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BUILDING CAPACITY FOR DISASTER PREPAREDNESS

Mozambique MIND Final Report

SEPTEMBER 30, 2005

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At a family compound on the banks of the Save River, women process maize while listening to one of the first Freeplay self-powered radios distributed by MIND.

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The author's views expressed in this publication do not necessarily reflect the views of the United States Agency for International Development or the United States Government.



Source: *Atlas* p. 19
Mozambique shares the Limpopo Basin (delineated in brown) with three neighboring countries, making disaster management an international matter.

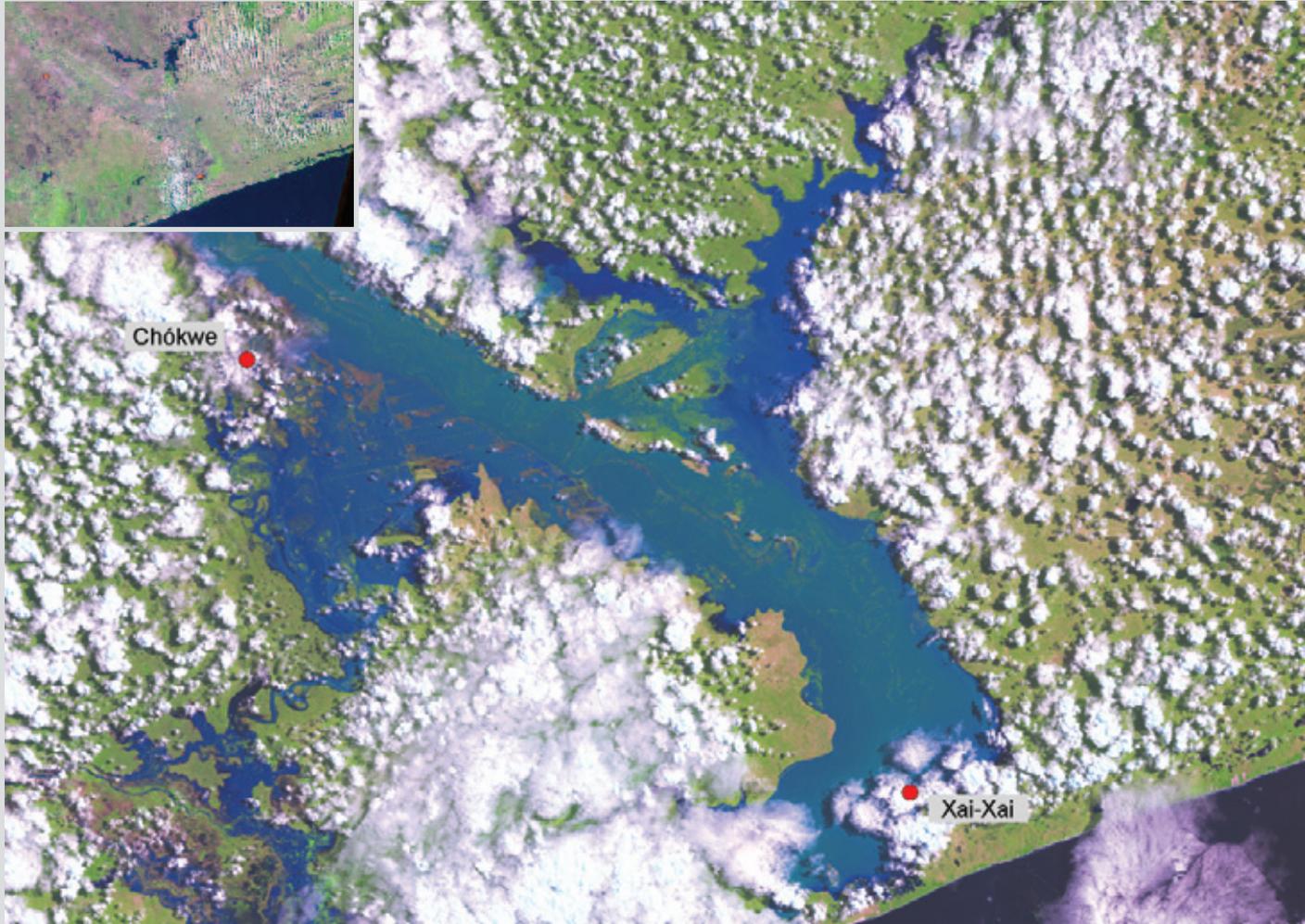
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ON THE COVER: (color photo) A secondary school student in Nova Mambone holds a blue warning flag from the Cyclone Early Warning System kit given to community members selected for their leadership. Children at all grade levels study the system of alerts, using the *Atlas* as a textbook.

(black and white) This measuring rod along the Save River shows that the area is in the midst of a serious drought. But when the river is rising, readings are taken three times a day to monitor the threat of flooding.

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Source: *Atlas* p. 11
Satellite photos of the Limpopo River document the extent of inundation in 2000. The small inset map shows normal conditions.

EXECUTIVE SUMMARY

In 2000 and 2001, a series of floods and cyclones overwhelmed central and southern Mozambique, revealing serious shortcomings in the nation's disaster preparedness and response systems. To strengthen Mozambique's ability to prevent human losses and economic disruptions from these natural hazards, USAID allocated \$4.7 million to the four-year Mozambique Integrated Information Network for Decision-making (MIND) project.

Through upgrades in data gathering, knowledge creation, and information sharing, MIND strengthened early warning systems for floods and cyclones and helped improve disaster management and contingency planning. In the process, MIND fostered networking and built Mozambican capacity to unprecedented levels. MIND combined a spectrum of tools — from high-tech, satellite-derived rainfall estimations to multicolored cyclone warning flags, from Internet-based radio broadcasts to wind-up radios — to ensure that appropriate information reached decision makers at all levels, and supported and

expanded early warning and response networks at the local level.

MIND found a natural home within the respected and well-established Famine Early Warning System Network (FEWS NET) activity, which has been working in southern Africa since the early 1990s to provide timely and reliable early warning and vulnerability information. FEWS NET has focused mainly on food insecurity caused by drought, which is a slow-onset disaster. The MIND project applied the same approach to predict and prepare for cyclones and floods — both rapid-onset weather events with enormous potential to affect food security and livelihoods.

One of MIND's major accomplishments was the *Atlas for Disaster Preparedness and Response in the Limpopo Basin*, published in 2003 in English and Portuguese. This groundbreaking work unified in a single, authoritative source accurate maps, recent data, original research and analysis, and information to respond to floods,



Eduardo Mondlane University (UEM) in Maputo partnered with the National Institute for Disaster Management and MIND to build a GIS program in the university's geography department.

cyclones, and droughts. The *Atlas* contains maps and data from the Limpopo Basin on “traditional” atlas topics (roads, schools, populations, soils), a detailed picture of how different socioeconomic groups obtain their livelihoods, and scenarios of the likely impacts of various disasters on households and local economies. The book was distributed widely and local workshops introduced it as a tool for disaster planning.

Though floods have not recurred in the Limpopo Basin since the *Atlas*' release, government and aid agencies have used it to assess and respond to recent droughts and food insecurity. Schools, development agencies, and the private sector use it for their own purposes; Mozambican and international researchers draw on it for many types of analyses and studies. The *Atlas* has received international recognition as well.

Malawi, Zambia, and Angola sent delegations to Mozambique to learn how it was prepared. South Africa, the regional powerhouse, invited Mozambique to share its experience in developing the *Atlas* and incorporated the *Atlas* into its own Internet-based vulnerability atlas. Embassies in Brussels and Paris refer to the *Atlas* to answer requests for information on Mozambique.

Benefits arising from the process of creating the *Atlas* are as – if not more – important than the book itself. The project built long-term human capacity for the country, created linkages between key institutions, and spurred demand for high-quality information for disaster management and national development. The *Atlas* brought to the table more than 100 people from government agencies, international and nongovernmental organizations,

and community groups and united them in a common purpose: to reduce Mozambique's vulnerability to natural disasters that impede sustainable economic development and threaten food security.

The Government of Mozambique provided leadership and political will. The *Atlas* provided the way, catalyzing a participatory process that embodied and supported democratization. Working on the *Atlas* established firm partnerships among many institutions, including MIND's unique collaboration with Eduardo Mondlane University (UEM) and the National Institute for Disaster Management

(INGC). The nation went from having zero geographic information system (GIS) capacity to a fully equipped, state-of-the-art computer laboratory and an academic program in UEM's Department of Geography. The *Atlas* trained a cadre of committed, talented Mozambican professionals to use the latest technological tools.

The *Atlas* presents a complete picture of the impact of the last floods and a scientific basis for making decisions about rescue, relief, resettlement, and planning. Its solid documentation of events and synthesis of information make it the reference of record. It is an educational instrument that guarantees administrators



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Sérgio Maló (pink shirt), one of the first UEM students to learn GIS mapping through MIND, now teaches these skills to others.

and planners have a baseline against which to assess future events.

The *Atlas* describes the early warning systems that MIND created and introduced. The flood early warning framework established for the Limpopo Basin, through technical assistance from the United States Geological Survey (USGS), enables Mozambican water agencies to model river basins,

forecast future rainfall, and measure water levels at key sites along a river. This allows specific villages to be warned of imminent risk and emergency responders to initiate preparedness well before floods reach populated areas. As an indication of the success of the capacity-building effort, Mozambican agencies are expanding the USGS model to other basins and training regional water authorities on its use.



Source: *Atlas* p. 78

The Stream Flow model developed by USGS/MIND and ARA-Sul produces maps showing areas under water in mild, moderate, or severe flood levels; the software automatically generates a list of towns to notify.

