Mozambique 2015: Damage Assessment and Early Recovery / Sustainable Reconstruction Priorities

Joint Rapid Assessment following the January-February 2015 Hydro-Meteorological Events in the Central and Northern Regions

Fig. 1. (cover page) Detected flood area during the flooding event – in light pink – and within the January 28 - February 10 period – in red (processed by WFP from MODIS and ESA Sentinel-1 and Landsat-8 data) ; Pictures from IFRC (damaged houses), UN-Habitat (bridge) and EDM (electricity tower)

Following a mission carried out from March 3-13, the Government of Mozambique, with support from its partners, developed this rapid assessment (later referred to as "the Assessment") with three chapters: 1. « Event Characterization and Underlying Risk Factors »; 2. « Environmental, Social and Economic Impacts: Damages and Preliminary Loss Estimates »; and 3. « Early Recovery and Resilient Reconstruction Framework ».

A total of 18 working groups, listed on pages 2 to 5 of the Executive Summary, contributed to the development of this report.

Photos courtesy of: (i) Orlando Missa, Electricidade de Moçambique; (ii) Camila Riveiro, International Organization for Migration; (iii) Javier Cidon, Danish Red Cross; (iv) Fernando Ferreiro, UN-Habitat; (v) Julia Oberreiter, The World Bank; and (vi) Lara Carrilho, World Food Program.

Some maps have been reproduced from previous publications and referred to in the last section of the report. Maps have been produced for the report from datasets provided by the National Institute for Disaster Management (INGC), the Eduardo Mondlane University, the Road National Administration (ANE), and from the location of damages by the working groups. Boundaries, colors, denominations and any other information shown on the maps reproduced in this report do not imply any judgment on the legal status of any territory, or any endorsement or acceptance of such boundaries.

The rapid assessment has been coordinated by the Government of Mozambique through the Ministry of Economy and Finance (MEF) and the National Institute for Disaster Management (INGC). The report was prepared by the World Bank Group in coordination with line ministries, United Nations agencies in the country, and funded by the European Union through the ACP-UE Natural Disaster Risk Reduction Program (ACP-EU NDRR), an initiative of the African, Caribbean and Pacific Group (ACP), funded by the European Union and managed by the Global Facility for Disaster Reduction and Recovery (GFDRR).

Acronyms

ACP	African, Caribbean and Pacific Group
AICD	Africa Infrastructure Country Diagnostic
ANE	Road National Administration
AIAS	Water and Sanitation Infrastructure Administration
ARA	Regional Directorate for Water Affairs
CTGC	Technical Council for Disaster Management
DFO	Dartmouth Flood Observatory
DNA	National Directorate for Water Affairs
EDM	Electricity National Administration
EU	European Union
FAO	Food and Agriculture Organization
GDP	Gross Domestic Product
GFDRR	Global Facility for Disaster Reduction and Recovery
INGC	National Institute for Disaster Management
INE	National Statistical Institute
IOM	International Organization for Migration
MICOA	Ministry for the Coordination of Environment Affairs
MEF	Ministry of Economy and Finance
NDRR	ACP-EU Natural Disaster Risk Reduction Program
SETSAN	Technical Secretariat for Food Security and Nutrition
UN-Habitat	United Nations Human Settlements Program
UNICEF	United Nations' Children Fund
WFP	World Food Program

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Executive Summary

I. Context

The Technical Council for Disaster Management (CTGC) activated the orange alert on January 8, 2015, in response to the heavy rains in the Center and North of the country reaching about 100 mm in 24 hours. These rains have contributed to the rising of water levels in the Zambezi, Licungo and Shire River basins, exposing the population to flooding. Since then, the Government of Mozambique has been responding rapidly in affected areas to assist in the timely evacuation and transport of affected people. An Institutional Red Alert for the central and northern regions was declared on January 12, in order to strengthen Government and partners' contributions for humanitarian and emergency response. The Institutional Alert was downgraded from Red to Orange on March 3, and then waived on April 10, due to improvements in weather and partial restoration of most critical infrastructures.

The Government initially requested support for a rapid assessment on February 25 (see Annex 1, later referred to as "the Assessment"). The World Bank, United Nations and European Union agreed to jointly respond to this request.

II. Objective of the Evaluation, and Methodology

Objective

The objectives of the Assessment were to (i) evaluate the impact of the events on the population and infrastructure; (ii) provide expert advice to the Government on handling the flood impact, managing the short to medium-term response and identify areas for follow-up advisory support; (iii) based upon the availability of funds, identify financial support to the flood response and recovery, consisting of potential reallocation from ongoing projects, additional financing and grant funding; and (iv) develop and agree with the Government on a set of next steps for achieving flood recovery and building long-term disaster resilience in the provinces of Nampula, Niassa and Zambezia.

The report includes three sections: (i) description of the event and analysis of hazard, exposure, vulnerability and key underlying risk factors; (ii) quantitative evaluation of damages in each sector and description of their impact to the economy and the population; (iii) proposal for priority activities related to recovery, reconstruction and disaster risk management, in order to reduce impacts on the occurrence of similar events in the future.

Task Coordination and Knowledge Sharing

Agencies and programs of the United Nations (UNICEF, WFP, FAO, UN-Habitat) and the World Bank have been working closely to support the government in the development of this Assessment. The participation of the World Bank was financially supported by the ACP-EU

Natural Disaster Risk Reduction Program, an initiative of the African, Caribbean and Pacific Group of States, funded by the European Union and managed by GFDRR.

Based on results from a meeting on March 4, with the INGC, ministries' focal points, UN and World Bank, a Coordination Committee was established (see table below) including focal points by sector from line ministries/governmental agencies and international organizations. Selected sectors included: energy; rural engineering (dikes and irrigation infrastructures); water and sanitation; transportation (roads, bridges, and railways); telecommunication; hydrometeorology; agriculture; fisheries; commerce and markets; education; environment; housing; urban development; community development; food security; health; flood protection; and non-structural disaster risk management.

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Fig. 2. Table: Coordination Committee focal points, working groups and contact information

Government counterparts were in charge to provide and coordinate information processing and international organizations, to provide support for estimating with a systematic approach and common methodology the cost of damages and priorities for recovery, reconstruction and reducing vulnerability.

A series of meetings were carried out with government representatives in order to gather the information required for analysis. This information was compiled in a master datasheet, available at http://goo.gl/x2ZXeu and shared with all government representatives and partners. The information validation process was supported by the World Bank and UN Agencies (FAO, WFP, UNICEF, UN-Habitat and IOM).

In addition, a field visit was carried out to Zambezia from March 7-9, focusing on the following sectors: roads; bridges; water supply; education; resettlement; and emergency response coordination. A team composed by INGC (Milton Barbosa); ANE (Daniel Patel Santos and Armando Fonseca); and the World Bank (Roberto White, Andre Carletto, Julia Oberreiter, and Daniel Baloi) visited a series of damaged infrastructure over the Licungo River Basin, at the localities of Mocuba, Malei, Licuari and Furquia, and held meetings with local representatives. The visit served to document the damage reporting mechanism used by

the Government, which relies upon decentralized governments and local administrations, and to validate selected damage estimates made available to the team prior to the mission.

The evaluation process has supported knowledge exchange and management of information resources. Event specifications, damages and recommendations are referenced on an open-source map, available from http://goo.gl/YSc6Qw (the file opens with Google Earth as a visualization engine). All inputs received and knowledge developed by the mission are available from the collaboration folder available at http://goo.gl/uTVO4D.

III. Summary of the Evaluation Findings

Rainfall and wind were of about a 15-30-year return period

The analysis of the event and related risks was based upon in-situ measurements; field surveys; satellite imagery; and knowledge from urban, water, sanitation, transport, hydro-meteorology, sustainable land management and disaster risk management experts.

With up to 590 mm over the month of January recorded in Mocuba, the rainfall is an event of about a 30-year return period. The Licungo River reached its highest levels since 1971 on January 12, and the associated runoff resulted in erosion of the Licungo banks on both sides of the Mocuba bridge with similar impacts as those observed 44 years earlier. Another peak above the 30-year return period was reached on February 2, in the Zambeze watershed. All seven major rivers have reached record levels, provoking the destruction of hydrological measurement scales and therefore inaccurate monitoring of water levels and runoff. Factors which contributed to the high level of flooding are: (i) heavy rainfall; (ii) flat terrain; (iii) high tide; and (iv) inappropriate drainage infrastructures.

The proximity of the tropical storm – which later converted into tropical cyclone Chedza – has also generated very high winds, which destroyed both the anemometer and anemograph of the national meteorological service and could not be recorded with accuracy. The wind contributed to a large number of damages to conventional and "precarious" buildings, including schools and health centers.

Damage are in the order of US$371 million or 2.4 percent of national GDP

About 326,000 people were affected; 140 were killed; about 30,000 houses, 2,362 classrooms and 17 health units were either partially or totally destroyed. 104,430 ha of crops have been lost during the event, impacting 102,000 farmer households.

The cost of damages is estimated to be around US$371 million, or 2.4 percent of GDP, and the costs of recovery and reconstruction are estimated at US$490 million. The incidence of poverty in the affected area is high, with the highest poverty rate in Zambezia province (at 70.5 percent of the population in 2009). Estimates suggest that the impact from the storms and floods is about 5 percent of GDP, with 2.4 percent in damages and about 2.6 percent in losses. The Government's fiscal position is currently very weak with expenditure overruns, higher than expected debt service costs and reduced foreign financing. As a result, responding to the crisis will put additional (and unexpected) pressure on public finances, which might further

widen the fiscal deficit. Economic forecasts from the international rating agencies confirm that the impact of heavy rains and flooding will not only negatively affect GDP in 2015 but also the government's fiscal position, exacerbating its upward debt trajectory in recent years. The estimated 2015 growth can be cut between 0.2 - 0.5 percent.

The preliminary estimates account for:

- US$155 million for roads and bridges;
- US$83 million for crops;
- US$56 million for housing;
- US$24.2 million for railways;
- US$14.2 million for irrigation infrastructure;
- US$13.3 million for energy;
- US$8.8 million for drinking water supply;
- US$6.7 million for dikes;
- US$6.1 million for education;
- US$1.5 million for health;
- US$970,000 for market and commerce infrastructure;
- US$376,000 for telecommunications;
- US$307,000 for drainage networks (Nacala, Mocuba); and
- US$104,000 for hydro-meteorological equipment.

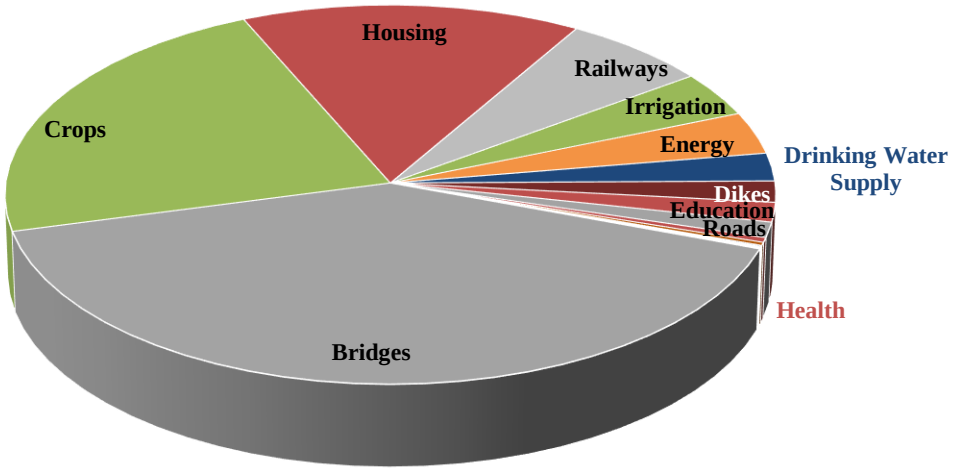


Fig. 3. Graph: Damages in most impacted sectors (not including losses)

It is important to note that losses, although not precisely assessed at this stage, are expected to overcome damages. **The total damage and loss impact of the disaster at the national level is therefore estimated to be at 5 percent of the Gross Domestic Product.**

The regional dimension of these impacts is also important to consider. Nampula, Niassa and Zambezia are jointly responsible for about 27 percent of the share of the national GDP (14

percent for Nampula, 10 percent for Zambezia and 3 percent for Niassa), and host the poorest populations in the country. Damages accounted for about **9 percent** relative to the provinces' share of GDP, and **damages and losses together could represent about 20 percent**.

Economic forecasts from the international ratings agency confirms that the impact of heavy rains and flooding will not only negatively affect GDP in 2015 but also put **increased pressure on the government's fiscal position**, exacerbating its upward debt trajectory in recent years. The estimated 2015 growth can be cut between 0.2 - 0.5 percent.

Priorities for Early Recovery and Sustainable Reconstruction Amount to US$490 million or 3.1 percent of GDP

Recommendations for the short, medium and long term have been proposed with the objective to increase the country's resilience and to advance the implementation of strategies set forth by the Government in relation to infrastructure development and disaster risk management.

The Government classifies post-disaster interventions into four categories:

1	Emergency Actions	Supplementing the National Contingency Plan to ensure continuity of humanitarian assistance and disease control, distribution of food and non-food emergency items and ensuring continuity of health and education services.
2	Immediate (early) recovery	Mostly funded from reallocations of national budget, including repositioning of infrastructure, service delivery and revitalizing production (agriculture, fishing, industry and commerce); this category includes emergency works needed to prevent further damage or enable provisional use of an infrastructure, and emergency support to communities; this category does result in sustainable recovery.
3	Post-disaster reconstruction	Activities needed to bring the infrastructure back to 100 percent use, or to provide the communities with their livelihoods as before the flooding. Costing in this report are indicative, and detailed engineering studies are often needed to confirm the approaches and recommend additional measures to reduce future risks. Funding for this category is highly dependent on external resource mobilization.
4	Vulnerability reduction	Structural and non-structural interventions, designed to mitigate the impact of future disasters, including slum upgrading, relocation of residents, development of additional or strengthened flood protection infrastructures and shelters, retrofitting of infrastructures and cross-cutting disaster risk management investments and technical assistance.

Fig. 4. Table: Four categories of post-disaster interventions

This Assessment complements previous emergency needs assessments developed by the humanitarian country team, and focuses on above categories 2, 3 and 4 in the affected zone. Section 3.1 on public infrastructure concentrates mostly in providing recommendations related to structural investments; sections 3.2 and 3.3 provide a balanced mix of structural and non-structural recommendations in order to restore the livelihoods and the competitiveness of the productive sectors. Finally, section 3.4 focuses on non-structural priorities for vulnerability reduction with a cross-cutting and long-term approach.

The total recovery and reconstruction priorities amount to US$490 million, whereas US$281 million is for roads and bridges; US$67 million for drinking water supply; US$46 million for agriculture, food security and fisheries; US$24 million for railways; US$14.5 million for energy; US$12.6 million for dikes; US$10 million for sustainable land and water management; and US$10 million for non-structural disaster risk management. The total of these priorities for recovery and reconstruction is equivalent to 3.1 percent of the national GDP.

