, recognizing at the same time that some areas like river banks, hill tops and slopes whilst habitable would require huge outlay of resources to make them safe for human habitation[1].

[1]Living with Floods Project - Final Report / UN-Habitat, Lilongwe;

1_MW 1.1

Safe Heaven & Housing

Reducing the vulnerability of communities living in low lands prone to low and moderate level flooding in Makhwira, Chikhwawa

Photo: UN-Habitat - Safe Heaven in use by displaced people : Nankapa Village / Chikwawa / S 16°17'41.3" / E 035°01'54.8"

THE PROJECT. UN-Habitat has taken one of the Malawian Districts most vulnerable to floods, Chikwawa District, as field of implementation of the project Living with Floods, including construction of demonstration shelters, shelter related flood mitigation infrastructure, Improved awareness, dissemination and advocacy activities undertaken at local and national levels. Under the coordination and monitoring of DoDMA and MLHUD at national level and the active involvement fo Chikwawa District Council, the project has been implemented in close collaboration with the local communities, participating to community awareness meetings, selecting the demonstration sites, and contributing in form of sand, brick and watera to the construction of Safe Heaven for Emergency Evacuation and 8 flood resistant houses. The technical designs of the resilient shelters, taking into account costs, available building materials and living local habits, the supervision and training of local artisans have been provided by UN-Habitat, that has hired the NGO Habitat for Humanity to lead the building implementation in the field. The Safe Haven structure provided refuge to hundreds of floods displaced people in 2013. After the floods, it is being used as an early childhood development centre and other community development activities when flood victims return to their homes after the floods have receded.

INTERVENTION DETAILS

Risk Addressed: Floods,Strong Winds, Earthquakes
Where: T.A. Makhwira / Chikwawa District
When: 2010 -2012 (20 months)
Main Goal: To reduce vulnerability to floods of communities living in low-lands, prone to low and moderate flooding by reinforcing local capacities and applying sustainable coping solutions through innovative small-scale shelter based mitigation interventions
Donors: ECHO / ONE-UN Fund
Partners: UN-Habitat; Habitat for Humanity; Chikwawa District Council; DODMA; MLHUD; CBO's
Budget of the Project: 100,000 USD (ECHO) + 100,000 USD (UN Expanded Funding Window)
Cost of the Built Intervention (including labor): approx. 3,500 USD / Demonstration House; approx. 28,000 USD / Safe Heaven;

ACHIEVED RESULTS

1 Safe Heaven built, including two large rooms for women and men complete with kitchen, female and male toilets and raised walkway
8 Houses built for 50 Beneficiaries
19 Local Artesans trained On-the-Job
12 Community Meeting held
583 Community Members residing in decent shelter during floods
1 Community Commitee formed to be responsible about Safe Heaven management/maintenance
1 Construction Manual elaborated

Photo: UN-Habitat - Safe Heaven: Nankapa Village / T.A. Makhwira / Chikwawa / S 16°17'41.3" / E 035°01'54.8"

Why the housing dwellings are "adaptive"?

Foundation: the floor is elevated according with established flood levels for the area; The ramp enables access to the house for people with physical disabilities, the elderly and children;
Roof: the heaped roof is designed according with sun orientation and to withstand strong winds;
Equipments: a khonde area is provided for coking and pit latrine floor level is equally raised above flood level

Photo: UN-Habitat - Flood Resilient House: Nantusi Village / Chikwawa / S 16°15'08.5" / E 035°02'53.2"

CHALLENGES.Low technical know-how and poor availability of useful (and environment friendly) building materials can affect the timing of the implementation. Income levels of the people affected offer significant challenges in determining technical solutions. Community participation can be compromised by cultural factors and lack of awareness.
LESSONS LEARNED. Hardware (construction) must go hand in hand with software (awareness, training) activities for maximum and sustainable effect. Community participation and/or contribution from design stage is very crucial for project success. Existing knowledge/practices should be the basis for any intervention. Partnership with NGO and community are critical success factors.There is a potential for replicating this to other districts experiencing similar conditions in the area.
IMPACT. The Sustainable Shire River Basin Management Programme (funded by WB) has in its DRM component adopted the Living with Floods approach and will scale it up in the lower Shire.The MLHUD plans to orient all its district based housing officers with the Living with Floods approach to support the communities in the districts. UN-Habitat has provided technical assistance to Christian Aid to do a similar intervention in another part of the Lower Shire. Both the Safe Heaven and the demonstration houses have performed successfully in 2013 floods.

Why the Safe Heaven is "adaptive"?

General Features: the Safe Heaven design includes 2 big rooms to accomodate respectively 500 men/ women, 4 male/female toilets and an external covered space for cooking; it is designed so that it remains useful to the community even during the longer dry season.
Site Selection: the Safe Heaven location has been properly selected because of a big tree called Ntondo that has traditionally served as a meeting point for flood victims. The demonstration houses occupy the same place of the damaged ones.
Foundation: An elevated plinth raises the building 750mm from the ground and a raised walk-way to the kitchen and toilets enables safe and dry access to these facilities even in flood conditions. The ramp to the khonde offers convenience to the elderly, people with physical disabilities and the children to access the safe haven;
Walls: the walls, made in fired bricks, are reinforced by ring beams, set at lintel and wall plate height.
Roof: the heaped roof, with angle increased up to 45° eliminates side gable walls and is better perThe veranda roof is separated from the main roof in order to fight a possible lift-up of the main roof in times of strong wind.

TECHNICAL RECOMMENDATIONS FOR REPLICATION:

According with the beneficiaries interviewed:
1) there's need of replication: in crisis time, more than 2,500 people look for shelter in the building;
2) there's need of a lighting system and a fence to guarantee safety of goods and people at night;
3) there's need of a rainwater catchment system;
4) The Safe Heaven is too far from the Health Post
5) The Houses dimension is too small;

TRAINING & CAPACITYDEVELOPMENT

The project was aimed to engage and train local artisans in the delivery of both the Safe Haven and Demonstration Houses so as to leave behind knowledgeable construction artisans who would assist the others in the delivery of houses that would 'fight' floods. 19 artisans have been trained on-the-job by 1 architect and 2 field technicians. The builders interviewed recognized to have approached construction techniques they didn't know before: they didn't find any difficulty in the technical implementation, while the biggest challenge was determined more by the erratic provision of construction materials. Unfortunately the builders admitted not to have had any opportunity to replicate the experience, since it requires more materials than an average family can afford.

Photo: UN-Habitat - On the Job Training

1_MW 1.2

Evacuation Centre

Reducing the vulnerability of communities living in floods prone areas of Chikwawa District

Photo: UN-Habitat - Surveyed Evacuation Centre: T.A. Ngowe / Chikwawa / S 16°30'50.2" - E 035°00'53.2"

THEPROJECT. During the night of the same day, 23rd January 2012, people from 14 villages namely Juma, Jimu, Kandale, Khula, William, Medison, Yula, Joning'abu, Kanaventi, Dickson, Komba, Kukulidwa, Kakang'ombe and Kahombewere under Traditional Authority Ngowe were caught unaware. "Oh it was terrible, you could not imagine the entire village was in water," said Chanza Jimu who is a village headman of Jimu Village. All this started with heavy rains which started on 19th January and continued until 24th January. Out of the total 625 victims of floods, 439 households were from the Traditional Authority Ngowe, where Christian Aid and Evangelical Association of Malawi in partnership with Chikhwawa district council implemented a 15 month Disaster Risk Reduction project from August 2010 to 31 October 2011 targeting communities in flood prone areas and including the construction of an evacuation center with technical support from UN Habitat. "God should bless people who constructed this structure, I do not know what could have happened without this structure," concluded Chanza Jimu[1]. The evacuation centre design and technical features are very similar to the Chikwawa Safe Heaven, reported in the previous page: the implementation strategy is different, because the building construction has been committed to a building contractor, inspite than to local builders.

INTERVENTION DETAILS

Risk Addressed:Floods,Strong Winds, Earthquakes
Where: T.A. Ngowe / Chikwawa District
When: 2010 - 2011
Main Goal: to reduce the vulnerability to natural disasters of communities within Chikhwawa district through development of small scale community flood mitigation structures and services
Donors: ECHO
Partners: Christian Aid; Evangelical Association of Malawi (EAM); Chikhwawa District Council;
Budget of the Project: 52,000 USD
Cost of the Built Intervention: 45,000 USD

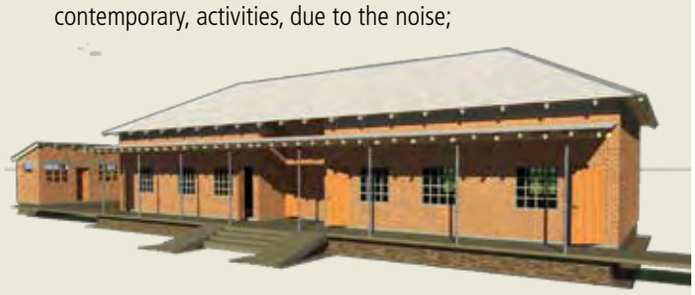
ACHIEVED RESULTS

1 Safe Heaven built, including two large rooms, female/male toilets and raised walkway
200 Community Members accomodated
1 Awareness Raising Community Training held
15 Community Members Trained
1 Community Commitee formed to be responsible for the Safe Heaven management/maintenance

The Community has contributed providing: 1) security for the building site; 3) planting of trees as wind-breakers; 4) downloading of materials when arriving on site; 5) identifying of place where to find building materials; 6) clearing of the ground; 7) bringing water for construction.

TECHNICAL RECOMMENDATIONS FOR REPLICATION

The same technical design applied to the Chikwawa intervention, has been provided by UN-Habitat to the Evangelical Association of Malawi to implement the Evacuation. The problems reported by the Beneficiaries interviewed are similar:
- The number of the flood victims that were accommodated in the center was larger than the capacity of the structure: the toilets as the kitchen space become insufficient.
The catchment area of the centre is too wide, thus the beneficiaries are too far. The intervention has to be replicated.
- There is need of lighting to guarantee security at night;
-The water provision is insufficient during overcrowded crisis times: there is need of a rainwater harvesting system;
- There is need to divide the rooms with gable walls: since they're communicating on the top part, it's difficult to run two contemporary, activities, due to the noise;



Drawing: 3D Model of the Safe Heaven Prototype Design used in Chikwawa and Ngowe - UN-Habitat - Lilongwe / Malawi

[1]Climate Change: Its Effects On Rural Communities In Chikhwawa District Have Been Reduced - Christian Aid;

1_MW
1.3

Resilient Schools

Education Sector Support Programme (ESSP)

Photo: UN-Habitat - New Built School / DFID, Lilongwe

THE PROJECT. From 1995, DFID funded the construction of 130 new schools under the Primary Community Schools Project (PCoSP) and completion of 200 classroom blocks under the Primary Education Programme (PEP). Building on the successes of these programmes, DFID initiated the ESSP in 2001. Between 2004 and 2008, DFID funded the construction of nearly 60% of Malawi's classroom construction[2]. The Government of Malawi and DFID are jointly committed to key policy reforms and targets specified in the Malawi Education Sector Implementation Plan, including onstruction and rehabilitation of school buildings and inspection of schools to ensure that they meet government requirements and standards.
The schools built under DFID Programme follow a common adaptive architectural model, based on Stabilized Soil Blocks Masonry, promoted by DFID in Malawi to sensitize communities in decreasing the use of fired bricks, hence deforestation. The building corners and opening frameworks are reinforced by blocks stabilized with a higher percentage of cement. The school raises on a variable high elevated platform, to avoid flooding, and, for the same reason, the landscaping is modelled with water drainaging channels. The roofing is implemented alternatively by metal panels coating or micro-concrete tiles, which have good climatic performances and are more silent in rainy conditions, but less mechanic resistance to strong winds. A double insulated ceiling can give the same thermal and acoustic insulation to the roof, but keeping the external metal panels coating.

INTERVENTION DETAILS

Risk Addressed: Multi-Hazard
Where: the whole country
When: 2003 - 2009 / 2008 - 2011
Main Goal: secure schooling for children through classrooms building, curriculum reform (and new text books), teacher training, and strengthened accountability
Donors: DFID
Partners: Education Infrastructure Management Unit (Ministry of Education)
Budget of the Project: £1,065,000 (2008 - 2012)[1]
Cost of the Intervention:

ACHIEVED RESULTS[2]

2,535 new classrooms used by 300,000 children between (2003 -2009)
287 Teacher Houses (2003 - 2009)
1,000 new classrooms used by 100,000 childrens (2008 - 2012)

TECHNICAL RECOMMENDATIONS FOR REPLICATION:

- The platform elevation should be increased;
- A veranda and continuous covered and elevated walkway should be included;
- The roof coating, where implemented by concrete tiles, has to be replaced by improved metal panels, strongly anchored to the underlying purlins;

THE CASE. Livunzu's community spontaneously replicate and improve the building design

Livunzu is a village located in the vulnerable floodplane of Chikwawa District, at T.A. Makwhira. DFID has funded the construction of a flood resilient school, implemented by a building contractor: the school includes 3 classrooms blocks, 1 offices unit, 4 VIP toilet respectively for girls and boys, and 2 teachers houses. The school, built in SSB (Stabilized Soil Blocks) is raised 50 cm above the ground, to prevent the flooding water to get into the classrooms. After DFID project completion, the community, needing one more classroom block, has spontaneously replicated the technical devices applied in the model building, even improving the raise of the platform which is set at 70cm above ground level and adding a covered veranda on the front.

Photo: UN-Habitat - the school block sponeously built by the community: Livunzu Village / Chikwawa / S 16°11'25.3' - E 035°00'18.9'

[1]http://projects.dfid.gov.uk/ Support to Education Infrastructure Management Unit
[2]Timely Project delivery: a case study of Malawian educational projects / Chirwa, Samwinga, Shakantu / Education Infrastructure Management Unit (EIMU), Lilongwe, MALAWI; School of the Built and Natural Environment, Northumbria University, Newcastle upon Tyne, UK / School of the Built Environment, Nelson Mandela Metropolitan University, Port Elizabeth, South Africa;

1_MW 2

Karonga District

Situation Overview

CHIKWAWA DISTRICT - CASES STUDIES LOCALIZATION

FACT SHEET

Disaster: Earthquake, Floods

Disaster Date: December 6th/20th 2009 - November 2010 (Earthquakes) ; cyclical flooding;

Deaths: 4

People Injured: 186

People Left Homeless: 15,000

Nr of Households Affected: 24,239

Nr of Houses Completely Collapsed or with Hazardous Cracks: 11,213

Reconstruction/Retrofitting Programmes Target Population: 2,400 (rc) + ...

Building Types:
New Built Houses - 45m2
Houses Retrofitting - 20m2 to 40m2
New Built Schools - 120m2/classroom
Schools Retrofitting - 100m2/classroom
New Built Infrastructure
Infrastructures Retrofitting

Material Cost per Building:
House Construction (including labor): approx 3,000 USD / Repair Grants: 350 USD/Household
Classroom Block Construction (including labor): approx 35,000USD/Classroom Repair: 3,000 USD

CASE STUDIES REPORTED:

2.1_ Low-Cost Housing Reconstruction / Retrofitting - Malawi Red Cross / DFID
2.2_ Low-Cost Housing Reconstruction & WASH Rehabilitation - CADECOM - Catholic Relief Service / USAID -OFDA
2.3_Education Facilities Reconstruction/Retrofitting - GoM / World Bank - Local Development Fund (LDF)
2.4_Infrastructures Construction/Retrofitting - Local Development Fund (LDF) - Paladin Energy Limited
2.5_Karonga Urban Structure Plan 2012 - Department of Physical Planning (MLHUD), Karonga District Council, Department of Disaster Management Affairs (DoDMA), UN-Habitat / ECHO

Data Sources: DREF operation n° MDRMW005 / GLIDE n° EQ-2009-000257-MWI /14 December 2009; SHELTER PROJECTS 2010 - UN-Habitat / UNHCR / IFRC;

VULNERABILITY OF KARONGA DISTRICT

Karonga, located in the Northern Region, is one of the border districts of Malawi, sharing the country's international boundary with Tanzania. Elongating on the African Rift Valley, the District main topographic features are the flat lift valley plain along the lakeshore and hilly plateau zone to the west towards Chitipa and Nyika National Park.On the 6 December 2009 an earthquake of magnitude 5.8 hit the district of Karonga, followed two weeks later by an earthquake of magnitude 6.2. These earthquakes caused widespread damage and destruction to houses, public buildings and infrastructures in Karonga.

On 21 December 2009, the Government officially declared the Karonga Earthquake a national disaster. Karonga was further hit in November 2010 by an additional 4.6 magnitude earthquake and on the 1 and 2 April 2011 by floods (caused by breaches of a 1985 dyke already weakened by the earthquakes)[1].The District is ciclically affected almost every year by devastating floods, caused by the raising level of the North Rukururu River and other smaller local rivers. In the last 20 years, more than 75,000 households have been affected globally, having their houses or cultivations damaged by the raising waters. 90% of the labour force in Karonga work in the agriculture sector (compared with 83% nationally), with almost all of these in unpaid work (subsistence farming). Furthermore, rice cultivation is the most practiced, inducing the families to live in wet low lands. As a result the majority of the population has been unable to cope with the impacts of multiple floods[2]. UN-HABITAT is working with the GoM to elaborate an urban plan for the town of Karonga that seeks to use urban planning as a tool for DRR in urban settlements.

Photo: UN-Habitat

Photo: DanChurchAid

Safer House Construction Guidelines

79% of the population in Karonga District (compared with 49% nationally) has bricks/blocks houses, with thatched or metal coating roofs. To economise on the use of bricks, walls a single brick thick were often built. These walls are not earthquake resistant. Additionally, the position and size of doors and windows and the type of un-braced roof construction, contributed to the structural failing of the buildings. A small percentage of households have traditional houses from wattle and daub with thatched roofs. While lacking durability, these dwellings made in local materials were largely undamaged by the earthquake. UN-HABITAT has supported the GoM and worked with a number of partners to elaborate and disseminate the 'The Safer House Construction Guidelines' as part of the Karonga earthquake recovery activities. UN-Habitat has assisted during the emergency phase providing an international shelter specialist and has promoted an alliance with government, other agencies and non-government organisations working in housing and shelter to elaborate and disseminate the 'The Safer House Construction Guidelines' as part of the Karonga earthquake recovery activities. The guidelines were produced as a manual and as a series of posters. It was recognised by the GoM that information should be made available nationally to reduce the risk of all hazards, including earthquakes. The guidelines would be the start of a process to create national guidelines and standards for construction

[1]Business Case for: Karonga Earthquake Integrated Recovery Project / DFID;

1_MW 2.1

Housing Reconstruction & Retrofitting

Emergency Shelter Relief and Recovery Karonga

Photo: UN-Habitat - Surveyed Reconstructed House: Zindi Village / Karonga / S 09°54'5.00" - E 033°55'10.90"

THE PROJECT. In the immediate aftermath of the earthquake. The Malawi Red Cross Society provided emergency shelter to 6,000 families that had been forced from their homes In order to reduce the vulnerability of the affected households for the long term, and with the financial support of DFID, the MRCS implemented a project that provided materials, cash grants and training to build and repair houses, sanitation facilities for households and schools, and disseminated better building practice, through training of hygiene promoters, training of artisans and beneficiary dissemination workshops. One of the guiding principles for the project was that householders, communities, and government were responsible for providing safe and adequate housing. The organisation would provide support were there were gaps in skills, knowledge, and resources. The District Council of Karonga was the responsible for the project management and monitoring. The project adopted rural housing designs already produced by the GoM, based on local materials, but improved their structural performances. Every beneficiary was given a range of designs to choose from and both householders and artisans were provided training to ensure that important construction details and methods were implemented. The organisation provided construction supervisors to monitor and assist the construction process[1].

INTERVENTION DETAILS

Risk Addressed: Earthquake
Where: Karonga - Northern Region
When: 2010 - 2012
Main Goal: to assist communities in housing reconstruction by providing information and technical direction on earthquake resilient houses in order to reduce communities vulnerability to future disaster
Donors: UK Aid (DFID)
Partners: Malawi Red Cross Society; Karonga District Council; MLHUD; UN-Habitat; TEVETA (Technical, Entrepreneurial, Vocational, Education and Training Authority); CBO's
Budget of the Project: 1,199,890 USD
Cost of the Intervention (including labor):
approx. 4,000 USD / house reconstructed
approx. 350 USD / house retrofitted

ACHIEVED RESULTS (2010 - 2011)

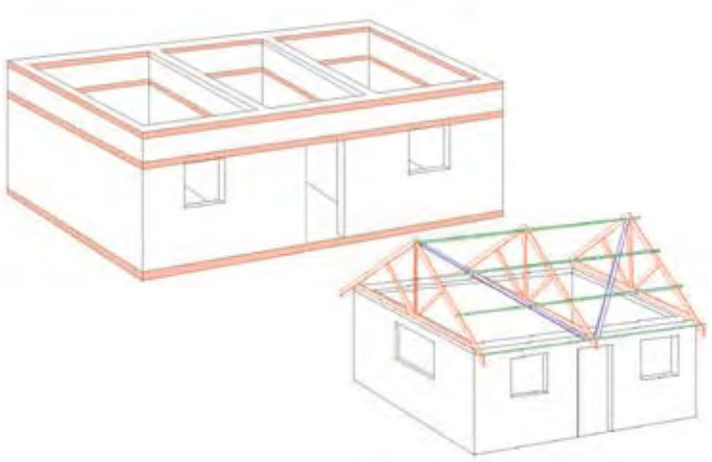
6,000 Beneficiaries residing in Emergency Shelter
2,400 Beneficiaries residing in Permanent Shelter
100 Houses Reconstructed
450 Houses Repaired through Cash Transfers to the families
250 Households VIP latrines and school sanitation facilities constructed
40 Artisans trained in seismic resistant building construction/retrofitting techniques
60 Red Cross Volunteers Trained in construction monitoring and communication strategies
More than 120,500 indirect Beneficiaries

Photo: UN-Habitat - Surveyed Retrofitted House: Karonga / S 09°56'46.96" - E 033°56'5.68"

TO REPAIR YOUR HOUSE, YOU JUST NEED YOUR MOBILE

500 beneficiaries are receiving cash transfers using mobile phones through Zain (a mobile telephone operator in the region) to fund the repair of their homes. MRCS Construction Supervisors, with the householders, surveyed the houses to identify the repairs and produce a prioritised schedule of work and an approximate budget. The transfers are given in two tranches with the second payment triggered once 50% of the work on the house is complete.

[1]SHELTER PROJECTS 2010 - UN-Habitat / UNHCR / IFRC;



CHALLENGES. Lack of coordination in the field between different ongoing programmes after the earthquake made it difficult deploying and sharing of resources in terms of personnel, vehicles, office spaces, and finance and administration systems. The project had to be implemented within a short time to coincide with the dry season, to meet donor requirements, and to meet the expectations of the community. The result of the project has to be a prototype that meet average 'seismic resistance or rating' as well as being affordable by the community.
LESSONS LEARNED. Strong links with communities, government, and other organisations enabled access to the affected communities. To ensure a reduction of the vulnerability in the long term, communities and local government have to be responsible for managing and monitoring the initiative.International links provided access to technical support and specific assistance, especially during the first phase of the emergency.
IMPACT. The project was able to engage with other initiatives like urban planning projects, disaster risk reduction planning and preparedness. Through the support of UN-Habitat, partnerships were formed with government and other stakeholders to develop a disaster risk reduction strategy to assist reconstruction, including the elaboration and dissemination Construction Guidelines to be adopted at national level.