“ If RANET lives up to its full potential, it should be stronger than traditional community radio because it will have the ability to download information from the satellite. ”

**LORENZO NESTI, OXFAM
SPAIN/INTERMÓN**

MIND acted quickly to fund the country's first cyclone early warning system (CEWS) in time for the 2001-2002 rainy season. While other partners worked to improve the National Institute of Meteorology's (INAM's) ability to track cyclones in the Mozambique Channel with radar, MIND worked with INAM to create public awareness of cyclone risks. The CEWS uses colors to tell remote, often illiterate communities when a cyclone will hit; numbers from 1 to 5 rank storm intensity and indicate potential damage to local houses and crops. Flags, posters, stickers, and local language radio help disseminate the system. Solar and wind-up radios have been distributed in high-risk communities to overcome low radio ownership and the high cost of batteries.

MIND's latest effort to enhance the communication of disaster warning messages is RANET. This innovative global initiative harnesses the power of the

Internet and disseminates real-time information to isolated communities via satellite while providing communities with their own local radio station in times when no disaster is looming. MIND also trained journalists to report weather information clearly and in actionable form, whether for decision makers in Maputo or vulnerable villagers living along a river.

MIND achieved significant progress only because it managed to rally people around a common goal to form partnerships, identify problems, and work together toward solutions. The *Atlas* epitomizes this spirit of collaboration, but MIND's other activities also illustrate what can be accomplished when non-traditional partners work together for the common good.



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TOP: The floods in 2000 inundated entire villages.

MIDDLE: The lower Limpopo Basin is virtually flat, so residents evacuated their belongings to the only high ground available, often in trees, and waited for rescue.

BOTTOM: Droughts and severe water shortages are very common throughout southern Mozambique, especially in the Limpopo Basin.

CHAPTER I

THE FLOODS OF 2000: A TIME OF RECKONING

The year 2000 brought more than the new millennium to Mozambique; it also brought an early and heavy rainy season, and a series of cyclones that dumped unprecedented amounts of water on Mozambique and upstream in neighboring countries, from whence it flowed downstream to overwhelm Mozambique's southern and central river basins. Entire communities were inundated in the worst flooding in 150 years.

More than 500,000 people in the Limpopo Basin were displaced; 700 lost their lives. Damage and destruction of homes, schools, health clinics, roads, railways, irrigation systems, electricity, water systems, and other infrastructure were extensive and widespread. Macroeconomic losses were estimated at \$600 million; Mozambique's economic growth

rate declined from a projected 8-to-10 percent to 2 percent.

Many families who had lost everything during decades of civil war and had struggled to rebuild since peace arrived in 1992 lost everything again in the 2000 floods. Dramatic images of people clinging to treetops as rescue boats circled and helicopters hovered were televised throughout the world. The mother who gave birth in a tree and her baby, Rosita, came to symbolize Mozambicans' resilience and tenacity. The international community responded generously to the Government of Mozambique's appeal for help.

The United States Congress authorized a \$136 million supplemental appropriation for post-flood reconstruction and disaster mitigation, to be administered by the United States

“ The 2000 floods woke us up to the fact that we had an institutional framework that didn’t work. There was no code of conduct. People didn’t know what to do when the storms struck. Now we have identified the safest places to go in case of emergency. ”

**FILIFE LÚCIO, DIRECTOR,
NATIONAL INSTITUTE OF
METEOROLOGY (INAM)**

Agency for International Development (USAID). Most of the funds went toward rebuilding roads and infrastructure. To help people get back on their feet, \$10 million were distributed quickly to 106,280 families as direct cash grants to female heads of household, and about \$22 million were disbursed as loans to small businesses and farmers.

USAID and officials in Mozambique understood that the country would continue to face droughts, floods, and cyclones. An average of one tropical storm or cyclone, three or four tropical disturbances, and one flood hit Mozambique annually. Over the last 20 years, an estimated 8 million Mozambicans have been affected by natural disasters, setting back sustainable economic development significantly.

When the Limpopo began flooding in early 2000, people assumed that their usual coping strategies would serve them. Historically, farmers have practiced flood plain recession agriculture along the banks of the Limpopo and other major rivers, which regularly overflow and nourish the soil. But the duration and magnitude of the 2000 floods came as a surprise, and they were followed in 2001 by further serious flooding along the Zambezi, the largest river basin in the country. How could Mozambique do a better job of predicting, preparing for, and living with its weather?

The key was to strengthen the country’s ability to prevent human and economic losses through contingency planning, and disaster preparedness and mitigation.

USAID/Mozambique allocated \$4.7 million to the four-year Mozambique Integrated Information Network for Decision-making (MIND) project to reduce risk from natural hazards. The USAID Office of Foreign Disaster Assistance (USAID/DCHA/OFDA) also contributed funds to MIND.

MIND found a natural home within the Famine Early Warning System Network (FEWS NET) activity, which has been working in southern Africa since the early 1990s to provide timely and accurate early warning and vulnerability information. Traditionally, FEWS NET has focused on food insecurity caused by drought, which is a slow-onset disaster. MIND applied the same approach to predict and prepare for cyclones and floods — rapid-onset disasters with enormous potential to affect food security and livelihoods. MIND monitored remotely sensed, satellite, and ground-based meteorological data; bolstered them with on-site, real-time research; and strengthened local early warning and response networks.



LEFT: The fertile areas along the Limpopo River have two or three growing seasons per year but face significant flood risks. The livelihoods of people in these zones are characterized as high risk and high return.

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RIGHT: The river is the central feature in nearly all livelihoods in the Limpopo Basin. Areas away from the river are semi-arid and very sparsely populated.

© CDFI, MAPUTO



FEWS NET's participatory framework and focus on networks and coordination helped MIND maximize its resources and those of its partners. Cooperating with the Technical Secretariat for Food Security (SETSAN), a multi-agency consortium led by Mozambique's Ministry of Agriculture, MIND built upon FEWS NET's vulnerability assessment methodology

to help map livelihood zones and likely outcomes of potential disasters based on their severity and the coping strategies and resources of distinct livelihood groups. Through capacity-building support to SETSAN's Vulnerability Assessment Committee (VAC), MIND was able to address critical information gaps in understanding the impact of disasters.



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TOP: Brochures explaining the Cyclone Early Warning System were distributed to public schools as part of a continuous education campaign.

MIDDLE: Traditionally, drums were used to sound the alarm where a disaster loomed. These traditional signals are being incorporated into the new Cyclone Early Warning System.

BOTTOM: At the Red Cross headquarters in Nova Mambone in the Govuro District of Inhambane, young volunteers report river-level readings via radio to relevant authorities.

CHAPTER 2

RELIABLE DATA FOR DISASTER MANAGEMENT

“ Solid information informs our decisions on food aid. That’s why the FEWS NET vulnerability assessments and monthly reports are invaluable. Without data, we can’t do anything. We justify our requests for funding, decide on interventions, and base our recommendations to USAID and the World Food Program on data. ”

**SUZANNE POLAND,
USAID DEPUTY TEAM
LEADER FOR RURAL
INCOME GROWTH AND
FOOD FOR PEACE OFFICER**

The floods of 2000 and 2001 showed that the Government of Mozambique was not fully prepared for large-scale disasters. To learn what would improve the emergency preparedness system, MIND staff interviewed people involved in the relief responses to the Limpopo and Zambezi floods from national, provincial, and local government; United Nations agencies; donors; and nongovernmental organizations. MIND’s survey identified critical information gaps that undermined Mozambique’s ability to cope and contributed to damage and loss. For example:

- Accurate weather forecasting, information on flood risk, and clear messages about what actions to take were not available or arrived too late for people to mitigate losses.
- People didn’t trust the information they did receive.

Farmers had acted on earlier weather forecasts that had proved to be false alarms and had suffered economic setbacks.

- People got flood warnings, but did not believe that the floods would be as bad as they were or last as long as they did. While households have coping strategies for minor and moderate floods, the Limpopo floods of 2000 were beyond anyone’s imagination or memory.
- People didn’t know how to interpret the information they did receive because it was given in technical terms, such as “knots” to describe wind speeds and “moving southwest” rather than naming the towns in the path of floods and storms. Information was not specific enough and didn’t convey levels of risk.

People didn't know whether to hang on or run for their lives.

- Previous assumptions were false. Areas that had been above floodwaters in 1977, the most serious flood older adults could recall, were regarded as high ground, and therefore safe. Over the years, people had moved there, only to be inundated in 2000.

Repeatedly, MIND researchers heard that information crucial for planning, mitigation, preparedness, response, and recovery was inaccessible, inaccurate, contradictory, or missing. Much information existed inside and outside of Mozambique, but it was not available to people who needed it. Maps used in rescue efforts were woefully out of date. Emergency responders reported that they did not have the names and coordinates of affected villages. In the 2001 floods, rescuers could not locate some tributaries of the Zambezi on a map.

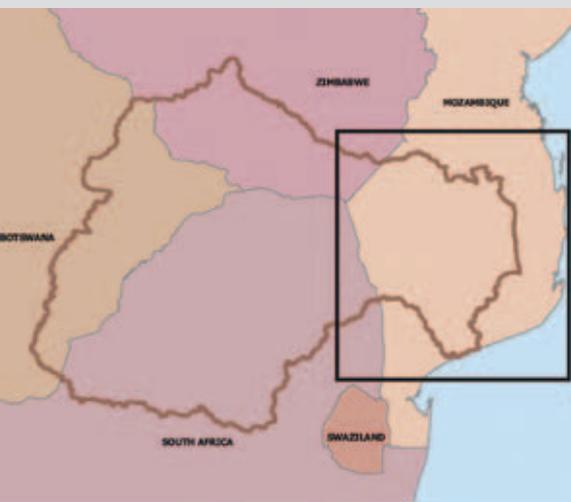
Data on rainfall, river levels, and discharges from major dams were not widely available because of an inadequate national rainfall measurement grid and the small number of river gauges. Information on the precise spatial extent of the flooding and

the vulnerability of affected populations was absent.