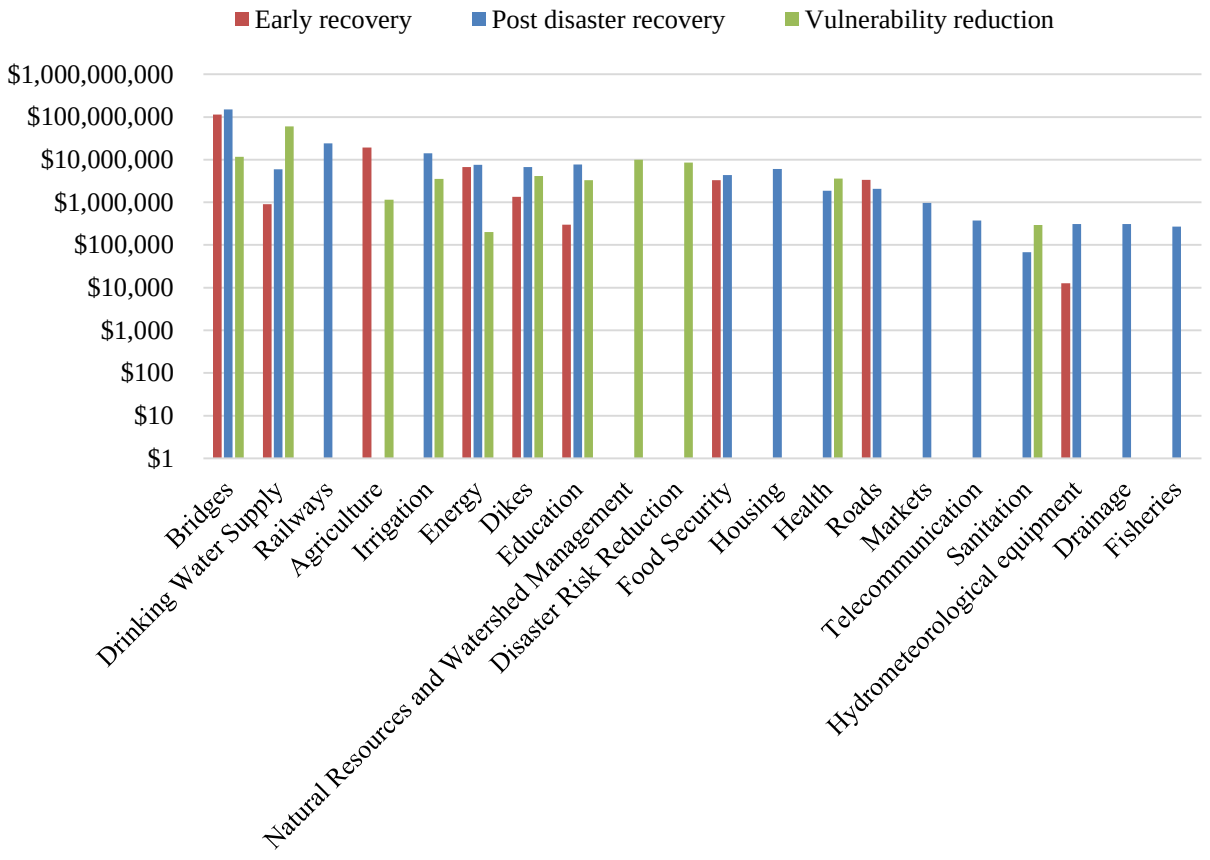


Fig. 5. Graph: Recovery and reconstruction priorities by sector

Early recovery actions are being carried out by the Government at the time of the mission, for an amount of **US$148 million**, out of which US$117 million is for roads and bridges; US$19 million for restoring agricultural productivity; and US$6.7 million for electricity. A total of

US$8.6 million in funding was identified as available or already engaged at the time of the mission to support early recovery, 75 percent provided by the Government.

Post-disaster recovery activities, aiming at compensating damages, have been identified in the amount of **US$234 million**, out of which US$153 million is for roads and bridges; US$24 million for railways (private sector); US$14 million for irrigation infrastructure; US$7.7 million for education; US$7.6 million for electricity; US$6.7 million for dikes; and US$6 million for drinking water supply, etc.

Activities contributing to the reduction of vulnerability with a long-term approach are still being identified and amount to a provisional total of **US$106 million**, out of which US$60 million is for drinking water supply; US$10 million for non-structural disaster risk management; US$10 million for sustainable land and water management practices; and US$9 million for the health sector.

	EARLY RECOVERY	POST-DISASTER RECOVERY	VULNERABILITY REDUCTION
Roads and bridges: US$281 million (damage = US$155 million)	Emergency repairs such as extension of temporary metallic bridges, protecting embankments with raw material, filling gaps for restricted access, cleaning of drainage infrastructure.	Reconstruction of the system of bridges over the Licungo River in Namacurra, extension of the bridge in Mocuba, rehabilitation and enhancement of drainage infrastructure, 28 other interventions on bridges and 16 on roads.	Construction of three new bridges.
	US$117 million	**US$153 million**	**US$11.6 million**
Drinking water supply: US$67 million (damage = US$8.8 million)	Cleaning and temporary repairs to water pipes. Rental and acquisition of generators and fuel.	Replacement and rehabilitation of pipes, channels, wells, submersible and floating pumps, treatment and distribution systems in Alto-Molocue, Cuamba, Ile, Lichinga, Mocuba, Nacala-Porto and Nampula.	Creating redundancy in the electrical system for emergency periods; strengthening reservoirs; construction of a new distribution center for Mocuba and extension of the distribution networks; development of new water points for resettled communities.
	US$942,000	**US$6 million**	**US$60 million**
Agriculture, food security and fisheries: US$46 million (damage = US$14 million infrastructures and US$83 million crops)	Provision of seeds, hoes, machetes and sickles, to enable the start of the next growing season on a total of 62,000 ha destroyed; food distribution targeting vulnerable households for recovery of community assets.	Rehabilitation of irrigation networks and pumping stations for a total of 1,850 ha of flooded-irrigated schemes. Food assistance for assets program with participation of affected vulnerable households.	Enhancing the resilience of irrigated schemes. Development of an agro-meteorological information system and local seed production and maintenance facilities.
	US$22.5 million	**US$18.9 million**	**US$4.7 million**
Railways: US$24.2 million (damage = US$24 million)		Rehabilitation of the Nacala Corridor railway between Nacala and Moalize (private sector)	
		US$24.2 million	
Electricity: US$14.5 million (damage = US$13.3 million)	Temporary repositioning of high voltage lines (110 kV and 220 kV) with wooden poles.	Replacement of high voltage towers, 13 transformer stations, and of about 54 km of distribution lines, out of which 44 km in Mocuba district.	Strengthening the foundations for high voltage towers crossing Rivers.
	US$6.7 million	**US$7.6 million**	**US$200,000**

	EARLY RECOVERY	POST-DISASTER RECOVERY	VULNERABILITY REDUCTION
Sanitation, drainage and dikes: US$12.8 million (damage = US$16.2 million)	Filling gaps and temporary reinforcement of dikes (Nante, Luabo)	Cleaning and repositioning of drainage ditches and canals (Mocuba, Nacala); rehabilitation of dikes (Nante, Luabo); reconstruction of latrines.	Strengthening of dikes (Nante, Luabo)
	US$1.3 million	**US$7.1 million**	**US$4.2 million**
Education: US$11.3 million (damage = US$6.2 million)	Emergency repairs to conventional roofs and walls (279 classrooms); rehabilitation of community schools (166 classrooms).	Repairing structural damages to roofs and walls (460 classrooms). Construction of 1,585 classrooms with improved traditional (non-conventional) specifications and materials.	Retrofitting of 435 additional conventional classrooms, to enhance resilience to strong winds.
	US$300,000	**US$7.7 million**	**US$3.3 million**
Housing: US$6 million (damage = US$56 million)		Construction of 510 houses for vulnerable groups.	
	-	**US$6 million**	-
Health: US$1.5 million (damage = US$1.5 million)		Rehabilitation of six conventional health centers	Construction of nine "small conventional" heath units in replacement of precarious destroyed units.
	-	**US$1.9 million**	**US$3.6 million**
Markets: US$964,000 (damage = US$1.3 million)		Reconstruction of 58 stands and eight shops in markets of Cuamba, Mocuba, Morumbala and Nampula.	
	-	**US$964,000**	-
Telecommunication: US$376,000 (damage = US$376,000)		Replacement of about 6.95 km of optic fiber cable, 93 wooden poles, 6.6 km of copper cable	
	-	**US$376,000**	-
Sustainable land and water management: US10 million (no damage reported)			Sustainable land management, forest protection, river bank stabilization and other integrated land and flood management interventions to be recommended following a hydrological study.
	-	-	**US$10 million**
Hydro-meteorological equipment and non-structural disaster risk management: US$10 million (damage = US$100,000)	Temporary repositioning of sections of 36 hydrological stations to ensure continuity in water level monitoring activities.	Replacement of 41 hydrological stations and nine meteorological stations useful for community early warning systems.	Support to the National Master Plan for Disaster Risk Reduction: real-time hydro-meteorological monitoring, strengthening flood contingency plans and early warning, disaster risk financing and early recovery capacities.
	US$13,000	**US$311,000**	**US$10 million**
TOTAL	**US$148 million**	**US$234 million**	**US$108 million**
	US$490 million		

Fig. 6. Table: Overview of priorities for recovery and reconstruction

Considering that the provincial share of the GDP in the three provinces is about 27 percent compared to the national (14 percent for Nampula; 10 percent for Zambezia; and 3 percent for

Niassa), the total of identified priorities for recovery and reconstruction of US$490 million represent 11 percent of the GDP.

Priority Activities: The most urgent activities to be supported by the Government are clearly (i) to restore with a resilient recovery approach the transport, telecommunication and energy networks, which are critical for the supply of the affected areas; restoration of trade links including for the sale of the agricultural production, and for the transit of raw materials (ores and wood) through the affected provinces; and (ii) to provide support for replanting of crops and for recovery of food security and nutrition situations of affected households before the start of the next growing season.

Parallel Processing of Activities: The challenges related to urban development, drainage and sustainable land management, can only be addressed with a long-term approach. However, cross-cutting non-structural disaster risk management activities, like flooding risk mapping, early warning systems and exploring opportunities for disaster insurance penetration, in the amount of US$10 million, can be launched as soon as possible in parallel to early recovery activities; taking advantage of this disaster as an opportunity to sustainably reduce risks. These new activities recommended for disaster risk management are complemented by an ongoing portfolio for disaster risk management and climate adaptation supported by several partners, including the United Nations, European Union, multilateral development banks and bilateral partners.

Strategic Recommendations: Humanitarian support was relatively quick and efficient, in line with the contingency plan for the rainy and cyclone season 2014-2015, released in October 2014. However, the mission recommends a critical strengthening of information and knowledge management among Government agencies and with partners, with clear responsibilities and operational procedures.

Implementation, Monitoring and Evaluation: The coordinated implementation and monitoring of this recovery and reconstruction framework would require setting-up specific mechanism arrangements based upon existing financial management tools available, in order to enable correlations between available funding and post-disaster priorities. As rightly pointed in the GFDRR Recovery Framework Case Study for Mozambique, INGC and MEF are jointly responsible for recovery and reconstruction.

1. Event Characterization and Underlying Risk Factors

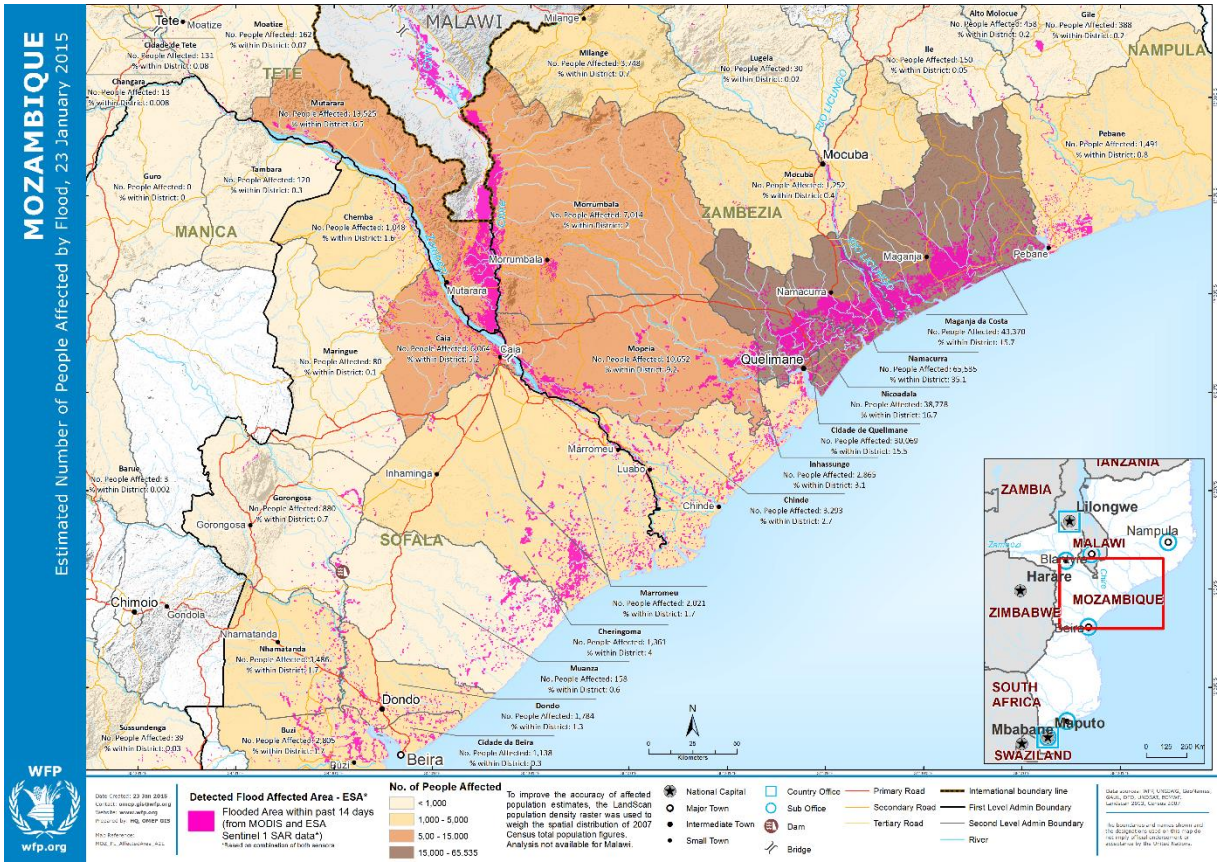


Fig. 7. Map: Maximum flood extent between January 10 - 23, 2015, and remote sensing-based estimate of people potentially affected (source: WFP)

Section 1/3 of the report

Characterization and understanding of the event and of the risk of the occurrence of a similar event in the future is essential to justify resilient recovery and reconstruction priorities. This section of the report is organized in three parts:

a) Description of hazards causing damage: rain, runoff, flooding, wind and erosion;

b) Elements exposed to these hazards in Nampula, Niassa and Zambezia; and

c) Major drivers of vulnerability for each sector.