EXPECTED RESULTS. The houses already rebuilt or repaired in Karonga with external support (including MRCS) are 961 (8,9% of the affected ones) and 540 houses (5%) have been rehabilitated by households able to recover with their own resources. The households still in need of help are 9,291 (86%). DFID is funding an ongoing project, implemented by MRCS, that aims to achieve the following results: rehabilitation of 2,000 damaged houses and reconstruction of 200; constructionn of 16 new boreholes and rehabilitation of 56; construction of 5,000 family new VIP toilet and hand washing facilties[1].

Why this architecture intervention is "adaptive"?

Shape: the house shape is squared and compact with a maximum span of unsupported walls inferior than 5 m;
Foundation: the plinth is raised 40mm from the ground. The foundation beam is made in concrete and the foundations walls are made by fired bricks layed according with English Bond and isolated by a damp proof membrane;
Walls: the walls, made in fired bricks, are reinforced by ring beams, set at lintel and wall plate height, and Brick Force Wire in every 4th course; the area of openings doesn't exceed 50% of wall area; a minimum distance of respectivley 600mm / 900 mm is kept between window/door openings and the corners of the buildings;
Roof: the pitch angle increased up to 45°, thus to reduce the uplift due to strong winds; the roof structure is made in wooden trusses, reinforcing the side masonry gable walls;

TECHNICAL RECOMMENDATIONS FOR REPLICATION:

According with the beneficiaries interviewed:
- The house is too small to satisfy the needs of a growing family;
- The covered space under the veranda, when present is too small;
- A covered space to be used as a kitchen should be annexed;
Furthermore:
- the elevated plinth height should be increased, specially in flood prone areas;
- a hipped roof should substitute the actual gable roof because more resistant to climatic agents

Vocational Skills Training On Safe Housing Construction

TEVETA in collaboration with MRCS and World Bank, trained unskilled and semi skilled workforce in construction industry working in Karonga, encouraging the adherence to the new approved safer construction guidelines. After community sensitization meetings, leading to the recruitment of artisans and supervisors, a ToT workshop was attended by 16 artesans coming from 5 different Karonga's areas: each trainee engaged 3 semi-skilled artisans with whom they work with at the site. In total therefore 40 artisans and 60 volunteers benefitted from this training programme, coordinated by 8 field technicians and 2 logistics facilitators[2].
THE STORY. Obvious Mwalwanda, one of 16 locals artesans trained, says, "The training has opened up the market for me. I can now work in town or the village with the new skills".

Photo: UN-Habitat - On the Job Training
[1]Business Case for: Karonga Earthquake Integrated Recovery Project / DFID;
[2]Tracer Study For Vocational Skills Training On Safe Housing Construction In Karonga / TEVETA;

1_MW 2.2

Housing Reconstruction

Post - Earthquake Rehabilitation Project / Community Managed Disaster Risk Reduction in Karonga and Kusungu

Photo: UN-Habitat - Surveyed Reconstructed House: Mwenitete Local / Karonga / S 09°48'53.25" - E 033°51'55.17"

THEPROJECT. With assistance from USAID through Catholic Relief Services (CRS Malawi), the Caritas Commission of Karonga Diocese has implemented a Post Earthquake Rehabilitation Programme, as long-term evolution of an emergency relief project dedicated to the victims of the 2009 earthquake. In this project, CADECOM oriented the district council and community based organizations on construction of earthquake resistant houses and built 85 permanent living houses for earthquake victims in Traditional Authority Kilupula, Karonga district. The houses and the on-the-job trainings have been carried out accordingly with the earthquake safe construction guidelines elaborated by the Government of Malawi, with the technical assistance of UN-Habitat. CADECOM is implementing others two community managed Disaster Risk Reduction and Management Programmes, namely Community Managed Flood Risk Reduction (CMFRR) and Community Managed Disaster Risk Reduction (CMDRR) in Karonga district and Kasungu district respectively. As already done for the housing reconstruction programme, the projects aim to build community resilience to disasters, while CADECOM plays a role of facilitation and assistance. The final product is an Action Plan which outlines strategies and activities to address capacity gaps so that communities are able to prevent or mitigate disasters in their localities.

INTERVENTION DETAILS

Risk Addressed: Earthquake / Floods
Where: Traditional Authority Kilupula, Karonga District / Northern Region
When: 2010 - 2011
Main Goal: building community capacity in management of disasters and creating awareness to empowering disadvantaged people to undertake integral, sustainable, gender and environment sensitive development
Donors: USAID / OFDA
Partners: CADECOM (Caritas Commission, Karonga Diocese); CRS Malawi (Catholic Relief Service); Karonga District Council; MLHUD; CBO's
Budget of the Project: 248,488 USD
Cost of the Intervention (including labor): approx. 3,000 USD / house reconstructed (including Project Personnel, Trainings and Logistics)

ACHIEVED RESULTS

85 Houses Built for Earthquake Victims
50 VIP Latrines built (Provision of Construction Materials and Training Artisans on Construction)
2 On-the-Job Trainings for 195 Members of Youth Groups on Stabilised Soil Blocks Making and Earthquake Resistant Techniques
30 Workshops Organized including 40 participants
12 Awareness Raising Community Trainings for 4000 Community Members (Traditional Leaders and Village Development Committees) trained in construction supervision

Why this architecture intervention is "adaptive"?

Shape: the house shape is squared and compact ;
Foundation: the plinth is raised 30mm from the ground. The foundation beam is made in concrete and the foundations walls are made by fired bricks layed with English Bond and isolated by a damp proof membrane;
Walls: the walls, made in SSB, are reinforced by ring beams, set at lintel and wall plate height, and Brick Force Wire in every 4th course; a minimum distance of 600mm is kept between window openings and the corners of the buildings;
Roof: the pitch angle is increased up to 45°the roof structure is made in wooden trusses, reinforcing the masonry gable walls;

TECHNICAL RECOMMENDATIONS FOR REPLICATION:

According with the beneficiaries interviewed:
- The house is too small to satisfy the needs of a growing family: a way of extension or replication should be provided
- A veranda and a covered space to be used as a kitchen should be annexed;
Furthermore:
- the elevated plinth height should be increased;
- a hipped roof should substitute the actual gable roof;

1_MW 2.3

Schools Reconstruction & Rehabilitation

Malawi Additional Financing for Third Social Action Fund APL II / Education Sector

Photo: UN-Habitat - Surveyed Reconstructed School: Mwenitete Local / Karonga / S 09°48'46.1' - E 033°52'23.9'

THEPROJECT. The school systems in Karonga and Chitipa Districts have been debilitated by two successive earthquakes in December 2009 and January 2010. A preliminary assessment indicates that 106 schools were damaged, comprising 376 classrooms, 268 teachers' houses, and 233 VIP latrines. About 50,000 students have been directly affected by the damage in terms of disrupted teaching and learning[1]. The main objetive of this intervention, funded by the World Bank through the Local Development Fund (LDF), was to support the reconstruction and retrofitting of classrooms, teachers' houses and sanitation facilities in order to minimize disruption to the teaching and learning and improve education outcomes in the district. The Project has been organized in a decentralized manner to facilitate greater autonomy and empowerment of local government structures and communities, required to contribute in the form of sand and bricks. However, given the devastating effect of the earthquake on people's livelihoods, the MASAF/LDF Technical Support Team revisited the requirement under the original Project which calls for a 20% community contribution and reduced it to a minimum of 5% .62 Local contractors have been contracted to facilitate the construction of good quality classroom blocks and staff houses: some of them were belonging to the artesans group trained by TEVETA.

INTERVENTION DETAILS

Risk Addressed: Earthquake
Where: Karonga - Northern Region
When: 2009 - 2014
Main Goal: to rehabilitate the education system in Karonga and Chitipa Districts to improve the livelihoods of poor and vulnerable households and to strengthen the capacity of local authorities to manage local development.
Donors: Local Development Fund (World Bank)
Partners: Government of Malawi / Ministry of Finance / MASAF / LDF Technical Support Team/ Malawi Social Action Fund
Budget of the Project: 5.4 millions USD[2]
Cost of the Intervention (including labor):
2 Classrooms/Block Construction: approx. 45,000 USD; 4 Classrooms/Block Retrofitting: 5,000USD; 1 Teacher House Construction: 18,000 USD / 1 Teacher House Retrofitting: 2,000 USD

ACHIEVED RESULTS[2]

13,220 learners in primary schools benefitted from restored educational services;
172 Classrooms Built Rehabilitated;
300 Teachers provided with improved housing;
1,300 Primary School Staff Houses Constructed
27,750 Beneficiaries with access to improved Sanitation;
233 VIP Toilets built;
150 artisans will benefit from improved and marketable skills in construction;

Photo: UN-Habitat - Surveyed Reconstructed School: Mwenitete Local / Karonga / S 09°48'46.1' - E 033°52'23.9'

[1] Malawi Additional Financing for Third Social Action Fund APL II / PROJECT INFORMATION DOCUMENT (PID) APPRAISAL STAGE / Report No.: AB5669;
[2] Report No: 54691-MW - World Bank;

Photo: UN-Habitat - Surveyed Reconstructed School: Mwenitete Local / Karonga / S 09°48'46.1' - E 033°52'23.9'

LESSONS LEARNED. The design of MASAF 3 APL-II benefited from the experience of implementing the three prior phases, and has built on the lessons learned. The project focused more on strengthening the capacity of local authorities to manage local development. To ensure technical viability, communities have been advised to undertake sub-projects that are simple, small in size, labor intensive, economically and socially viable, and that can be maintained and operated by communities in a sustainable way. An Impact Evaluation conducted at the end of MASAF 3APL-I in March 2008 concluded that sub-projects implemented by communities were technically sound and were done according to prescribed designs. Local councils have demonstrated capacity to facilitate implementation of public works and other sub-projects[1].

EXPECTED RESULTS. Within 2014 the number of primary school classrooms built or retrofitted is supposed to increase to 244 and the people with access to improved learning environment should reach 50,000[2] pupils. DFID is funding a parallel project, regarding scholl sanitation, including 25 double VIP school latrines, 10 urinals and 10 hand washing facilities will be constructed in 5 schools, serving a total of 2,200 pupils. The schools that the facilities will be constructed will be those with no current existing sanitation facilities and are not included in the World Bank rehabilitation plans[3].

Why this architecture intervention is "adaptive"?

The shape: the building shape is rectangular and compact (ratio 1:3) with a maximum span of unsupported walls inferior than 5 m (using of buttresses / intermediate walls);
Foundation: the plinth is raised 40mm from the ground and the foundation is set on a depth of 750mm. The foundation beam is made in concrete and the foundations walls are made by fired bricks layed according with English Bond and isolated by a damp proof membrane;
Walls: the walls, made in fired bricks, are reinforced by ring beams, set at lintel and wall plate height, and Brick Force Wire in every 4th course; the area of openings doesn't exceed 50% of wall area; a minimum distance of respectivley 600mm / 900 mm is kept between window/door openings and the corners of the buildings;
The roof: **the roof is hipped thus to eliminate gable masonry walls** and the pitch angle is increased up to 45°, thus to reduce the uplift due to strong winds;the wall plate is secured with metal wires into the masonry;

TECHNICAL RECOMMENDATIONS FOR REPLICATION:

The school surveyed in the Village of Mwenitete-has been designed according with a student/classroom ratio of 60, but at the moment has more than 1000 students with a ratio of more than130/ classroom. Some of the student are following the lessons outside, sitting in the yard on bricks aligned to form small chairs. The structure needs to be extended and replicated.

Training and Capacity Development

The World Bank school construction and rehabilitation activities in earthquake-affected areas of Karonga and Chitipa, have also aligned their "build back better" approach to the earthquakesafe building guidelines prepared by the Ministry of Lands, Housing, and Urban Development, with UN-Habitat technical assistance (see pag 8): any construction and retrofitting activities under MASAF in fault line areas are required to comply with these new guidelines. Community contractors/artisans Training have been trained in the new construction techniques and building codes, which has equipped them with marketable new skills. The artisans have been trained by a contracted government institution with facilitation from the Technical Vocational and Entrepreneurship Training Authority (TEVETA - see pag.). In addition, a preliminary agreement has been reached between MASAF and the Mzuzu Technical College which has agreed to train community identified artisans on the new construction guidelines. It will also assist with follow-up supervision visits, together with local service providers, to ensure adherence to the new building codes. It was noted that the artisans have acquired marketable skills and their names has been kept in a roster at the District Councils. Lessons learned from this experience will be shared with other Bank-supported operations[1].

[1]Malawi Additional Financing for Third Social Action Fund APL II / PROJECT INFORMATION DOCUMENT (PID) APPRAISAL STAGE / Report No.: AB5669;
[2] Report No: 54691-MW - World Bank;
[3]Business Case for: Karonga Earthquake Integrated Recovery Project / DFID;

1_MW 2.4

Infrastructures

Malawi Additional Financing for Third Social Action Fund APL II / Public Works Sub-Projects Program

Photo: UN-Habitat - Surveyed Bridge: Mwenitete Local / Karonga / S 09°52'28.9' - E 033°53'46.1'

THEPROJECT. Karonga District has experienced recurrent flooding during the last years. The floods are also intensified as a result of rice growing activities in the surrounding low lands as water is retained in the rice plots and cannot flow downstream to the lake. During April 2011 excessive rainfall led to swelling of Lufilya, Kyungu and North Rukuru Rivers resulting in damage to the dyke along North Rukuru River: the dike, built in 1985 to protect the urban areas from the cyclic floods, was already weakened by overgrazing and the previous earthquake of December 2009. Over 5,599 households had been affected.The 20 m break rehabilitation has been funded by a private investor through the LDF, and implemented by the District Council, through a building contractor. Other small-scale mitigation interventions, in terms of rural infrastructures, like elevated unpaved roads and small bridges allowind the flow of the water to the rice cultivations, have been impelemented under the public work component of the LDF.

Photo: UN-Habitat - Rehabilitated Dike / Karonga / S 09°55'46.0' - E 033°55'15.1'

INTERVENTION DETAILS

Risk Addressed: Floods
Where: Karonga - Northern Region
When: 2010 - 2012
Main Goal: strengthening public infrastructures to improve food security and create community assets.
Donors: Local Development Fund
Partners: Government of Malawi / Ministry of Finance/ MASAF / LDF Technical Support Team Malawi Social Action Fund
Budget of the Project: 5.1 millions USD
Cost of the Intervention: 3,900 USD

ACHIEVED RESULTS 2010 -2013

Communities and Local Authorities to successfully manage (prepare, implement and evaluate) a targeted public work program.

28,000 Km of Rural Road Rehabilitated
13,396 Ha of Area provided with new/rehabilitated irrigation/Drainage Services

INTERVENTION DETAILS

Risk Addressed: Floods
Where: Mamatope Village
When: 2012
Main Goal: to reduce the vulnerability of communities living in low lands of Karonga
Donors: LDF / Paladin Energy Limited
Partners: Karonga District Council
Budget of the Project: 12,000 USD
Cost of the Intervention: 12,000 USD

ACHIEVED RESULTS

20 m of the dyke rehabiliated

TECHNICAL RECOMMENDATIONS FOR REPLICATION:

Inspite of the presence of the dyke, some members of the local community, unaware the risk, are building on the floodable side of the infrastructure: urban and communtiy planning, as a measure of DRR, has to be strenghten.

1_MW 2.5

Urban Planning

Karonga Urban Structure Plan 2012

Karonga Urban Structure Plan 2012

THEPROJECT. UN-HABITAT is working with the GoM to elaborate a urban plan for Karonga town to create and maintain a urban environment which ensures that high quality physical and social development is coordinated and in which environmental negative effects and development conflicts are minimized or avoided.The intervention is not an architectural intervention. It is a human settlement planning intervention. Integrating DRR in human settlements planning is fundamental to adaptive architecture and is also fundamental to protection and resilence of the built environment.The relevance of this intervention in Southern Africa is given by the fact that up to now human settlements planning in the region has not integrated DRM on a significant scale. **IMPACT.** This experience has involved and aroused interest both of national and local governments. The Department of Physical Planning now has officers who have practical experience of integrating DRM in urban planning and will be in a position to use this knowledge, experience and skills for other human settlements planning tasks in the country. The Ministry of Local Government and Rural Development is now working to ensure that all district development plans should integrate DRM in their pipelines.

INTERVENTION DETAILS

Risk Addressed: Earthquake/Floods/Strong Winds
Where: Karonga Municipality / Northern Region
When: 2012 - ongoing
Main Goal: to formulate a human settlements plan that seeks to enhance protection of existing investments and livelihoods and guide future development that integrate disaster risk management principles
Donors: ECHO, One-UN Fund
Partners: Department of Physical Planning (MLHUD), Karonga District Council, Department of Disaster Management Affairs (DoDMA), UN-Habitat
Budget of the Project: 20,000 USD

ACHIEVED RESULTS

1 Urban Structure Plan in elaboration to be approved by Government Institutions and replicated in other districts of the country
18 technicians from urban local authorities, universities and relevant government departments in urban risk mapping
30 members of the Malawi Institute of Physical Planners in Mainstreaming DRR and CC in Urban Planning

Proposals to build resilience and reduce vulnerability in Karonga Town

In order to promote the efficient use of land within the planning area and to create and maintain a urban environment which ensures provision of adequate social services and facilities to meet present and future needs of communities, Karonga Urban Structure Plan includes measures to minimize or avoid environmental negative effects due to natural disasters. The measure address[1]:
- Lake level rise leading to flooding
- River swelling leading to flooding of the town
- Strong Winds
- Earthquakes
- Drought

[1]Vulnerability Reduction Measures as per Urban Strcuture Plan can be find in Annex: A_MW_2.5.c

Photo: Karonga Floods April 2011 / DoDMA

SECTION 2
Chapter 2

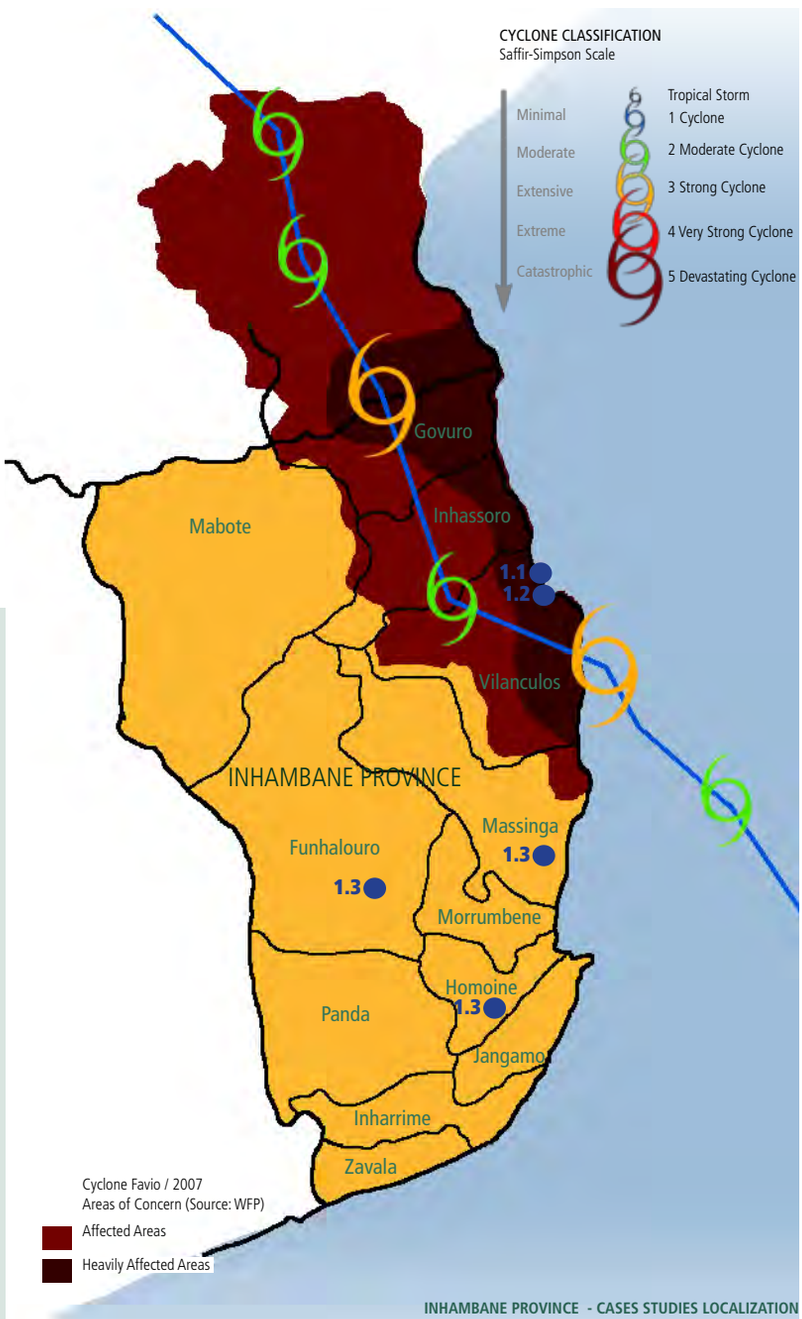
Principles and Cases of Adaptive Architecture

Mozambique

2_MZ 1

Inhambane Province

Situation Overview



FACT SHEET

Disaster: Cyclone Fàvio

Disaster Date: February 22nd 2007

Deaths: 9

People Injured:

People Left Homeless: 50,000 people

Nr of Households Affected: 160,000 people

Nr of Houses Completely Collapsed or Partially Destroyed: 6,500

Documented Initiatives Target Population: more than 18,000 people

Building Types:
Cyclone Shelters, Housing &
Public Infrastructures (Primary School);
Rain Water Harvesting Systems;

Material Cost per Building:
House Construction (including labour): approx. 6,000 USD / House
Kindergarten/Cyclone Shelter Construction (including labour): approx. 40,000 USD
Water Harvesting Systems (including labour): approx. 40,000 USD per system

CASE STUDIES:

1.1_Housing Workshop and Prototype Testing
UN-Habitat - Municipality of Vilanculos / ECHO - UNJPDRR

1.2_Cyclone Resistant Kindergarten
UN-Habitat - Vilanculos Municipality / Associaçao Moçambique Alemanha

1.3_Water Catchment Systems
International Relief and Development (IRD) / OFDA

Disasters Data: Mozambique – Floods and Cyclone / Fact Sheet #1, Fiscal Year (FY) 2007 / March 22, 2007/ USAID;

VULNERABILITY OF INHAMBANE PROVINCE

Mozambique has a large coastline exposed to the Indian ocean leading to the threat of cyclones. Additionally the country is prone to floods, droughts and earthquakes. The number of events has dramatically increased this century. Coastal areas of Mozambique are very prone to cyclones. Vilankulo municipality is a geographically exposed coastal town, included in the Province of Inhambane, that has been hit several times by cyclones and strong winds. In the urban context of Vilankulo municipality, infrastructure and houses are very vulnerable to strong winds[1].