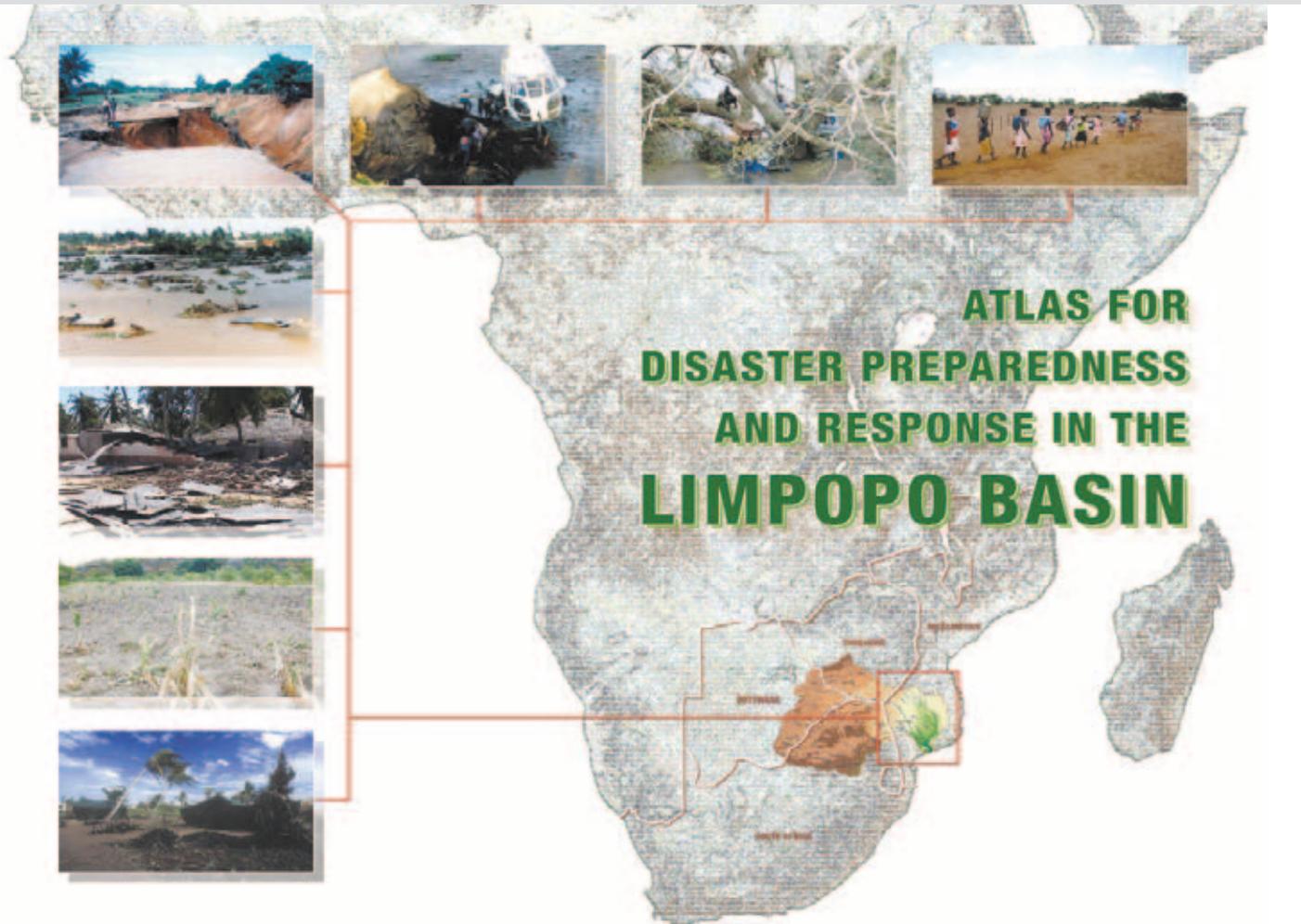
There was no single, official source of information on floods or river systems. To remedy these information and communications gaps, MIND proposed the *Atlas for Disaster Preparedness and Response in the Limpopo Basin*. As a tool for disaster management, it would harness the power of integrated information to:

- Bring reliable data together; where information didn't exist, MIND generated it.
- Disseminate data and information in real time directly to those who needed it.
- Organize and present the information so that it is useful to people at every level of government, in international development and relief agencies, and in local communities.
- Present information by river basin rather than by administrative units such as districts and provinces.

THE LIMPOPO BASIN WITHIN MOZAMBIQUE



Source: Atlas p. 27
 Within Mozambique, the Limpopo River Basin spans 16 districts, in which levels of social and economic development vary widely. MIND researchers examined various indicators of human welfare in each district: poverty prevalence, source of household water supply, type of sanitation, and radio ownership.



Source: *Atlas cover*

The *Atlas* brought together data on the hazards, resources, and livelihoods in the Limpopo Basin and pre-analyzed potential impacts of major disasters.

CHAPTER 3

NO ORDINARY ATLAS

“ The *Atlas* was a turning point. It cast a wider net. It aimed to reach more users and to change the ingrained, ‘constant emergency’ mentality in Mozambique. ”

CHRISTINE DEVOEST,
USAID, MIND CTO AND
RURAL INCOME GROWTH
TEAM LEADER

The *Atlas for Disaster Preparedness and Response in the Limpopo Basin* is a groundbreaking work. It furnished a scientific basis for making decisions about rescue, relief, resettlement, and planning. It is a one-stop, authoritative source of recent data, research, analysis, and other information relevant to floods, cyclones, and droughts. The *Atlas* combines maps and data from the Limpopo Basin on “traditional” topics (roads, schools, populations, soils) to draw detailed profiles of how different livelihood groups obtain food and income, and scenarios of the impacts of various disasters on households and local economies.

Benefits arising from the process of creating the *Atlas* are as – if not more – important than the book itself. The project built long-term human capacity for the country, created linkages

between key institutions, and spurred demand for high-quality information applicable to disaster management and national development.

PROCESS IS OUR MOST IMPORTANT PRODUCT

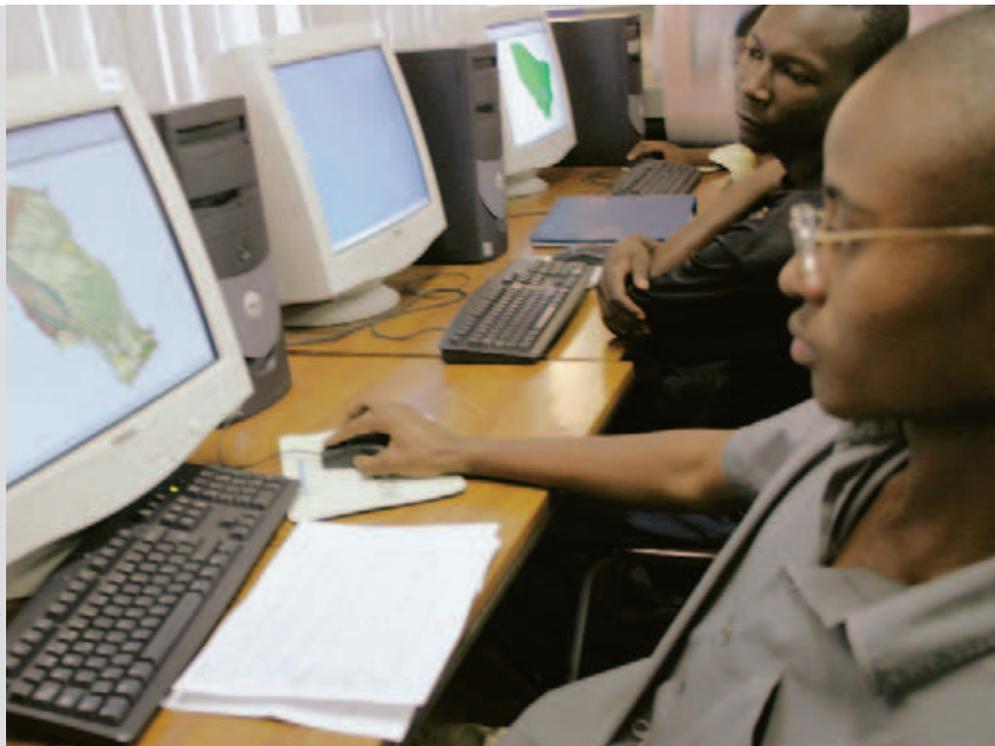
The *Atlas* galvanized collaborators, fostered consensus, and inspired cooperation. It brought to the table more than 100 people from government agencies, international and nongovernmental organizations, and community groups and united them in a common purpose: to reduce Mozambique’s vulnerability to natural disasters that impede sustainable economic development and threaten food security. The experience of the 2000 and 2001 floods created urgency; everyone was motivated to improve the nation’s ability to respond to emergencies. Collaborators had the political

will. The *Atlas* provided the way and catalyzed a participatory process that embodied and supported democratization in Mozambique.

Working on the *Atlas* established firm partnerships among the institutions that contributed to it. Early on, MIND initiated a partnership with Eduardo Mondlane University (UEM) and the National Institute for Disaster Management (INGC). MIND supplied the latest technology — computers and geographic information systems (GIS) software — and trained a cadre of committed, talented Mozambican professionals to use these tools.

Within a few years, the nation went from having zero GIS capacity to a fully equipped GIS lab and an academic program in the geography department of UEM. Professors, students, and staff of the institutional partners, none of whom had had the ability to produce even simple maps before, created nearly 100 maps for the *Atlas*. The U.S. Geological Survey and Geographic Information Management Systems gave technical support.

The emerging cartographers learned by doing. In addition to gathering and verifying existing data in Maputo, research teams drove more than 10,000 kilo-



Students use data from the *Atlas* as part of their coursework.