Among the three risk factors (intensity or frequency of hazards, exposure and vulnerability), some are natural (e.g. topography, rainfall, geology) while others are a direct consequence of human influence (e.g. assets in flood zones; changes in slopes for the construction of roads; lack of maintenance and cleaning of drainage and sewage systems). This section focuses on positive and negative influences of human activities, in order to highlight potential benefits related to the implementation of proposed recovery and reconstruction priorities.

1.1. Analysis of Hydro-Meteorological and Physical Parameters

1.1.1. Rainfall

In the second half of the 2014/2015 rain and cyclone season, particularly in January, the country began recording heavy rains in the northern and central regions. The low pressure formed on the coast of Zambezia on January 11 contributed large amounts of precipitation, before moving toward the coast of Madagascar as a tropical depression and later converted into tropical cyclone "Chedza" from January 15 onwards.

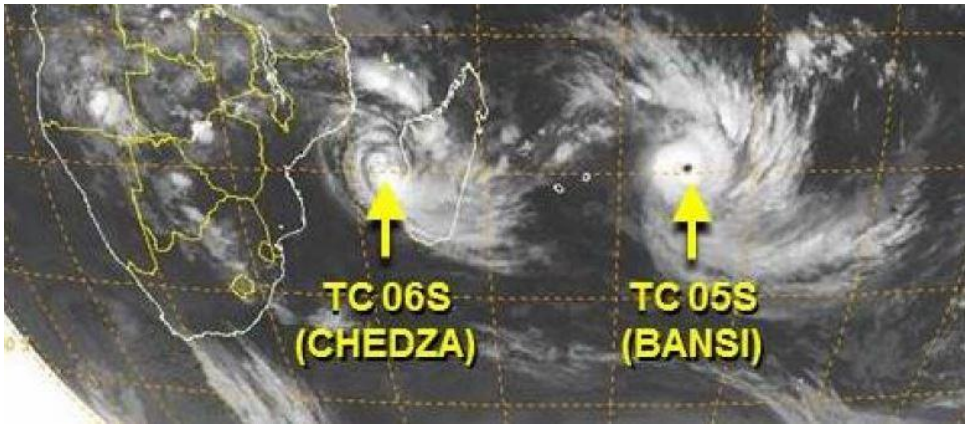


Fig. 8. Map: Tropical Cyclones Chedza and Bansi in the Indian Ocean on January 16, 2015 (source: Eumetsat)

Climatologically, the regions receive on average about 1,200 mm to 1,800 mm of rain annually, as illustrated on the isohyet map below.

Fig. 9. Map: Isohyets - Average (climatological) rainfall in the Assessment area (source: Conservation of the biological diversity in Mozambique, MICOA, 1997)

Climatologically, heavy rains in the central and northern regions start late January; however, in 2015, rains began earlier, particularly in Nampula, Niassa and Zambezia.

The rainfall in Cuamba and Mocuba has exceeded 500 mm over the month of January, while the 10-year return period precipitation are 332 mm and 291 mm, respectively. Another low pressure system also formed in the same area (coast of Nampula and Zambezia) on February 4 and have evolved to become a moderate Tropical Storm Fundi in the Mozambique Channel. In addition, heavy rains were felt in the extreme south of Malawi over the same period.

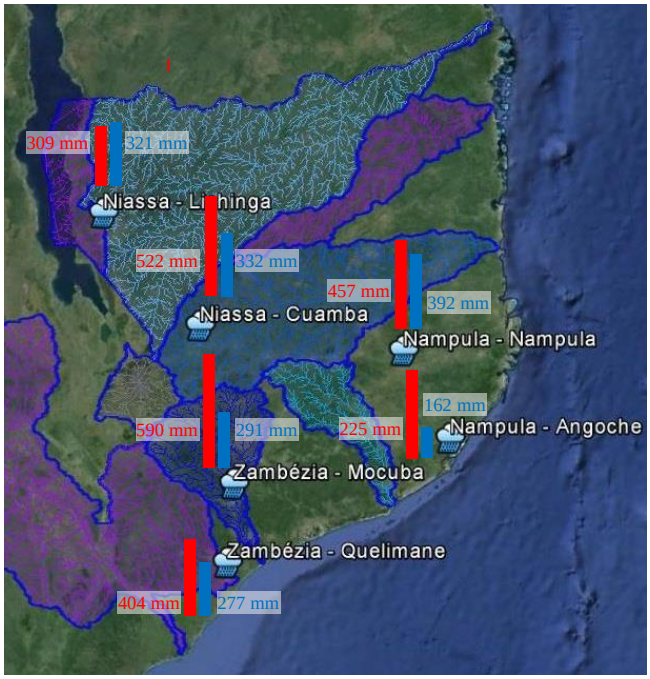


Fig. 10. Map: Six meteorological stations with precipitation records over January 2015 (red) compared to 10-year return period rainfall for January (blue)

Província	Estacão	Prec. Jan 2015 (mm)	Prec. Jan 10-y return period (mm)	Prec. Feb 2015 (mm)	Prec. Feb 10-y return period (mm)
Niassa	Lichinga	309.2	321.1	216.3	239.5
	Cuamba	522.3	332.5	194.4	230.8
Nampula	Nampula	457.0	392.0	243.2	198.6
	Angoche	225.5	162.1	184.4	174.0
Zambezia	Quelimane	404.2	277.1	226.9	184.0
	Mocuba	590.3	290.9	189.7	216.9

Fig. 11. Table: Rainfall records between January 1 - February 28, 2015 at the level of the six meteorological stations, compared to the 10-year return period

The most intense rainfalls were recorded in upstream areas in the Shire-Namuli formations, flowing into both Licungo and Shire Rivers.

1.1.2. Runoff

Runoff is monitored from a network of 37 hydrological scales ("stations") within the Assessment area. Most of them are manual reading scales, which have suffered damages during the event and have not been able to record the peak discharge with accuracy.

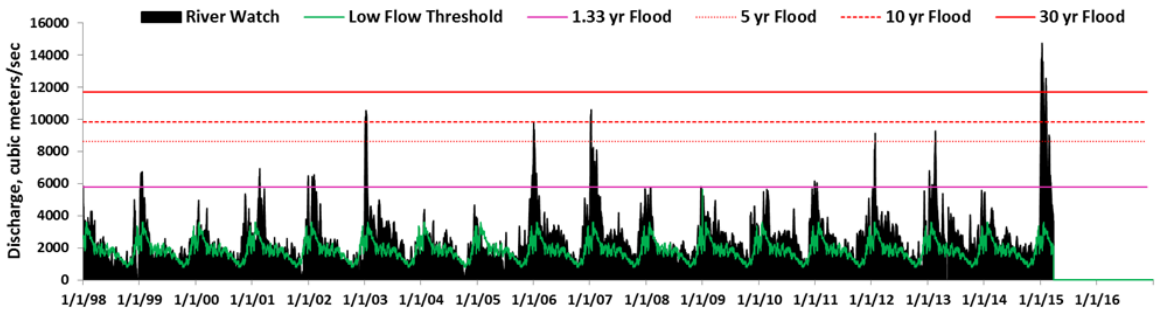


Fig. 12. Hydrograph in the Shire River in Malawi near the border with Mozambique

The Shire River, monitored with a satellite-based estimate situated in the upstream area of the catchment in southern Malawi, reached a peak on January 12 and another on February 2, both above the 30-year return period flow.

The hydrographs presented below clearly show how the Licungo River in Mocuba reached a sharp peak on the same day when highest precipitations were recorded, while the Zambeze in Marromeu followed a more progressive – thus also devastating – increase in level and runoff. The main factor explaining these different types of responses is the size of the watershed, as detailed below in section 1.1.4.1.

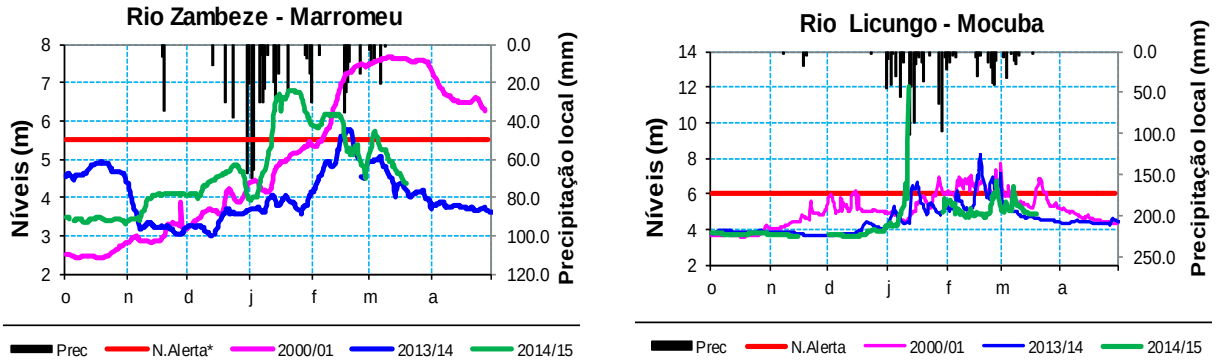


Fig. 13. Hydrographs in Marromeu (Zambeze) and Mocuba (Licungo) (source: DNA, Hydrological Situation, March 31, 2015)

The conjunction of these three extreme situations (1- Tropical Storm and Cyclone Chedza; 2- exceptional rainfall pattern in Malawi; 3- Tropical Storm Fundi), resulted in extreme flooding. The last comparable episode took place in January 1971 and resulted similarly in the isolation of Mocuba bridge.

More detailed information is available in the document, "*Heavy rains accompanied by thunderstorms and strong winds in the provinces of Nampula, Niassa and Zambezia*" from the National Meteorological Institute (INAM) and "*Licungo River Flooding*" and "*Preliminary Report on Licungo River Basin Flooding*," from the National Water Directorate (DNA).

In addition, strong erosion of riverbanks due to high speed and water flow rates caused loss of vegetation and dragged eroded soil.

Fig. 14. Pictures: Flooding of vast area in the Licungo plains and erosion of banks along the Lingonha River

On January 17, the Moderate Resolution Imaging Spectroradiometer (MODIS) on NASA's Terra satellite captured the image below, which shows flooding along the Licungo and other rivers in coastal Mozambique. Thick plumes of sediment-rich water are also visible in the Mozambique Channel, and can be directly attributed to the specific January rainfall event by comparison with an image from the same area from February 1, 2014.

Fig. 15. Maps: Comparison of MODIS images of the Licungo outlet from January 17, 2015 (left) and February 1, 2014 (right) highlight high concentrations of sediments

The relationship between rainfall and runoff and inundation is influenced by various parameters detailed in the next sections.

1.1.3. Flood Extent

Out of the 32 million hectares of land in Nampula, Niassa and Zambezia, about 633,000 ha or 2 percent have remained under water for a sufficient time between January 12 - February 17 to be labeled as "flooded" from remote sensing (combining several data from MODIS, ESA Sentinel-1 and Landsat-8 provided by the Dartmouth Flood Observatory). The extent of the combined area having been flooded, is shown in dark blue on the map below.

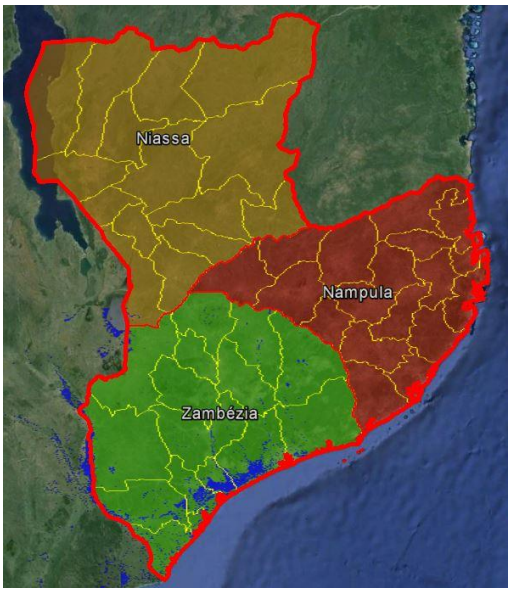


Fig. 16. Map: Flood extent estimated by remote sensing (source: DFO)

Most of the flooded area is either (i) close to the coastal strip in Zambezia (close to Maganja da Costa and on both sides of the Licungo watershed) or (ii) along the Zambeze River, at the boundary between Zambezia and Sofala and Tete provinces. It is important to note that the flood extent map depicts places where water has stagnated and does not identify exhaustively all places having experienced high runoff, erosion and/or strong winds.

1.1.4. Erosion, Flooding and Contributing Risk Factors

1.1.4.1. Size of the Watersheds, Distance between Rainfall and Exposed Elements

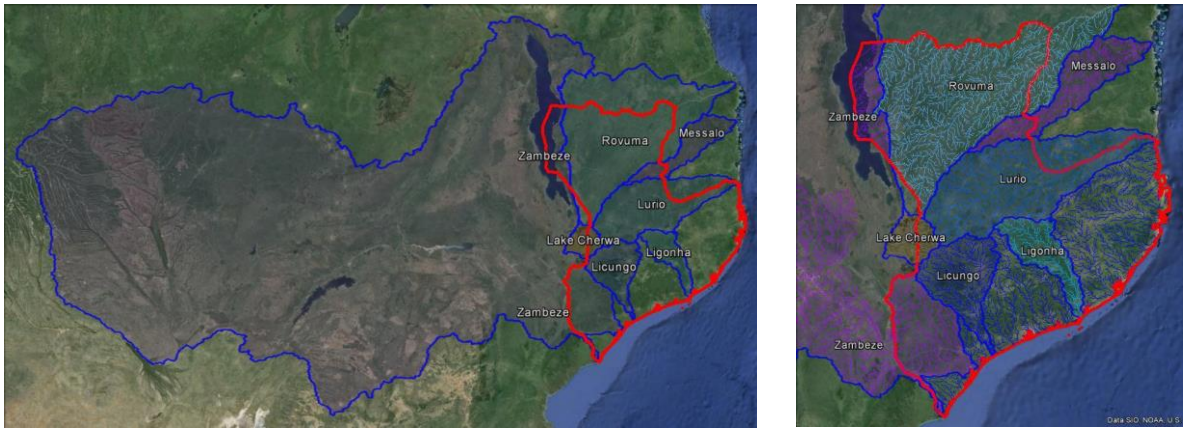


Fig. 17. Seven major watersheds intersecting the Assessment area

The size of the watershed, and the position of assets within each watershed, is a critical factor explaining the flood risk. Seven different watersheds intersect the Assessment area:

- Licungo and Ligonha watersheds are fully located in the Assessment area, with a maximum distance between upstream areas and the catchments of about 300 km. The high runoff levels observed in both watersheds have resulted from local rainfall, 100 percent within Nampula, Niassa and Zambezia. The distances being limited, the peak flow in the Licungo River at Mocuba was observed on January 12, the exact day when the rainfall records were the highest;
- Only 3 percent of the Zambeze watershed, including the outlet, are located inside the Assessment area, and the distance between the upstream and the outlet are greater than 3,000 km. Heavy rainfall in the upstream areas, including in Malawi, have critically contributed to the high water levels observed in the southern Zambezia region;
- The watersheds of Rovuma and Messalo, which cover most of the Niassa, have their outlets outside of the Assessment area;
- Lake Chewa watershed is evenly shared between Malawi and the Assessment area;
- Lurio watershed is mostly inside the Assessment area.