On February 22/2007, Tropical Cyclone Favio made landfall in Vilankulo District, Inhambane Province, as the equivalent of a Category 4 storm, and continued through Sofala and Manica provinces. It hit some coastal areas of the central region of Mozambique, generating torrential rains and wind speeded up to 220 Km/hour onto an area that had already been flooded the month before. High wind speeds caused the majority of damage. According to the INGC, the cyclone killed 9 people and affected more than 160,000 people, destroying crops and threatening local food security. In the immediate aftermath of the cyclone, the INGC, together with the U.N. World Food Program (WFP), implemented a response plan and provided food assistance to cyclone-affected populations[2]. Damage field assessments conducted one month after in order to determine damage on houses and public facilities, realised that most of the buildings were not resistant to strong winds, due to the construction techniques and quality. It appeared more sustainable to reconstruct in a resistant manner than to spend money every two or three years rebuilding after the cyclone[1].

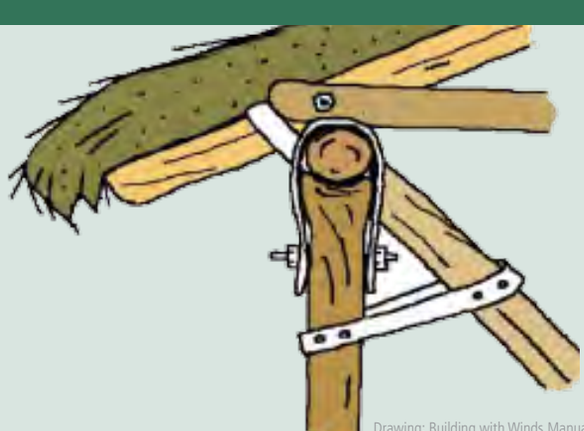
Photo: http://earthobservatory.nasa.gov/NaturalHazards - Cyclone Favio as per satellite images

Photo: Joshua Sullivan

Photo: Mozambique Red Cross

BUILDING WITH WINDS

A first manual, targeted at technicians and local communities, with simple recommendations on how to improve local construction techniques, including simple graphic designs and explanatory texts, had been developed before the cyclone. The technical solutions proposed have been than tested and reviewed in a "living workshop" of prototypes construction implemented in the post-disasters reconstruction. The new online version of the manual is now available and spread worldwide in portuguese and english version[3]. The purpose of developing technical manuals and implementing pilot projects is to ultimately influence national and local policies, so that proper building techniques and be integrated in the codes and regulations.



Drawing: Building with Winds Manual - UN-Habitat - Mozambique

[1]SHELTER PROJECTS 2010 - UN-Habitat / UNHCR / IFRC;
[2]Floods and Cyclone / Fact Sheet #1, Fiscal Year (FY) 2007 / March 22, 2007/ USAID;
[2]www.unhabitat.org / www.preventionweb.net

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Housing Workshop

Response to the 2007 Cyclone Favio in Mozambique

Photo: UN-Habitat - Semi-prefabricated vaulted housing model

THEPROJECT. The project identified and tested innovative small-scale mitigation interventions for cyclones, using participatory approaches and focusing on local capacity building in vulnerable pilot areas. The major goal of the project was to disseminate the initiative and prepare the conditions for future replication[1].
Following the cyclone, UN-Habitat has created a live workshop of various cyclone shelters, used for different functions such as houses or schools, to represent a catalogue of different techical solutions adapted to urban contexts in Mozambique, including some pre-industrialised techniques and materials. The workshop, aimed to evaluate the technical feasibility of the solution included in the Manual "Building with Winds" targeted master builders and technical staff, in order to encourage replication, as craftsmen would "learn by doing".
The applied principle is that a building's reaction to cyclone winds is related to its shape and its weight or its technological characteristics. In particular, the cyclone resistant houses feature a compact plan and are roofed using prefabricated wire mesh concrete vault whose shape, slope and weight ensure excellent reaction to cyclones. The ferrocement roof channels system was developed by the Auroville Earth Institute and introduced by UN-Habitat in Mozambique[2].

INTERVENTION DETAILS

Risk Addressed: Cyclone
Where: Vilanculos Municipality
When: 2008/2010
Main Goal: Supporting Innovative Local Mitigation Interventions for Reducing Vulnerability to Floods and Cyclones in Mozambique
Donors: ECHO / UN Joint Programme for Disaster Risk Reduction and Emergency Preparedness in Mozambique
Partners: INGC / Vilanculos Municipal Council / UN- Habitat
Budget of the Project: -
Cost of the Built Intervention:
approx. 6,000 USD including labor / Demonstration House;

ACHIEVED RESULTS

11 Houses built, among which:
9 ferro-cement channels roofed houses
1 Dome House
1 vault roofed house
50 Beneficiaries Accomodated
30 Builders Trained On-the-Job
1 Workshop organized and 40 Beneficiaries trained, including University Students and Government Technical Staff
1 Technical Manual Developed

Photo: UN-Habitat - Houses covered with pre-industrialized ferro-cement vaulted roofing panels

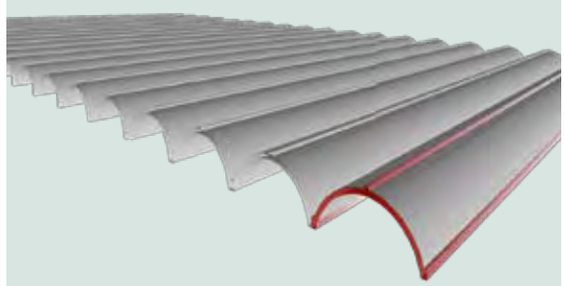
[1]SHELTER PROJECTS 2010 - UN-Habitat / UNHCR / IFRC;
[2]Focus on Mozambique: A dacade experimenting distaster and risk reduction strategies / UN-Habitat / 2011;

Photo: UN-Habitat - Brickwork Dome House

CHALLENGES. The construction of the prefabricated vaulted elements was implemented in Mozambique for the first time, representing a challeng for the the Trainer and the Trainees.
LESSONS LEARNED. The applied design did not include the possibility for the houses to be modified or extended, like it happens in the majority of dwellings.The high cost of ferro-cement, compared with the average possibility of the families, prevents a large scale uptake. Latrines, kitchens and water wells should be included in a future replication.
IMPACT. The organisation worked with the municipality at local level, and the National Institute of Disaster Management at country level. This allowed different government institutions to be involved and allowed for advocacy at different levels. Construction techniques have been accepted by the local population, local master builders and the municipality, which is now building new facilities according to the building recommendations and new techniques. Some families are also building their new houses replicating the techniques. At national level, the building process was periodically presented to national government institutions and other stakeholders (including humanitarian institutions, universities and private sector), which were also invited to visit the construction site.

Why this architecture intervention is "adaptive"?

Site Selection: located in a council owned land in a suburb area, home to some of the most vulnerable people in the city. The original houses that were built on the site with local materials were destroyed by the cyclone[1].
Walls: Walls were made from concrete blocks (first phase) and compressed earth blocks (second phase).
Roof: Different solutions for covering were tried.
- 3cm thick ferro-cement vaults (0.70 x 6m) manufactured on the ground and then raised.
- 8 cm thick concrete vaults (3 x 6m) using a metal formwork on the beams for easy assembly and disassembly.
- Self-supporting dome made with compressed earth blocks.



TECHNICAL RECOMMENDATIONS FOR REPLICATION:

According with the results of the prototype construction testing, the ferro-cement prefabricated technique revealed to be very performant but easier to be replicated by more industrialized construction companies, than simple builders in the field. The dome model is very effective but the people cultural background obstacles its replication.

TRAINING & CAPACITYDEVELOPMENT

In the town, local master builders and municipality technical staff were very involved in the construction of the shelters. They received special trainings on the new techniques and practiced by building the shelters. The steps followed during the prefabricated elements construction training are: design of the shape and laying of a series of bricks are then placed along this perimeter; piling up of stones and earth, creating a mass within the bricks perimeter, forming a semi-cylindrical formwork finished with concrete; mould covering with tarpaulin; chicken wire mesh installmente and covering with concrete layer; laying of three reinforcing steel bars, two along the edges of the semicylinder, another set at the pinnacle of the vault. Finishing with 2-3 cm concrete layer.

[1]SHELTER PROJECTS 2010 - UN-Habitat / UNHCR / IFRC;

Photo: UN-Habitat - On the Job Training

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Kindergarten

Reducing the vulnerability to cyclone in Mozambique

Photo: Exterior view of the primary school - UN-Habitat

THEPROJECT. The kindergarten is also located in Vilankulo and can be used as shelter in case of a cyclone. The school has 200m² plan, divided into: a multipurpose room, refectory, office, kitchen and female/male toilets. The project came as a result of the impact of the prototype testing workshop that UN-Habitat implemented with the Municipality of Vilankulo: one year later the Municipality decided to spontaneously replicate a cyclone resistant intervention, funded by an international organization, and asked to UN-Habitat for technical assistance. While analogous to the previously analysed cyclonne performant roof structures, in this case the prefabricated vaults are of much larger dimensions, each covering three bays for a total length of 9 meters. The curve of the arch of each section measures some 80cm from the spring point, with a radius of curvature of 180cm. Thus the section is not a true semicircle, but rather a flattened arch. The dimensions of each single element have been increased by substituting the chicken wire with a prefabricated solid steel formwork, used to support the curved slabs until cure and hardening is complete. The vault formwork technology was developed by the Institute of Cooperation and the United Nation Educational, Scientific and Cultural Organisation Chair for Basic Habitability, Technical University of Madrid, and adapted by UN-Habitat in Mozambique[1].

INTERVENTION DETAILS

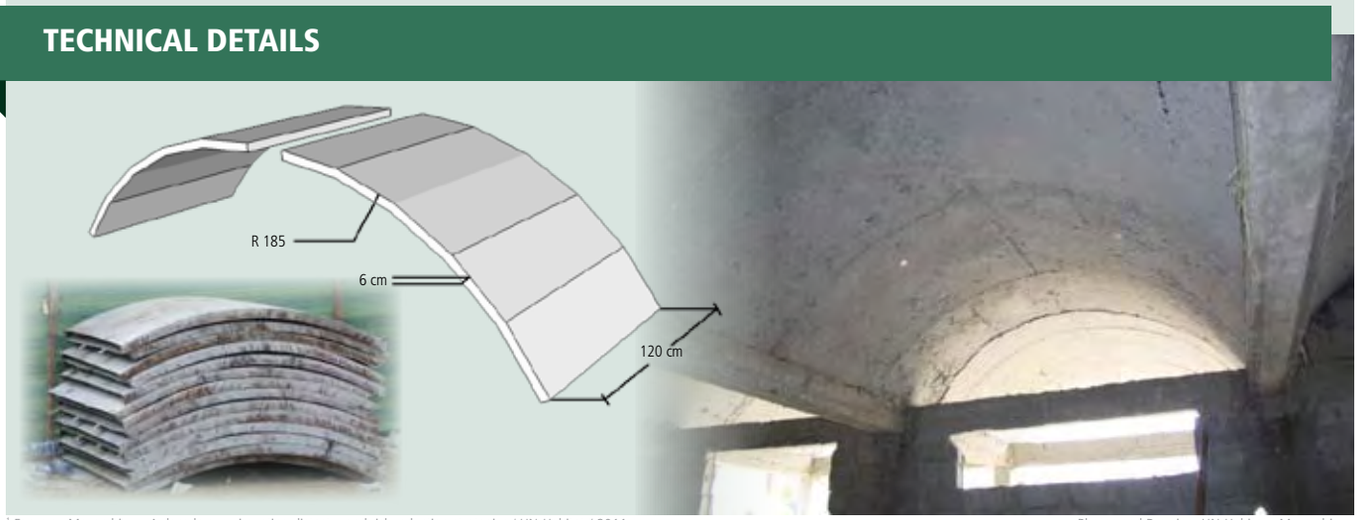
Risk Addressed: Cyclone
Where: Vilanculos Municipality
When: 2010 - 2011 (6 months)
Main Goal: Supporting Innovative Local Mitigation Interventions for Reducing Vulnerability to Floods and Cyclones in Mozambique
Donors: Associaçao Moçambique Alemanha
Partners: Vilanculos Municipal Council / UN-Habitat
Cost of the Built Intervention (including labor): approx. 40,000 USD / Demonstration House;

ACHIEVED RESULTS

1 Primary School/Cyclone Shelter built
50 Children provided with spaces for education
200 People provided with cyclone-resistant shelter

Photo: Interior view of the primary school - UN-Habitat

TECHNICAL DETAILS



[1] Focus on Mozambique: A dacade experimenting distaster and risk reduction strategies / UN-Habitat / 2011;

Photos and Drawing: UN-Habitat - Mozambique

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1.3

Water Harvesting Systems

Reducing Vulnerability to Drought, Cyclones & Climate Change in Mozambique

Photo: IRD - Water reservoir and concrete made units / Mabihale, Massinga District

THE PROJECT. For over a decade, Inhambane province, Mozambique, has experienced severe cyclones and prolonged droughts, leading to cyclical food shortages. The impact of these repeated shocks is exacerbated by the high incidence of HIV and poverty. With support from USAID's Office of Foreign Disaster Assistance, the Colheita I and II projects, are reducing vulnerability to natural disasters in five districts of Inhambane province and increasing resiliency to future shocks. In coordination with provincial agriculture authorities, IRD is complementing agricultural activities with initiatives to improve water supply and sanitation. The project is repairing water points using appropriate pump technology, rehabilitating rooftop rainwater harvesting systems (RWHS) in public buildings, and promoting RWHS at the household level. IRD is rehabilitating 30 RWHS in public buildings, installing 500 RWHS in homes, and repairing or installing 30 water pumps. To ensure sustainability, the project formed and trained local committees to manage each water point. The project has also improved hygiene practices by constructing 1,000 household latrines and training a network of community activists who will promote basic hygiene and personal health practices, including construction of hand washing facilities near latrines and use of elevated dish drying and storage racks[1].

INTERVENTION DETAILS

Risk Addressed: Drought/Cyclone
Where: Massinga District, Inhambane Province (Muludjane, Nhachengue, Mhabihali, Bambatela, Liondzuane), Homoine and Funhalouro Districts
When: 2009 - 2011; 2012 - 2014
Main Goal: Reducing Vulnerability to Drought, Cyclones & Climate Change in Mozambique
Donors: OFDA
Partners: International Relief & Development (IRD)
Budget of the Project: 200,000 USD
Cost of the Intervention: 40,000 USD / System

ACHIEVED RESULTS

5 Water Dam for catchment of surface water
5,000 Community Members involved into the implementation and provided with water
5 Awareness Raising Training organized and
500 Beneficiaries mobilized

Photo: IRD - Water tanks / Mabihale, Massinga District

Retrofitting Of Existing Rain Water Harvesting Systems of Schools and Health Centers

IRD is implementing another ongoing WASH project, to be finalised in 2014, and funded by OFDA. The project, focused on retrofitting of existant water harvesting systems by replacing of sealant, high quality gutters and water disposal units, aims to:

- provide water, stored duirng the rainy season to 300 students in 40 school, for a total of 12,000 students;
- involve the community in the project implementation, organizing 80 community training sessions for a total of 12,000 people involved;

The project aims to obtain an awareness raising impact, since through the construction implementation, it supports and widespreads better hygiene practices in the scholar system. To be completed it would require a component of WASH improving in the families houses.

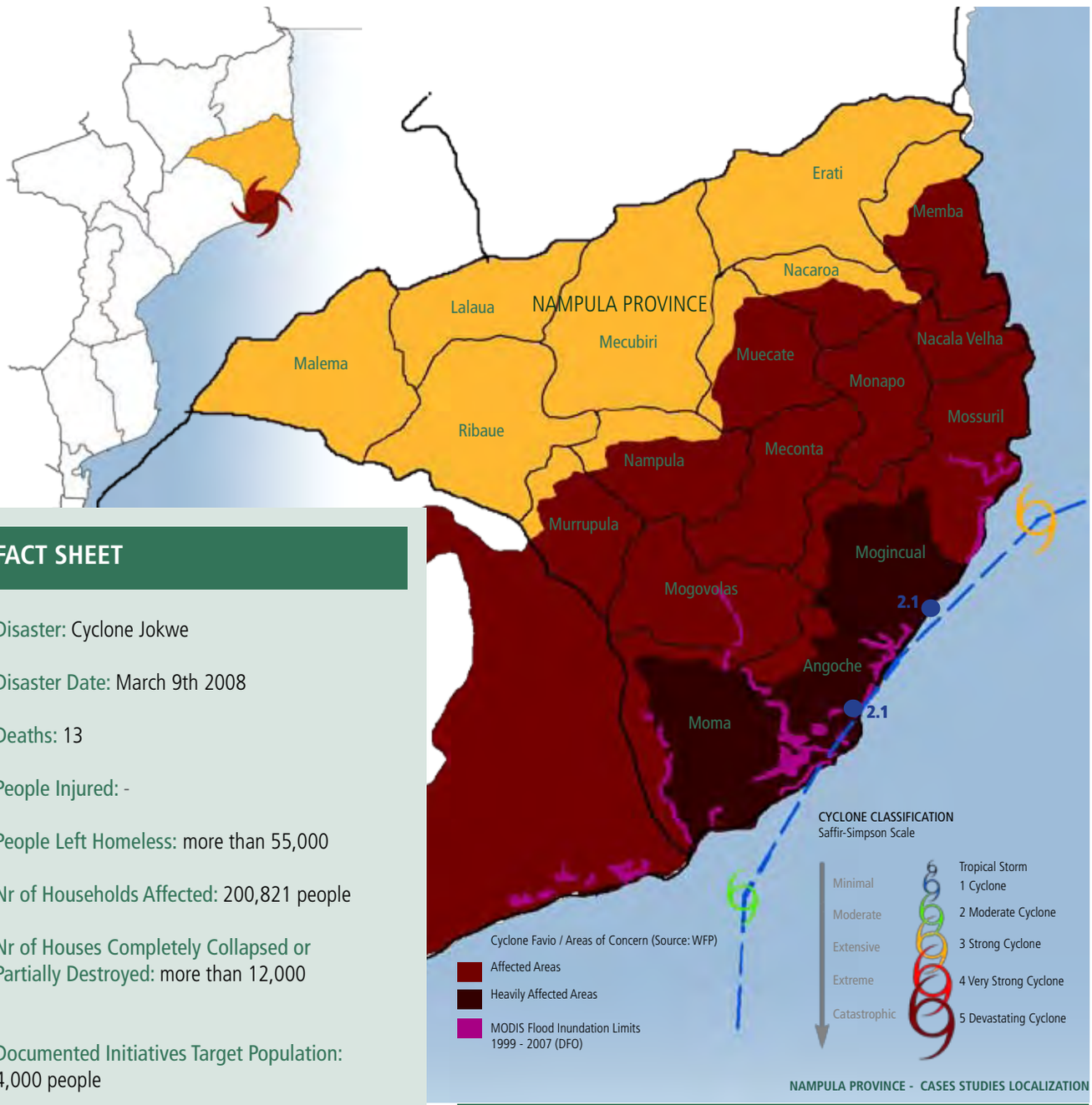
Photo: IRD - Water tanks / Mabihale, Massinga District

[1] Reducing Vulnerability to Drought, Cyclones & Climate Change in Mozambique / IRD / May 2012;

2_MZ 2

Nampula Province

Situation Overview



FACT SHEET

Disaster: Cyclone Jokwe

Disaster Date: March 9th 2008

Deaths: 13

People Injured: -

People Left Homeless: more than 55,000

Nr of Households Affected: 200,821 people

Nr of Houses Completely Collapsed or Partially Destroyed: more than 12,000

Documented Initiatives Target Population: 4,000 people

Building Types:
Cyclone Resistant Community Shelters - 90m^2,
Low-cost Housing - 20 m^2

Material Cost per Building:
Cyclone Shelter Construction (including labour): approx. 6,000 USD/Shelter
House Construction (including labour): approx. 2,000 USD/House

CASE STUDIES REPORTED:

2.1_ Cyclone Resistant Community Shelters and Housing
UN-Habitat - Oikos - District Government / ECHO - UNJPDRR

Data Sources: IFRC / DREF operation n° MDRMZ003 GLIDE n° TC-2008-000033-MOZ 28 November 2008;

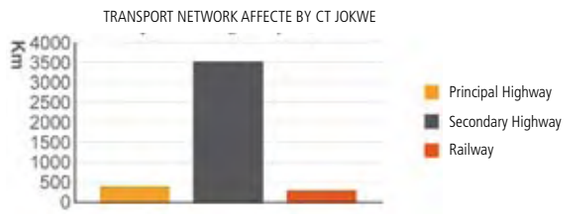
VULNERABILITY OF NAMPULA PROVINCE

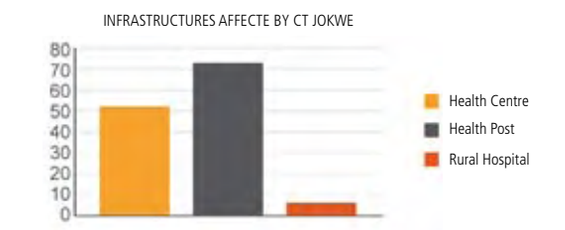
On 9 March 2008, tropical cyclone `Jokwe` hit the Northern and Central parts of Mozambique, causing heavy rainfall that caused extensive damage to homes, schools and roads infrastructure. The worst affected areas were Angoche and Moma districts in the Northern Province of Nampula, as well as Nacala Porto, Monapo and Mogovolas districts. It was estimated that 200,000 people were directly and indirectly affected by the cyclone, and a total of 13 deaths were recorded. The local government in Nampula Province estimates that a total of 100,000 hectares of crops were washed way[1].

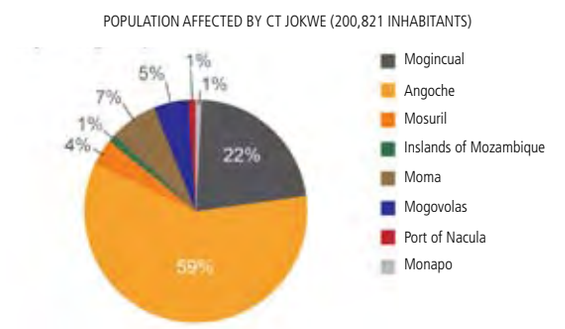
Cyclone Jokwe was the first tropical cyclone to make landfall in Mozambique since Cyclone Favio struck in the previous year. The tenth named storm of the 2007-08 South-West Indian Ocean cyclone season, Jokwe was first classified as a tropical depression on March 2 over the open Southwest Indian Ocean. It tracked west-southwest, crossing northern Madagascar as a tropical storm on March 5 before intensifying into a tropical cyclone on March 6. Jokwe rapidly intensified to reach peak winds of 195 km/h (120 mph), before weakening slightly and striking Nampula Province in northeastern Mozambique.

