

June 2007


# IntoAction

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## Flood-warning system in Mozambique

### Completion of the Búzi project

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**Munich Re  
Foundation**  
From Knowledge  
to Action

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### Project overview – Búzi project

#### Duration

August 2005–December 2006

#### Budget

50% Munich Re Foundation,  
50% German Agency for Technical  
Cooperation

Continuation in Project Save  
Rio Save Machanga/Govurobis,  
as of April 2007

#### Project management

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on-site: Wolfgang Stiebens

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In Mozambique, as in many other African countries, women and girls have to fetch water. Distances of some 30 kilometres are by no means uncommon.

Village life in Búzi centres on the main street. The weekly market is inundated if flooding occurs.

## Floods in Mozambique

**In recent decades, there has been a significant increase in flood disasters in many parts of the world, Mozambique being no exception. It suffered its worst floods in recent history in 2000. At the heart of the country, thousands of square kilometres were inundated and more than 700 people lost their lives.**

This southeast African nation also had to contend with floods at the beginning of 2007. Following weeks of rain, major rivers in Central Mozambique such as the Zambezi and the Búzi burst their banks. Many people lost their lives in the worst floods the region had experienced for six years. Thousands were left homeless. According to estimates by Mozambique's National Institute for Disaster Management (Instituto Nacional de Gestão de Calamidades), some 285,000 people in the Zambezi region alone were endangered by flooding between December 2006 and January 2007. Around 163,000 lost their huts, possessions and fields. 107,500 were evacuated to emergency centres.



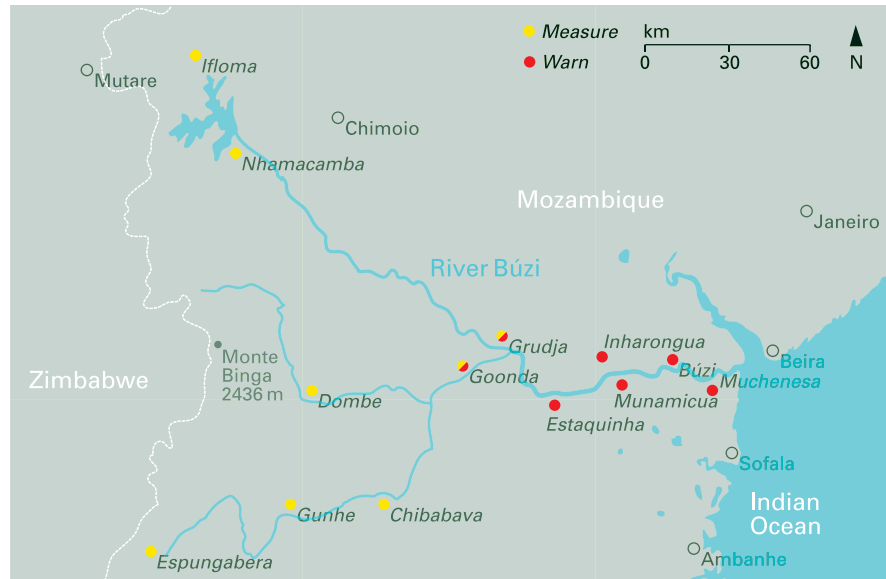
As the region is very flat, floods transform whole areas into vast lakes in a matter of hours. In 2000, people had been forced to seek refuge on bridges that protruded above the waters.

Not everyone made it to safety; many drowned in the flood waters.



## Red flag signals danger

Efficient warning systems are a vital part of any viable prevention strategy. The Munich Re Foundation's Mozambique flood-warning system project has been involved in setting up a simple but effective early-warning system along the River Búzi since 2005. Representatives of the German Agency for Technical Cooperation (GTZ), actively involved in the country for many years, developed a warning system adapted to the specific needs and skills of the people. The way it works is remarkably simple: village officials take daily precipitation readings at strategic points along the Búzi river basin. At the same time, they monitor clearly marked gauges on the river. If precipitation is particularly heavy or the river reaches critical levels, this information is passed on by radio. If reports reaching the control centre indicate widespread heavy rainfall, the alarm is raised. The gauges along the river are vital monitoring devices. Special training ensures that people are fully aware of the risk. Blue, yellow or red flags are raised depending on the flood-alert level and an army of helpers spreads the warning by megaphone. Critical areas are evacuated.



A number of villages located in the river basin have set up local disaster-prevention groups helped by experts from Honduras who have successfully installed a similar community-based system in their own country. The Central American experts prepared training material and coordinated the flow of information between those involved on village, district and provincial levels.

The map shows the River Búzi project. Precipitation and water levels are recorded and forwarded to the control centre. A flood warning is issued if there is widespread heavy rain.

### Alert level

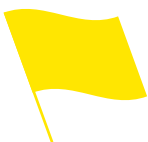
### Signification

### Action



Threat of storm-force winds within the next 48 hours, and within 24 hours at the earliest

Secure all items which could be torn loose by the wind (loose roofing materials, fences, scaffolding, aerials, outdoor furniture, plant pots, etc.) Factory premises: Take appropriate safety measures. Moor boats safely.