1.1.4.2. Elevation, Topography and Slope

The Assessment area is composed of three topographic zones: (i) mountains, with altitudes over 1000 m; (ii) highlands, with altitudes ranging from 200 to 1000 m; and (iii) lowlands, forming a strip of about 60 km along the coast and following the Zambeze River inland about 300 km.

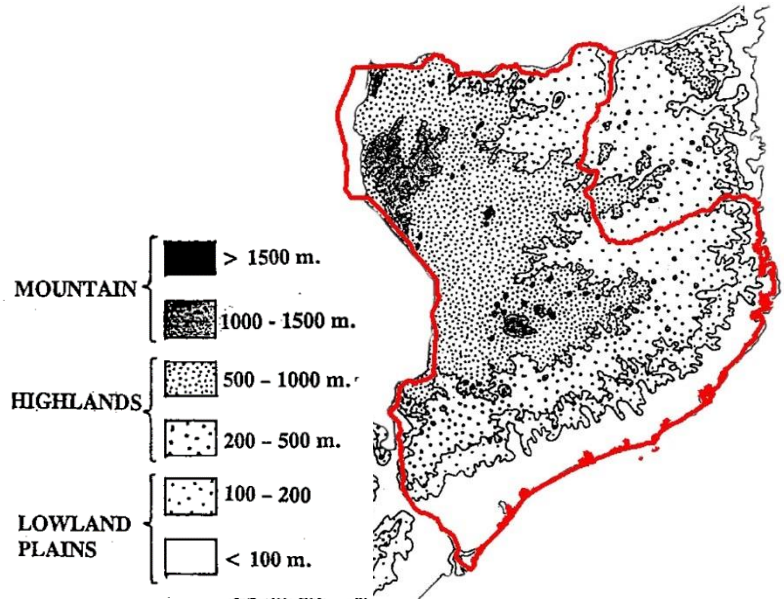


Fig. 18. Map: Topography of the Assessment area (source: Conservation of the biological diversity in Mozambique, MICOA, 1997)

The slopes are particularly important, with recurrence of strong erosion pattern, in the highlands which cover nearly 80 percent of the assessment area. The sediments transported from the highlands tend to deposit in the lowland, composed of wetlands, grasslands and mangroves, and can cause obstructions in rivers' and streams' flow.

1.1.4.3. Vegetation Cover

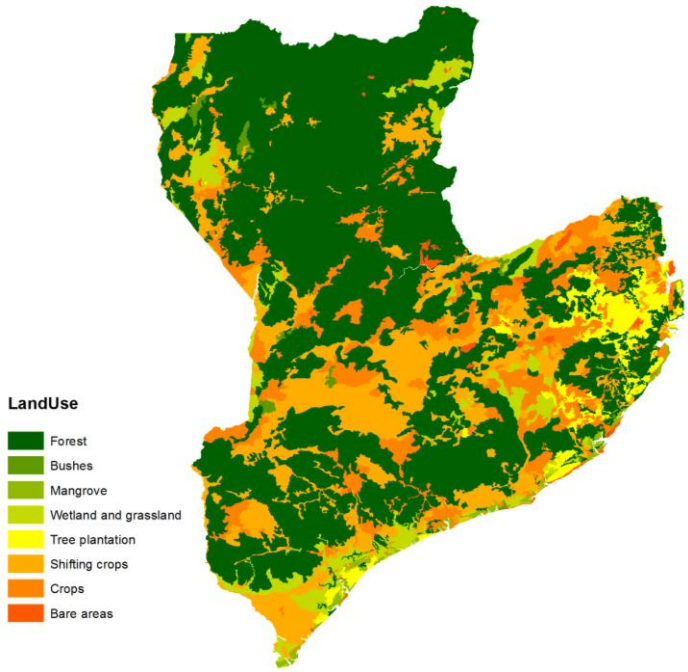


Fig. 19. Map: Vegetation cover in the Assessment area (source: Department of Forestry Inventory, 2007, data derived via remote sensing from Landsat TM data)

Although some dense forests remain in the north-central interior and on the Chimoio Plateau, most of the northern and east-central areas are open forests, increasingly anthropic. Shifting cropping systems are intensely practiced in the deforested areas. The deforestation's impact on flood risk is high, with reduced rainfall infiltration leading to increased runoff, reduced friction to water flows leading to increased runoff velocity, altogether increasing the erosive potential of water streams.

Land cover	Total ha	Ha flooded	% of total flooded	% of type flooded
Bare areas	219,293	1,263	0.2%	0.6%
Bushes	184,877	16	0.0%	0.0%
Crops	3,542,775	42,571	6.7%	1.2%
Forest	19,331,660	95,894	15.1%	0.5%
Natural water bodies	57,866	458	0.1%	0.8%
Mangrove	285,063	42,645	6.7%	15.0%
Shifting crops	5,931,711	169,444	26.8%	2.9%
Tree plantation	1,174,857	25,797	4.1%	2.2%
Wetlands and grassland	1,751,100	254,967	40.3%	14.6%
Grand Total	**32,479,203**	**633,055**	**100.0%**	**1.9%**

Fig. 20. Table: Total area and area flooded for different categories of vegetation cover

Most of the areas flooded between January 12 - February 17 were wetlands and grasslands (40 percent of the total flood extent). The combination of "crops" and "shifting crops" categories represents 34 percent of the flooded area, a total of 210,000 ha. The Ministry of Agriculture and Food Security has reported that out of this 210,000 ha, 104,430 ha suffered crop losses.

1.1.4.4. Inadequate Drainage Infrastructure in Urban Areas

The official statistics of Mozambique show that the current urban population is 31.8 percent of the total, with a noticeably growing trend (30.4 percent in 2007). The standard layout of urban settlements in the country is a legacy of past colonial era: an orderly and reticular central area with paved roads, water and energy infrastructure serving buildings of conventional construction used for housing and services, surrounded by larger areas of slums of unconventional and poor houses laying disordered and being served by unpaved paths and insufficient and erratic water and energy infrastructures. The central area is home to official services, commerce and houses of the local elite, while the poor communities reside in the "suburbs."

Drainage infrastructure, where it exists, is usually restricted to central areas, but even there the systems are underdeveloped: (i) buildings drain uncontrolled water rains to the streets with ancillary open channels of insufficient capacity and using natural streams as outlets. This usually results in serious urban erosion and inundations; (ii) sometimes very limited sewerage networks can be found but are usually out of service after obstructions due to lack of maintenance.

In the peri-urban unplanned areas, with exception of Quelimane, no formal drainage system is available.

Fig. 21. Picture: Absence of drainage lead to erosion in Nacala

1.2. Analysis of Exposed Elements

District governmental authorities play a critical role in coordinating the interaction between the government and the communities, in particular with prioritizing vulnerable groups among the communities in need of special assistance, as well as in identifying priorities for replacing or repairing damaged infrastructure. The information in this section is preliminary, based on information made available to the team during the rapid assessment mission.

The analysis takes into account the following districts:

– In Nampula:

→ Angoche → Cidade de Nampula → Ilha de Moçambique → Lalaua → Malema → Meconta → Mecubúri	→ Memba → Mogincual → Mogovolas → Moma → Monapo → Mossuril → Muecate	→ Murrupula → Nacala - Porto → Nacala - Velha → Nacarôa → Namapa - Eráti → Nampula - Distrito → Ribaué

– In Niassa:

→ Cidade de Lichinga → Cuamba → Lago → Lichinga - Distrito	→ Marrupa → Maúa → Mavago → Mecanhelas → Mecula	→ Muembe → N'Gauma → Nipepe → Sanga

→ Majune → Mandimba	→ Metarica	

– In Zambezia:

→ Alto Molócué → Chinde → Cidade de Quelimane → Gilé → Gurué → Ile	→ Inhassungue → Lugela → Maganja da Costa → Milange → Mocuba → Mopeia	→ Morrumbala → Namacurra → Namarroi → Nicoadala → Pebane

Nampula and Zambezia are the most populated provinces of Mozambique, with a total population of 5 million and 4.8 million, respectively (source: INE - projections for 2015). Niassa, despite being one of the biggest provinces in the country, remains the least populated with about 1.65 million inhabitants. About 11.5 million people are living in these three provinces, which accounts for 44 percent of the country's population. All have been exposed to strong winds, flooding, erosion or a combination of these hazards.

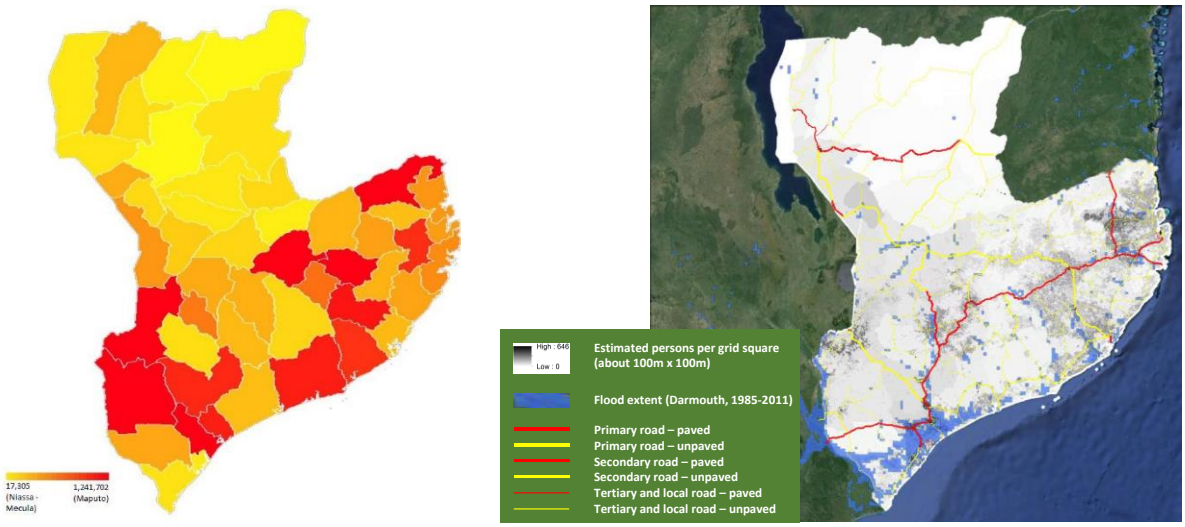


Fig. 22. Maps: population by district (left; source: 2015 projections from INE) and gridded model of population with road network and maximum flood extent 1980-2012 (right; source: Afripop, Dartmouth Flood Observatory and ANE)

In spite of its wealth of natural assets, Zambezia has the lowest GDP per capita in the country. The incidence of poverty in the Assessment area is high. Overall, Mozambique's rapid economic expansion over the past 20 years has had a moderate impact on poverty reduction, and the geographical distribution of poverty remains largely unchanged. Nationally, the poverty rate is the highest in Zambezia, at 70.5 percent of the population in 2009, while Niassa is at 31.9 percent and Nampula at 54.7 percent.

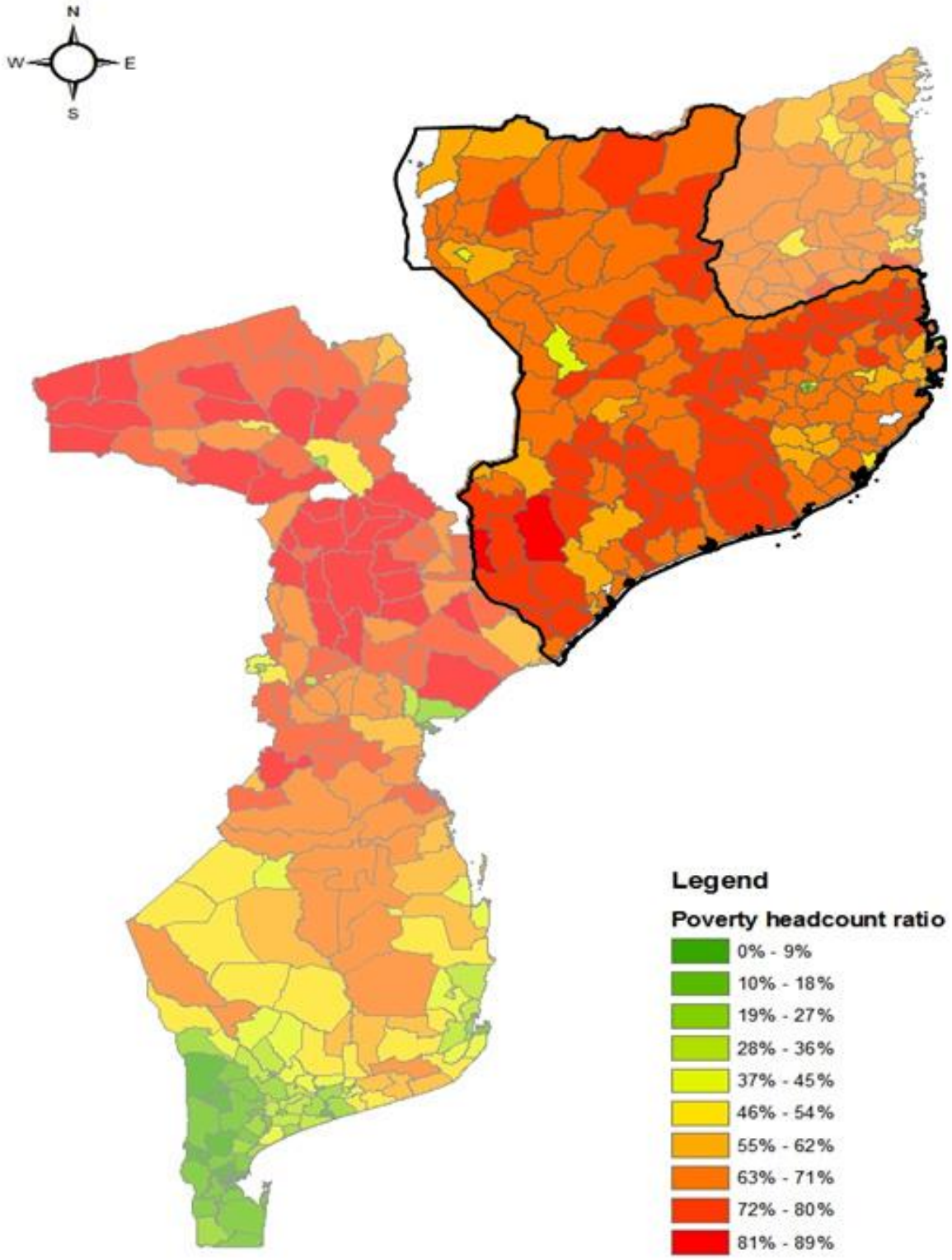


Fig. 23. Map: Poverty headcount by administrative posts in Mozambique

1.3. Vulnerability Analysis

1.3.1. Public Infrastructures

1.3.1.1. Roads and Bridges

Transport infrastructure is developed transversally, along west–east corridors, connecting mining and agricultural clusters within Mozambique as well as in neighboring countries (Zimbabwe, Zambia, Malawi) to exit ports. The connectivity among population concentrations, as well as the quality of roads along these transport corridors is relatively good.