Accross Nampula Province the cyclone destroyed the roofs of at least 80 schools, a bridge across the Mogincual River, which left the town of Namige isolated, destroyed 9,316 houses and damaged 3,220 more, most of which in Angoche. In Pebane District in neighboring Zambezia Province, the cyclone destroyed 9 houses. Rainfall was reported throughout the province, though damage was not as heavy due to lack of strong winds. Throughout Mozambique, the cyclone affected 200,000 people, with a total of 55,000 people left homeless[2].

Photo: http://earthobservatory.nasa.gov/NaturalHazards - Cyclone Jokwe as per satellite images







Data Source: INGC Climate Change Report - Mozambique

Photo: UN-Habitat

Photo: UN-Habitat

[1] DREF operation n° MDRMZ003 / GLIDE n° TC-2008-000033-MOZ / 28 November 2008

[2] INGC / National Institute for Natural Disaster Management;

2_MZ 2.1

Community Shelters

Response to the 2008 Cyclone Jokwe in Mozambique

Photo: UN-Habitat - Community Shelter in Quelelene Island - Angoche District, Nampula Province;

THE PROJECT. In March 2008 approximately 200,000 people were affected by cyclone Jokwe in northern Mozambique, especially Nampula province where public infrastructure such as health centres, schools and more than 40,000 houses were destroyed. UN-Habitat's idea was to design simple community shelters in isolated and vulnerable locations ensuring maximum use of local knowledge, building techniques and materials to facilitate maintenance and replication at community level. The adopted architectural design is based in one cyclone-resistant prototype developed by Care in Madagascar. The model has been upgraded to allow its use for multipurpose activities. For this purpose, shelters of 120-150 m2 were designed to accommodate a maximum of 250-300 persons with a reinforced wooden structure using "A" shape with 40-450 pitch slope. The construction has been implemented using local master builders who were trained to improve their knowledge. The structure includes reinforced bracing and connections between parts, local ballast foundations to resist the wind uplift forces. The roofing is made with reinforced traditional woven palm leaves (makuti): rainwater harvesting system, sanitation facilities and suspended shelves to storage families assets in emergency times were included[1].

INTERVENTION DETAILS

Risk Addressed: Cyclone
Where: Angoche/Mogincual Districts, Nampula Province
When: 09/2010 - 12/2012
Main Goal: Supporting Local Mitigation Interventions for Reducing Vulnerability to Cyclones in Nampula Province, Mozambique
Donors: ECHO; UN Joint Programme for DRR
Partners: UN-Habitat; Oikos; District Government;
Budget of the Project: 497,966 USD (ECHO: 266,195 USD + UNJPDRR: 231,801USD)
Cost of the Built Intervention (including labor):
House Construction - 20 m2 (including labour): approx. 2,000 USD/House
Cyclone Shelter Construction - 90m2 (including labour): approx. 6,000 USD/Shelter

ACHIEVED RESULTS

12 Community Shelters built
3600 Beneficiaries provided with safe heavens
20 House Reconstructed or Retrofitted and 100 Beneficiaries accomodated
10 Training Sessions organized with average 30 Beneficiaries per session
300 Beneficiaries Trained on Evacuation Simulation

[1] Focus on Mozambique: A dacade experimenting distaster and risk reduction strategies / UN-Habitat / 2011;

Photo: UN-Habitat - On the Job Trainings on Costruction

Photo: UN-Habitat - Reinforced Houses made in wooden sticks framework with improved anchorages

CHALLENGES. The hardest challenge for the community mobilization and the project implementation was the remoteness of the islands where the shelters have been constructed. The construction materials transport carried out by boat between Angoche land and the islands was made even more difficult by the tide oscillation. Another significant challenge was represented by the reluctance of the community to participate and even to accept the presence of the project. Only once built, the community perceived the good impact and utility of the shelters and spontaneously asked for replication in other island.**LESSONS LEARNED.** The shelter project has been implemented for the first time in Madagascar, in smaller scale and use confined to the exclusive moment of emergency: in Mozambique the "double purpose" building concept has been applied by UN-Habitat also to this building, providing the characteristics of a space that can be used as a school or a community multi-purpose centre during normal times, even though these uses should be more stimulated among the community members. **IMPACT.** The project represented and interesting construction experiences exchange between the two countries. Furthermore it represent a built example of local techniques improving, visited and documented by government institutions and NGO's.

Why this architecture intervention is "adaptive"?

Shape: the "A" shaped building section and compact plan, composed by a unique space 100 m2, contribute to wind resistance;
Site Selection: the implementation site has been chosen to be far from trees falling caused by strong winds; it has been oriented, according with the wind direction, to protect the entrances;
Foundation: the main structure wooden post are strongly anchored to the ground by cross bracing them with horizontal wooden elements; furthermore the foundation elements have been protected from the damp raising and insects by a tarpaulin layer and engine oil painting;
Walls/Roof: a series of 4,5m high "A" shaped wooden trusses set on span of 2 m, coated with palm leaves represents the walls and roof at the same time. Bracing wooden beams reinforce the longitudinal central axis. The leaves coverage is properly dried and treated, before being interlaced with vegetal rope, starting from the eaves to the ridge. The coverage layers must be doubled as way to ensure the impermeability of rainwater.

TECHNICAL RECOMMENDATIONS FOR REPLICATION:

The bamboo framing treatment by diving into salt water should be increased by engine oil painting, as per the woden elements, to increase its durability. The windows have to be correspondent on both sides of the building and the door has to open to the outside: the massive doors and windows used are very performant for wind strenght, but difficult to be handled by children and elderly. A latrine should be placed inside in future replication.

Vocational Skills Training On Improved Construction

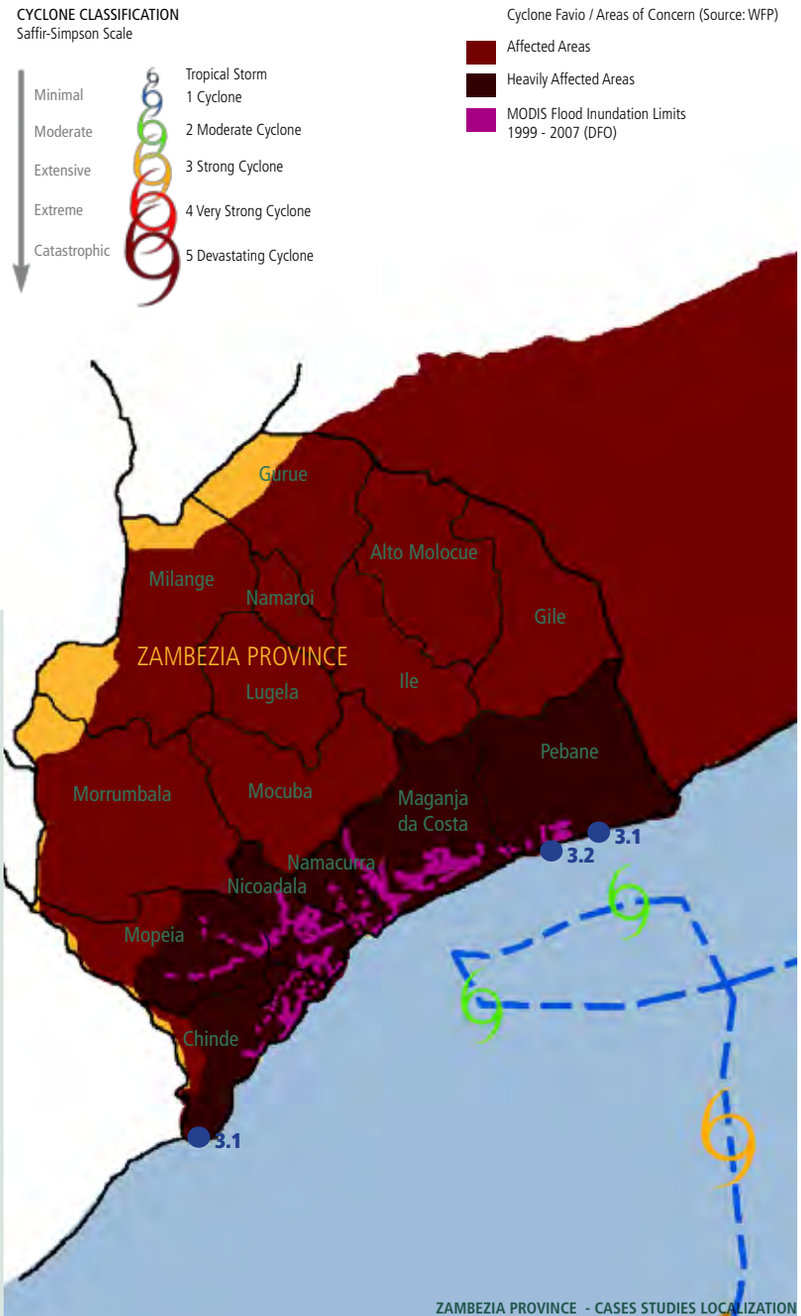
UN-Habitat has accompanied the whole construction process with a continuous activity of capacity building among the local communities: 10 Training have been organized on contruction techniques, water and sanitation, hygiene, with an average of 30 participants per training.
A team of 3 trained master builders and UN-Habitat Staff was moving from island to island to select and trained local groups of builders, composed of 5/6 people per session. Furthermore an early warning, evacuation and emergency response simulation has been organized with the participation of the whole community, and thanks to the coordination of local INGC representatives and government institutions.

Photo: UN-Habitat - .....

2_MZ 3

Zambezia Province

Situation Overview



FACT SHEET

Disaster: Cyclone Funso

Disaster Date: January 20 -23 / 2012

Deaths: 47

People Injured: -

People Left Homeless:

Nr of Households Affected: 66,946 (Zambezia)
2,835 in southern Nampula)

Nr of Buildings Completely Collapsed or Partially Destroyed:
9,167 Houses Partially Destroyed
4104 Houses Completely Destroyed
4455 Houses Flooded
850 Classrooms Damaged

Documented Reconstruction Programmes Target Population: more than 700 people

Building Types:
Housing Reconstruction (20/28/35 m^2) and Retrofitting

Material Cost per Building:
House Reconstruction (including labour): approx. 400 USD/House in Pebane (area: 35 m^2)
House Reconstruction (including labour): approx. 150 USD/House in Chinde (area: 21 - 28 m^2)

CASE STUDIES:

3.1_Post- Cyclone Low -Cost Housing Reconstruction
UN-Habitat / CONCERN Worldwide / Samaritan's Purse International Relief / District Goverment / IOM

3.2_Cyclone Resistant Housing Prototypes
CVM (Mozambican Red Cross), Province Directorate of Public Works and Housing (DPOPH) / German Red Cross

Disasters Data: CTGC Table – 10 February 2012; 2nd Edition of the Clusters funding request for flooding and cyclone season 2012 of the UN Humanitarian Country Team; INGC

VULNERABILITY OF ZAMBEZIA PROVINCE

On 18 January 2012, moderate tropical storm Dando hit southern Mozambique affecting approximately 51,670 people in Maputo, Gaza and Inhambane provinces. Days later the central and northern regions of the country were affected by Tropical Cyclone Funso, category 3 and 4 with winds ranging from 166 to 212km/h and heavy rainfall, between 20 and 23 January 2012, affecting approximately 66,946 and 2,835 people in Zambézia and southern Nampula provinces respectively. A considerable number of houses, schools and health centres were damaged in six districts of Zambézia province, the worst affected. The death toll reported is 47 deads, mostly caused by falling roofs[1]. During January 2012, the long lasting vulnerability of Mozambique to natural disasters has been strongly reconfirmed by these new disatrous events. Damage and need assessments conducted by UN-Habitat in the immediate aftermath of the emergency showed extremely high vulnerability of communities as concerns housing, low capacities and urgent need for support, particularly in women and/or children lead households surveyed[2]. From the findings it appeared essential thet resources should have been channeled for sustainable reconstruction as soon as possible, and that immediate emergency assistance would be used to ensure sustainable recovery, trusting on the coping strategies of the communities. Two activities have been promoted as a example of the possible shift from emergency to future development approach: low-cost solutions for improved reconstruction; low-cost solutions for retro-fitting and reinforcement of non-affected houses, to prevent future damages.

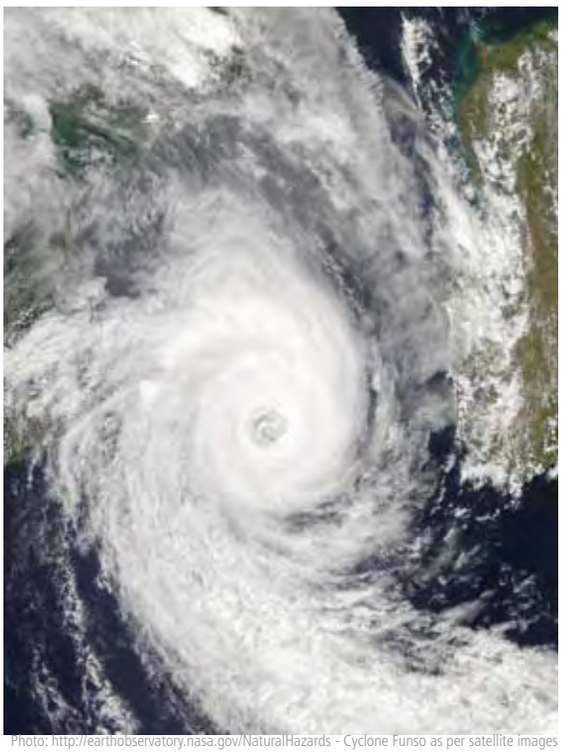


Photo: http://earthobservatory.nasa.gov/NaturalHazards - Cyclone Funso as per satellite images

Photo: UN-Habitat

MAIN DEFECTS AND TECHNICAL FAILURES OF LOCAL BUILT ENVIRONMENT

- Absence of proper reinforced foundation system;
- Absence of stabilization or compaction for wall filling materials;
- Absence of bracing systems for walls and roof;
- Frail connections between walls primary and secondary structure;
- No closing systems or reinforcing framework (lintels) for openings;
- Bad mixture for adobe blocks/rammed earth walls implementing;
- Frail connections between roof structure and walls;
- Reduced wooden element dimensions for roof structure;
- Bad quality and no drying system for wooden elements;
- Reduced roof covering thickness and bad assembling;
- Absence of eaves to protect underlying walls;
- Bad performing roof shape (2 slopes);

Photo: Cyclone damages in education structures - Quelimane / UN-Habitat

[1] 2nd Edition of the Clusters funding request for flooding and cyclone season 2012 of the UN Humanitarian Country Team; INGC
[2] Post-Disaster Housing Damage Assessment / March 2012 / Zambezia, Mozambique/ UN-Habitat

2_MZ 3.1

Housing Reconstruction

Housing Early Recovery and Reconstruction in post-cyclone Funso affected Districts of Zambezia

Photo: Reconstructed House - Chinde District / UN-Habitat

THE PROJECT. The project, coordinated at Province and District level with INGC and Ministry of Public Works and shelter clusters members, has been the result of a joint action by different organization, each providing its specific contribution and expertise: IOM provided the implementation funds and the general coordination; two NGO's, CONCERN Worldwide and Samaritans Purse were responsible to provide logistic support through selection of reconstruction beneficiaries among the most affected vulnerable categories, training site selection and preparation, building material and tools purchasing, transport facilitating.
UN-Habitat was responsible to providing technical assistance through : provision of didactic Tools and Technical Materials Elaboration to support Training Sessions in the field (Banners, Manuals, Models); two On-the-JobTraining Sessions during 2 days per District for theory/practical lessons about building back better practices fitted to local construction technics; technical lead and Day-by-day Monitoring through 2 local construction technicians based in the field during 45 days, following up the reconstruction activities on 150 houses per District; while UN-Habitat Architects were supervising both district weekly. The whole project has been carried out in a participatory way focusing on local technicians and master builders involvement and community mobilization.

INTERVENTION DETAILS

Risk Addressed: Cyclone
Where: Chinde / Pebane Districts, Zambezia Province
When: 03/2012 - 08/2012
Main Goal: Deliver rapid housing reconstruction capacity building at District level using building back better and safer practices and increase community preparedness / response capacity to cyclone emergencies
Donors: IOM (OFDA Funds);
Partners: UN-Habitat (Technical Assistance); CONCERN Worldwide / Samaritan's Purse International Relief (Logistics)
Budget of the Project: 220,000 USD
Cost of the Built Intervention (including labor):
House Reconstruction (including labour): approx. 400 USD/House in Pebane (area: 35 m2)
House Reconstruction (including labour): approx. 150 USD/House in Chinde (area: 21 - 28 m2)

ACHIEVED RESULTS

211 Houses Reconstructed or Repaired
650 Beneficiaries Accomodated
4 On-the-Job Training Sessions organized
80 Beneficiaries trained, including Builders and Government Technicians

HOUSING MODELS

UN-Habitat Technicians, jointly with the community, have elaborated different housing models to respond effectively to the community needs.

Drawings: UN-Habitat

Photo: Reconstruction Details - UN-Habitat

CHALLENGES. One of the major challenges of the project was the remoteness of the areas, particularly in the case of Chinde, a district extending along the Zambezi River delta, made of islands often isolated by the ocean tides. The isolation of the areas created problems affecting the materials transport and logistics aspects, like the cash flow to be available for the materials purchasing, since there are no banks in the field. The local technical capacities of the builders were not including any knowledge about reinforced construction, but just basic notions about traditional techniques. **LESSONS LEARNED.** The strenght of the project founded on the complementarity and coordination between different organizations, each providing a specific competence. Furthermore the immediate results obtained with the construction process represented a strong factor of community involvement, moving the willing of people to further replicate the intervention, while still ongoing: the constructive solutions have been perceived as local, psichologically confortable and durable. **IMPACT.** The housing building activities contributed to create a spontaneous demand among the population. The builders participating to the Trainings and the whole reconstruction process tied a bond with the local institutions and NGO's to be employed for future construction activities in the field.

Why this architecture intervention is "adaptive"?

General Features: the housing shape has been designed compact and squared to resist better to strong winds;
Foundation: the foundation **has been set at increased depth (0,7 - 0,9 m) respect of the local tradition, and** the main structure wooden post are strongly anchored to the ground by cross bracing them with horizontal wooden elements;
Walls: diagonal bracing posts have been strongly anchored to the vertical structure, through increased connections, made with nails, vegetal rope and iron wire; openings frameworks and lintels have been reinforced;
Roof: **a heaped roof has been implemented in Pebane, while the two slopes roofs in Chinde have been improved by adding side enclosures;** the roof structure has been reinforced with diagonal bracing connecting horizontally the walls plates corners and along the roof pitchs.

TECHNICAL RECOMMENDATIONS FOR REPLICATION:

For time reasons the reconstruction process focused on strenghtening and improving only some of the local construction techniques, like the cob wall, with wooden structure and earth plastering. The adobe blocks masonry is as much widespread among the local communities as the cob wall, particularly in Pebane District, and represents a much more eco-friendly solution, since it doesn't contribute to any deforestation. It would be advisable to focus further adaptative architeture interventions in the area on the afoermentioned construction technique.

TRAINING & CAPACITY DEVELOPMENT PLANNING

The Training Planning in Chinde and Pebane Districts has been organized as follows:
- 2 Training Sessions (Training of Trainers - 2 days /session) per District on theory of construction techniques and WASH;
- 5 Core Team formed by a Trainee (Master Builder) and 3 assistants per each house to be recontructed;
- 2 Field Technicians mobilized (1 per each District) to supervise the action;
- INGC, District Technicians from Planning and Infrastructure Section and Local Committees for Disasters Management Representatives participating to the trainings and the reconstruction process.

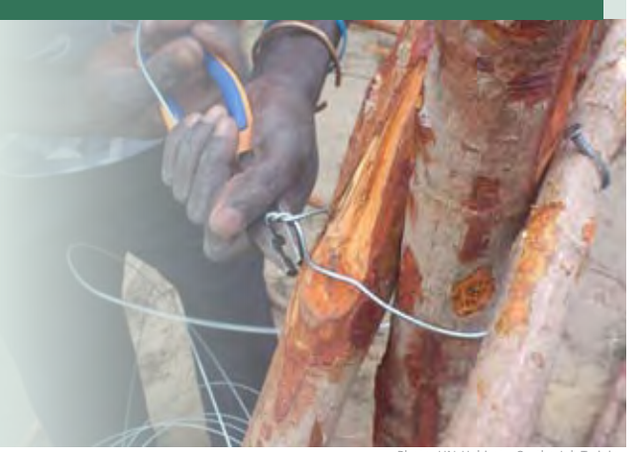


Photo: UN-Habitat - On the Job Training

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3.2

Housing Prototypes

Capacity building on construction of cyclone resistant housing prototypes made in local materials

Photo:

THE PROJECT. The aim of the project was to disseminate simple improvements in traditional houses' building systems so that they become strong enough to withstand strong winds and even cyclones. This was a replication of an earlier experience carried out in another province of the country. Technical improvements were developed by a local government architect, based on existing manuals adapted to the country. House's design and materials were discussed with each of the communities, in order to obtain their feedback and approval of adapted model. The construction was entirely made with low-cost, eco-friendly local materials were used for the construction.
The target group was the population living in rural areas with very low incomes. Local committees for risk management and local professionals were involved, so that they could disseminate the techniques learned: capacity building activities were carried out with 60 voluntaries on strong winds resistant housing construction techniques. The community participation to the project was gender balanced, including women to carry out different tasks in the construction process (e.g. bringing water, plastering the houses).