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Researchers traveled around the Limpopo Basin to gather information for the *Atlas*.

meters, taking geographic positioning readings of roads, villages, schools, and clinics. In addition, vulnerability assessment teams visited communities in the Limpopo Basin to understand how households live and cope with periodic shocks and to designate livelihood zones, which are geographic areas where people are subject to similar hazards and share common options and strategies for obtaining food and cash income. MIND analyzed information on the physical and human characteristics of the Limpopo Basin, developed scenarios of hazards and their potential impacts, and entered this information into the *Atlas* database.

The project engendered a continuous learning environment for and within affiliated organizations. These educational and capacity-building accomplishments were explicit goals of the MIND

project. But the *Atlas* also inspired a cascade of unanticipated benefits that touched the hearts and changed the minds of those who collaborated to pull the book together. In the course of cooperating to produce the *Atlas*, those who worked on it forged professional relationships and institutional networks that had not existed before and that spanned the national, provincial, administrative post, and community levels.

BUILDING QUALITY INFORMATION FOR DISASTERS AND DEVELOPMENT

The *Atlas* is important for technical and political reasons. Planners and public officials use it to avoid repeating mistakes.

Community authorities use it to support difficult decisions, such as relocating families to safe areas

“ People forget and rebuild in the same spots. [The *Atlas*] will keep us from going backwards. ”

MARIO UBISSE,
HEAD OF THE NATIONAL
EARLY WARNING UNIT,
MINISTRY OF AGRICULTURE

rather than allowing resettlement in high-risk locations. The *Atlas* establishes and perpetuates institutional memory, which helps bridge political transitions and changes in personnel.

AN ATLAS ON EVERY DESK

The *Atlas* presents a complete picture of the impact of the last floods. Its solid documentation of events and synthesis of information make it a record to consult with confidence. It is part of Mozambique’s collective memory of the floods, an educational instrument that guarantees administrators and planners have a baseline against which to assess future events. Its uses extend far

beyond disaster planning. It is used in various assessments by development agencies and private companies. Schools use it as a text. Mozambican and international researchers draw on it for many types of analyses and studies. The MIND project and the *Atlas* helped make vulnerability a factor in the national dialogue. Since 2003, the concept of vulnerability has been included in at least three strategic short- and long-term planning documents. Vulnerability had not been not emphasized in the preparation of the 2000-2005 and 2005-2009 strategic plans, but “the *Atlas* helped make it important,” according to Silvano Langa, national director of INGC.

Representatives from USAID, MIND, and INGC listen to the rector of Eduardo Mondlane University describe the benefits of the new GIS lab during the opening ceremony.

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“ FEWS NET MIND brought focus to many organizations. They worked together with an unprecedented level of cooperation. MIND created networks of key qualified Mozambicans at all different levels to contribute to the knowledge pool, including those that had not contributed before. This will be the long-term legacy of the MIND project. ”

SIDNEY BLISS,
USAID NGO FOOD
SECURITY LIAISON



MIND’s staff meteorologist had to stretch to reach the high-water mark in Jofane; the ruler on the building is a constant reminder of flood risk.

The 2004 constitution included a component on emergency response for the first time.

The *Atlas* has international uses as well. Malawi, Zambia, and Angola sent delegations to Mozambique to learn how it was prepared. South Africa, the regional powerhouse, invited Mozambique to share its experience in developing the *Atlas* and incorporated the *Atlas* into its

own Internet-based vulnerability atlas. Embassies in Brussels and Paris refer to the *Atlas* to answer requests for information on Mozambique. When the new U.S. ambassador to Mozambique asked about disaster preparedness and progress since 2000, MIND staff realized that many embassy personnel had not been in Mozambique during the floods. The *Atlas* can serve as their introduction to the country.

SUCCESS STORIES

On-the-Job Training in GIS



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Sérgio Maló (top) and José Rafael (bottom) realized professional goals through the MIND project that advanced their individual careers and enriched UEM's geography program.

At Eduardo Mondlane University (UEM), MIND supplied equipment and technical assistance that transformed the lives of students and professors alike. MIND offered professional opportunities to many of the people in the geographical information systems (GIS) program, which literally made careers and allowed talented people to rise to the top.

In 2001, when Sérgio Maló was a geography student at UEM, he began a six-month internship at MIND that changed his life. Without the *Atlas*, he might have been teaching geographic theory instead of using his GIS skills to aid in Mozambique's development. At 30, he has been involved with the project for five years, mapping livelihood zones, entering data on access to food, risks, and sources of income, and creating many of the *Atlas'* other maps.

"I am very proud of the *Atlas*. I went to every district in the Limpopo Basin to publicize it," he said. His enthusiasm and talent made him stand out. First, the university hired him to teach GIS courses, using the *Atlas* as a text. Next, the World Food Program hired him, and then UN-HABITAT. His career exploding with promise, he is thinking of applying for a Fulbright scholarship. Studying disaster management abroad is attractive, but in other countries, he noted, "you study other disasters, not ours. I want to work on something close to our reality."

For José Rafael, head of UEM's GIS lab and coordinator of cartography for the *Atlas*, MIND helped realize huge improvements in his department. "When this lab was founded, the university was in the midst of reviewing its programs and creating new curriculums. I had been looking for funding to start a GIS lab, and MIND was the answer to my search. We always had a big problem doing research before," he said. "We had no computers and couldn't process information or produce digital maps. Now we can do all of that."

The primary purpose of the GIS laboratory is to teach students, he stressed. "Our work was very theoretical before. With the laboratory, we had the opportunity to put theory into practice. Our students don't have theoretical knowledge alone. They can do useful, practical work on the real problems of the country."

The program started with three hand-picked students (including Sérgio Maló) and has since increased to 20 per year. Ten to 12 students will graduate from the GIS program in 2005. Rafael's affiliation with MIND spurred him to further his own education. "I went to South Africa for my master's degree to study GIS. This has enriched not just me, Rafael, but also my role as a UEM professor: It enabled me and the department to have an international profile, to exchange ideas."

One of the most powerful benefits of the *Atlas* may be the least tangible: pride. Everyone associated with it feels ownership of it. This beautiful book has contributed substantially to Mozambique's disaster preparedness and changed perceptions about Mozambican capacity, especially among Mozambicans. According to José Rafael, a professor in the geography department of Eduardo Mondlane

University and coordinator of cartography for the *Atlas*, "When people first saw the *Atlas*, they said it couldn't have been done in Mozambique. They didn't believe it." But attitudes are changing. Now people from other countries are coming to Mozambique for assistance. And Mozambique, so often labeled one of the poorest countries in Africa, has much to share.

WHAT'S IN THE ATLAS?

The first three chapters profile weather, geography, and socioeconomic conditions in Mozambique; Chapter 4 analyzes the information presented in Chapters 1 through 3 to show the consequences of various disasters and predict outcomes by region.

Hazard Characterization. Droughts, floods, and cyclones affect Mozambique and the Limpopo Basin. Descriptions of each hazard cite the number of events and people affected over the last 20 years.

The Geographic Baseline. The longest chapter in the *Atlas* covers regional climate, international river systems, and average rainfall and gives an in-depth portrait of the Limpopo Basin, including geology, soil water-holding capacity, national parks and conservation areas, and land cover. A section on the portion of the Limpopo Basin within Mozambique highlights the provinces and districts the basin straddles and offers a demographic analysis, including population density, housing types, transportation, infrastructure, communications, and levels of poverty and radio ownership.

The Livelihoods Baseline. This chapter describes each of the four livelihood zones in the Limpopo Basin, including access to food and cash by different wealth groups. Livelihood-based vulnerability analysis is essential because it identifies what household types will be most affected by which shocks. This information can be used to reduce risk, minimize the cost of emergencies, and maximize the benefits of development.

The Scenarios. Using risk-outcome analysis, this chapter answers the question "What would happen

if...?" for floods, cyclones, and droughts of varying severity levels for each livelihood zone. The scenarios combine data on a zone's resources and vulnerability to generate action-oriented information for planning and mitigation efforts. Each scenario demonstrates how a hazard of a given magnitude might affect the basin in a particular place and time, suggests which people will require the most assistance, and lists the questions that must be posed in the immediate aftermath of a disaster and during the period of economic and agricultural recovery.

The **Flood** scenario illustrates how elevation maps, rainfall estimates, river level measurements, and forecast flow rates are used to predict potential floods and describes the three flood early-warning levels developed by Mozambique's Southern Regional Water Administration (ARA-Sul), INAM, and USGS/MIND.

The **Cyclone** scenario describes the early warning system established by INAM, INGC, and MIND to alert communities that a storm is coming. Illustrations show the widely publicized color-coded system that tells how soon a storm will arrive and its severity.

The **Drought** scenario analyzes the spiral of consequences of regular, prolonged droughts, beginning with detection through use of satellite imagery, assessment of production losses, evaluation of coping capacity among households of different wealth levels, and the impact of response and recovery efforts on human health, nutrition, and livelihoods.

“ The *Atlas* is considered an extremely useful tool by the Southern Regional Water Administration, the Department of Agriculture, and urban housing planners. Its preparation enabled my institution to make great gains since 2000. It raised our consciousness that we have to learn to live with risk. I would like to have it replicated for all the other river basins. ”

SILVANO LANGA, DIRECTOR,
NATIONAL DISASTER
MANAGEMENT INSTITUTE
(INGC)

WHAT MAKES THIS *ATLAS* SPECIAL?

All information in the *Atlas* is useful in emergencies; this was the main criterion for selecting content. Major partners, regional disaster specialists, geographers, cartographers, hydrologists, spatial analysts, and experts in GIS, remote sensing, and vulnerability and livelihood assessment convened and agreed that the *Atlas* would consist of four chapters (see box, p.15).

One of the highlights of the *Atlas* is the way it harnesses GIS to allow users to store, organize, and manipulate different types of data and represent them spatially in map form. Visual presentation of these data, and the possibility of layering one kind of data over others, conveys a wealth of information in an instant. Imagine a map of inundated areas on which a map of towns and settlements is superimposed. Population centers under water can be identified at a glance. Overlay a map of health clinics, and the level of medical assistance necessary in an emergency becomes apparent. Do the same with a map of areas under cultivation, and a quick evaluation of lost harvests can inform the need for food assistance. Such analyses can be done in minutes, saving precious time in an emergency.