Mozambique's total road network length in 2012 is 37,000 km, of which only 6,000 are paved. Roads are central to food security, health, commerce, rural employment and development. They provide benefits within the Assessment area and also serve as transport linkages across different corridors.

Due to the mountainous nature of the regions, much of the road network in Nampula, Niassa and Zambezia cross the valleys and lower lands in the direction to coastal main cities, and are highly exposed to water accumulation and erosion.

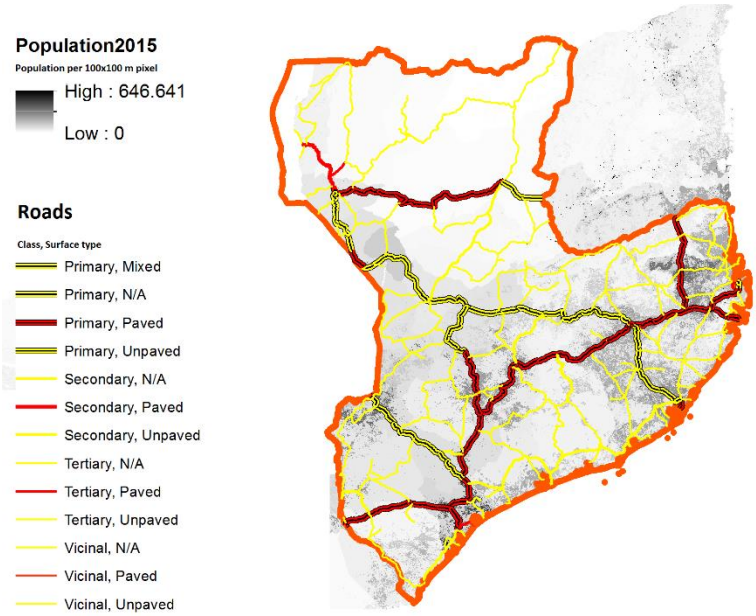


Fig. 24. Map: Road network in Nampula, Niassa and Zambezia (Source: ANE) overlaid on the population density (Source: Afripop)

Maintenance of the road network is appropriately managed by the road fund, established in the early 2000s with the mandate of providing centralized funding for routine road maintenance. The fund receives adequate levels of financing, largely based on revenues coming from a fuel levy.

The vulnerability of the road network materializes through a combination of design limitations, limited drainage capacity and the need to reach scattered communities through secondary roads, often not properly maintained. The road infrastructure is closely linked to the system of irrigation and dykes in the flood plain.

The infrastructure along the three targeted provinces includes about:

	Paved (km)	**Unpaved (km)**	**Total (km)**
Primary	1650.621	1198.995	2849.616
Secondary	112.100	1152.700	1264.800
Tertiary	71.158	5439.163	5510.321
Vicinal	10.315	2723.729	2734.044
TOTAL	1844.194	10514.587	12358.781

Fig. 25. Table: Length of different road classes and surface types

The network is a mix of under-designed roads, according to contemporary hydrological conditions in Mozambique, and new constructions up to code. A sequence of floods and extended hydrological records highlight the vulnerability of the network.

Nampula, Niassa and Zambezia constitute an important area of prime agricultural potential, with significant levels of public and private investment, and commercial exploitation of wood. The region is both a source of natural resources, like timber and minerals, and a corridor for transporting commodities from nearby provinces and neighboring countries, which ultimately contribute negatively to the conditions of the road network.

1.3.1.2. Energy

The energy grid is overall robust; however Mozambican access to electricity is very low, in both urban and rural areas. On average, 30 percent of the population in low-income countries have access to electricity, compared to only 10 percent of Mozambicans. 26 percent of the urban population and 1.1 percent of the rural population are connected to the power grid.

The provision of power is reliable and the national utility company has a good - and improving - performance record. Although Mozambique is a very large country and faces some issues related to the distance between generation sources and load centers, the network has expanded rapidly over the last decade, from 55 districts covered in 2005 to 110 in 2012. Nevertheless, the progress achieved so far would require adequate and massive electrical infrastructure to ensure continuous economic growth in the country. Power transmission is mainly three high voltage corridors, one of which supplies Maputo and the southern region via South Africa. Large development are under implementation in order to enable transmission of around 9,200 MW additional generation.

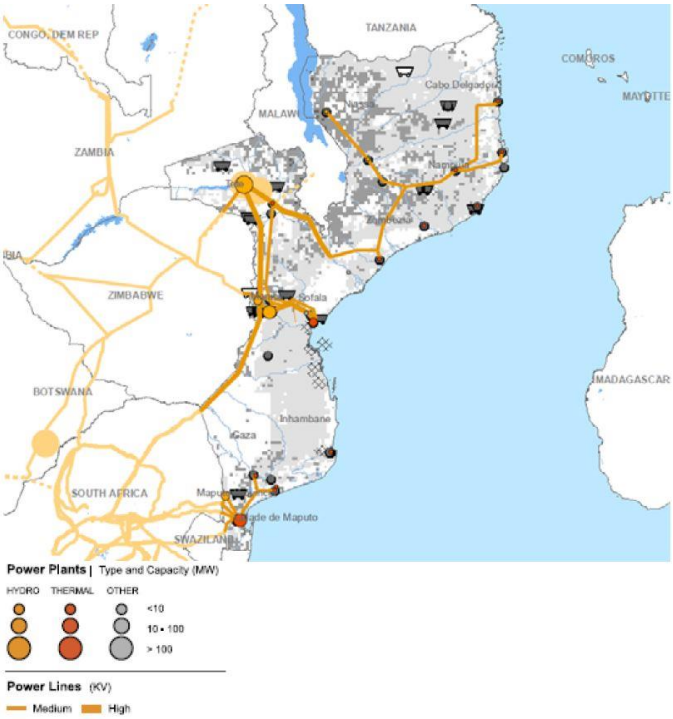


Fig. 26. Map: Energy infrastructure in Mozambique (Source: AICD Country Report, 2011)

The country, already a net exporter of electricity and a member of the Southern Africa Power Pool (SAPP), still has large untapped hydropower, coal and natural gas potential and the possibility of becoming a key player in the regional energy supply market. Multiple power generation and transmission projects are ongoing, and it is considered that the development within the next two to three years could set the competitiveness of the whole sector for a 10- to 20-year period. Ensuring a rapid recovery from the 2015 flood is therefore of paramount importance to avoid delaying the rapid growth of the sector, critical for the country's economy.

1.3.1.3. Irrigated Schemes

The irrigation infrastructure in Mozambique is less developed than in other average Sub-Saharan African countries. As of 2007, 2.7 percent of the country's cultivated area was equipped for irrigation, which is below the Sub-Saharan average of 3.5 percent. The equipped irrigation area contributes merely 4.8 percent to the total agriculture output. Between 1973 and 2003 the irrigated area grew 4.4 percent annually, while Mozambique's agriculture sector is growing 9 percent per year on average. The country's current irrigated area could be increased substantially with good economic returns. Mozambique stands as the country with the largest potential area increase for small-scale projects; however, the potential benefits of new irrigated agriculture using large-scale schemes is low.

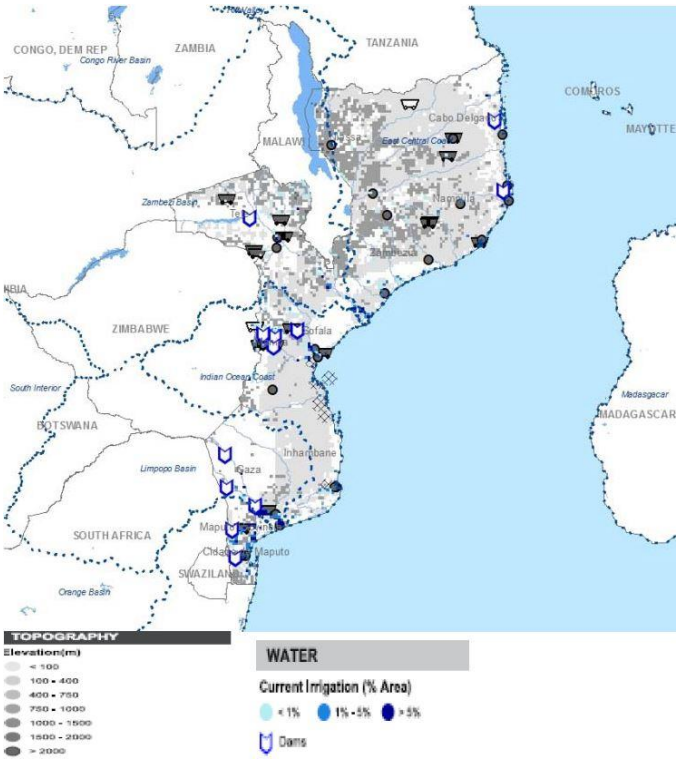


Fig. 27. Map: Irrigation infrastructure in Mozambique (Source: AICD Country Report, 2011)

The contribution of irrigation therefore is critical in stabilizing agricultural production and increasing productivity, particularly in food production. Crops such as rice, corn, vegetables and tropical fruits have an important nutritional and economic value, and if irrigated and subject to good cultural practices, can have immediate productivity increases of at least 200 percent of its production in rain-fed conditions.

In 2009, there were 619 ha of irrigated land in Nampula, 490 ha in Niassa and 1,327 ha in Zambezia. Irrigation infrastructure in these provinces is scarce and was initially established more than 60 years ago, and rehabilitated after 1992. Even with the further expansion of irrigated areas in 2004, there are still 60,000 ha that are inactive. In general, there are insufficient human resources at provincial and district levels and a lack of norms and procedures to properly manage and develop irrigation activities.

The vicious cycle of irrigation scheme linking low payment rate of water fees, inadequate maintenance and poor infrastructure functioning leading to water users' dissatisfaction is true overall in Mozambique, including in irrigation systems in the northern and central regions. In addition, the flood risk limits the willingness of investors and donors to invest in the schemes.

In the particular case of rice, the crop can withstand a moderate submersion period (seven to 10 days) if well-established and thus may survive a flood event if the plot is normally irrigated afterward. Therefore, losses in rice crops in damaged irrigation facilities can only be confirmed weeks later.

1.3.1.4. Flood Protection and Dikes

Flood protection works are not abundant in the affected area. In Mozambique, dikes protecting irrigation schemes and urban areas are institutionally under the responsibility of water authorities, the ARA's *Regional Water Administrations*, while dykes lying within irrigated schemes are under the Ministry of Agriculture. Affected dykes are located on the left bank of the lower Licungo River (Nante) and on the right bank of the lower Zambezi River (Luabo). These are very flat, productive and densely populated areas where thousands of people live and work protected by dikes.

Dikes are old infrastructures built from the 1960s - 1980s. They have been subject to recurrent flooding (every one or two years) and consequent erosion with lack of maintenance. Sometimes they have suffered important breaches, which went several years with no repair, aggravating exponentially the vulnerability of areas (as it happened recently with the Nante dike).

Their top surfaces are used as local roads, and thus lowered when considered obstacles to crossing, especially for cattle. In addition, water pumping from the river toward the irrigated fields leads to excavations of the embankments. Aggravations of flood intensities over the last years indicate that design features are in great need of review.

1.3.1.5. Drainage Networks

The urban drainage networks are not particularly vulnerable to flooding risks; however, their under-development, inappropriate development and/or design in relation to urbanization, generates additional flood risks in populated neighborhoods, as shown in the 1.1.4.4 section "Inadequate Drainage Infrastructure in Urban Areas."

1.3.1.6. Railways

Mozambique's railway system is functional and has been attracting private interest and investment in recent years. It is facing a rapidly increasing demand due to growing trade with neighboring countries and significant increase in domestic coal production.

The Nacala Corridor (CFM Norte), with about 620 km of rail in the Assessment area, is the most recent addition to Mozambique's railway system. It connects the Nacala Development Corridor and links to the Central East African Railway (CEAR) of Malawi. The Nacala Development Corridor operates the railway system, and recently, the Brazilian Mining Company Vale invested in a possible link from Moatize coal mines, either via the Sena line to the port of Beira, or to Malawi, connecting to the existing line to Nacala.

Fig. 28. Map: Nacala Corridor Railway (Source: africa-confidential.com)

This railway system, although planned considering the country's hydrological conditions, in recent years, has proven highly vulnerable to flooding, and associated erosion in some stretches, which paired the transit of commercial cargo and in addition, increased the overall vulnerability of the tracks.

1.3.1.7. Telecommunication

The telecommunication infrastructure in the Assessment area vulnerable to flooding and storms includes:

- 2,500 km of optic fiber network, positioned along the primary roads (displayed on the map below), are primarily vulnerable to flooding and to inadequate road drainage infrastructures; and
- telephone lines, mostly on wooden poles, are vulnerable to high winds, which are more frequent along the coast in relation to tropical cyclones.

Fig. 29. Map: Optic fiber network in the Assessment area

1.3.1.8. Drinking Water Supply and Sanitation

The coverage of drinking water supply in the three affected provinces is relatively lower when compared to the country averages:

	Urban	Rural
Zambezia	27%	40%
Nampula	40%	38%
Niassa	24%	42%
Country	54%	51%

Fig. 30. Table: Population with access to drinking water supply in the central and northern regions (%)

The main factors contributing to the vulnerability of drinking water systems are:

- Lack of compliance with the protection areas in the surroundings of capture sites;
- Flood protection infrastructure below standards; and
- Proximity of infrastructures to areas prone to high runoff or landslides.

The water supply systems in urban areas in affected provinces are particularly vulnerable to the direct impact of floodwaters in their most exposed components, usually lying in or near the riverbeds, such as water intakes, pumping stations and main transport conduits. The intakes of Mocuba, Molocue and Ile and conduits in Cuamba and Nacala are good examples. The systems proved indirectly vulnerable to energy outages.

In rural areas, water boreholes and hand pumps, when situated in low lying areas of the Licungo basin, are vulnerable to flooding. The same is true for latrines.

1.3.2. Productive Sectors

1.3.2.1. Rain-Fed Agriculture and Livestock

The agriculture sector accounts for about 30 percent of GDP and 80 percent of the labor force. Based on Agricultural Census (2010), Nampula, Niassa and Zambezia have 44.7 percent of the agricultural production area of the country, and together account for almost 50 percent of small farmers. It is important to note that small farmers are largely dedicated to subsistence agriculture.

Based on the 2011 Strategic Plan for the Agriculture Sector Development, one of the main problems affecting the sector is the low productivity, which is among the lowest in Southern Africa. This is due to a combination of several factors, including low adoption rates of productivity-enhancing agriculture technologies, inadequate provision of agriculture services, limited access to rural finance and an inadequately enforced land law. The plots are usually cultivated using the work and hand tools, with minimal use of improved seeds (10 percent for maize, 1.8 percent for rice), chemical inputs (4-5 percent) and animal traction (11 percent). 95 percent of agriculture exploitations are less than three hectares, which represents a natural

limit to the amount of food that can be produced for home consumption and for sale, thus limiting the possibility of generating income and investing in vulnerability reduction.