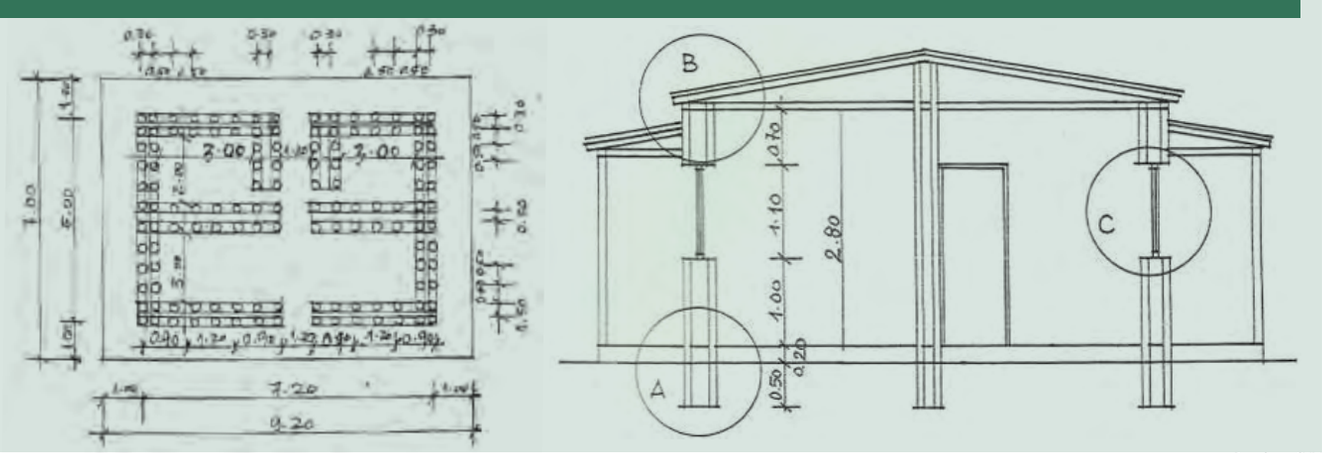
INTERVENTION DETAILS

Risk Addressed: Cyclone
Where: Pebane District, Zambezia Province
When: 2009 -2010
Main Goal: Reducing vulnerability to cyclones in rural coastal areas of mozambique prone to cyclones and tsunamis
Donors: German Ministry of Foreign Affairs (MOFA)
Partners: Provincial Directorate of Public Works and Housing (DPOPH) / Mozambique Red Cross (CVM) / German Red Cross (GRC)
Budget of the Project: -
Cost of the Built Intervention: 1,000 USD/House (including just construction materials)

ACHIEVED RESULTS

5 prototype houses built with improved local techniques and materials
5 local committees of risk management with expertise on how to build resistant to cyclones (through seminars and practical work)
60 direct beneficiaries, of which 45 members of local committees and 15 Red Cross volunteers
10,000 Indirect Beneficiaries, belonging to five rural communities

HOUSING MODEL



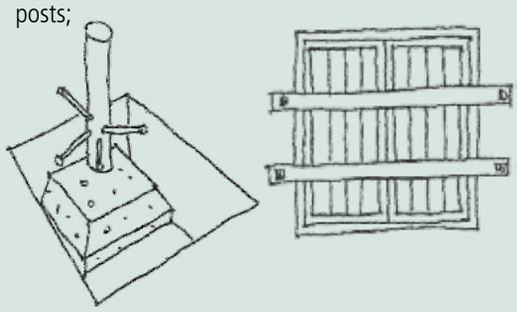
Drawings: CVM

Photo: CVM - On the Job Training

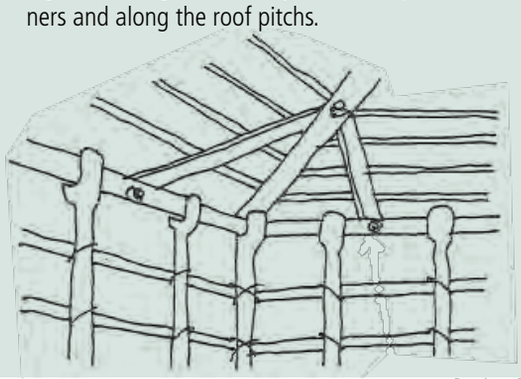
CHALLENGES. In some districts thre are not available technicians with enough skills as to design resistant houses and to explain the improvements to trainees. Latrines and kitchens were not included in the design. **LESSONS LEARNED.** Local government's architects and engineers can play a crucial role in shelter programs. The dissemination of localized technical manuals and succesful experiences have a multiplier effect. Built prototypes can be used as premises for local committees, becoming a community asset and also increasing their visibility and availability to be shown to the families interested in building/reinforcing their house. **IMPACT.** Local authorities recognized that it is possible to build resistant with local materials and asked CVM for replicating the experience among other communities in the area. Two years after the closure of this project, cyclone Funso impacted the district. Prototypes served for replication during the Early Recovery phase. CVM learnt from its own experience how to succesfully include the shelter component in DRR programs.

Why this architecture intervention is "adaptive"?

General Features: the housing shape has been designed compact and squared to resist better to strong winds. The prototype design is based on traditional houses in the area.
Foundation: the foundation has been set at increased depth (1m) respect of the local tradition, reinforced with a concrete plynth and anchored by nails clinging to the ground along the wooden posts;



Walls: made with a double frame of vertical wooden posts, connected and anchored to each other by a thick frame of horizontal bamboo canes; the doors and windows are reinforced by wooden bars anchored to the side walls;
Roof: is heaped and reinforced with diagonal bracing connecting horizontally the walls plates corners and along the roof pitchs.



Drawings: CVM

TECHNICAL RECOMMENDATIONS FOR REPLICATION

- While it is strongly recommended to count on local technicians for the design and construction of improved houses, it should be convinient that an experienced advIser reviews the whole process;
- The final design of the models should be discussed with the communities, not only for getting them involved in the project but for improving the model by adding their own experience on local techniques and materials. The approval of the model by the community will facilitate its replication among the local population;
- Monitoring of the houses should be done during some years after its completion, especially in case of a weather event occurrence, in order to confirm their suitability to local hazards.

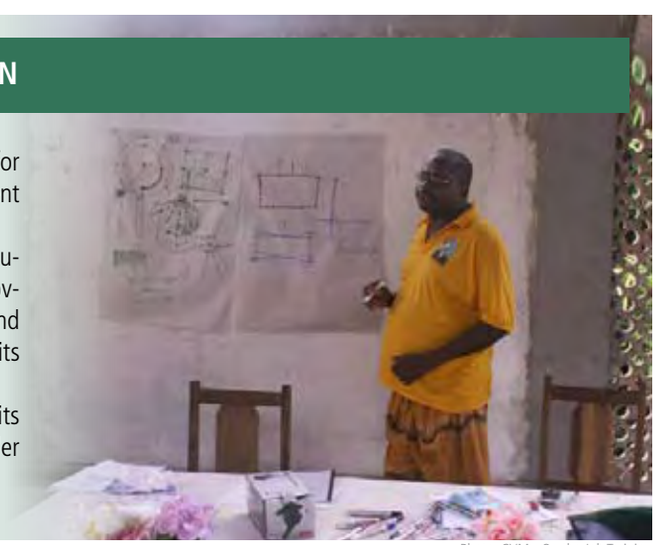
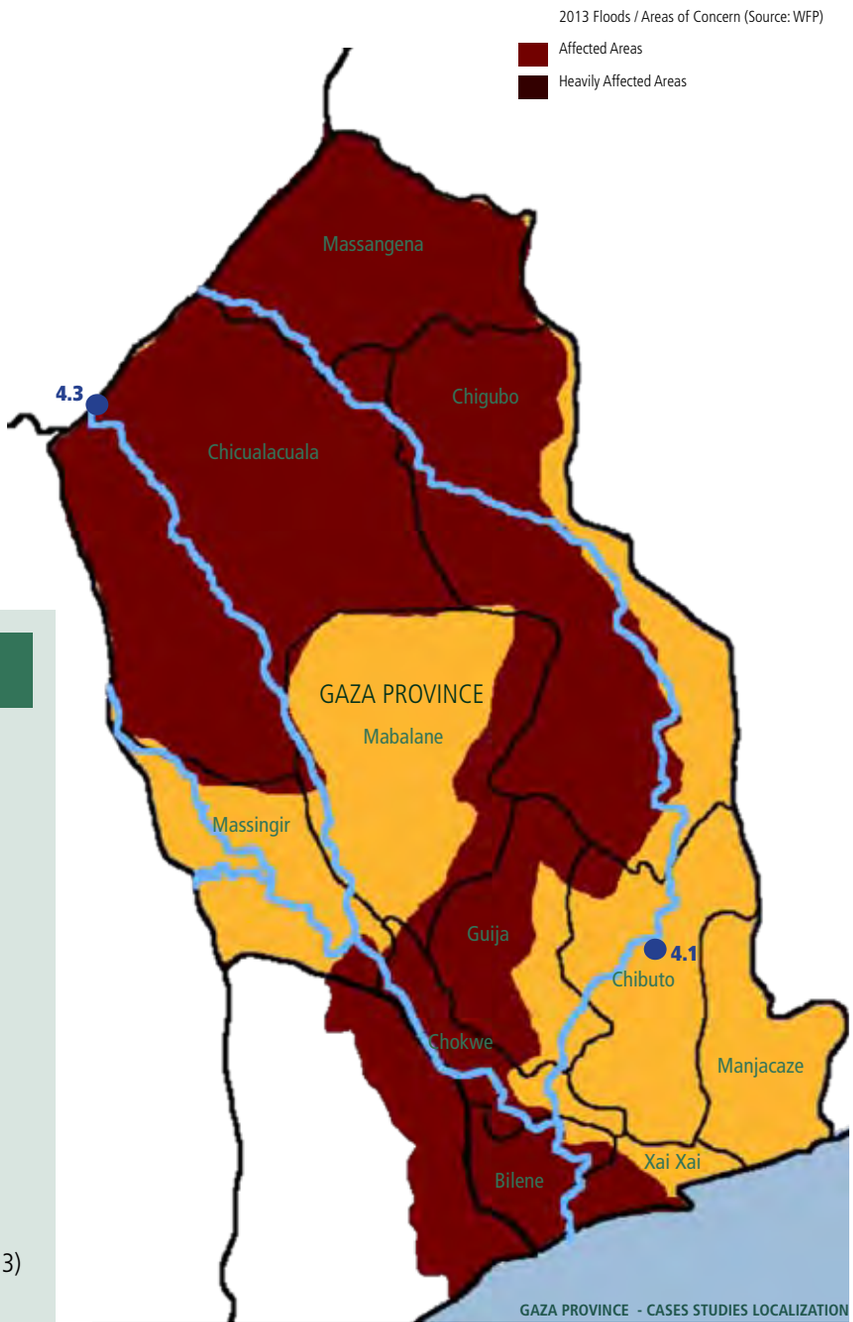


Photo: CVM - On the Job Training

2_MZ 4

Gaza Province

Situation Overview



FACT SHEET

Disaster: Floods

Disaster Date: February 20 - 22 / 2000;
January 12 - 20 / 2013

Deaths: 640 (2000); 97 (2013)

People Injured: -

People Left Homeless: 250,000(2000);
140,000 (2013)

Nr of Households Affected: 490,000(2000);
213,000 (2013)

Nr of Houses Completely Collapsed or
Partially Destroyed: 680 houses inundated (2013)

Documented Reconstruction Programmes
Target Population: more than 2500 people

Building Types:
Elevated School / Safe Heaven (200 m2)
Multi-purpose Community Center (570 m2)
Rainwater Harvesting Systems

Material Cost per Building:
School Construction (including labour):
approx. 30,000 USD
Multi-purpose Community Center:
approx.200,000 USD
Big Water Tank / approx. 4,000 USD;
Small Water Tank / approx. 700 USD;

CASE STUDIES:

4.1_Elevated School
UN-Habitat / Government of Mozambique / MICOA / DINAPOT / CBOs

4.2_Participatory Physical Planning in the Limpopo River Basin
UN-Habitat / Government of Mozambique / MICOA / DINAPOT / CBOs

4.3_CERUM - Multi-purpose Community Centre
UN-Habitat / FAO / UNEP / UNIDO / UNDP / WFP / INGC / MICOA

Disasters Data: Global Register of Major Flood Events - Dartmouth Flood Observatory; MOZAMBIQUE FLOODS 2013: RESPONSE AND RECOVERY PROPOSAL / Maputo, 31 January 2013 / Humanitarian Country Team; Southern Africa: Floods / Situation Report No. 5 (as of 08 February 2013) / OCHA; World Bank - A Preliminary Assessment of Damage from the Flood and Cyclone Emergency of February-March 2000 / March 27 - 2000

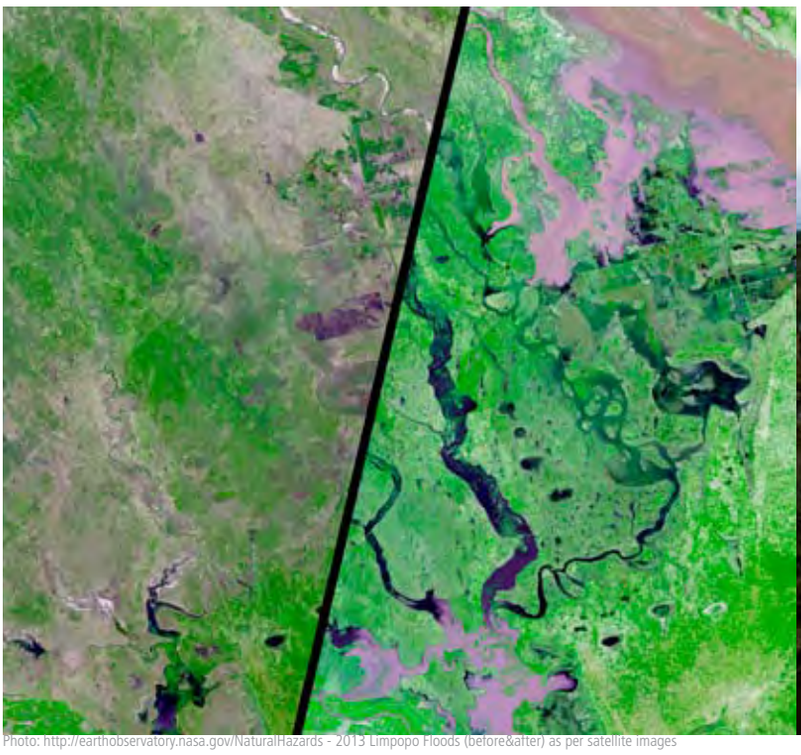


Photo: http://earthobservatory.nasa.gov/NaturalHazards - 2013 Limpopo Floods (before&after) as per satellite images

Photo: Centro de Documentação e Formação Fotográfica de Moçambique

VULNERABILITY OF GAZA PROVINCE

The Limpopo overflowing that hit Mozambique in January 2013 set the mind back to the disastrous occurrence of 2000 devastating floods striking the same area of Gaza Province.
In that year, the flooding took place during February and March, and resulted in the forced evacuation of hundreds of thousands of people. Villages and farmland were flooded for days, with crops and livestock destroyed. Over 100,000 families lost their livelihoods. The 2000 floods left 1,500 square km devastated. Aid and assistance from government and the international community of Mozambique was slow to get through.
Fast forward to 2012 and 2013 and we have a very similar picture. Heavy rains have hit the region and again, horrific floods have been the result. This year the flooding has been longer and even more damaging. In 2013 the floods first began in October 2012, and have continued until April (at least). On 12 January 2013, the Mozambique authorities declared an orange alert due to heavy rains that lasted for more than a week.
Until 20 January 2013, moderate to intense rains had already affected 150,000 persons throughout the country and total of 55 people lost their lives. According to the UN Resident Coordinator's Office in Mozambique, since October 2012, floods in Mozambique have killed a total of 97 people, of which 69 people have been killed since the major flooding began in January 2013. In total, an estimated 213,000 people have been affected by floods across Mozambique since October 2012, the majority having been affected since January 2013. The total number of displaced people in the most affected province, Gaza, is around 140,000; as some isolated areas becomes accessible this number could increase[1].
Many have lost everything in the floods and will thus require continued humanitarian assistance. Public infrastructures have not received a lesser strike than private housing (29.1 million USD damage): 1,300 classrooms have been destroyed or partially damaged, for a total of 18.7 million USD damage in the education sector; 53 health facilities have been affected, for 15.7 million USD damage to the health sector[2].

[1]Southern Africa: Floods / Situation Report No. 5 (as of 08 February 2013) / OCHA;
[2]World Bank - A Preliminary Assessment of Damage from the Flood and Cyclone Emergency of February-March 2000 / March 27 - 2000

Photo: Centro de Documentação e Formação Fotográfica de Moçambique

2_MZ 4.1

Elevated School

Pilot Demonstrative Interventions to provide and test sustainable solutions to reduce vulnerability to floods in the Limpopo River Basin

Photo: UN-Habitat -

THE PROJECT. Maniquenique is located 6 km from Chibuto, where the district administration is located, in a quite vulnerable position to floods. The village was totally inundated in 2000 at an average height of approximately 1 m above ground level. The participatory planning sessions were held in the existing primary school: the construction of a new school was selected as the priority intervention by the community to be carried out with the available project funds, especially considering that another important social service, i.e. a health centre, is available in Chibuto which is close by. Of course, this was found to be a perfect occasion to, once again, introduce an innovative architecture but adapted to the local reality. The Elevated Primary School to be built in Maniquenique has also a double-function, i.e. to function as a school in normal times, and as safe-haven in case of floods. For this purpose, the floor of the school was built higher than the level reached by the flood waters in 2000. In addition the roof structure was reinforced, so that it can ultimately be used as higher refuge-platform in case of a dramatic event. Again, the school includes rainwater harvesting system and improved & elevated sanitation facilities, which can be used both during a flood and in normal times. The architectural design of the school took maximum advantage of local knowledge, building materials, and local man-power.

INTERVENTION DETAILS

Risk Addressed: Floods
Where: Maniquenique Village, Chibuto District, Gaza Province
When: 2007 - 2008
Main Goal: provide and test sustainable solutions to reduce vulnerability to floods in the Limpopo River Basin
Donors: Global Environment Facility (GEF)/ UNEP
Partners: Government of Mozambique, MICOA - DINAPOT, UN-Habitat, CBO's
Budget of the Project: 970,000 USD
Cost of the Built Intervention (including labor): 200 m^2 - approx. 30,000 USD

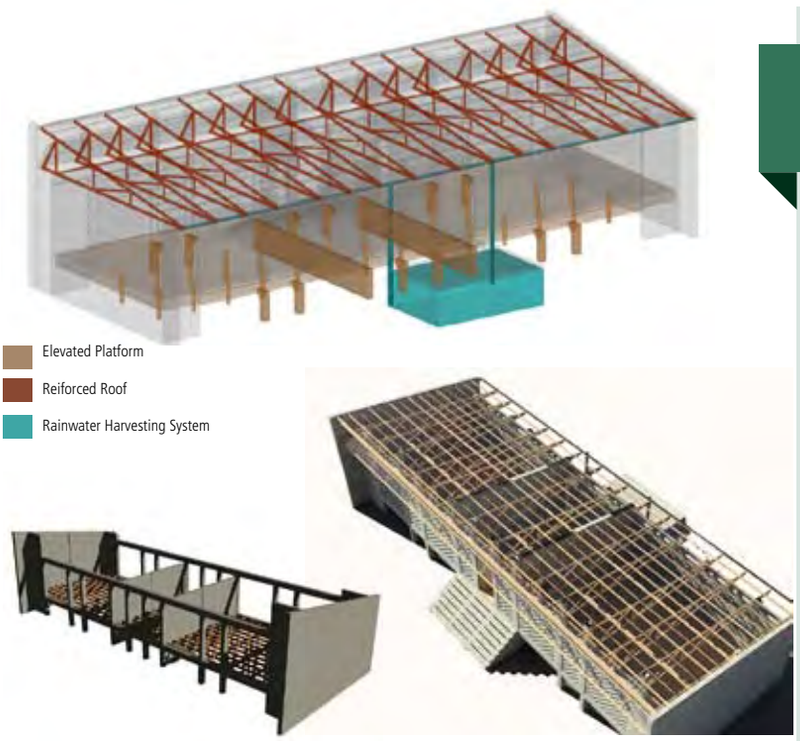
ACHIEVED RESULTS

1 Primary School / Safe Heaven built
300 Children provided with education spaces
150 Community Members provided with flood emergency shelter
Awareness raising activities organized and 120 Beneficiaries trained
20 Builders trained on-the-job
1 Workshop organized on site with CVM
1 Workshop organized on site with the Faculty of Architecture of Maputo

Drawing: UN-Habitat - the Sahe Heaven in use during the emergency period

LIVING WITH FLOODS

Concerning floods, the main challenge has been was to identify sustainable alternatives to massive resettlement operations of the population in areas at risk. This approach has been called Living with Floods and consisted of reinforcing disaster preparedness capacities of local communities and authorities and implementing small-scale adaptation/mitigation solutions through the architectural design and construction of public buildings which could serve as a refuge in case of floods and as a social facility in normal times.



Drawing: UN-Habitat

CHALLENGES. One of the hardest challenges for the intervention implementation has been represented by the aim to keep a constant high level of community involvement during the whole project development. A school awareness method has been applied, to let the students, the final beneficiaries of the intervention, being the reminders within their own families of the community's responsibility in carrying out the different tasks, like unloading the trucks transporting building materials or bringing water for construction. **LESSONS LEARNED.** The community participation has not been gender balanced: because of cultural reasons the women have contributed almost entirely to hard construction tasks. An improved model of community participation should be developed for future replications, including and distinguishing the tasks according with age and gender, and involving university students and other professional volunteers to develop awareness raising activties. Additional work should be carried out for deeply analysing the community dynamics but also to implant a greater understanding of the fundamental concepts of community participation, to support the project. **IMPACT.** The experience was one of the first UN-Habitat implemented in Mozambique, contributing to advocacy making and attention focusing on disaster risk reduction possible strategies.

Why this architecture intervention is "adaptive"?

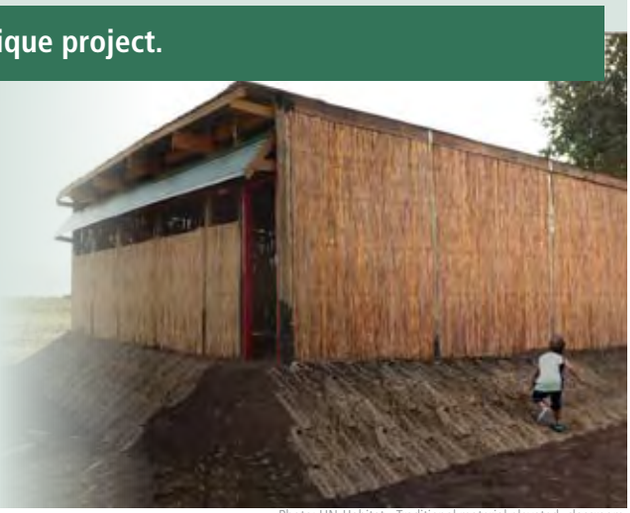
General Features: The building is oriented East-West to obtain a good natural illumination as well as proper ventilation. Importantly, the design of the building allows to further developing it laterally and at the back in order to increase the size of the school in the future.
Site Selection: the site selection is the result of the participatory planning held with the community.
Foundation: The elevated platform is raised by 1.5m above the ground. The structure of the deck is based on a grid of pine wood beams, with a primary system of 228 x 50 x 5cm beams, set at 150cm axis, crossed with a secondary grid of beams measuring 152 x 50 x 5cm, set at 60cm axis, and reinforced by off-set bracing (152 x 50 x 5cm) at 70cm axis. The primary beams are supported by onsite-cast reinforced concrete pilotis.
Walls: the walls are in cement blocks plastered.
Roof: The roof structure, made with triangular semi-trusses in pine wood crossed with 7.5 x 3.8 cm section beams set at 60cm axis, is reinforced to be capable of supporting the weight of at least 50 people in case of major flood. The roof, which is ventilated, also allows rainwater harvesting into gutters and down pipes, which converge in a cistern located behind the building with a capacity of 50,000 litres.

TECHNICAL RECOMMENDATIONS FOR REPLICATION:

The elevated platform could be realised by a concrete slab instead of wood deck, which more resistant and durable in time and more familiar to builders experience. The wooden roof structure could also be substituted with metal trusses.

Second classroom as an extension of the Maniquenique project.

Following the completion of the school, and given that a considerable quantity of materials was left over, the decision was made to build a second, simpler and smaller elevated structure alongside it. It was designed to host a 9.5x5m classroom which would be elevated through the construction of a compacted landfill, approximately 120cm in height, entirely built using local materials and techniques by the community itself with the technical assistance of UN-Habitat. The vertical supports are in pine wood, like the roof structure; a primary order of beams rests on the columns below and a secondary order of beams is covered with corrugated steel decking, fixed with nails. The traditionally built walls are made of reeds and leave a horizontal opening below the roof for ventilation[1].