FORMATS FOR MANY USERS

The *Atlas* was designed and produced in four formats to serve as many users as possible.

The baseline data and the analyses are the foundation for all of these products.

- **Print.** The hard copy, issued in November 2003, was the first of the four distinct but related products of the MIND project. Its many maps, charts, and graphs display an artist's attention to color and composition.
- **Interactive digital version.** The entire content of the print version, plus additional information, is available on CD. (A PDF version is on the CD that accompanies this report). Text and maps from the *Atlas* can be viewed, cut, and pasted into other documents. The digital version features simple interactive functions. Users with minimal technical skills can customize maps from *Atlas* data or create new ones.
- **Full database.** For more sophisticated technical users, the CD contains a complete database and files of original *Atlas* research, which can be used for many mapping applications.
- **Internet/real time version.** The *Atlas* is available on the Internet through the Technical Secretariat for Food Security and Nutrition (SETSAN) at www.setsan.org.mz. This version is accessible worldwide and allows data updates and analyses during an emergency.

“ Mozambicans are now equal to their counterparts in other countries. They increasingly attend multinational forums, and their reports bubble to the top as the best work. The Mozambique delegations are no longer the weakest link or the poor country cousin. They have experienced competence, and their success feeds their capacity. ”

SIDNEY BLISS,
USAID, NGO FOOD
SECURITY LIAISON

In November 2003, the Portuguese and English versions of the *Atlas* were officially launched in print and interactive digital form in Maputo and Xai-Xai, a town at the mouth of the Limpopo River hard hit by the floods. The foreign minister of Mozambique sent congratulations, saying the work was “of great value” to the country. Teams of representatives from MIND, INGC, and UEM visited all 11 districts in the Limpopo Basin to introduce

and distribute paper and digital copies of the *Atlas* and to leave large, laminated, wall-size maps at municipal offices, schools, and clinics. Workshops in each locale familiarized district government officials, heads of administrative posts, members of provincial and local emergency planning agencies, and community leaders with the *Atlas*, explaining why and how it was produced and demonstrating how to use it for disaster planning.



Source: *Atlas* p. 65
MIND created district maps, showing the exact locations of villages, health facilities, schools, roads, and suspected mine areas. MIND partners distributed wall-sized copies of these maps to local authorities, many of whom had only handdrawn maps of their districts before.



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In ARA-Sul's river modeling center, Rodrigues Dezanove predicts which areas will flood and sends bulletins directly to government agencies, NGOs, and the media.

CHAPTER 4

THE FLOOD AND CYCLONE EARLY WARNING SYSTEMS

“ In 2000, we couldn’t tell where the floods would occur. Now we can.”

RODRIGUES DEZANOVE,
ARA-SUL

Though sometimes related, floods and cyclones are different events requiring distinct early warning systems. Both systems depend on data collection and analysis, and on dissemination of urgent information to vulnerable communities. MIND worked to improve the information side, as well as the critically important communication side, of the preparedness equation.

To strengthen data collection and analysis for the two early warning systems, MIND worked closely with the technical agencies responsible for monitoring floods and cyclones — the regional water authorities (ARAs) and INAM.

FLOOD EARLY WARNING SYSTEM

With the support of a USGS technical expert assigned to MIND, ARA-Sul staff built river

modeling software around the characteristics of the Limpopo Basin. MIND funded equipment to measure river levels, radios to speed communication of information from upstream to downstream, and computer and GIS facilities to analyze data.

ARA-Sul generates flood warnings for specific locations through a river modeling program that overlays satellite data on current and forecast rainfall with the *Atlas*’ baseline information on land cover, evaporation, elevation, soil characteristics, and water penetration level. Satellite rainfall estimates are also compared to rainfall measurements from ground stations. It takes only 20 minutes to run the model and get the results. The computer automatically produces inundation maps and a list of communities that should receive first-, second-, and third-level



NATIONAL INSTITUTE OF METEOROLOGY (INAM)

LEFT: INAM's ability to track cyclones before they hit Mozambique's coast was greatly improved through important technical upgrades, like this radar station in Xai-Xai in 2004.



©CHEMONICS 2005 (JOEL CHIZANE)

RIGHT: When INAM tracks cyclones through radar and satellite, information is conveyed to local officials who hoist the appropriate color CEWS flag.

“ The very first year of the cyclone early warning system, the color codes were broadcast on television. Cyclones that year did not result in loss of life. People lost homes and fields, but not their lives. ”

**SUZANNE POLAND,
DEPUTY TEAM LEADER
FOR RURAL INCOME
GROWTH AND FOOD FOR
PEACE OFFICER**

alerts. Warnings are transmitted immediately via high-frequency radio to government agencies at all levels; nongovernmental and civic organizations, such as the Red Cross; and radio, television, and newspapers.

ARA-Sul has adapted and applied the flood model to the Incomati, Maputo, and Umbeluzi river basins and is training personnel from ARA-Centro, MIND's major partner in flood early warning work in the Save River Basin, where MIND provided equipment to improve flood monitoring along the site of very serious flooding in 2000 and 2001.

CYCLONE EARLY WARNING SYSTEM (CEWS)

Though more than 5 million Mozambicans live in high-risk cyclone zones, there was no system in place to receive cyclone information and transmit it to communities in the path of a storm. MIND hired the former director of meteorology for Western Australia, an expert on cyclone early warning systems, to collaborate with INAM and MIND's meteorologist on CEWS. The team traveled to communities most vulnerable to cyclones to consult residents and assess probable cyclone damage based on local housing construction and vegetation patterns.

“ There is strong universal support for the new tropical cyclone warning system. . . Community leaders had a good understanding of [it]. Many of them had received training from aid agencies, and [were] passing their knowledge down to villages and communities. ”

**LEONARD BROADBRIDGE,
FORMER DIRECTOR OF
METEOROLOGY FOR
WESTERN AUSTRALIA AND
MIND CONSULTANT,
AFTER A VISIT IN 2004 TO
EVALUATE THE CEWS**

MIND then created a color-coded alert system with numerical rankings to indicate storm severity. With support from MIND, a working group of more than 14 agencies from government and civil society developed colored flags, posters, brochures, and other educational materials and made them freely available for any organization to reproduce and distribute. Publicizing CEWS through the schools is a long-term process that will continue until all children are brought up with the system and all remote communities have been reached.

Implementation involved many partners, including the Ministries of Education and State Administration; INGC and INAM; the Mozambican Red Cross and other civil society organizations; and the media. INAM launched the new system in November 2002. All of the season's cyclones were tracked using the new system, and by the end of the season, INAM, INGC, and the press were all quoting the coding system developed with MIND support. International donors and non-governmental agencies have been indispensable in disseminating the system at the local level. GTZ, the German development agency, has worked with communities in the Búzi District, including a full simulation of a cyclone event to test CEWS. The Mozambican Red Cross has fully integrated CEWS into its disaster preparedness activities and has trained its volunteers around the

country. Action Aid in Pebane and Oxfam in Govuro have built CEWS into their risk-reduction activities. DFID, the British development agency, and UN-HABITAT have produced instructional card games and other learning materials for children based on the CEWS and information in the *Atlas*.

GETTING THE MESSAGE OUT

The most important feature of cyclone and flood early warning systems is communicating to vulnerable communities.

Mozambique did not have the efficient communications systems required for timely emergency alerts. Although the technical agencies can now track cyclones via satellite and radar due to recent technical upgrades, communities about to be hit by a cyclone or flood are often unaware of its existence, especially in Mozambique, where isolation, illiteracy, and poor communications are common.

MIND commissioned a study to learn how early-alert efforts had worked during the floods of 2000 and to identify specific measures to improve them. This research confirmed that radio was the overwhelming source of flood warnings to at-risk populations. The report revealed that 95 percent of people interviewed in four districts of Gaza Province had received advance warning of the floods. Almost 45 percent learned of the floods by radio, and 25 percent were informed by

neighbors or local organizations that had gotten the news by radio. The pivotal role of radio in the early warning process was emphasized repeatedly.

MIND diagnostics following the 2000 and 2001 floods also revealed that warning messages had lacked timeliness, detail, and clarity, so that final users either did not get accurate information soon enough to act on it or did not know what to do with the information they got. To improve the content and clarity of media reports, journalists received MIND training on disaster topics. The distinction between message dissemination and communication is important. Dissemination refers to the simple provision of information; communication refers to sharing the meaning.

During the 2000 and 2001 floods, the media did a reasonable job of disseminating the warning messages received from technical bodies, but journalists' ability to communicate the meaning of those messages was limited. The media often reported how many millimeters of rain fell, or the depth of rivers at given points, or the latitude and longitude of a cyclone. But this technical information meant little to most users, whether they were decision makers in Maputo or vulnerable villagers living along a river.

MIND realized that journalists were the primary interpreters of disaster information, as well as

providers of education to the public about the early warning systems. The 2000 and 2001 experiences had made it clear that reporters did not know how to translate technical information for the public. MIND organized a study tour for four reporters to the Cahora Bassa hydroelectric dam, and to the annual South Africa Regional Conference Outlook Forum meeting in Malawi. In all, fourteen Mozambicans, including the journalists, attended the forum, which covered technical background so journalists could convey the meaning of rainfall and climate forecasts. Because the regional meeting was conducted only in English, MIND sponsored simultaneous translation to benefit the entire delegation. A number of articles and radio pieces resulted.

WORKSHOPS ON REPORTING WEATHER

Back in Mozambique, MIND sponsored a weeklong course for 15 radio journalists and communications officials at technical agencies involved in disaster management (DNA, INAM, INGC, ARA-Sul, and ARA-Centro). The workshop introduced attendees to technical topics; in a breakout session, journalists practiced reporting on weather-related emergencies. Several media organizations later submitted proposals to MIND to produce special programming on climatic disasters for local radio.