3.7 million small farms are spread in the country, out of which about 50 percent (1.85 million) are in Nampula, Niassa and Zambezia. These farms account for 95 percent of total agricultural production (mainly rain-fed and subsistence-based), while about 400 commercial farmers produce most of the commercial and export crops (sugar cane, tobacco, tea, citrus) and livestock.

Several production systems exist in relation with different types of soil. In heavy textured and poorly drained soils, the predominant production system is the monoculture of rain-fed rice and sweet potato. In moderately drained soils, the cultures of corn, sorghum, millet, cassava and bean are more common. In Niassa, maize, cassava and beans are the most common crop. The coastal strip of Nampula is dominated by the production of cassava intercropped with beans and peanuts. Rain-fed rice is produced in the dry season on the plains of major rivers; however, vulnerability to climatic events contributes to low levels of production and productivity, in average 800 kg/ha. Poor households have few assets to sell and their consumption is already low, so in times of scarcity due to disasters, they do not have much to prevent food insecurity.

There are two planting seasons, one of which begins in April or May. It is therefore critical to ensure recovery of communities for the next harvest.

Due to the occurrence of the tse-tse fly, much of the zone is unsuitable for cattle grazing (70 percent of cattle are located in the south of the country).

In relative terms, small farmers are more vulnerable to natural hazards compared to commercial farmers. The damages and losses result in direct impacts on food security, with impacts potentially lasting more than one season because of insufficient access to alternative resources to compensate and launch new crops after the occurrence of flooding or drought.

1.3.2.2. Fisheries

The Fishery sector contributes about 3.6 percent of GDP with a total production estimated at about 213,000 tons (2012), of which small-scale fisheries accounts for 87 percent, industrial and semi-industrial fisheries to 12 percent and aquaculture to 1 percent. The fisheries sector can be classified in three categories: (i) industrial fishing represented by companies and ship-owners operating vessels over 20 m in length, with a processing autonomy and freezing on board; (ii) semi-industrial fishing comprised of companies and ship-owners operating vessels between 10 and 20 m, with capacity for conservation on board; and (iii) small-scale fishing composed of artisanal fishers and small ship-owners operating vessels less than 10 meters in length and limited to ice conservation as well as operators fishing without vessels. Semi-industrial and industrial fishing is mainly concentrated in marine waters, while artisanal fisheries are present in both marine and inland waters (i.e. lakes and rivers).

Small-scale fishing is the larger productive component of the fisheries sector in terms of number and volume of production (the fish consumption per capita is estimated at 6.9 kg per year in Mozambique), and the most important, relative to job creation. Shrimp fishing in shallow waters by semi-industrial and industrial operators has historically a high relevance for the country's economic performance in terms of foreign exchange and balance of trade.

Small-scale fishing activity remains an alternative to agriculture and contributes to an enriched diet of the most vulnerable people in coastal communities. Destruction of aquatic environment, combined with increased pressure from fishing and other economic activities, is a reality along the coastline of these provinces. When a disaster occurs it aggravates the pressure on the resource use and coastal livelihoods and the situation may further deteriorate, especially for people that are directly involved in the artisanal fisheries sector. Small-scale fishing communities in Nampula, Niassa and Zambezia are vulnerable to the direct threats of floods and cyclones, and to the impact of the changing of an ocean's temperature, water quality and biology, related to climate change, over-fishing (including some illegal fishing), deforestation, erosion and pollution. Small-scale fishers are at risk of losing their vessel and or gear due to climatic events, such as storms and floods. They might also suffer from reduced catches following change in fish resource distribution and reduced incomes following difficulties to conserve and or market their catches and products.

Aquaculture is a nascent industry, expanding rapidly in particular inland for small-scale operators. The emerging shrimp aquaculture sector was recently affected by viral disease, and production drastically reduced. Aquaculture vulnerability to flooding lies, in particular, in risk of pond destruction, water intrusion that could cause destruction (e.g., desalinization) or escape of fish stocks, loss of feed stock and damage to infrastructures.

1.3.2.3. Industry and Commerce

The economic vocation of Nampula, Niassa and Zambezia prompts the region to develop its commercial and limited industrial base around either agriculture or extractive activities. The scattered population and long distances impose a high dependency on road transport, since both fluvial and railway modes are limited. Disruptions in the very restricted road network is currently affecting directly the economy of the region, driving up the prices of industrialized goods, processed food and services at short notice.

As per quality of the infrastructure, small business and market merchants tend to own or operate in very precarious material-built stalls or tents highly vulnerable to strong rain and wind. Larger businesses tend to own or operate in stronger quality infrastructure, although some of them are very exposed to flooding due to the location of their buildings.

1.3.3. Livelihood and Social Sectors

1.3.3.1. Environment

Mozambique has some of Africa's largest total renewable water resources (216 km^3). The country is the outlet of nine of its 13 major river basins, and more than 50 percent of the

country's total-mean-annual runoff is generated outside Mozambique's boundaries. Upstream activities and neighboring weather/water conditions directly affect the country. The rainfall extremes, combined with limited storage and flood-control infrastructure, result in frequent flooding and variable inter-annual river flow.

Deforestation is a significant problem deriving from fuel wood collection, shifting agriculture, forest fires, timber export and lack of land use plans. Wood consumption for fuel is estimated to account for 250 times that consumed for logging operations. Although current commercial logging is 25 percent less than the permitted capacity, many sources believe that this is under-reported and not sustainable. The environmental impact of deforestation includes land degradation, exacerbated flooding, erosion and sedimentation. Specific data from IFAD/IFPRI indicates that the northern forests of Niassa are at risk in relation to logging and charcoal wood harvesting, while dense forest monoculture growth is decreasing due to agriculture burning. Areas used for agriculture often coincide with ecologically-sensitive areas such as river banks, freshwater springs and wetlands, resulting in adverse impacts to these habitats in some cases.

The Great Inselberg Archipelago of northern Mozambique occupies an area of approximately 500 km by 160 km in Nampula and Zambezia. It is characterized by unique flora and fauna (endemics and biogeographical outliers) contained in the isolated rainforest, patches of which form aprons around the flanks and base of inselbergs.

About 10 percent of the land is protected for the conservation of soils and biodiversity, including in the Niassa National Reserve (42,200 km²) in Niassa, and in the Gilé National Reserve (2,100 km²) in Zambezia. In the 90 percent remaining area, introduction of sustainable land and water management practices would be a matter of high priority in order to ensure more optimal use of water resources, and reduce risks related to runoff and erosion.

1.3.3.2. Education

Schools design in Mozambique is overall largely unsuitable to prevailing flood and wind hazards, as reported by the exposure and vulnerability analysis carried by UN-Habitat. The use of precarious materials, such as straw-bale, haystack, timber poles and raw mud as wall finishings, expose the infrastructure to high damages. Likewise, structures built with conventional materials, including bricks and concrete, are often exposed to the strength of the flooding, as they tend to be located in proximity of the river beds, and are not equipped with levee protection, drainage ditches or high foundations.

In addition, the quality of the covering material is not the most resistant in those conventionally built. Corrugated roofing has an inadequate thickness (0.3 mm) to withstand overloads, especially in cases when it is used as shelter. The quality of construction is often inadequate to resist to recurrent winds and this results in frequent damages and destruction of roofs.

As a result from the insufficient construction quality, inappropriate location and orientation of school buildings, the number of classrooms destroyed in a single windy or flooding event

often overpasses the annual number of classrooms planned to be constructed under the Accelerated School Construction Program.

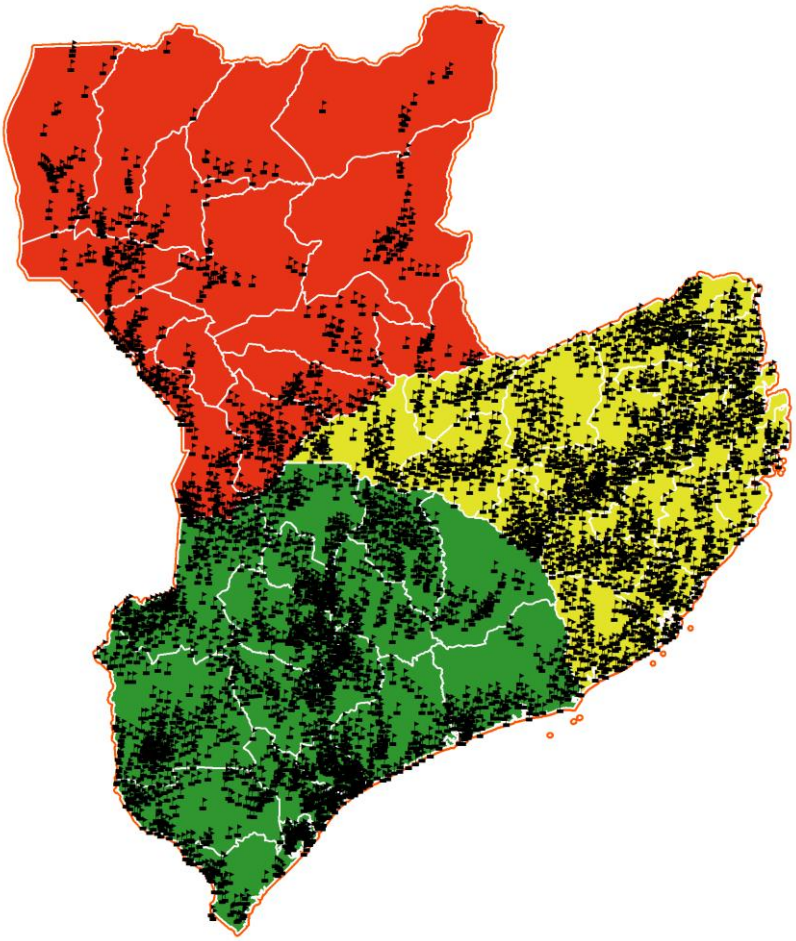


Fig. 31. Map: Density of the schools' network in the Assessment area (Source: INGC)

About 4,400 schools are located in the Assessment area. Most of them are located in storm-prone and flood-prone zones. Due to their high exposure and vulnerability to winds (along the coast) and floods (near the Licungo and Zambeze Rivers), urgent attention is required at all phases of emergency repair, post-flooding reconstruction and vulnerability reduction. This is required in order to bring back teaching and learning activities to the affected communities, with infrastructures able to withstand flooding, wind and earthquake risks, with a multi-hazard approach, taking into account the zoning of respective hazards.

1.3.3.3. Health

The average coverage index for the National Health Service is very low in all three provinces. In 2012, it corresponded to: (i) one health unit for 19,797 people; (ii) one bed for 2,915 inhabitants, (iii) one health technician for 3,071 inhabitants.

Overall, 609 health facilities are located in Nampula, Niassa and Zambezia: 235, 205 and 169, respectively. Of these, 536 are type II and type I health centers and health posts. In addition,

there are six rural and nine district hospitals. Most district hospitals are located in the district capital, but in some cases they can be found in a rural setting.

Together, the network of primary health care facilities at the district level comprises of 58 type I and 403 type II health centers and 75 health posts. The latter are gradually being replaced by health centers type III. These facilities, specifically health posts and type III and II health centers, are located close to communities at district and sub-district levels, thus when damaged as a result of natural hazards, physical access to health care worsens.

Health centers are usually made of conventional material (concrete blocks, bricks, zinc plate, lusalite tile or concrete slab), but lack regular maintenance and are very prone to damages, especially due to their weak infrastructure and design, and poor materials used during construction. Other health infrastructures at this level include warehouses for storage of medicines and vaccines, and medical supplies. These facilities are usually located within the limits of the health center and/or near general hospitals. In the three provinces, most warehouses are physically weak or old, with inadequate roofing and acclimatization, as many were not designed for the storage of medicines and vaccines.

A significant proportion of existing health facilities was built before independence, i.e. more than 40 years ago. Most do not follow construction standards that take natural hazards into consideration. Currently, the design and construction of health facilities is regulated by the Ministry of Health and Ministry of Environmental Affairs from a technical and environmental perspective. The Ministry of Public Works and Water Resources (MOPRH) provides overall construction guidance relative to general design of any public facility. In addition, the oversight of public works and accreditation of construction firms is under the purview of the MOPRH. A key weakness in the process of building health infrastructures relates to poor/inadequate supervision, which has resulted in structural deficiencies, making them more vulnerable to disasters.

Although the detailed design of health centers does not mention any provision to make these facilities resilient to natural hazards, it does include environmental and social safeguards and some specifications for the structure and roofing of the buildings. For example, the selection of the construction site and construction techniques should be guided by a set of criteria that includes avoiding areas prone to flooding, soil erosion, landslides and/or sites occupied by persons and/or used for other purposes (farms, pastures for cattle, native forests, etc.). Similarly, both the foundations and floor of the facilities should rest on concrete and the roofing should be made with wood and zinc.

Community health posts are generally sites constructed with non-conventional/precarious materials (grass, straw, palm thatch, bamboo, reed, sticks and wood). They are built in accordance with local construction techniques and are not necessarily part of the National Health Service, but help provide initial care to those living far from a health center.

In addition to the main buildings, where diagnostic services and health care are provided, the health centers include elevated plastic water tanks, sewage systems and electric wiring linked to the general electric grid or solar panels. Facilities for disposal of medical waste are

mandatory and these include biological tanks, and/or incinerators (Monffort type). In general, the above mentioned facilities are often not fully functional due to lack of maintenance.

1.3.3.4. Food Security and Nutrition

Regarding food security and the nutrition situation, the northern and central provinces have the highest prevalence (Source: 2013 National Food Security and Nutrition Baseline). Overall, the percentage of chronically food insecure households is 24 percent, being higher in rural households (27 percent) than in urban households (18 percent). The highest prevalence of acute food insecurity is in Niassa (30 percent). The prevalence of acute food insecurity at the country level is 3.5 percent.