[1] Focus on Mozambique: A dacade experimenting distaster and risk reduction strategies / UN-Habitat / 2011;

Photo: UN-Habitat - Traditional material elevated classroom.

Photo: UN-Habitat - Construction Process

2_MZ 4.2

Physical Planning

Sustainable Land Use Planning for Integrated Land And Water Management for Disaster Preparedness and Vulnerability Reduction in the Limpopo River Basin

UN-Habitat: Limpopo Basin Strategic Plan for Reducing Vulnerability to Floods and Droughts

THE PROJECT. Maniquenique elevated school (see previous datasheet) is included in UN-Habitat implemented a sub-regional project in the Limpopo River basin from 2004 to 2007 with the overall objective to develop and implement participatory land use tools and plans to reduce the impact of floods. The project allowed UN-Habitat to express its mapping capabilities for territorial planning and flood risk mapping using several techniques such as satellite image processing, aerial photo interpretation and land cover classification within a Geographic Information System environment[1].

Two main outcomes resulted from the challenging tasks:

• A regional integrated land use management plan to lessen land degradation and minimise the risk of losing life and damage to ecosystems in future floods;

• Enhanced capacity and effective tools in participatory land use planning and disaster preparedness techniques for sustainable land management to reduce the vulnerability of communities living in flood prone areas[2]. Furthermore, as a result of several experiences in working in different areas with communities, local authorities and government technicians from centra to local levels, a methodological tool for participatory planning was developed based on six sequenced phases[3].

INTERVENTION DETAILS

Risk Addressed: Floods
Where: Mozambique, Botswana, Zimbabwe, South Africa
When: 2004 - 2007
Main Goal: to develop and implement participatory land use tools and plans for sustainable land management in the Limpopo River Basin in order to reduce the impact of floods on land, ecosystems and human settlements.
Donors: Global Environment Facility (GEF) /UNEP
Partners: Government of Mozambique, MICOA - DINAPOT, UN-Habitat, CBO's
Budget of the Project: 970,000 USD

ACHIEVED RESULTS

"Limpopo Basin Strategic Plan for Reducing Vulnerability to Floods and Droughts" elaborated and approved

Photo: UN-Habitat - Community Participatory Meeting

THE RIVER GAME

Since 2003, UN-Habitat has developed several tools for increasing awareness on preparation and adaptation to natural hazards, as well as giving recommendations and technical innovation regarding the way of thinking about architecture and infrastructure solutions in vulnerable settlements. One of the most striking products is the River Game with which, through playing community members can learn how to face the flooding phenomenon.

[1][3] Focus on Mozambique: A dacade experimenting distaster and risk reduction strategies / UN-Habitat / 2011;
[2] Limpopo Basin Strategic Plan for Reducing Vulnerability to Floods and Droughts / UN-Habitat, UNEP, GEF / July 2007;

2_MZ 4.3

CERUM / Multi-purpose Community Center

Environmental Mainstreaming and Adaptation to Climate Change in Mozambique

Photo: UN-Habitat - Development Plan of CERUM area in Vila Eduardo Mondlane

THE PROJECT. Chicualacuala district, Gaza province, is affected by chronic droughts, and rainfall rarely exceeds a few hundred millimeters per year. The project is meant to raise awareness amongst local communities for reducing their vulnerability, by introducing innovative rainwater harvesting techniques and through the testing of drought-resistant crops. The main building area includes housing, offices, meeting rooms, kitchens, toilets, porches, Recreational and playground spaces and public parks. The rectangular main building is made of concrete columns and beams and stabilized interlocking blocks masonry. The single-pitched roof slope has been specially designed for the collection of rainwater with the use of gutters and down pipes connected to a water-harvesting system that ends in three underground tanks with a total capacity of 40,000 litres. The most interesting feature of the project is the complex rainwater harvesting system, using roofs that are similar to canopies, situated above the cultivated fields. The geometrical form allows the roof harvesting system to interact with renewable energies, such as sunlight, creating a new type of sustainable agriculture. The roof slopes converge in collection holes used to channel water into large tanks. Collected rainwater can then be used to irrigate crops in the fields[1].

INTERVENTION DETAILS

Risk Addressed: Drought
Where: Chicualacuala District, Mapae Administrative Post / Vila Eduardo Mondlane
When: 2008 - 2013
Main Goal: Streamline climate change adaptation within local, provincial and national decision making processes; Strengthen the coping mechanisms of local populations to extreme climatic and environmental events
Donors: Spanish Gov. / UNDP MDG-F
Partners: FAO; UNEP; UNHABITAT; UNIDO; UNDP; WFP; INGC; MICOA
Budget of the Project: 7,060,000 USD
Cost of the Intervention (including labor):
approx.200,000USD / Community Centre(570 m^2)
approx. 4,000 USD/ Big Water Tank;
approx. 700 USD/ Small Water Tank;

ACHIEVED RESULTS

1 Multi-purpose Community Centre built
3 Community Tanks built
30 Family Tanks built
60 Family Metal Tanks provided
4 Boreholes opened
1600 Students provided with water
90 Householed provided with rain water harvesting systems

[1] Focus on Mozambique: A dacade experimenting distaster and risk reduction strategies / UN-Habitat / 2011;

KEEPING THE WATER

As a result of the experience in Chicualacuala andto promote adaptation to climate change awareness activities, UN-Habitat has elaborated a manual on rain water harvesting solutions and construction techniques explained with simple and visual language (Guardar a Agua - Keeping the water) and a educational game (O Jogo da Seca - The Drought Game) that hep community members to learn through playing how to face the progressive desertification phenomena.

Photo: UN-Habitat - Guardar a Agua Manual

UN-Habitat - Main Building, construction process

CHALLENGES. The remoteness of the area has represented a big challenge for the project logistics. Due to logistics and operational difficulties for the materials to arrive, phase shifts between the training sessions on costruction and the real starting of the building works were frequent. Chicualacuala is a border post featured by a consistent railway path, that represent the major demand of manlabor n the area. The Trainees, waiting for the building works on the project to be started or continued, were often employed by the railway company, obliging the project to recruit other builders to be trained again.
LESSONS LEARNED. The building units have been characterized by the peculiarity to use interlocking SSB (Stabilized Soil Blocks), thanks the District Government making available one block machine of his own. These kind of blocks are not commonly used in Mozambique and UN-Habitat took the opportunity to test one more construction technology in the field: the solution proved to be really advantageous, specially because it allows to save a big quantity of mortar, where it's difficult and expensive to find cement. **IMPACT.** The project has aroused the interest of INGC (National Institute for Natural Calamities Management) which would like to replicate the experience, on the base of the drawings and technical expertise of the first intervention.

Every house can collect its own water...

Ferro-Cement Tanks / Model 1: half-cylindrical shape made in iron mesh, iron chicken wire and double concrete layer, founded on concrete slab.

UN-Habitat - Ferro-Cement Tank Model 1, construction process

Ferro-Cement Tanks / Model 2: same structure as above. The tank is moulded on a tarpaulin designed for the purpose, than filled with straw to keep the shape, why the builders work on the outside.

UN-Habitat - Ferro-Cement Tank Model 2, construction process

COMMUNITY WATER TANKS

An interesting solution is underground community rainwater tanks. Their circular plan makes them resemble unidentified flying objects which have just landed. All that appears above ground is a 60cm high concrete brick wall, surrounded by a flat dome with a hole that lets rainwater in, and another hole used for inspection and drawing water. The 25cm-thick wall sits on a small concrete foundation plinth, set 45cm below the surface. The 6cm thick dome is made of steel mesh reinforced concrete. The underground tank is a huge semi-spherical volume made of reinforced concrete, with a central concrete pillar. The semi-spherical structure is 6cm thick and descends 2.5m below the surface, with a diameter of 6m. The concrete pillar drops 3m below the surface and sits on a 70cm square foundation pad[1].

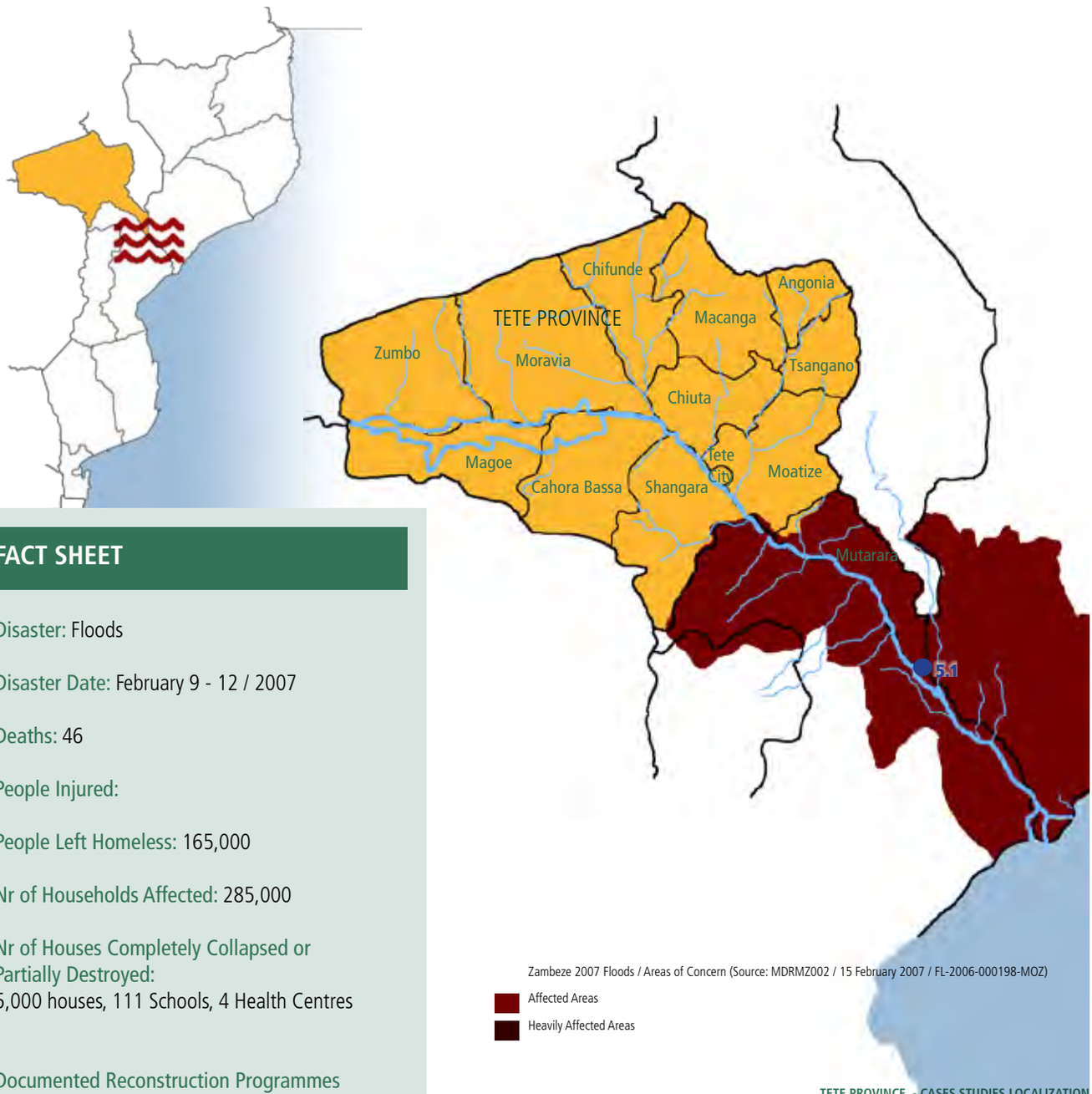
[1] Focus on Mozambique: A dacade experimenting distaster and risk reduction strategies / UN-Habitat / 2011;

Photo: UN-Habitat - Community Tank / On the Job Training

2_MZ 5

Tete Province

Situation Overview



TETE PROVINCE - CASES STUDIES LOCALIZATION

FACT SHEET

Disaster: Floods

Disaster Date: February 9 - 12 / 2007

Deaths: 46

People Injured:

People Left Homeless: 165,000

Nr of Households Affected: 285,000

Nr of Houses Completely Collapsed or Partially Destroyed:
5,000 houses, 111 Schools, 4 Health Centres

Documented Reconstruction Programmes Target Population: more than 1,000

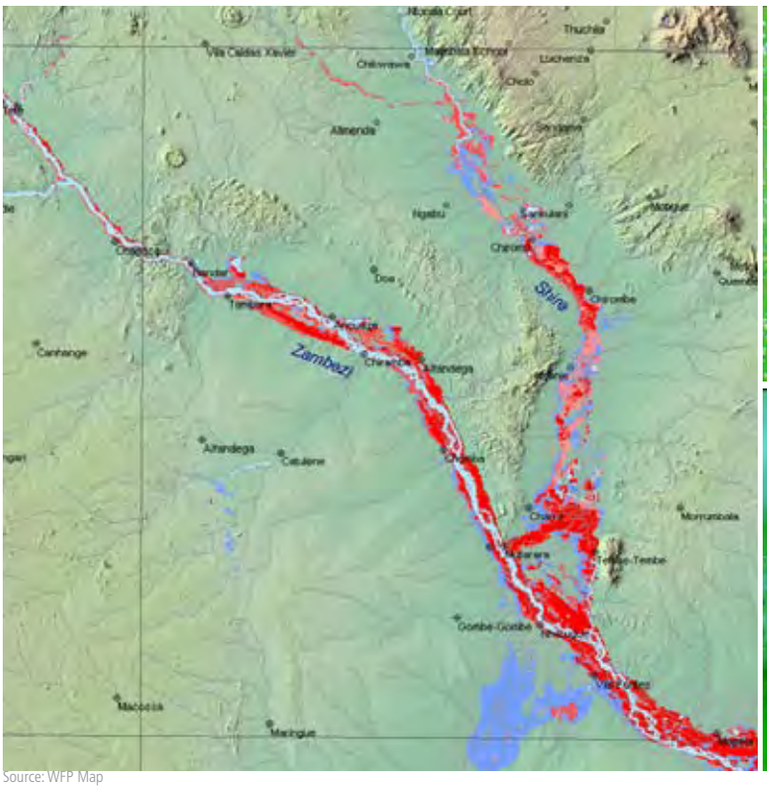
Building Types:
Elevated Multipurpose Community Centre (240 m2)
Housing (20 - 30 mq)

Material Cost per Building:
Multipurpose Community Centre Construction (including labor) approx. 120,000 USD;
House Construction (including labor) / approx. 7,000 USD

CASE STUDIES:

5.1_Elevated Safe Heaven
INGC / UN-Habitat / District Government

Disasters Data: Appeal no. MDRMZ002 / GLIDE no. FL-2006-000198-MOZ / 16 February 2007 / IFRC



Source: WFP Map

Photo: http://earthobservatory.nasa.gov/NaturalHazards - 2007 Tete Floods as per satellite images

VULNERABILITY OF TETE PROVINCE

Torrential rains throughout the southern Africa region (from Angola in the west to Mozambique in the east with Malawi, Zambia and Zimbabwe in between) led to overflowing of rivers and pressure on dams, resulting in wide spread flooding in central and southern parts of Mozambique. The Zambezi, a flood plain river that crosses the continent - with three major dams, burst its banks; its tributaries flow into Cahora Bassa hydroelectric dam in northwestern Mozambique. Mozambique's National Water Directorate began discharging water from the overflowing dam, which covers more than 1,000 square miles at a rate of up to 353,000 cubic feet a minute on 9 February 2007.
The discharge rate of the Cahora Bassa dam was reduced from 8,400 to 6,600m3/s on Monday 12 February but the influx of water into the reservoir does however remained high (around 10,000m3/s). These heavy rains closely followed earlier flooding from October to December 2006, which affected 46,500 people[1].

On February 4 The National Institute for Disaster Management activated its national disaster response plan and began evacuating populations from low-lying communities in the Zambezi River basin[2]. In Mozambique and neighbouring countries the rain continued and combined with the dam discharge caused, according to the government, the displacement of approximately 74,000 people and the temporary relocation of 29,000 people in accommodation centres and in resettlement centres that were established after the 2001 floods.
The most affected provinces are Zambezia, Sofala, Manica and Tete where flooding caused destruction of houses, 111 schools, four health centres, several roads, bridges and 45,000 hectares of crops.
INGC estimated that 285,000 people have been affected by the emergency.Throughout the affected areas, the incidence of diarrhoea, malaria and cholera has increased dramatically[3].

[1]Appeal no. MDRMZ002 / GLIDE no. FL-2006-000198-MOZ / 16 February 2007 / IFRC;
[2]Floods and Cyclone / Fact Sheet #1, Fiscal Year (FY) 2007 / March 22, 2007/ USAID;

Photo: Centro de Documentação e Formação Fotográfica de Moçambique

2_MZ 5.1

Elevated Primary School

Reducing vulnerability and promoting sustainable development of communities living in flood prone areas of Zambezi River

Drawing: UN-Habitat - Safe Heaven 3D Model

THE PROJECT. Inhangoma is located in Mutarara district, Tete province, in the midst of the Zambezi River floodplain. The architectural solution hereby presented follows the double-purpose building concept: public structures required by communities vulnerable to natural disasters that can serve as shelters in the event of flooding disasters. The concept has here further evolved since the elevated school built in Inhangoma is capable of sheltering more people while simultaneously housing other functions to maximise its use.

Added to those elements that provide security in the case of floods, some traditional elements widely used in the area were reinterpreted and integrated as fundamental design elements of the architectural project. The aim is that local people can feel at home in these new buildings. The principal element is the corridor, the space between the walls and the roof, which surrounds a traditional house in Mozambique. It is a flexible space that is closed or open depending on the weather conditions and the required use.

The corridor and the vegetable mats that enclose it protect the building from wind, rain and sun. The leaning roof is a rainwater-harvesting system to provide safe drinking water, especially in times of disaster[1].

INTERVENTION DETAILS

Risk Addressed: Floods
Where: Inhangoma Administrative Post, Mutarara District, Tete Province
When: 2009 - 2013
Main Goal: reducing vulnerability and promoting susteinable development of communities living in flood prone areas of Mozambique
Donors: ECHO / UN Joint Programme for Disaster Risk Reduction and Emergency Preparedness in Mozambique
Partners: INGC; UN-Habitat; District Government
Budget of the Project:
Cost of the Intervention (including labor):
approx. 120,000 USD/Multipurpose Community Centre Construction; approx. 7,000 USD/House Construction;

ACHIEVED RESULTS

1 Multi-purpose Community Centre built, being at the same time: a) Primary School available for 400 students; b) Elevated Platform / Safe Heaven available for 350 People
7 Elevated Houses built
40 Beneficiaries accomodated
40 Builders trained on-the-job
1 Awareness Raising Training organized with the participation of 100 beneficiaries
1 Risk Mapping elaborated

[1] Focus on Mozambique: A dacade experimenting distaster and risk reduction strategies / UN-Habitat / 2011;

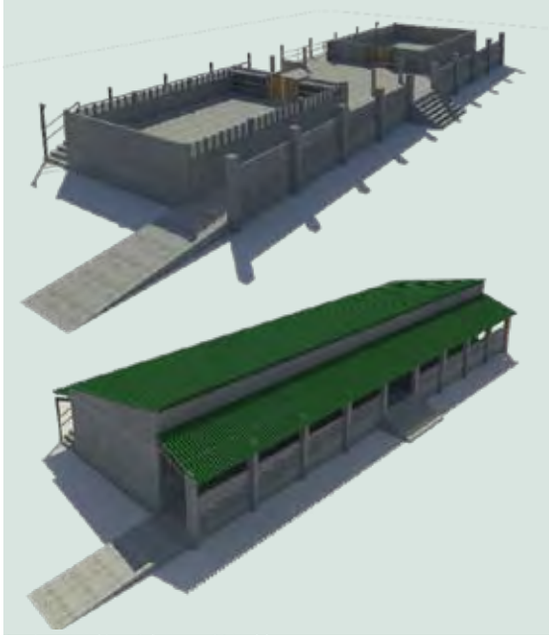
Photo: UN-Habitat - Construction Process

Photo: UN-Habitat - Construction process

CHALLENGES. One of the major challenges of the project was the remoteness of the areas that affected the materials transport and logistics aspects. Furthermore, the community mobilization has been made even more difficult by the extreme widespreading of the village in an extensive rural area. Thus, the adaptive intervention has been implemented by a contractor, superivsed by UN-Habitat technicians in the field.**LESSONS LEARNED.** The size of the intervention could compromise its replicability as it is, specially if located in remote areas.
IMPACT. The experience has represented a referenced examples for local and national authorities, being included into a Strategy of Vulnerability Reduction and Promotion of Sustainable Development, elaborated by the Technical Council for Calamities Management (CTGC, body of INGC), with the technical support of UN-Habitat. The implementation of Multipurpose Centres is already included into the Master Plan for Prevention and Mitigation of Natural Calamities. In the 2nd strategic line of the Strategy, the implementation of double purpose building in flood prone areas is to be accompanied with resettlement initiatives in a coordinated way, thus to create a network of support platforms interconnected with the resettlements sites.

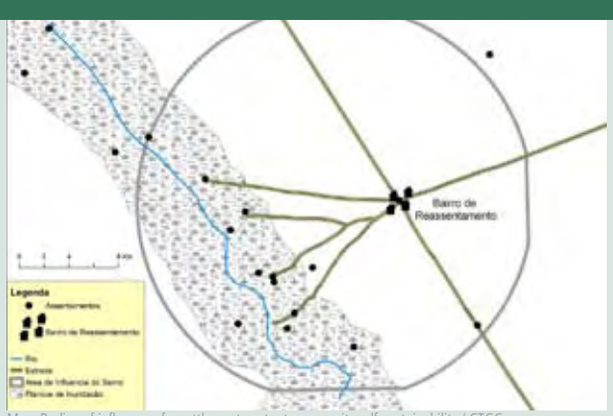
Why this architecture intervention is "adaptive"?