Storm-force winds and heavy rainfall within the next 24 hours

Secure doors and windows. Stock emergency food and water supplies. Schools close. Factories stop work. Evacuate flood-prone areas as quickly as possible. Secure watercraft and fishing vessels against storms. Heed the latest storm warnings.



Storm-force winds or threat of storm-force winds within the next six hours

Secure doors and windows. Take final safety precautions. Do not go outdoors. Roads and bridges also close. Round-the-clock radio bulletins.



## Success factors

### Experienced project partners

Experts with years of experience in the area of development cooperation manage the project in the field. The project leader, Wolfgang Stiebens, sent to the area by German consortium Ambero-IP Consult on behalf of the German Agency for Technical Cooperation (GTZ), has worked in the country for 15 years and knows the people and their needs.

### Propagation

Adoption of a successful scheme (from Honduras). Experts who have set up similar flood-warning systems in Central America have come to Mozambique to train the people there. This avoids having to reinvent the wheel.

### Testing and practice drills

Regular testing of the system as a whole and practice drills for everyone concerned at least once, every autumn, before the start of the rainy season.

### Ownership

The people along the river and the local government understand the system and are responsible for it.

Officials are selected and formally appointed. This enhances their status, which helps to ensure that they take their duties very seriously.

Follow-up training for the officials and regular mustering of the village communities so that people maintain their vigilance.

Hand-drawn risk map and satellite image. Modern technology can be used to verify the accuracy of the risk and evacuation plans drawn up by the local communities and ensure that individual perception of the

surrounding area is not significantly different from the reality. The high-resolution satellite image shows the geographical features around Muchenesa compared with the way the people see their surroundings.



## Flood-warning system a success!

An emergency drill marked the conclusion of work at Sofala on the Búzi. A viable warning system was handed over to the District Administrator – in time for the December to March rainy season.

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When the province of Sofala was struck by Cyclone Favio, more than 2,000 people along the River Búzi and their possessions were evacuated to emergency accommodation centres.

In the wake of Cyclone Favio, there were severe floods along the river from 25 February 2007. The different levels of alert had been progressively issued from 21 February onwards, using the available means (radios, megaphones, etc). People living along the river then sought refuge in areas less liable to flood.

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The Category 4 cyclone struck the Búzi area on the evening of 22 February. Strong winds and heavy precipitation caused major damage. In the villages along the river, precipitation readings regularly topped the 250 mm mark. The rivers rose rapidly. 12,800 people were at risk, but they had been well prepared. The district's disaster-mitigation committee had alerted threatened villages two days previously and announced evacuations. Despite initial resistance in Mandiri, Guara Guara and Zindoga, for instance, the inhabitants of the danger zone were evacuated to safe areas in less than two days. Around 2,300 people were taken to emergency accommodation centres. The District Administrator played a major part in coordinating and directing the operations.

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On 25 February, low-lying areas along the river around Búzi and parts of the district capital were under water. There was extensive property damage. Many buildings had lost their roofs. In all, four people were killed and 76 injured in the disaster zones, which extended from Vilankulos (in the province of Inhambane) to the River Búzi. Without the warning system, the figures would have been much higher.

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The deputy director of the INGC (National Disaster Management Institute) thanked the helpers and singled out the SIDPABB (Inter District Operational Flood Warning System for the Búzi River Basin) for special praise.

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## Chronology of Cyclone Favio 2007

Abridged version of the original flood report drafted in February 2007 by Sérgio Sional Moiane, head of the district government responsible for the Búzi:

**20.02.2007** The district government receives a blue-alert storm warning (cyclone approaching within the next 48 hours) advising that severe Tropical Cyclone Favio is on its way. In the afternoon, the Búzi district government convenes a meeting in order to decide what action to take. The assessment and prognosis group of the SIDPABB (Inter District Operational Flood Warning System for the Búzi River Basin) is asked to monitor rainfall and water levels along the rivers.

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**21.02.2007** The district government receives a yellow-alert storm warning from the provincial government, indicating that Favio will arrive in 12 hours. The CENCOE (disaster operation centre) district office is advised and accordingly working groups are formed. Using two-way radios provided by SIDPABB and the local community and the services of the local council, the heads of the administrative centres and members of the local disaster-prevention committees are instructed to raise the warning flags and alert people to the approach of Cyclone Favio.



Altogether some 300,000 people were affected by the floods in Central Mozambique in the period between December 2006 and February 2007, over half losing personal possessions. Bicycles in particular are treasured possessions in the region.



The local disaster committees of Muchenesa, Inharague, Munamicua, Grudja, Begaja, Inhanjou, Estaquinha and Mamunje raise the warning flags. They use traditional methods such as drums, whistles and megaphones to ensure that people are alerted to the danger of the approaching cyclone. All administrative centres are warned of the threat of a severe tropical cyclone. Following the instructions that are issued, people begin to leave the danger zones and make their way towards previously identified safer zones by their own means.