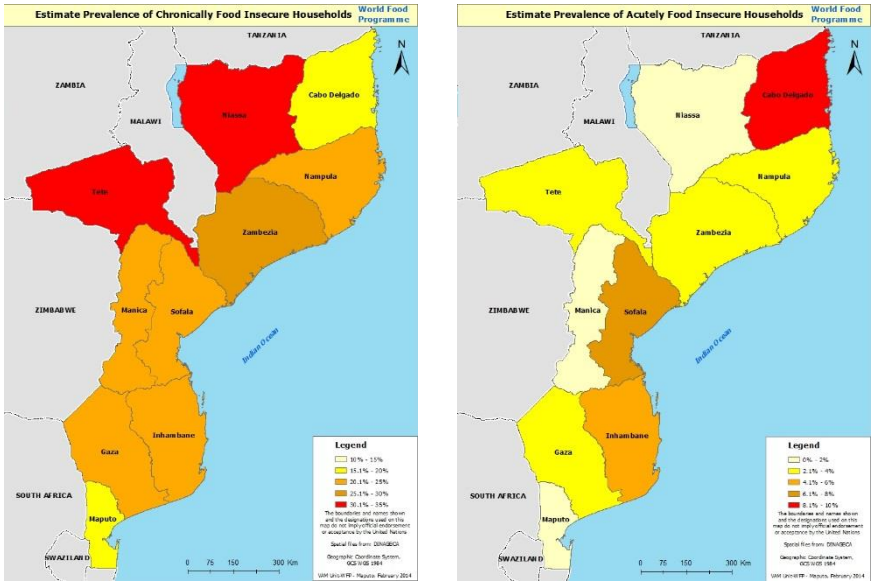


Fig. 32. Maps: Prevalence of chronic and acute food insecurity in Mozambique in 2014 (Source: WFP/SETSAN)

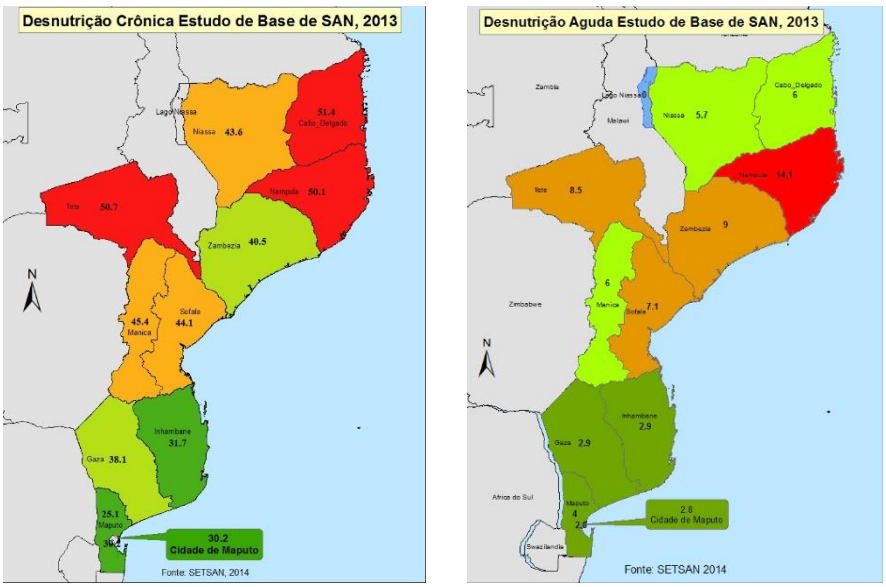


Fig. 33. Maps: Chronic and acute malnutrition risks in Mozambique (Source: SETSAN)

Overall, 43 percent of children aged 6-59 months is stunted (chronic malnutrition) and 7 percent is wasted (acute malnutrition). Nampula is the province with the highest prevalence of stunting (50 percent) and of wasting (14 percent).

1.3.3.5. Community Development and Rural Housing

The rural population in Nampula, Niassa and Zambezia has very limited access to the existing transport corridors (highways, roads and rail). This is because of a lack of sufficient "feeder" rural roads, due to the high vulnerability of unpaved rural roads to weather (i.e., poor maintenance condition means roads are closed for several months during rainy season) and because of high service costs. This limits the rural population's access to markets, productive inputs and many different economic and human development services. Less than 5 percent of the population in the existing transport corridors, like Nacala, has access to the road systems. In particular, the implementation of economic diversification and densification activities require finding technically and economically viable ways to increase rural mobility and access to the markets and services.

With regard to houses or dwellings, traditionally those are built using reed and straw in a circular shape, with wood-made windows and doors. These constructions typically use roofing made of straw secured with ropes and stones, and lack strong foundations due to scarce knowledge, material and to inadequate soil. As per location, communities tend to build their houses near bodies of water, mostly as close as possible to fertile soil and irrigation infrastructures, which expose them to flooding. Some brick and concrete structures are available with thin roofing; however, they often neglect incorporating adequate design for flooding or strong winds.

1.3.3.6. Urban Development and Housing

Mozambique's cities, which are particularly vulnerable to flood and erosion risks, play a critical role in the country's development by providing essential commercial, transport and supporting services to the agriculture, tourism and extractive sectors, which are the main sources of wealth.

Cities and towns are increasingly being considered as key for both economic growth and poverty reduction, through a combination of improved urban living conditions, a more competitive platform for investment by the private sector and increased productivity of both people and assets. Urban population is growing faster than the country as a whole, and is expected to double by 2030. High urban population growth has been accompanied by a notable lack of corresponding investments in basic infrastructure: as a result, deficits in urban services have been worsening. Flooding and erosion are increasing threats in many cities and towns, both on the coast and along economically important river basins and inland corridors, such as those cities in affected districts of Nampula, Niassa and Zambezia.

Urban management in Mozambique has been decentralized to municipal authorities since approval of the 1998 Local Government Framework legislation, which allocates political and financial powers to elected municipal council. Despite a broadly enabling legal and political

framework, few municipal councils have the institutional capacities needed to effectively mobilize and manage resources and to sustainably provide adequate services to meet the social, environmental and economic challenges they face. From initially being providers of such local facilities as local roads, markets, parks, cemeteries, public lighting and solid waste services, existing legislation has been gradually increasing municipal responsibilities to provide more complex services like health and education, as well as responding to climate-related environmental challenges.

Large, complex and capital intensive urban investments in Mozambique typically remain in the purview of national Government, while operation and maintenance for urban facilities and public services are delegated either to municipalities or public utility companies. Surface drainage to control urban flooding and erosion, including those exacerbated by climate impacts, often require these sorts of investments. Where drainage infrastructure is inadequate, storm water contamination is more severe and the health effects of floods are more dramatic. Urban flood events are frequently associated with cholera outbreaks; this problem is most chronic in large informal settlements located in low-lying flood-prone neighborhoods. In cities like Nacala, where slopes are severe, rains are intense and soils are fragile, intense runoff from increasingly violent storms, including tropical cyclones, results in wide erosion damage, which threatens both public infrastructure and private assets. The high vulnerability of these cities to climate change impacts has been flagged by numerous studies. Increasing the resilience of these cities to climate impacts, such as flood and erosion, is amongst the priorities raised by these studies.

2. Environmental, Social and Economic Impacts: Damages and Preliminary Loss Estimates

Fig. 34. Destroyed bridge over the Licungo River in Mocuba City

Section 2/3 of the report

2.1. Public Infrastructure

2.1.1. Roads and Bridges

The map below provides an overview of locations where damage to the road network was observed in Zambezia.

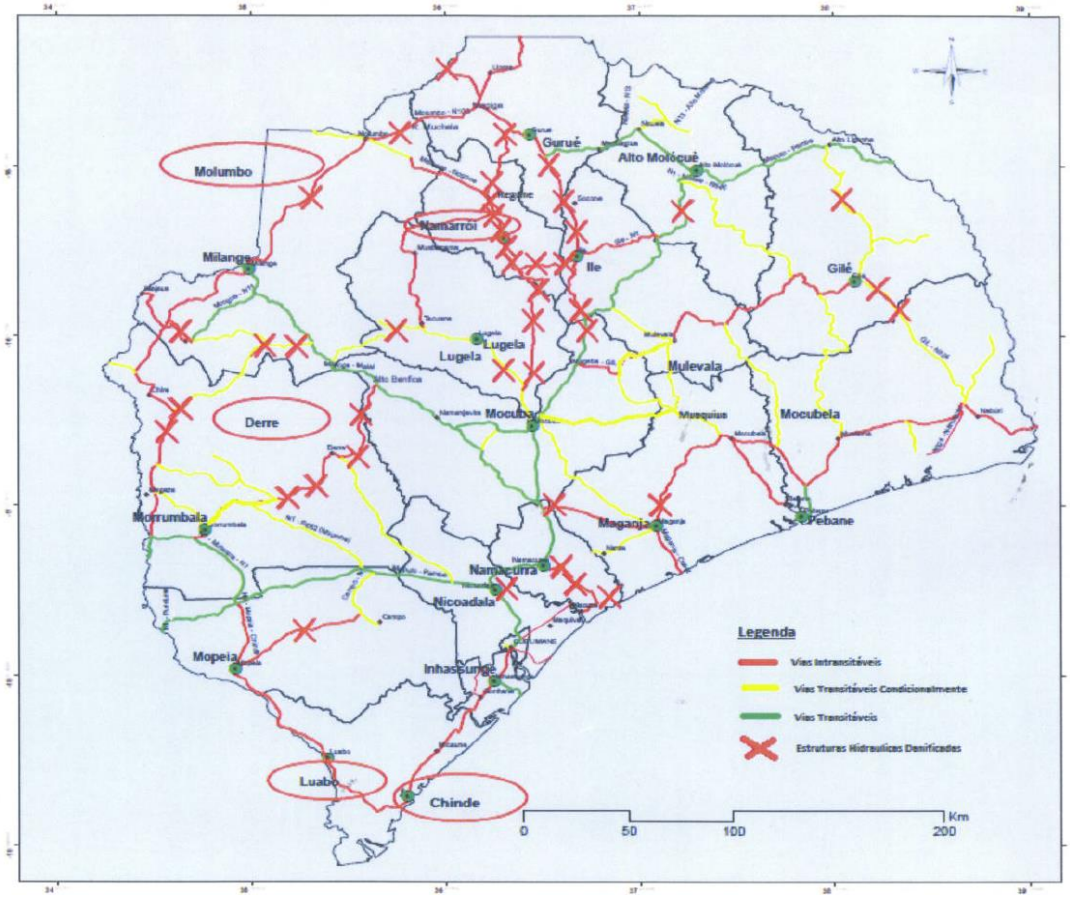


Fig. 35. Map: Location of damages and closure of roads and bridges in Zambezia (Source: ANE)

The road network was severely affected during the several days of heavy rainfall. Damages to roads and bridges amount to US$155 million, 74 percent of total damages. Damage to stretches of paved roads and bridges, including the main national road (N1) and the unpaved road system, prevent accessing services in rural areas, and many flooded communities still remain inaccessible at the time of preparation of this report, while others are cut off from any road transport but can be reached by boat. The main roads along the east coast in low-lying areas of the three disaster zones and some stretches along the higher land roads were completely flooded and had to be closed for several days. It should be noted that heavy rainfall was experienced throughout the country and many other districts experienced floods, although to a lesser degree compared to the above-mentioned provinces. Approximately 90 km of the road network was damaged due to the flood. The damages ranged from the stripping off of the asphalt-wearing course and formation of potholes to damages to bridges, culverts and retaining structures.

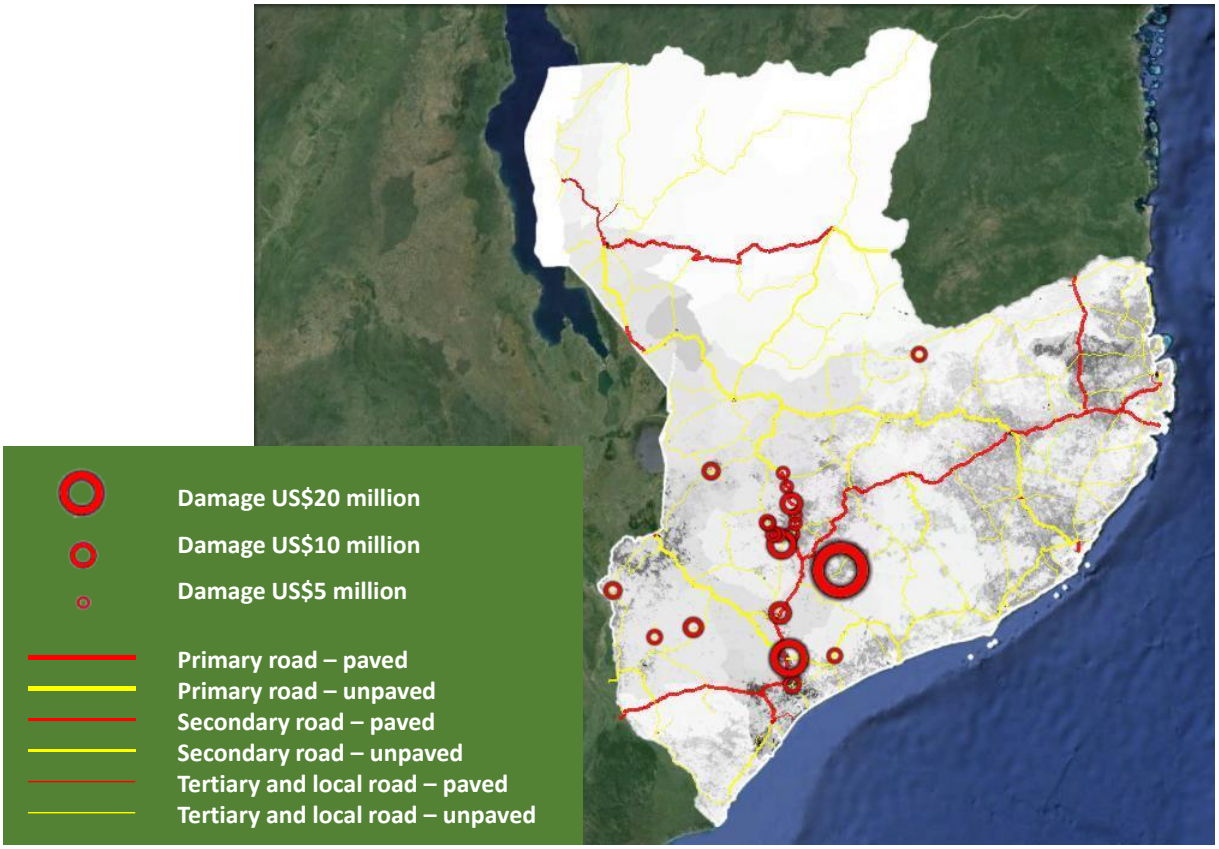


Fig. 36. Map: Location of largest damages to roads and bridges (from ANE data)

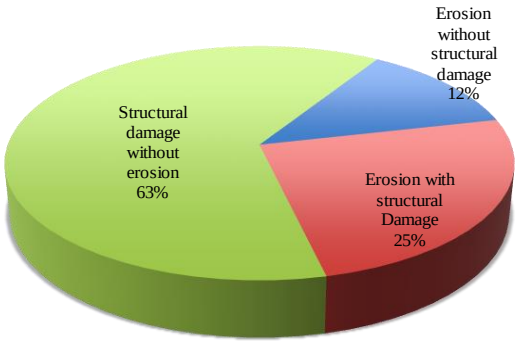
Fig. 37. Picture: EN324 road stretch destroyed in Malei (Zambezia)

Item	Roads		Bridges		Total	
	Cost (US$ million)	Length (km)	Cost (US$ million)	Length (km)	Cost (US$ million)	Length (km)
a. Erosion without structural damage	0.6	6.1	12.0	30.5	12.7	36.5
b. Erosion with structural damage	1.2	4.6	56.4	0.5	57.6	5.0
c. Structural damage without erosion	3.0	46.0	81.5	2.0	84.5	48.3
Total	**4.8**	**56.7**	**149.9**	**33.0**	**154.8**	**89.8**

Fig. 38. Table: Typology of damages to roads and bridges

The table above, based on estimates from the National Roads Administration (ANE), shows the overall damage to the road infrastructure for three provinces amounts approximately US$155 million. This figure is determined by a combination of the damages in bridges structures and abutments caused largely by erosion due to excessive water pressure or overtopping. Overflow also led to high erosion in riverbeds in several points of the Licungo basin causing disconnection between some bridges and roads. This phenomenon was exacerbated due to some bridges being built at river bends or having their abutment without protective coats to withstand rising waters. Other minor damages in the bridge network include damages in retaining walls, guardrails, aqueducts and structural columns.