General Features: the building is composed of
• Closed Space: conceived to keep people's belongings during disaster. It will be used for different types of activities in normal times, such as a classroom or community centre (100 m2);
• Semi-Opened Space: meeting and multi-activities area. During a flood, this will be the space used for most of the emergency activities (75 m2);
• Open Space: it contains the distribution system like corredor, access stairs and slopes (25 m2);
8 Elevated VIP Latrines (33 m2) and a 40.000 Lt Water Tank are annexed
Foundation: is elevated above the floods level;
Walls: are made in Stabilized Soil Blocks;
Roof: is studied to work as a Rain water catchment system connected to the 40.000 Lt Water Tank;

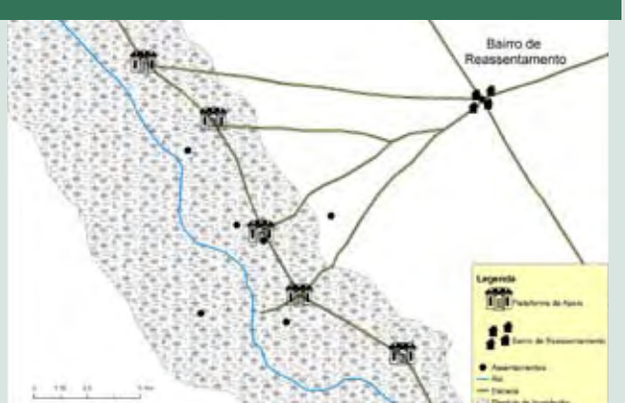


Drawing: UN-Habitat - Safe Heaven 3D Model

Strategy for Vulnerability Redcution and Sustainable Development of Zones Prone to Flooding



Map: Radius of influence of resettlement center to ensure its self-sustainability / CTGC

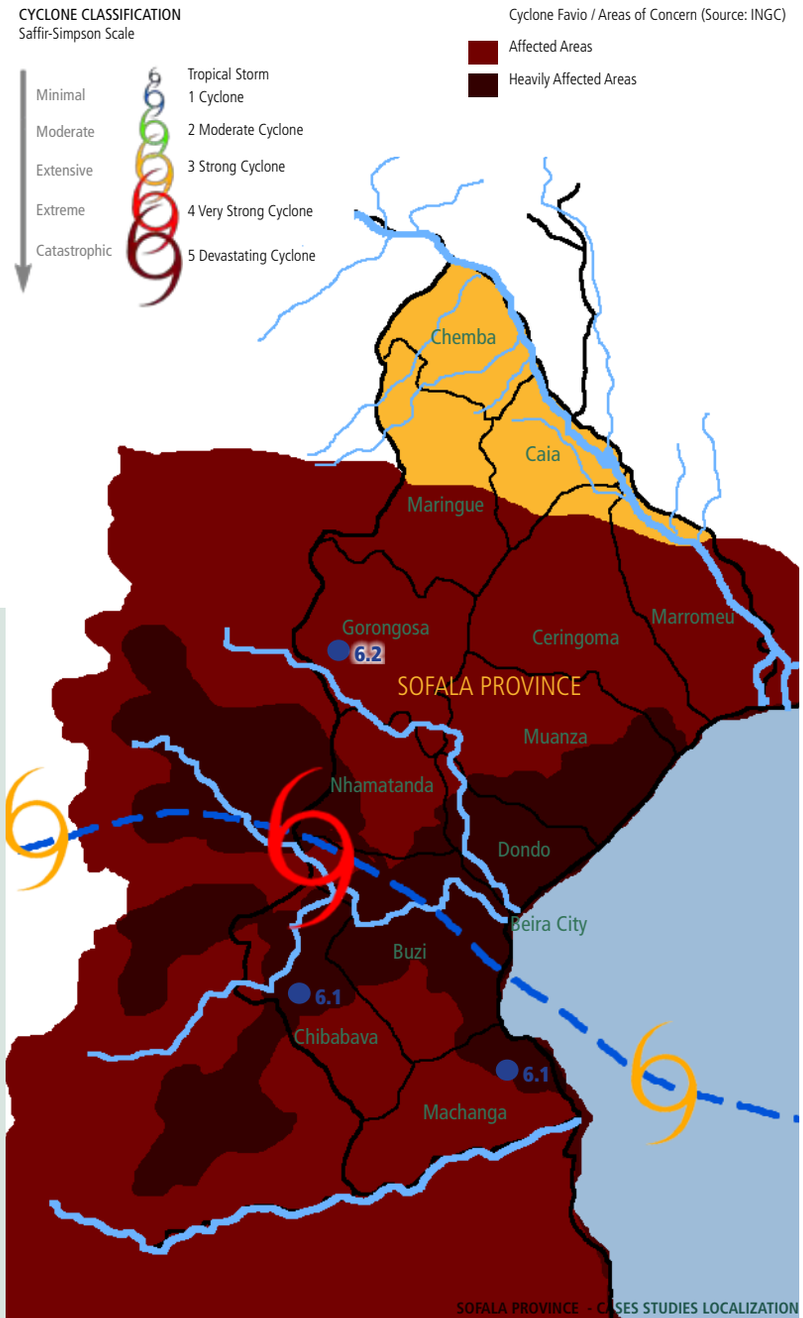


Map: Interconnection between support platforms and resettlement centers / CTGC

2_MZ 6

Sofala Province

Situation Overview



FACT SHEET

Disaster: Tropical Cyclone Eline and following floods

Disaster Date: February 22 / 2000

Deaths: 640

People Injured: -

People Left Homeless: 490,000

Nr of Households Affected: 1,9 million people

Nr of Houses Completely Collapsed or Partially Destroyed: 11,900 in Sofala (in Machanga (9,952), Búzi (1,499), and Chibabava (417)); 1 Central Hospital, 1 Rural Hospital, 12 Clinics, 267 Classrooms

Documented Reconstruction Programmes Target Population: more than 3,000

Building Types: Housing, VIP latrines, conventional and traditional materials schools, Health Posts, Water Pumps, Water Tanks

Material Cost per Building: 1,200,000 USD including Housing (28m²/64m²), Schools (2/3 Classrooms - 200/290 m²), Health Posts: 200 m2)

CASE STUDIES:

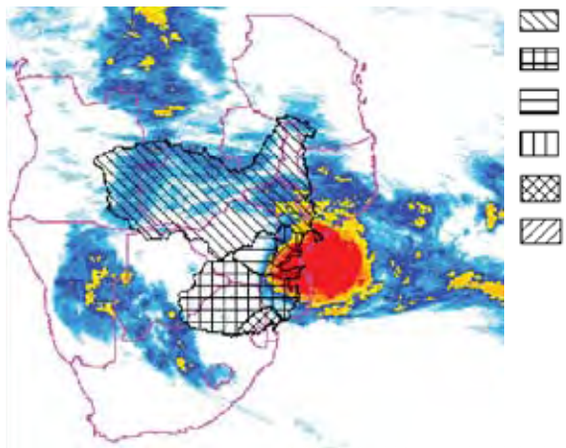
6.1_Post Flood Reconstruction and Rehabilitation of Infrastructure GIZ /Ministry of Agriculture and Rural Development;

6.2 _ Community-Based Self-Help School Construction Programme GIZ /Ministry of Agriculture and Rural Development;

Disasters Data: Contribuição do PRODER para a reabilitação e reconstrução das infra-estruturas nos distritos afectados pelas calamidades naturais de 2000 e 2001 INGC; World Bank - A Preliminary Assessment of Damage from the Flood and Cyclone Emergency of February-March 2000 / March 27 - 2000

VULNERABILITY OF SOFALA PROVINCE

From February 4 to 7, 2000, due to the effects of cyclone Connie, Maputo city received 455 mm of rainfall, or nearly half the average annual total. Similar exceptionally heavy rains across southern Mozambique exacerbated normal seasonal flooding, inundating low-lying areas. From February 20 to 22, heavy rainfall associated with cyclone Eline boosted rainfall totals in neighboring South Africa, Zimbabwe and Swaziland, filling reservoirs on river basins draining through southern Mozambique and triggering more extensive flooding, particularly along the Limpopo, Incomati and Umbeluzi rivers. In early March, heavy rainfall affecting the Save, Buzi and Pungoe river basins threatened to cause additional flooding in these areas further to the north.
The provinces currently most affected are Maputo, Gaza, and northern Inhambane, Sofala and Manica. The total population in the five affected provinces is about five million. According to the Instituto Nacional de Gestao de Calamidades (INGC), as of March 23, 640 people have lost their lives due to the flooding and about two million people are experiencing severe economic difficulties, including 491,000 people who are either displaced or trapped in flood-isolated areas. Break points in the transportation system, resulting from destroyed roads, bridges and railways, separated people in the affected areas from food, water, and essential services. More permanent structures such as schools, clinics, and municipal buildings have also sustained damage. In addition, lectrical and telecommunications grids have been ripped asunder, and water systems and sanitation systems have been rendered inoperable through siltation[1].



Map: ReliefWeb / Special Report on Floods in Southern Africa

TRANSPORT NETWORK AFFECTE BY CT JOKWE

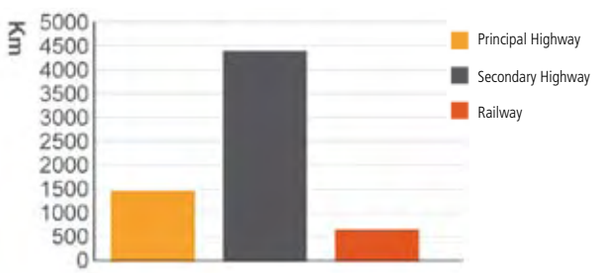
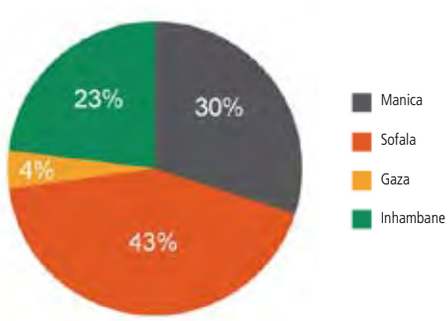


Photo: Centro de Documentação e Formacão Fotográfica de Moçambique

POPULATION AFFECTED BY CT ELINE



Data Source: INGC Climate Change Report

[1]World Bank - A Preliminary Assessment of Damage from the Flood and Cyclone Emergency of February-March 2000 / March 27 - 2000

Photo: Centro de Documentação e Formacão Fotográfica de Moçambique

INFRASTRUCTURE SITUATION IN SOFALA PROVINCE IN THE IMMEDIATE AFTERMATH OF 2000 FLOODS AND CYCLONE

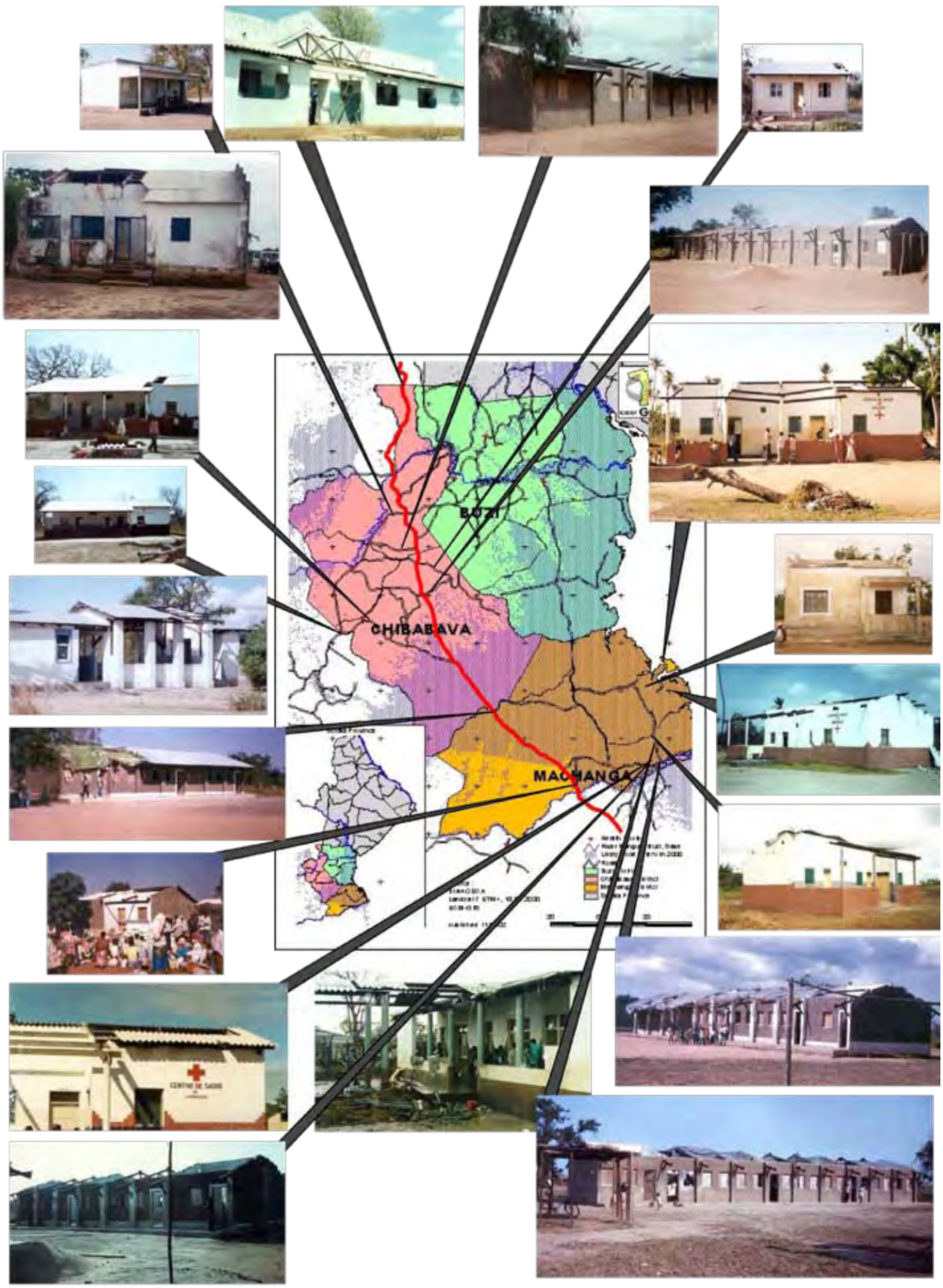


Photo: GTZ - Contribuição do PRODER para a reabilitação e reconstrução das infra-estruturas nos distritos afectados pelas calamidades naturais de 2000 e 2001

INFRASTRUCTURE SITUATION IN SOFALA PROVINCE AFTER PRODER INTERVENTIONS

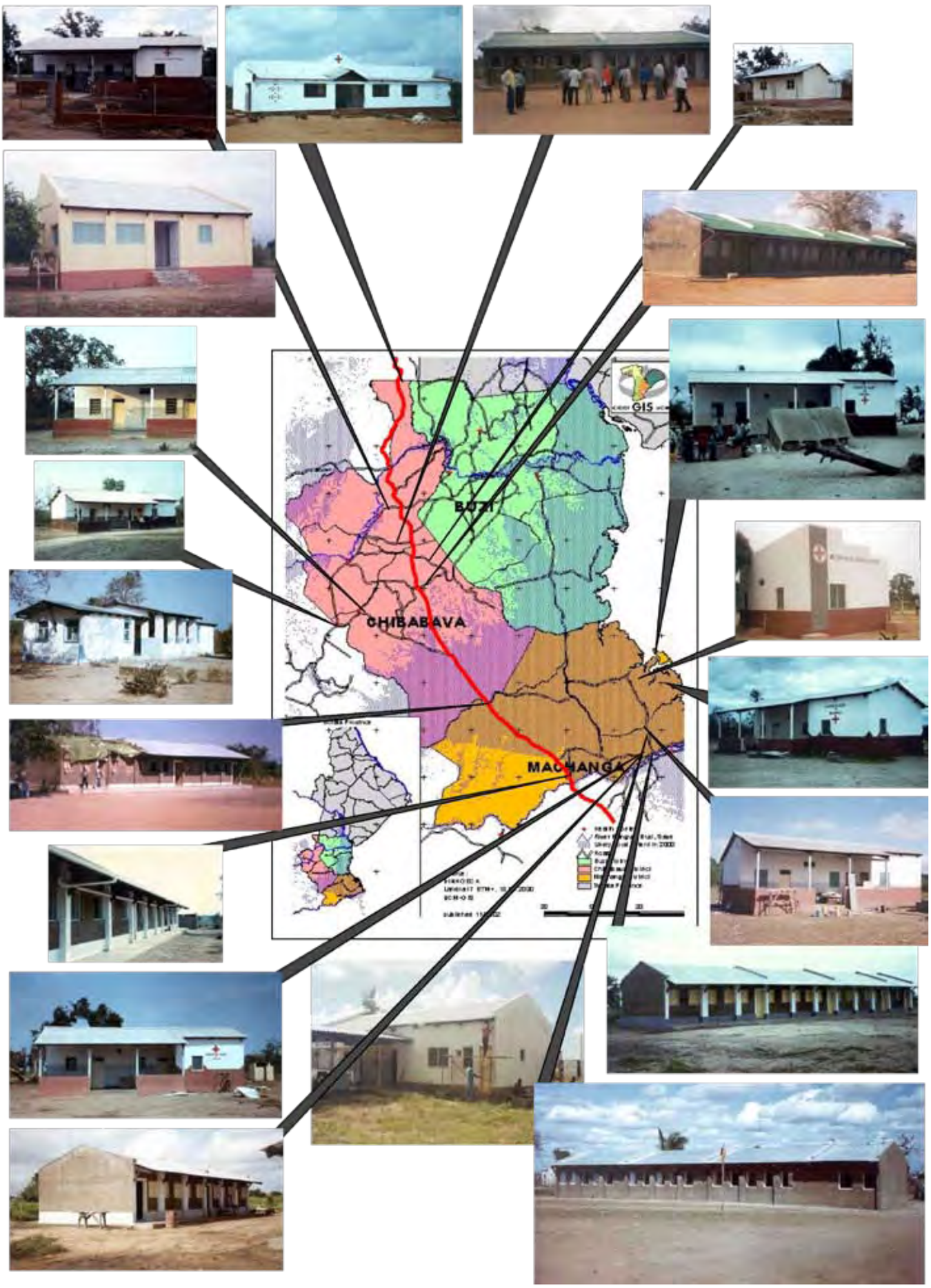


Photo: GTZ - Contribuição do PRODER para a reabilitação e reconstrução das infra-estruturas nos distritos afectados pelas calamidades naturais de 2000 e 2001

2_MZ 6.1

Reconstruction of Infrastructures & Housing

PRODER - Rural Development Programme

Photo: GIZ / Health Post Divinhe

THE PROJECT. 2000 Cyclone Eline seriously damaged the majority of buildings located in an area of 200km from the costline: in particular, the Districts of Govuro, Machanga, Chibabava and Búzi have been devastated. Anyway, depending on their localization and construction technology, the buildings have been damaged in a diversified way. Almost all the buildings have recurrent construction defects causing their partial collapses. The costs to rehabilitate the buildings have been estimated corresponding to the 20-25% of the entire reconstruction costs. Once evaluated the possibility to introduce construction improvement during the rehabilitation phase, the activities of PRODER (Programa de Desenvolvimento Rural) aimed to rehabilitate the infrastructures damage or destroyed in the southern Districts of Sofala Province, focusing on three sectors: 1) Rehabilitation of public facilities like schools and health centers in Machanga, Chibabava and Buzi Districts, by introducing improved construction techniques to increase their resistance to future disasters; 2) Rehabilitation of the building occupaied by the District Direction of Agriculture and Rural Development in Machanga and Chibabava; 3) Rehabilitation of water catchment points in Machanga, promoting systems of maintenance and management of water resources and training with local committees.

INTERVENTION DETAILS

Risk Addressed: Cyclone/Flood
Where: Machanga, Chibabava and Buzi Districts - Sofala Province
When: 2000 - 2002
Main Goal: Housing and Public Facilities Rehabilitation and Reconstruction in the Districts of Sofala Province affected by 2000/2001 natural disasters
Donors: BMZ (Federal Ministry for Economic Cooperation and Development - Germany)
Partners: Ministry of Agriculture and Rural Development; GIZ (German Society for International Cooperation);
Budget of the Project: 2,000,000 USD
Cost of the Built Intervention (including labor):
Building Costs (Housing: 28m^2/64m^2; Schools: 2/3 Classrooms - 200/290 m2; Health Posts: 200 m^2) .....1,200,000 USD
Project Staff.....350,000 USD
Training Costs.....50,000 USD
Logistics.....200,000 USD
Miscellaneous.....200,000 USD

ACHIEVED RESULTS

15 Schools Reconstructed or Repaired
21 Health Posts Reconstructed or Repaired
45 Houses Reconstructed or Repaired
44VIP Latrines Rehabilitated
13 Water Pumps
3 Water Tanks
6 Government Technicians Trained

Photo: GIZ / School Muguruze

Photo: GIZ / Houses in Muguruze and Chinhuke

CHALLENGES. One of the hardest challenges the project had to face was the coordination of action within a scenario of different organizations operating in the field. This was worsened by the lack of leadership and capacity of the local Government Staff, insufficient in number to undertake the big quantity of work determined by capacity building and project management.

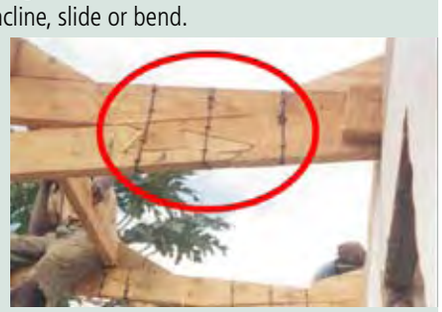
LESSONS LEARNED. Involving Government institutions at national level can help to provide a wider impact and further replication possibilities for constructive best practices. Accompaning the intervention implementation with local technicians training sessions and capacity building is necessary for the success of the project;

IMPACT. The building rehabilitated have demonstrated the successful possibilities to include construction improvements into retrofitting and rehabilitating processes, providing a suitable alternative to entire reconstruction. Technicians at District level have been trained on the aforementioned reinforcing techniques, and the practices have been documented and replicated at Province level.

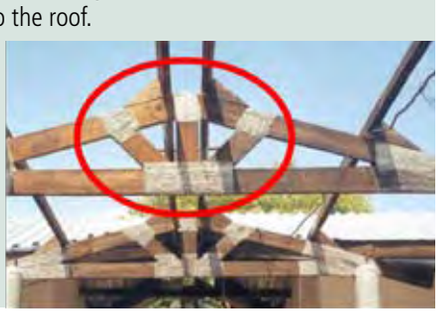
Why this architecture intervention is "adaptive"?

Anchoring: each element has to be anchored to a strong one, able to resist the wind strenght, from the roof to the foundation.

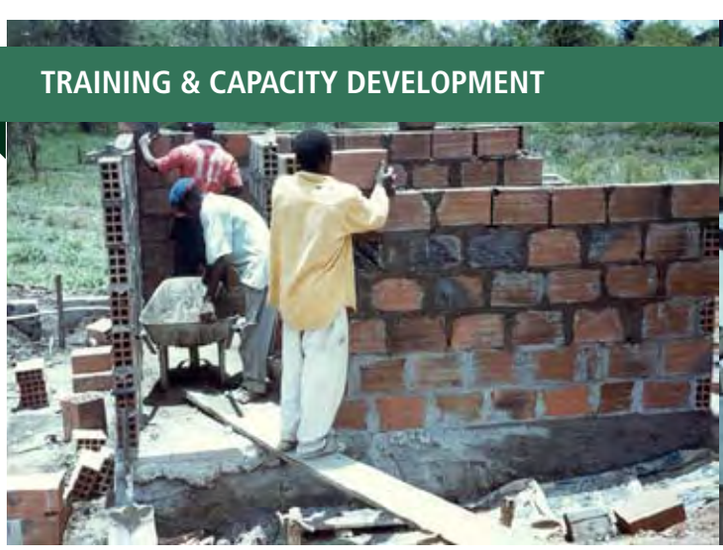
Reinforcing: each element has to be reinforced not to incline, slide or bend.