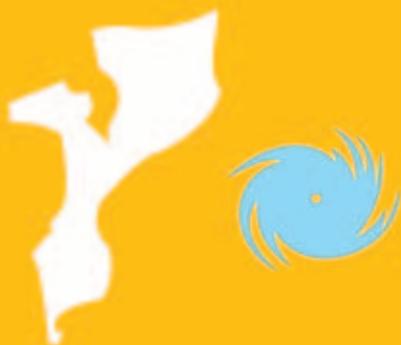
MIND supported production of many educational series for

OPPOSITE PAGE:

Source: *Atlas* p. 11
Posters hung in prominent places in the community explain the two parts of the new CEWS: the color coding, indicating the amount of time until the cyclone makes landfall; and the numerical alerts, indicating the intensity of the cyclone. Posters were designed to be understood by illiterate or semi-literate rural communities.

NEW CYCLONE WARNING SYSTEM FOR MOZAMBIQUE

COLORS = TIMING OF A CYCLONE'S APPROACH



BLUE ALERT

WITHIN 24 TO 48 HOURS
STRONG WINDS AND RAIN
MAY AFFECT THE AREA



YELLOW ALERT

WITHIN 24 HOURS
STRONG WINDS AND RAIN
MAY AFFECT THE AREA



RED ALERT

WITHIN 6 HOURS
STRONG WINDS AND RAIN
MAY AFFECT THE AREA,
OR ALREADY MAY BE OCCURRING

NUMBERS = INTENSITY OF A CYCLONE

CATEGORY
1

MODERATE TROPICAL STORM

SOME RISK FOR PRECARIOUSLY CONSTRUCTED HOUSES IN EXPOSED AREAS. LOOSE ROOFING SHEETS FLY. SOME DAMAGE TO CROPS SUCH AS MAIZE, CASHEW TREES, AND COCONUT TREES.

CATEGORY

2

SEVERE TROPICAL STORM

INCREASING RISK TO PRECARIOUSLY CONSTRUCTED HOUSES. MANY TRADITIONAL HOUSES IN EXPOSED AREAS COLLAPSE. SOME ROOFING SHEETS FIXED TO BATTENS FAIL. MAIZE, CASHEW AND COCONUT TREES BADLY DAMAGED OR DESTROYED.

CATEGORY

3

TROPICAL CYCLONE

WIDESPREAD DESTRUCTION OF PRECARIOUSLY CONSTRUCTED HOUSES AND LESS WELL-CONSTRUCTED BUILDINGS. INCREASING DAMAGE DESTRUCTION TO MORE SOLID HOMES. WIDESPREAD DESTRUCTION OF CROPS AND TREES. GREAT DANGER TO PEOPLE.

CATEGORY

5

VERY INTENSE TROPICAL CYCLONE

VEGETATION DESTROYED (AS IF IN A FIERCE BUSH FIRE). CATASTROPHIC CONDITIONS. EXTREME DANGER TO PEOPLE.

CATEGORY

4

INTENSE TROPICAL CYCLONE

TOTAL DEVASTATION OF PRECARIOUSLY CONSTRUCTED HOUSES AND WIDESPREAD DESTRUCTION OF OTHER BUILDINGS. MOST OR ALL CROPS AND TREES DECIMATED. EXTREME DANGER TO PEOPLE.

BASED ON WORK CARRIED OUT BY THE NATIONAL INSTITUTE OF METEOROLOGY AND THE NATIONAL DISASTER MANAGEMENT INSTITUTE, WITH SUPPORT FROM USAID/FEWS NET MIND.

An old man cradles the new model of Freeplay radio, distributed by the Mozambican Red Cross with support from MIND.

©CHEPHONICS 2005 (JOEL CHIZIANE)



“ RANET will ensure that information reaches remote rural communities. It really transforms the way we do business. It is a very powerful tool to educate the public. ”

**FILIFE LÚCIO,
DIRECTOR, INAM**

radio. Radio Mozambique in Zambézia Province aired 20 programs in Portuguese, Chuabo, and Lomué over a five-month period. The programs explained basic climate concepts and the new cyclone classification system. In Tete Province, the local media association produced 15 educational programs aimed at reducing vulnerability among people living in disaster-prone areas. The programs, broadcast in Portuguese, Nyanja, and Nyungue, included information on procedures during and after emergency situations, and on alternative sources of food available in parts of the province affected by drought.

In Sofala Province, Comunitário, an association of journalists, produced 10 radio programs in collaboration with Radio Mozambique, which broadcast them over a two-month period in Portuguese and Ndaou for

Machanga and Govuro Districts. In addition to building a culture of listening to the radio for early warning information, the programs targeted children and community activists. The broadcasts introduced climate concepts and CEWS and promoted debates on disaster issues.

RADIO IS KING

Despite dependence on radio for information in rural areas, radio ownership levels in Mozambique are very low. Poverty and weak marketing networks make batteries difficult to obtain for households that own radios. In remote rural settings particularly, wind-up and solar-powered devices offer distinct advantages.

To find ways to bridge the gap between radio dependence and ownership, MIND conducted a one-day workshop in July 2001 that examined experiences with Freeplay radios, which don't

require batteries and are powered by manual winding or solar panels. Experts from all relevant sectors attended the workshop and strongly endorsed the use of Freeplay radios for early warning in Mozambique.

MIND immediately ordered 1,800 self-powered radios, which were manufactured in Cape Town to MIND specifications (with USAID logo and Portuguese text embedded in the casing) and imported duty-free into Mozambique. MIND also signed an agreement with the Mozambican Red Cross to assist with distribution and to ensure that the radios reached beneficiaries before the 2001 rainy season began in November. To identify the 75 communities that received

the radios, MIND reviewed records on floods and cyclones to determine the locations and frequency of each type of disaster. The Red Cross list of priority districts for disaster preparedness activities corroborated which locations were most in need.

MIND worked with the Red Cross and a local artist to design posters on how to operate the radios and how to use them for disaster early warning. Traditional leaders and Red Cross volunteers selected the radios' guardians, who are influential members of the community. They signed an agreement pledging to use the radios for the public good, not for personal benefit. MIND carefully oversaw distribution at the district level.



The Mozambican Red Cross, MIND's partner among first responders, helped prioritize which locations and individuals should receive Freeplay radios.

SUCCESS STORY

The Lady of the Radio



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Gina Antonio (top), shown here with her three year old daughter, and an older family member (bottom) stand ready to alert neighbors in case of a storm.

“We heard the news on Radio Mozambique, as did the fishermen, who came to collect people,” Gina Antonio recalled. “No one imagined that it would be like that. No one knew exactly what to do. We had seawater entering the house as well as water from the river — it came up to the windows. I put the children on the table. We sheltered anyone who needed it, as if they were family.”

Gina is a Red Cross activist and community leader in Nova Mambone who has been chosen to be the keeper of the Freeplay radio. Each recipient signs an agreement guaranteeing the safety of the radio and promising to use it for the good of the community, not for personal benefit. Gina is responsible for listening to the radio regularly for important news, transmitting emergency alerts to a five-member emergency preparedness group, and rousing her neighbors. Several people in the core group are entrusted with keys to the storage areas where the Red Cross has stockpiled emergency rescue and relief supplies; all spring into action when an emergency looms.

Gina also has a kit with blue, yellow, and red cyclone warning flags provided by MIND, which she will raise to indicate how much time there is before a storm strikes. She or a family member might hop on a bicycle to circulate throughout the community, waving the flag and blowing a whistle, to tell the neighbors to spread the word. At night or in very remote areas where the flag may not be visible even in a high tree, the alert system relies on traditional means of communication, such as a ram’s horn or drums beating a special rhythm to let people know that a natural disaster is approaching. Using a combination of the latest in satellite and radio technologies, drums, and an organized community grapevine to spread the word, Nova Mambone has put the early warning systems in place, identified gathering points on high ground, and distributed disaster preparedness kits.

Prevent, don’t just react. That philosophy drives Gina and other citizens of Nova Mambone to make the flood and cyclone early warning systems part of daily life.

Como Usar Rádio para Diminuir os Efeitos dos Ciclones e Cheias

TAREAS do membro da comunidade



TAREAS do membro da rádio

- Responda pelo estado do rádio e comunicação de informação da comunidade, alertas comunitários e a comunidade.
- Assegure que o rádio esteja sempre em funcionamento.
- Plano para passar a informação.
- Acompanhar a evolução do ciclone / cheia.
- Assegure que a informação seja dada para todos.

TAREAS do membro para aviso prévio

- Responda por informar aos membros da comunidade da chegada de um perigo (ciclone, cheias).
- Nos comunidades onde existem líderes, estes deverão ser líderes no envio de mensagens para facilitar a nível da organização da comunidade (de evacuação, preparação e resposta) como a distribuição de informação durante as situações de emergência dos ciclones / cheias.

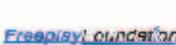
Ciclone



Choias








MIND and its partners produced and distributed posters describing the duties of the radio keepers: maintain the radio in good repair, listen to it regularly for information, follow the progress of storms, and spread the word to everyone. Once alerted by the radio, members of early warning committees raise flags and circulate in the community to inform neighbors. Cartoon illustrations convey this information even to people who can't read.

MIND continuously evaluated the radio distribution program. After the first round of evaluations reported high levels of breakage, MIND investigated the situation in Inhambane Province. Local radio technicians trained under MIND were doing a good job fixing small problems, but they lacked the spare parts to complete many repairs. In 2004, Freeplay approached MIND to help distribute new, improved radios, redesigned to correct the breakage problems identified earlier. The Mozambican Red Cross is the direct recipient of these improved radios, donated by VODACOM, a cell phone company. The new radios are being distributed in the Save

River Basin and elsewhere as part of the early warning system.