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**22.02.2007** With Favio due to strike in six hours' time, the district government receives a red-alert storm warning from the provincial government. Orders are issued that schools are to be closed and safety measures taken. At around 7.30 p.m., the Búzi district is devastated by Favio. Houses and electricity pylons are destroyed and the infrastructure severely damaged.

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**23.02.2007** Torrential rain is recorded. The district government monitors the rising water levels in the upper reaches of the Búzi, Lucite und Revue using readings taken at SIDPABB gauge points in Dombe and Grudja.

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**24.02.2007** Rainfall on the upper reaches of the River Búzi basin increases in intensity. The water level suddenly rises, exceeding flood-alert levels. The Búzi district government orders the mandatory evacuation of the populations of the commune of Grudja and of the Mandiri I and Mandiri II, Guara Guara and Zindoga areas of Búzi. There is initial resistance on the part of the inhabitants.

Five boats, off-road vehicles and tractors supplied by the district government and private farmers are used in the evacuation. Regional Red Cross helpers perform sterling work in the local disaster-prevention committees.

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**25.02.2007** Lower-lying, flood-prone zones in the Búzi district, including parts of the district capital, are completely awash. All access roads to Búzi itself are cut off. The deputy director of the INGC praises the work of the district government and local disaster-prevention committees.

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**26.02.2007** Work begins on compiling details of the people affected and quantifying the flood damage. The losses are dramatic but, without the disaster-prevention programme, things could have been much worse.

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Sérgio Sinal Molane  
(Administrador do Distrito do Búzi)

## Learning

Awareness of the risks has to start at an early stage – The photo shows the school in Búzi.

In rural areas, villagers gather in the shade of the trees to hear news from the capital. The flood-warning drills also took place here.

Experts from Honduras were in charge of the special training programme. They were able to contribute a wealth of experience, having set up similar systems in their own country. Photographs and maps are useful visual aids.



## Measuring



Precipitation levels are measured daily and critical readings reported. The carefully maintained plot set aside for the measurement stations shows how seriously officials take their work.

Child's play: Red markings indicate the danger levels along the river.





## Warning



Critical levels are reported to the central analysis point in Búzi. If the river reaches danger levels or there is widespread heavy rain, the alert is sounded. Coloured flags are hoisted and specially trained helpers set off on bicycles armed with megaphones to warn people along the river.

## Rescuing

The Búzi project also involves evacuation and flood-rescue drills on the river. In an emergency, people and possessions must be taken to safety as quickly as possible.

During the major floods of 2000, people often sought refuge on bridges. In next to no time, all available space was taken. This shows how important it is to have an orderly evacuation plan that uses predefined escape routes – as was the case in February 2007.



# About Mozambique

Mozambique is one of the world's poorest countries. Some 70% of its people manage on the equivalent of less than 40 US cents a day. With only about a quarter of the population (23%) living in towns, Mozambique has one of the lowest urbanisation rates in the world.

17 years of civil war, which ended in 1992, and conflicts with South Africa have cost at least one million lives and laid waste to vast tracts of land and much of the infrastructure. In addition, the region is frequently hit by natural catastrophes.

The country has suffered severe droughts in recent years, in addition to having to contend with the cyclones that strike the southeastern part of the African continent each year. Several hundred people lost their lives in heavy flooding in 2000 and 2001 (which also affected the Búzi in Central Mozambique); many more lost their livelihoods.



**Mozambique**  
 Area  
 801,590 sq km  
 Population  
 19.4 million  
 Population density  
 24 inhabitants per sq km

## Insights

Mozambique / Germany

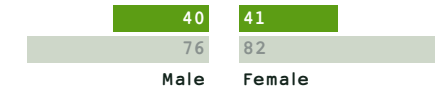
Access to clean drinking water (%)



Days of rain per year in Maputo / Berlin



Life expectancy in years



Illiteracy rate (%)



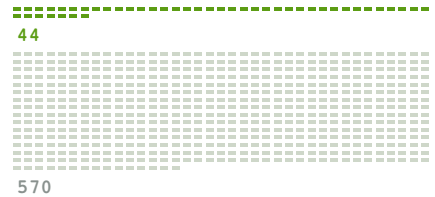
Kilocalories / person / day



Number of kilometres of tarmac roads (%)



Radios / 1,000 people





## Our regional partner

We make use of both existing structures and the experience of renowned organisations. The German Association for Technical Cooperation (GTZ) has been active in Mozambique since 1998. It has implemented a comprehensive programme designed to promote agricultural development and combat poverty. Experts from the GTZ and the World Institute for Disaster Risk Management (DRM) set up the early-warning system with the help of local experts and institutions. The ownership factor plays a vital role in ensuring the support of the people of the Búzi District. Long-term success relies to a great extent on the support and help of village elders, mayors and the District Administrator. Volunteers from Munich Re's South African office are also helping with the project and were responsible for monitoring the situation.

### Picture credits

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Inter District Operational Flood Warning System for the Búzi River Basin (SIDPABB), Wolfgang Stiebens, Maputo/Mozambique  
Pages 5 top, 13 top, 15

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