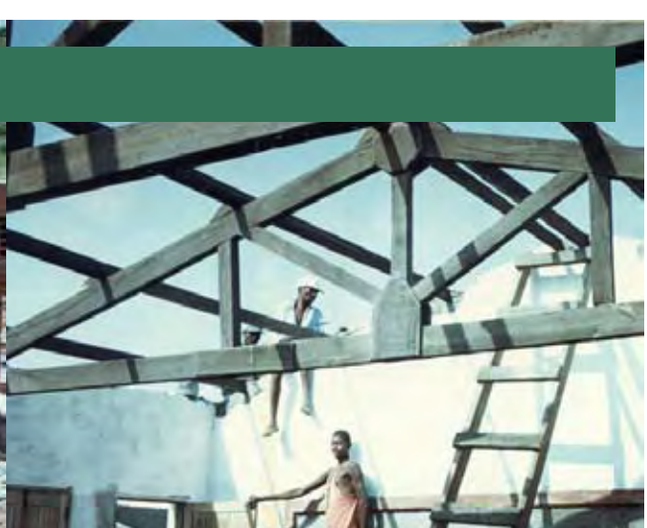


Continuity: each element has to be properly connected in continuity to the next one from the foundation to the roof.



TRAINING & CAPACITY DEVELOPMENT





Photos: GIZ

2_MZ
6.2

Improved Schools Construction

PRODER - Rural Development Programme

Photo: GIZ / School Machisso

THE PROJECT. In Gorongosa District, the local communities have already started the implementation of a series of school built in locally available traditional materials. The starting assumption of the project is the possibility to improve and strenghten the traditional school model, through the introduction of simple construction rules and minimum use of imported construction materials, like cement, roof metal coating, painting and nails. The aim is to empower the community in self-help improving of local infrastructures with locally available resources.
The school model, repeated in 10 schools in Gorongosa District, is 126 m^2 wide, including two classrooms blocks (46,5 m^2 each) and varanda (26 m^2). The foundation walls, made in full cement blocks, is elevated respect of the ground level and filled with sand/gravel layer to avoid damp raising. The wall structure is mixed, with wooden posts anchored in the foundation podium and fired bricks masonry infill: the wooden posts are come from the most resistant trees of Mozambique and are carefully selected to be regular and treated to resist damp and insects attacks; he bricks are layed according with a "common bond" brickwork, that includes a crossed layer every 4/5 bricks courses, to increase the resistance of the walls. The wooden trussed beams supporting the roof are doubled and is treated to be protected from the insects[1].

INTERVENTION DETAILS

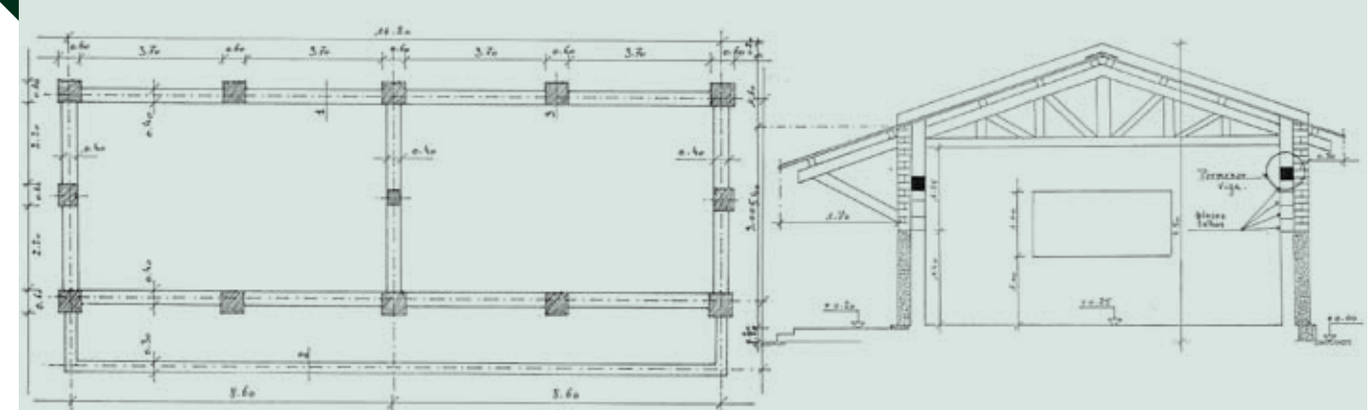
Risk Addressed: Flood / Strong Winds
Where: Gorongosa District
When: 2002 - 2006
Main Goal: Vulnerability prevention and mitigation through self-help public infrastructures building interventions, included into the District Development Plan
Donors: BMZ (Federal Ministry for Economic Cooperation and Development - Germany)
Partners: Ministry of Agriculture and Rural Development; GIZ (German Society for International Cooperation);
Budget of the Project: -
Cost of the Built Intervention (including labor): School Reconstruction - 126m2 (including labour): approx. 6,000 USD

ACHIEVED RESULTS

10 Schools Reconstructed or Repaired
20 Community Members Trained

Community Participation in the following activities:
- provision of man labor
- brick firing
- provision of wooden boards
- provision of sand and stones

SCHOOL'S ARCHITETURAL MODELS



[1]Projecto de Construção dumaEscola Comunitária " / Programa de Desenvolvimento Rural, Sofala - Eng. Jean-Paul Vermeulen

Drawings: GIZ

COSTS DISTRIBUTION FOR ONE SCHOOL IMPLEMENTATION

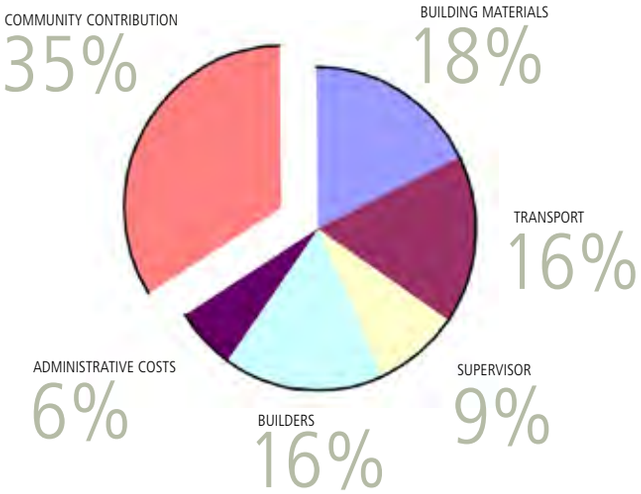


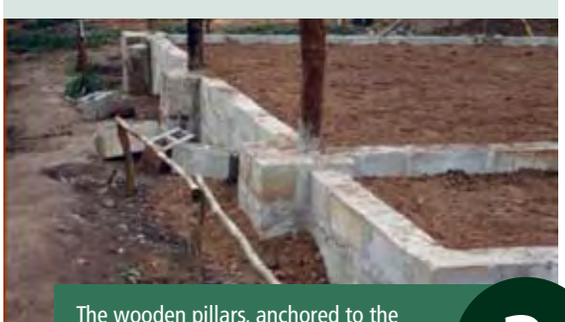
Diagram from: "Projecto de Construção dumaEscola Comunitária " / Programa de Desenvolvimento Rural, Sofala - Eng. Jean-Paul Vermeulen

CHALLENGES. Since the self-help construction process doesn't include any payment for the work provided by the community, on the other side providing the funds for part of the construction materials, one of the biggest challenges of the project has been represented by the community involvement, for them to feel the responsibility of a self-driven committment. This caused delays in implementation times.
The community has participated for the equivalent of 35% of the construction costs, providing man labor, bricks, woden posts and sand. The improved construction techniques introduced has to be very simple, since the building skills of such a farming community were very low.
LESSONS LEARNED. Community mobilisation and pariticpation is a key factor for the success of the project. Involving Government institutions at national level can help to provide a wider impact and further replication possibilities for constructive best practices.Such in terventions could have a stronger impact if included in a wider community development programme to avoid dispersion. **IMPACT.** The project has demosntrated that is possible to build stronger just using using local materials, construction techniques and man labor.

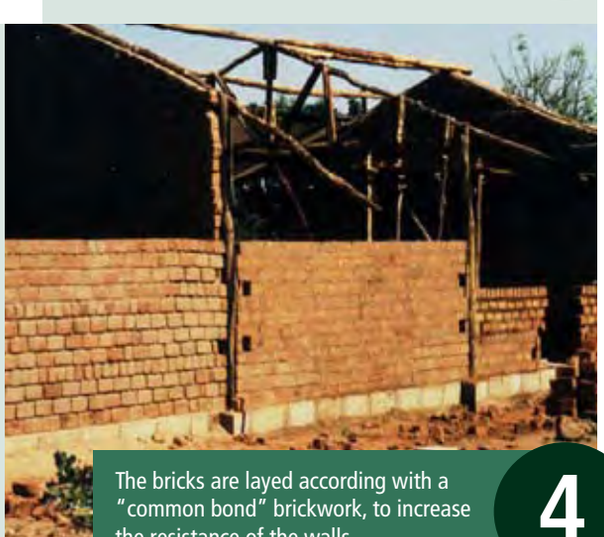
What is the construction process?

15.000 Fire Bricks Makng, starting from muromuchè soil, which presents the best characteristiques **1**

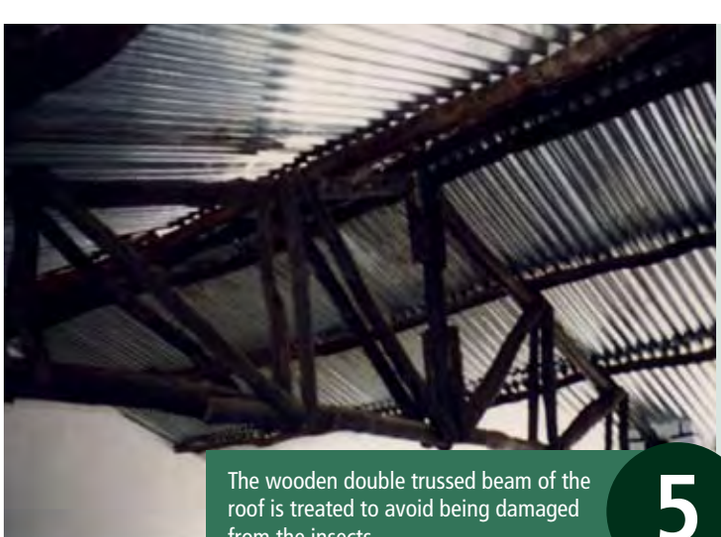
The elevated foundation is made in full cement blocks, settled on sand/gravel layer, to avoid damp raising. **2**



The wooden pillars, anchored to the foundation, come from the most resistant kind of trees in Mozambique. **3**



The bricks are layed according with a "common bond" brickwork, to increase the resistance of the walls. **4**



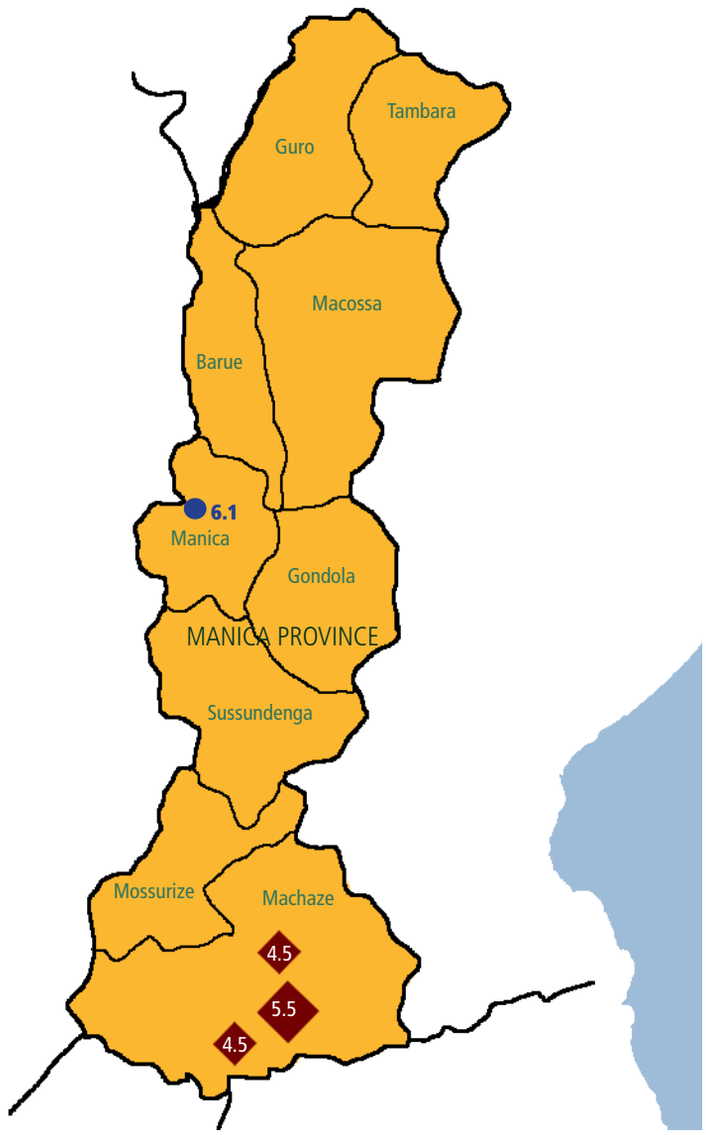
The wooden double trussed beam of the roof is treated to avoid being damaged from the insects. **5**

Photos: GIZ

2_MZ 7

Manica Province

Situation Overview



Earthquake Magnitude in Mozambique (Source: USGS NEIC / WDCS -D)

4 - 5

5 - 6

Earthquake Epicenter Coordinates (Source: USGS NEIC / WDCS -D): 21.215°S / 33.337°E

MANICA PROVINCE - CASES STUDIES LOCALIZATION

FACT SHEET

Disaster: Earthquake (7.5 Magnitude)

Disaster Date: February 22 - 23 / 2006

Deaths: 4

People Injured: 36

People Left Homeless: more than 1000 people

Nr of Households Affected: more than 1500 people

Nr of Houses Completely Collapsed or Partially Destroyed: 288 Houses, 6 schools, 1 water tank, 3 water points, and 2 small bridges

Documented Reconstruction Programmes Target Population: 640 people

Building Types: Housing (35 m2)

Material Cost per Building (including labor): approx.10,000 USD / House

Disasters Data: OCHA / Situation Report Nr. 2

CASE STUDIES:

7.1_Capacity Building and Awareness Raising Activities on Earthquake Proof Construction Techniques
UN-Habitat / INGC / Manica District Government / Manica Municpality;

VULNERABILITY OF MANICA PROVINCE

While there is no published study on historical seismicity in Mozambique and a consistent lack of written information, particularly due to the deficiency and age of scientific research and the network of monitoring instruments, three significant seismic events are reported to have occurred in Mozambique during the 20th century, on 1951, and1957. The earthquake that occurred on Thursday 23 February 2006 at 00:19:07 local time was estimated as having a magnitude of 7.5 on the Richter Scale, even if, after further analysis, this was decreased to 7 (USGS, 2006). In the nearby cities of Beira, Chimoio and Maputo, its intensity was perceived as V on the modified Mercalli Scale. In spite of its great magnitude, considered to cause important losses of lives and serious damage to buildings and infrastructures, the event was less severe compared to devastations caused by earthquakes of the same intensity in other countries; this is perhaps due to the fact that it occurred in a sparsely populated area with a low population density and few infrastructures. The fault line is situated 10 km from the epicentre, and is supposed to be 30 km long. Locally the rupture resembles a high (up to 2 m) and steep west-facing scarp, made of sandy soil, which ends in a deep open fissure. The epicentre area is located in a region of flat-lying topography covered almost entirely by Holocene age unconsolidated quartz sands deposited by fluvial systems, most likely during a flood stage when neighbouring rivers such as the Rio Save burst their banks and inundated the surrounding countryside.

Photo: UN-Habitat - Ground rupture at epicentre / Machaze

Photo: UN-Habitat - Linear landmark produced by ground rupture at epicentre / Machaze

MAIN DEFECTS AND TECHNICAL FAILURES OF LOCAL BUILT ENVIRONMENT

- irregular building shape
- excessive building height (two or more storeys)
- poor and uncontrolled material quality;
- lack of foundations and plinths
- walls too high, too long,too thin without reinforcing intersections
- deficient bonds at walls corners (7);
- openings (doors/windows) too large, too close to corners;
- excessive slenderness of pillars supporting verandas roofs;
- lack of lintels or their deficient bedding (11);
- lack of horizontal reinforcements (12);
- unsupported gable walls and heavy roofs (14);
- lack of connection between roof and vertical structures (15);

2_MZ 7.1

Capacity Building

Supporting Local Mitigation Interventions for Reducing Vulnerability to Earthquakes in Manica Province

Photo: UN-Habitat - Construction Training with 10 local builders

THE PROJECT. Manica province is located at the southern end of the Great African Rift and was affected in February 2006 by the more important earthquake recorded in Mozambique in the last century which provoked consistent infrastructure and building damage. UN-Habitat has carried out a feasibility study for designing architectural models of non-engineered earthquake resistant houses inspired from traditional techniques and making use of local materials. Indepth interviews were carried out among the targeted communities regarding the best housing design to be adopted. The proposed solution involves the use of double walls of stabilised soil blocks filled in with a structure in bamboo for confering the required flexibility to the house overall structure, and reinforced foundations in concrete. The project has focused on training local master builders in improved construction techniques and to sensitize the local population. For the purpose awareness and didactic materials, such as posters, manuals and publications, have been elaborated and used as a working base material to organize participatory sessions, conferences, seminars and workshops to start wide-spreading knowledge about earthquake among vulnerable communities selected in the area to benefit directly of the project activities, supported by INGCand local Government institutions.

INTERVENTION DETAILS

Risk Addressed: Earthquake
Where: Manica District, Manica Province
When: 2011 - 2012
Main Goal: Supporting Local Mitigation Interventions for Reducing Vulnerability to Cyclones and Earthquakes in Nampula and Manica Provinces, Mozambique
Donors: ECHO; UN Joint Programme for DRR
Partners: UN-Habitat, INGC, District Government, Municipality of Manica
Budget of the Project: 497,966 USD (ECHO: 266,195 USD + UNJPDRR: 231,801USD)
Cost of the Intervention (including labor): 13,000USD /Training Organizing and Implementing; 10,000 USD /Housing Model

ACHIEVED RESULTS

30 Beneficiaries, including District Technicians, CLGR Members, University Students trained on safer construction techniques and evacuation simulations
30 Primary School Students and 1 Teacher trained on evacuation procedures
10 Builders Trained on-the-job of different technical solutions for safer housing construction
1 Awareness raising training session organized including 100 Community Members
10 Municipality Technicians trained on Improved Architecural Models for Earthquake resistant housing

Photo: UN-Habitat - Training with the students of school "7 de Abril" / Manica Municipality

BE PREPARED, AT SCHOOL!

30 Students and 1 Teacher of the school "7 de Abril" in Manica Municipality have participated to the exercise/training concerning how to act before, during and after an earthquake, including elaboration of school contingency plan and simulation of behavior and evacuation in case of a seismic event. 2 Scaled Architectural Models (one made n wood and one made in sponge) have been implemented for the purpose in the reinforced and non-reinforced way, to show earthquake different actions on building structures, depending on presence of reinforcement systems.

Photo: UN-Habitat - Wall Reinforcement Techiques: bamboo slats and metal wire

CHALLENGES. During this activity seismic risk has been for the first time object of debates, building trainings and evacuation simulations in Mozambique after the 2006 earthquake: for this, the activities can be considered a test to improve the next ones. Inspite the introduction of new techniques, the building activity has received excellent feedback, given that Manica is rich in good quality construction materials and the locally produced SSB are strong, regular and cheap.

LESSONS LEARNED. Earthquake risk awareness needs to be widespread and scaled up with further interventions. Earthquake sound building layout for non-engineered houses needs to be tested and applied all over the seismic prone area.

IMPACT. Government institutions at national level has shown their interest in including in their agendas and budget lines the application of earthquake resistant solutions for low-cost construction in public buildings implementation as an example for communities; Government intitutions at local level have asked to be supported by UN-Habitat technical assistance to elaorate earthquake sound low cost housing models; all the Training Materials used have become patrimony of the District Government Planning and Infrastructures Office.

Why this architecture intervention is "adaptive"?

General Features: the house architectural layout has a compact squared shape, with butresses and internal walls to reinforce the walls strenght; the opening are small and far from each other and from the corners.

Foundation: traditional local stone/mortar foundation has been implemented wider (60cm) and deeper (90cm), with a reinforced concrete foundation beam to connect the wall reinforcement with the foundation system;

Walls: double course of SSB; two kind of wall reinforcement tested: bamboo slats/ chicken wire. The horizontal reinforcement has been set every four blocks courses, interlaced with a vertical frame, made in the same material, applied to the walls corners, lintels, opening frameworks;

Roof: the roof is hipped with upper ventilation; the slope inclination is more than 30°; the wooden structure is reinforced.

TECHNICAL RECOMMENDATIONS FOR REPLICATION:

The double course wall is stronger and allow to implement stronger joints at the corners than the single course one, but requires too much construction material to be affordable to be spontaneously implemented by an average family.

Bamboo is quite widespread in Manica mountains, it is cheap and the interlacing tecnique is already known by the builders, even though it needs a thicker layer of plaster to be coated.The chicken wire reinforcement is quick to be implemented and doesn't need too much thickness of mortar or plaster.

LOCAL ARCHITECTURAL PROTOTYPES FOR EARTHQUAKE RESISTANT HOUSING

Basing on the Feasibility Study and contruction training carried out, UN-Habitat has signed an agreement of cooperation with the Municipality of Manica to provide the local staff with technical assistance in elaborating architectural layouts for the implementation of earthquake resistant housing in the new development areas of the Municipality. Different model have been designed, from bigger (50 m2) to smaller (25m2) solution, with interior bathroom or external VIP latrine, in order to possibly satisfy different needs and affordability conditions. The housing is to be made in SSB, with reinforced elevated foundation, walls reinforcement (bamboo/chicken wire), rainwater harvesting system and wind/earthquake proof roofing system. 10 model houses are under construction in Manica Municipality.

Photo: UN-Habitat - On the Job Training

SECTION 2
Chapter 3

Principles and Cases of Adaptive Architecture

Madagascar

3_MD 1

Province

Situation Overview

IN PROGRESS

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FACT SHEET

Disaster:

Disaster Date:

Deaths:

People Injured:

People Left Homeless:

Nr of Households Affected:

Nr of Houses Completely Collapsed or Partially Destroyed:

Documented Initiatives Target Population:

Building Types:

Material Cost per Building:

CASE STUDIES:

Disasters Data: Mozambique – Floods and Cyclone / Fact Sheet #1, Fiscal Year (FY) 2007 / March 22, 2007/ USAID;

SECTION 3

Leassons Learned&Recommendations for Government Institutions, Donors and Operators

Malawi
Mozambique
Madagascar

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Lessons Learned & Recommendations
Region

IN PROGRESS

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CONCLUSIONS

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