UPGRADING TECHNOLOGY TO IMPROVE COMMUNICATION

What happened in Nova Mambone, a town at the mouth of the Save River in the Govuro District of Inhambane Province, illustrates how inadequate communications slowed the transmission of crucial warnings. Under the system in effect during the floods, valuable time was lost relaying weather warnings along a convoluted bureaucratic hierarchy. Word came too late of the accumulating wave of water traveling down the Save River and the large surge of seawater from cyclone Eline that traveled upstream.

“ A moderate tropical cyclone can mean different things to different people. A storm might produce severe damage to a *palhota* (traditional mud house with a thatched roof), but not harm a sturdier house at all. Using the color-coded warning system, MIND associated specific wind speeds with their real impact on specific neighborhoods. ”

**FILIPE LÚCIO,
DIRECTOR, INAM**

Since then, MIND has supported efforts to reroute messages efficiently to concerned agencies and rescue organizations, and immediately to affected communities using radio and satellite.

MIND rehabilitated the monitoring and communication system along the Save River from the point where it enters Mozambique to the mouth of the river at Nova Mambone. MIND installed a chain of monitoring stations along the Save River that measure water levels three times a day and provided a high-frequency radio to ARA-Centro to receive this information. The radio is housed in the Red Cross office in Nova Mambone. Data from upstream is no longer relayed through a centralized reporting chain, but is available immediately to the appropriate agencies and first responders in the areas about to be affected.

In addition, MIND is supporting the creation of RANET stations in Mozambique, which will help get information to vulnerable communities before a disaster strikes and also provide a tool for community education in non-disaster times. RANET is a global initiative, with funding from the National Oceanic and Atmospheric Agency (NOAA) and USAID/DCHA/OFDA, among others, that combines radio and Internet technologies to provide real-time information to remote communities on climate and other issues. RANET allows communities to receive urgent information about their local area

via direct satellite linkages – even when there is no electricity – and provides them with the means to broadcast this information over a 30 square-kilometer area. The radio broadcasts can be received on Freeplay or conventional FM radios.

MIND worked with INAM on the development of RANET in Mozambique and funded two full RANET stations. One will be placed in Nova Mambone as part of the improvements to early warning in the Save River Basin. The second will be placed in Pebane District in Zambézia Province, a heavily populated area with very poor communications and high cyclone risk. Once RANET is operational, INAM can transmit flood and cyclone warnings directly to community radio stations, bypassing intermediaries in the reporting hierarchy that delay an alert. RANET functions like a normal community radio station, with the added capacity for receiving urgent data via satellite. Using the same equipment, communities can broadcast programs of local interest in local languages, as well as receive educational and informational programming from other radio services.

MOZAMBIQUE

Save River



Nova Mambone is a small, remote community located more than 330 km from Inhambane, the provincial capital. Although Beira is closer, warning messages passed through Inhambane and Maputo, which wasted time and resulted in transmission of irrelevant information. RANET and point-to-point radio communications along the river will help warn communities at the mouth of the Save River before a disaster strikes.

SUCCESS STORY

Never Again Will People Be Taken by Surprise



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For José Mucote, founder and leader of AJOAGO, the great floods of 2000-2001 were a turning point that defined his life's work.

José Mucote remembers where he was when the floods hit Nova Mambone, in Govuro District at the mouth of the Save River. It was night, he felt the house tremble and heard the water roar as it rushed in.

When the wave came downstream from Zimbabwe, it accumulated along the river, and submerged the city suddenly. He was 19 and still in school at that defining moment.

"We were all victims of the calamity," he said. The experience gave him the idea for AJOAGO (Associação de Jovens e Amigos de Govuro), a club for young people who wanted to make a difference. He sought partnerships with nongovernmental organizations and convinced a few adults to back him. At first, José worked from an office in his bedroom. Five years later, AJOAGO is the most vibrant grassroots organization in town, with a brand new headquarters. Near it are 10 of the 45 cyclone-proof houses AJOAGO built for families who lost everything in the flood, each with a small, experimental plot to grow food.

AJOAGO was formally founded in January 2001 as a pilot project funded by Intermón, the Spanish arm of Oxfam. The World Food Program asked AJOAGO to plan and administer a food distribution program. But very quickly, José changed strategy. Instead of distributing food, he motivated farmers to plant drought-resistant crops. With the exception of children, old people, and others who couldn't work, José distributed food only to those who participated in the experimental community garden project.

"We want to be active participants in society, not passive recipients of food," he said. "Our goal is to deal with disasters locally, without having to depend exclusively on international donors. We want to educate society to live with floods and to reduce the damage they cause."

José's ability to realize big dreams made AJOAGO an ideal partner to implement MIND's early warning systems in Govuro District. He personally delivers training on the cyclone early warning system in public schools so that children know what to do and can tell their families.

What excites José most is Nova Mambone's RANET/community radio station, to be housed at AJOAGO. Members of AJOAGO will learn to produce and broadcast the programs, donating their time and labor. MIND purchased radio equipment capable of receiving weather alerts or other urgent information by satellite. In normal times, it will function as a community radio station. It will hook into community radio, which will give people a chance to share information on topics of local interest. Anyone can propose and produce a program, and everyone can express their opinions. The radio station will be owned by the community, which will establish editorial policies and positions.

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©CHEMONICS 2005 (JOEL CHIZIANE)

“We want to use community radio to create patriotism and a sense of citizenship,” José said. “Democracy is very new to Mozambique, and we want to cultivate democratic expectations. We want to have open discussions about important issues, such as how our cultural habits might contribute to the spread of AIDS.”

Community radio will serve many purposes when no natural emergencies threaten. But José has not forgotten its primary mission. It will receive news from Radio Mozambique and information directly from the Red Cross and ARA-Centro high-frequency radios along the Save River that report river levels three times daily. When RANET is fully operational, Nova Mambone will get information about weather events directly via satellite. In case of emergency, this will save time — and lives.

“Radio will change everything,” José said. “We will know about the danger two or three days before it arrives in Nova Mambone. We will always be prepared.”

AJOAGO's brand new building (top) will house new equipment (bottom) to receive RANET information and broadcast community-centered programming.



TOP: Community leaders and local government representatives discuss ways to improve early warning systems in the Save River Basin.



BOTTOM: Teams from SETSAN's Vulnerability Assessment Committee (VAC) talk with women in rural communities to find out how they respond to shocks such as droughts, floods, and cyclones.

“ Disasters are not the necessary outcome of a hazard. . . Droughts, floods, or cyclones only become disasters if the necessary vulnerability conditions exist or if appropriate responses are not taken to reduce the immediate losses caused by the hazard. On its own, the hazard information tells us only that a threat exists. Likewise, on its own, the livelihood vulnerability information tells us only how people normally live. Separately, each set of information does not help decision makers identify appropriate actions to take in the event of a hazard. But together, these critical sets of information can help decision makers see a powerful new picture of the likely impact of these hazards on different people and places. ”

Atlas, p. 76

CHAPTER 5

BRINGING PEOPLE TOGETHER

MIND achieved significant progress in four years by catalyzing people around a common goal to form partnerships, identify problems, and work together toward solutions. The *Atlas* epitomizes this spirit of collaboration, but other activities also illustrate what can be accomplished by working together toward a common goal — even among nontraditional partners.

FOOD SECURITY PARTNERS BAND TOGETHER AT SETSAN

Food security is a major challenge in Mozambique: Nearly half of the population is chronically undernourished. The traditional focus of the FEWS NET project has been on food security, vulnerability assessment, and drought early warning, and these activities continued in Mozambique, along with the expanded focus on floods and cyclones. The Government of Mozambique had created a Technical Secretariat for Food Security and Nutrition (SETSAN) to coordinate the many agencies working on ending

hunger as part of its national food security strategy and in response to the 1997 World Food Summit. But SETSAN had languished in the intervening years, and coordination among the many players was relatively weak.

In 2003, MIND staff began collaboration on food security with a Food and Agriculture Organization of the United Nations (FAO) project designed to support SETSAN. Staff from the two projects set up a joint office and initiated discussions with government and other partners. The national agricultural research institute provided office space, and government food security staff soon joined, followed by GTZ and the United Nations Development Program (UNDP).

In less than two years, SETSAN has become a national hub of food security work in Mozambique. SETSAN partners share infrastructure, networks, and a Web site. SETSAN operates through working groups, which convene as needed to address a specific topic or issue. The best

Harvesting and processing canhu, an indigenous fruit used to make a traditional alcoholic drink, is an important livelihood strategy in some rural areas.

© CDFI, MARUTO



“ SETSAN has helped WFP better prepare for crises through its regular monitoring of food security conditions. When a problem arises, like the 2004/2005 drought, SETSAN and its working groups provide us with consistent information reflecting the consensus of stakeholders. With this, we are able to appeal to donors for resources and to target assistance to the most needy. ”

**ANGELA VAN RYNBACH,
WFP COUNTRY DIRECTOR**

known working group, the Vulnerability Assessment Committee, is housed at SETSAN.

MIND’s contribution to SETSAN has been a continuous part of its work. Early on, a FEWS NET vulnerability assessment specialist from Washington, D.C., and SETSAN conducted a baseline evaluation in the flood-affected areas of the Limpopo Basin. Livelihood-based vulnerability analysis helps reduce risk by identifying relevant shocks for different household types and groups households according to livelihoods instead of traditional boundaries such as administrative areas or food production zones.

Livelihood information is important for emergency and development strategists and practitioners because it can help minimize the cost of emergencies and maximize the benefits of

development. Human action can go a long way toward reducing the impact and costs of hazards through preparedness for identifiable threats and mitigation efforts to increase people’s resilience. SETSAN’s analysis highlights who will be most affected by what, which is critical for preparedness. SETSAN also identifies ways to strengthen livelihoods so people can better withstand the inevitable shocks.

The spirit of collaboration at SETSAN, its wide range of partners, and the leadership of the Government of Mozambique has attracted international attention. Missions from Sierra Leone, South Africa, Zambia, and other countries have visited SETSAN to learn how Mozambique has mobilized people and brought them together to create a public good.

DAM TRIP

Following the 2001 floods in the Zambezi, some blamed the two massive dams along the river, Kariba on the Zambia-Zimbabwe border and Cahora Bassa in Tete Province of Mozambique, for contributing to the severity of floods. To find out more about the role of international river flows and upstream dam management, MIND invited senior government officials from Mozambique's National Institutes for Disaster Management, Water, and Meteorology; chief editors of Radio Mozambique and *Jornal de Notícias*, a newspaper; the

World Food Program country director; and a Southern African Development Community (SADC) Regional Remote Sensing Unit representative to tour the Kariba and Cahora Bassa dams. The delegates learned about operations and how dam authorities monitor seasonal weather forecasts to plan their annual discharges. The trip opened a dialogue between the dam operators and Mozambican water and disaster authorities, and raised awareness of the consequences of water releases upstream and the need for cross-border information sharing and cooperation.



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The Kariba Dam, one of the world's largest, is located on the Zambezi River along the borders of Zimbabwe and Zambia. Because water from the dam flows through Mozambique to reach the sea, decisions about water management at Kariba affect millions of Mozambicans. MIND took a group of senior disaster managers from government, the UN, and SADC, and prominent journalists on a study tour of the dam to build understanding and communication between dam managers and disaster officials.

SEEING IS BELIEVING: PUNGUÉ FLY-OVER

Bringing people together to generate consensus can be powerful, as a MIND-sponsored fact-finding mission to the Pungué River illustrates. MIND quickly organized a flight for eight representatives of major first-responder institutions to assess firsthand the magnitude of the flooding there in 2004. After the major floods of 2000 and 2001, flood awareness was high. When the national newspaper began a series of front-page articles about flooding on the Pungué River, national and international agencies began to fear that another serious flood was developing. Upon inspection,

these decision makers found that the situation was not the emergency portrayed by the media and jointly issued a press release so stating. The decision makers were thus able to calm fears and adjust their own institutions' response to appropriate levels.

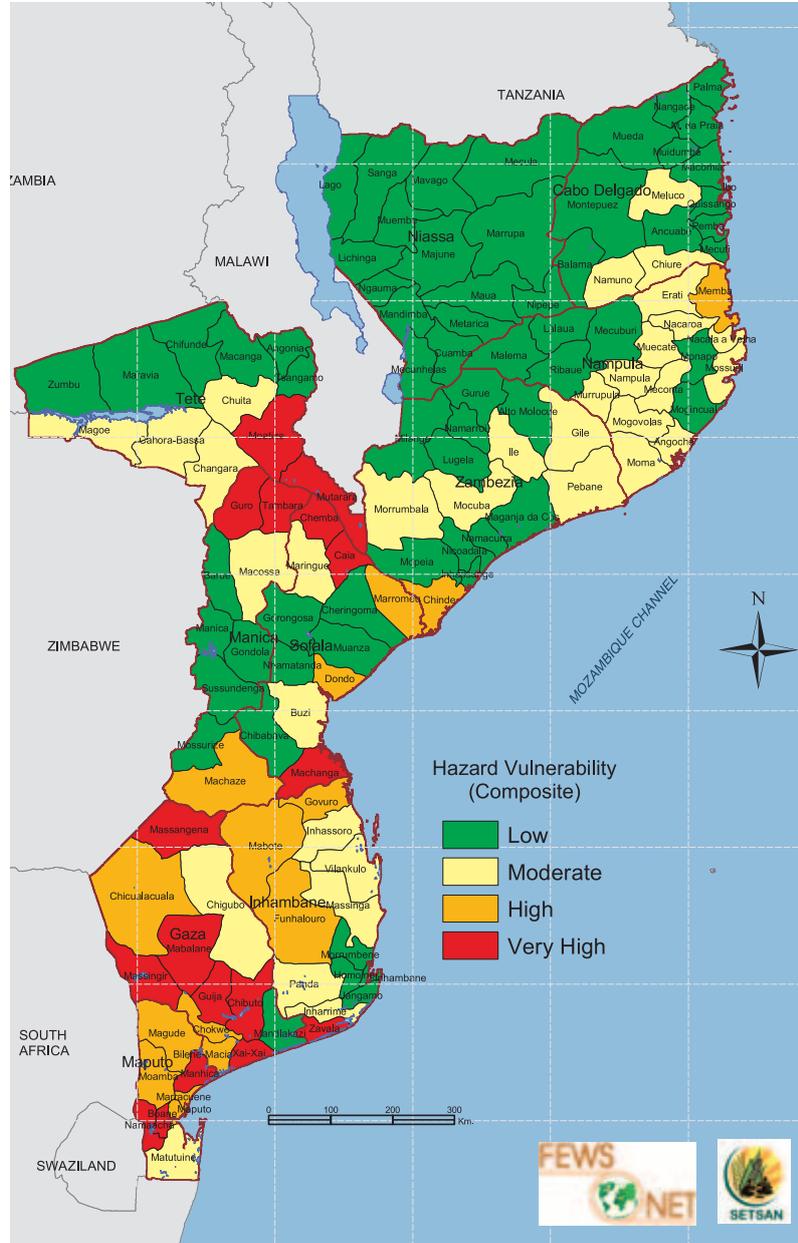
MAPPING DISASTER RISKS

Since Mozambique is a country prone to many types of natural disasters, most people have a general notion about which areas are vulnerable to flooding, cyclones, or droughts. But each agency had a different list of vulnerable districts and no methodology had been defined to categorize areas according



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Edgy after the 2000 and 2001 floods, the media exaggerated the severity of flooding along the Pungué River in 2004. MIND sponsored a site visit for Mozambican officials to see for themselves that the “emergency” was overblown.



Source: SETSAN
 Technical agencies came together under SETSAN's working group for early warning to create this composite map, showing the districts with the highest level of risk from floods, droughts, and cyclones. Individual maps were created for each hazard and then combined using GIS technology. A flood-risk map was created by overlaying satellite images of inundated areas during different major flood events. The drought risk map overlaid satellite images of vegetation during selected droughts; while the cyclone risk map interpolated cyclone events over a 75-year period.

to their risk. Instead of producing the maps on its own, MIND helped revitalize GAPSAN (Early Warning for Food Security and Nutrition), a working group within SETSAN. MIND brought GAPSAN's technical experts together to define methodologies and create disaster risk maps for each major hazard, plus one composite map showing overall risks by district (above). The maps now belong to the entire disaster risk assessment community in Mozambique and can be used to direct disaster prevention and preparedness activities.

In 2004/2005, drought threatened southern and central Mozambique. GAPSAN technicians analyzed data and prioritized districts for in-depth field assessment by the VAC. VAC teams visited the districts of concern to estimate the number of people in need of emergency assistance. The government and its partners then developed response plans to meet the critical needs. The SETSAN-led process succeeded in generating consensus and producing credible and timely information – a significant improvement over the past.



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A Nova Mambone resident shows off her home repairs.

CHAPTER 6

NEXT STEPS

Disaster preparedness has progressed immensely since the devastation of the 2000 floods. Human capacity exists, better and more integrated information is available, and partner coordination under government leadership is stronger.

While the post-flood congressional funding for MIND has ended, USAID plans to continue to reduce the risk of disasters in Mozambique under the FEWS NET project. Recognizing that disasters have the potential to disrupt gains made under its improving rural incomes objective, USAID has built risk reduction into its 2004-2010 strategic plan. The following major actions will build on progress made thus far:

- Initiate RANET as a means to provide vulnerable communities with direct, real-time access to disaster warnings, as well as an avenue for sharing important information. Mozambique is a large country with very poor communications, so RANET could be a vehicle to improve information flows to isolated

rural communities. If RANET fulfills its potential, widespread expansion should be considered. Niger, one of the first RANET countries, now has 75 stations, and many more communities have petitioned for them.

- Continue to develop and disseminate flood and cyclone warning systems. Additional river basins should be modeled, and river monitoring and communications systems enhanced, so flood early warnings reach all communities in time. Public education must continue teaching about both the flood and cyclone early warning systems, and additional partners should be sought to enhance community-level training and preparedness plans.
- Develop additional packages of integrated information for disaster preparedness and development. Although various organizations have expressed interest in producing atlases for other river basins and the director of the disaster agency

Chronic malnutrition remains one of Mozambique's most serious problems. By applying lessons learned under the MIND activity about collaboration and capacity building, food security partners working under SETSAN can help tackle this problem through the analysis of risks, vulnerability, and livelihoods.

WORLD FOOD PROGRAMME



has stated it as a priority, the amount of effort and cost involved has limited progress. Given the knowledge and skills that now exist in Mozambique, it would be possible to produce a less comprehensive, but still useful, atlas requiring less input. The idea of *Atlas* “lite” has been floated and merits serious consideration, given the positive impact of the Limpopo *Atlas*.

- Enhance SETSAN’s role to maintain the momentum of MIND in understanding livelihoods, analyzing disaster

risks, and supporting responses that bolster Mozambique’s development. MIND has focused on rapid-onset disasters like floods and cyclones but chronic malnutrition, one of Mozambique’s most vexing problems, continues. Tackling this complex issue will require a thorough understanding of livelihoods and risks — best accomplished through the type of collaboration, partnerships, and capacity building that were the hallmark of the MIND project.



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USAID
FROM THE AMERICAN PEOPLE

**BUILDING CAPACITY FOR
DISASTER PREPAREDNESS**

MOZAMBIQUE MIND FINAL REPORT

**CAPACITAÇÃO EM PREPARAÇÃO
CONTRA DESASTRES**

RELATÓRIO FINAL DO MIND
EM MOÇAMBIQUE



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