Damages to roads: US$4.8 million



Damages to bridges: US$149.9 million

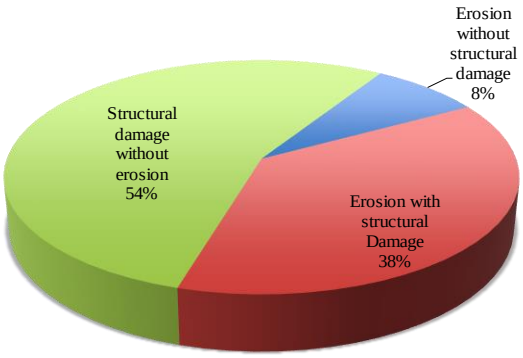


Fig. 39. Graph: Distribution of damage in roads and bridges by type of damage

Damages in the road network account for approximately US$4.8 million, where major structural damages were associated with a combination of erosion and collapse of the infrastructure; most drainage systems proved insufficiently designed to sustain the magnitude of registered flows.

2.1.2. Energy

The damage to the energy sector amounts to US$13.3 million, and is primarily related to destruction of poles and towers.

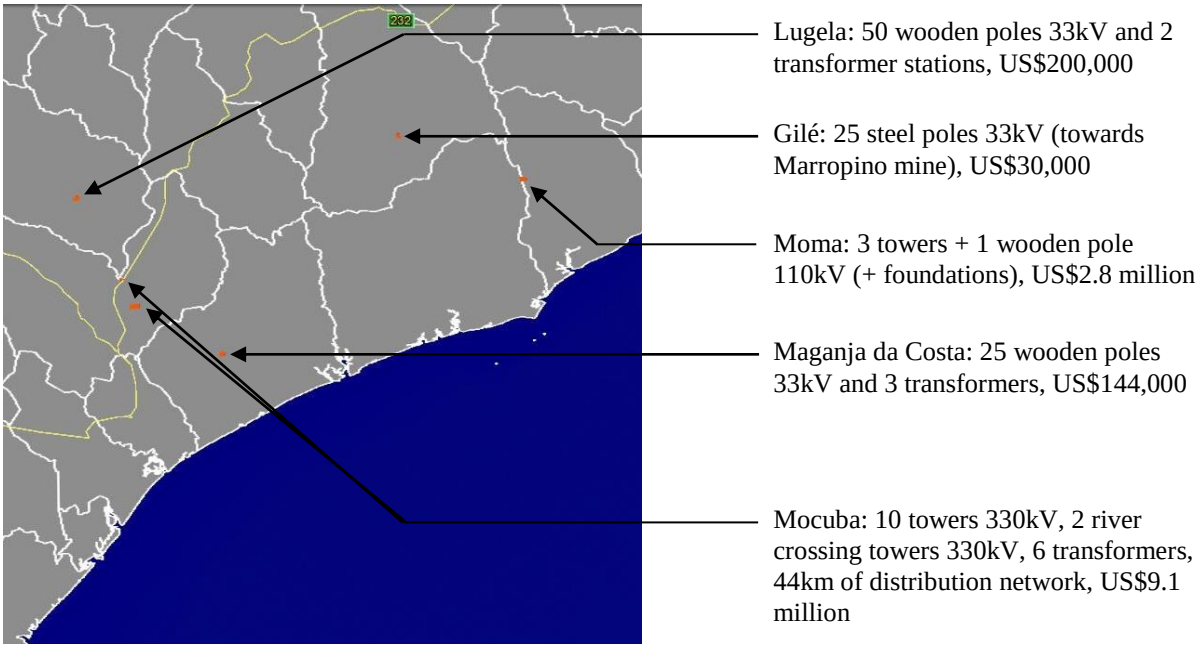


Fig. 40. Map: Damages to the electricity network

Fig. 41. Picture: Electricity transmission tower damaged in Mocuba

Damages to the electric infrastructure are listed in the table below:

Nampula : Moma : High Voltage 110 kV	3 towers + 1 wooden pole with destroyed foundations	US$2,820,000
Zambezia : Gilé : 33kV Marropino	25 destroyed steel poles	US$30,000
Zambezia : Lugela : 33KV Lugela	50 wooden poles destroyed and two transformer stations destroyed	US$206,000

Zambezia : Maganja da Costa : 33kV	25 wooden poles and 3 33kV transformer stations destroyed	US$144,000
Zambezia : Mocuba : High Voltage 220 kV	10 towers destroyed with foundations in good condition; 2 crossing towers and destroyed foundations	US$8,643,582
Zambezia : Mocuba : Distribution network of Mocuba district	6 flooded transformer stations; 44 km of distribution line destroyed	US$1,488,000
TOTAL		**US$13,331,582**

Fig. 42. Table: Damages to the electricity network

2.1.3. Irrigated Schemes

Flooding waters substantially affected several areas of agriculture production in northern and central Mozambique, resulting in crop and livestock loss and damage to agriculture infrastructure and equipment. Irrigation infrastructure, farm equipment and stations and energy transport lines for irrigation were reported damaged. Since there are still many flooded areas, the inventory of infrastructure damage and loss is still very incomplete. Preliminary estimates, nevertheless, indicate that the Licungo river basin was the most impacted. Preliminary estimates of damages to the irrigation sub-sector account for US$14,209,706.

Damages to irrigation infrastructure are listed below:

Item	District	Area affected (ha)	Cost
Munda Munda irrigation scheme	Maganja da Costa	400	US$405,000
Ntabo irrigation scheme		300	US$2,941,176
Thewe irrigation scheme	Mopeia	300	US$10,588,235
Mziva irrigation scheme	Nicoadala	400	US$275,294
Mucelo irrigation scheme		250	damages to be estimated at a later stage
Morire irrigation scheme		200	
TOTAL		**1,850**	**US$14,209,706**

Fig. 43. Table: Damages to irrigated schemes

2.1.4. Flood Protection and Dikes

Damages to dikes were registered in the Licungo basin in Nante, in the Zambezi basin in Luabo and Mopeia. In addition, damages to the dikes protecting irrigated schemes are reported in the irrigated schemes section above. At the time of the assessment, there were still flooded infrastructures and road traffic was disrupted. Damages have been estimated on the assumption that 30 percent of the value of the flooded area was lost, and require further and accurate evaluations.

Damages to dikes are listed in the table below:

Bacia de Licungo (Nante)	Destruction of about 30% of 15 km of a dike which cross-section is on average 27 m²	US$6,075,000
Bacia de Zambezia (Luabo)	Destruction of about 30% of 1.5 km of a dike which cross-section is on average 27 m²	US$607,500
	TOTAL	**US$6,682,500**

Fig. 44. Table: Damages to dikes

2.1.5. Rainwater Drainage Networks

The drainage networks are underdeveloped and did not present substantial damage themselves: minor damage in urban drainage systems are reported in Mocuba and Nacala, amounting to US$0.3 million. However, major environmental damages are reported as a consequence of unplanned land use in urban areas and lack of adequate drainage works to accommodate resulting settlements. Nacala, Nampula and other cities present important erosions, landslides and sediment transport phenomena, responsible for damages and destructions of houses and infrastructures (mainly roads). No estimates for these damages were available at the time of the assessment.

2.1.6. Railways

Fig. 45. Picture: Damages to railways

Although reports of disruption of service in some points of the Nacala Railway were reported by the national media, no information was provided detailing the extent of damage nor the mitigation measures taken to restore the service. By the time of preparation of this report, the service remained disrupted, affecting the population and cargo transit from Malawi, and Nampula and Niassa to and from the port city of Nacala. An estimate issued on March 31 by the Ministry of Economy and Finances indicates damages of about US$24 million, however

the detailed information about location of damage, and whether the damages are insured or not, is not available yet.

2.1.7. Telecommunication

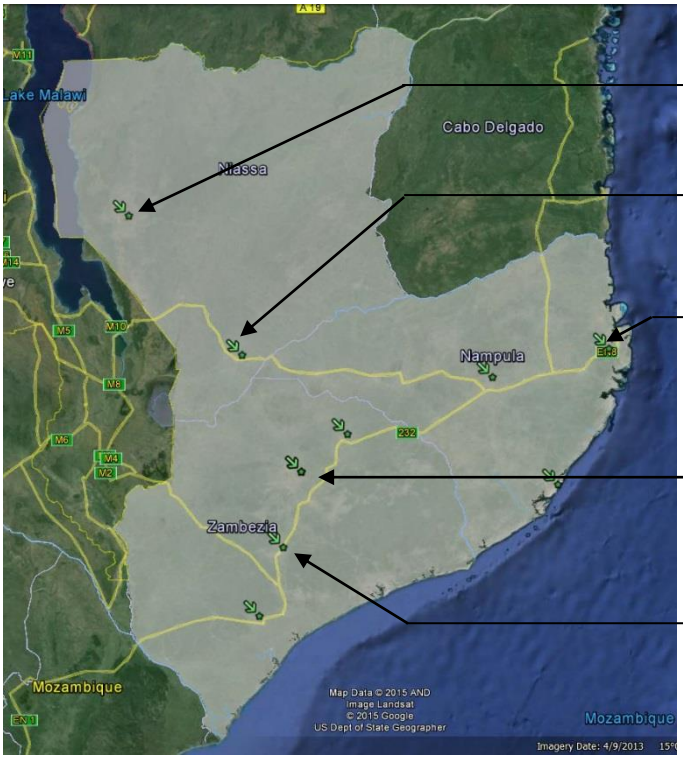
Damages to the telecommunication infrastructures are estimated on the basis of the reconstruction cost (see section 3.1.6) and listed in the table below:

Districts	Description of proposed works	Value
Nampula : Memba, Moma, Namapa - Eráti, Nampula – Distrito	19 wooden poles, 3.2 km of optic fiber cable, 6 km of copper cable, 1 car	US$214,225
Niassa : Majune, Marrupa, N'Gauma, Sanga	14 wooden poles, 1.55 km of optic fiber cable, 0.6 km of copper cable	US$39,857
Zambezia : Alto Molócué, Gilé, Gurué, Ile, Milange, Mocuba, Namarroi	60 wooden poles, 2.2 km of optic fiber cable	US$121,706
	TOTAL	**US$375,788**

Fig. 46. Table: Damages to the telecommunication network

2.1.8. Drinking Water Supply and Sanitation

Damages in water supply infrastructure of large municipalities have been listed for approximately US$8.7 million. This amount does not include damages to rural drinking water supply. Systems in major capital cities such as Nampula, Lichinga and Quelimane were affected by a power outage caused by almost a one month interruption of energy supply from the national grid as a consequence of destruction of 10 pylons at the Licungo river crossing. Some examples of damages observed are presented on the map below.



Lichinga intake and distribution
- damages: US$5,353
- priorities: US$384,147

Cuamba intake, transport, distribution
– damages: US$4.5 million
– priorities: US$5.7 million

Nacala-Porto intake, treatment, transport and distribution
– damages: US$150,000
– priorities: US$12 million

Ile intake
– damages: US$617,000
– priorities: US$3.3 million

Mocuba intake, treatment, distribution.
– damages: US$3.5 million
– priorities: US$44 million

Fig. 47. Map: Examples of drinking water supply systems impacted by the floods

Fig. 48. Damages to the main drinking water system intake in Mocuba

Damages to water supply infrastructure are listed in the table below:

Alto Molocue intake system	Damage of the intake system	US$100,000
Intake, treatment and distribution systems of Cuamba	Damage to the main water conduit (30 km)	US$4.5 million
Intake system of Ile district	Destruction of the distribution tower and pumping equipment	US$615,000
Intake, adduction, treatment systems, reservoirs and distribution network of Mocuba	Destruction in capture tower, pumps, well protection wall, technical unit building and machines, 150 m of pipeline, water treatment reservoirs and distribution network	US$3.5 million
Intake, treatment, transportation and distribution systems of Nacala-Porto	The pipeline from the Nacala dam to Nacala-Porto city was submerged. It is made of fibro-cement and originally in poor condition.	US$150,000
Nampula intake, treatment and distribution system	Failure of the automatic control circuit of the telemetry system due to electric shocks caused damages to communication, command and data visualization systems. The pump control system in the EB4 distribution centre stopped due to flooding.	US$5,000
TOTAL		**US$8.8 million**

Fig. 49. Table: Damages to drinking water supply

2.1.9. Meteorological and Hydrological Networks

Damages to hydrological and meteorological infrastructures include damages to 37 hydrological scales, seven rain gauges, five meteorological shelters, one wind sensor and one anemograph, for a total of US$104,430. The affected stations are represented on the map in section 3.1.8 and listed in the table below:

Hydrological station #128 Namapa, Lurio	
Hydrological station #153 EN8 Malema-Cuamba, Lurio	
Hydrological station #195 Malema, Malema River	
Hydrological station #144 on Namaponda-Liupo road, Motemode River	
Hydrological station #506 Companhia de Borror, Ligonha River	
Hydrological station #91 Mocuba, Licungo River	
Hydrological station #SN Nanti, Licungo River	US$52,647
Hydrological station #94 Lugela, Lugela River	
Hydrological station #108 Malei, Licungo River	
Hydrological station #126 Murupula Estrada 232, Meluli River	
Hydrological station #90 Gurue, Licungo River	
Hydrological station #389 Malessani, Lussa River	
Hydrological station #89 Maganja da Costa, Raraga River	

Hydrological station #397 Mugeba, Licungo River	
Hydrological station #87 Yasso, Lugela River	
Hydrological station #106 Munhamade, Nhamacurra River	
Hydrological station #92 Tacuane, Lugela River	
Hydrological station #127 Nametil, Meluli River	
Hydrological station #141 Nalumi, Nalumi River	
Hydrological station #124 Namapa, Namapa River	
Hydrological station #129 Muite, LuRiver	
Hydrological station #418 Noisse, Noisse River	
Hydrological station #139 Namialo, Monapo River	
Hydrological station #121 Mecuburi, Mecuburi-Sede River	
Hydrological station #206 Mecuburi, Mecuburi River	
Hydrological station #140 Fabrica, Monapo River	
Hydrological station #143 Nataleia, Nataleia River	
Hydrological station #234 Namina, Mecuburi River	
Hydrological station #120 Muecati, Monapo River	
Hydrological station #154 Congerenge, Lugenda River	
Hydrological station #148 Estrada Marrupa Maua, Messalo River	
Hydrological station #155 EN8 Mandimba-Belem, Lussangaze River	
Hydrological station #536 Mataca, Mbetano River	
Hydrological station #537 Macaloge, Mbuluize River	
Rain gauge #839 Namapa	
Rain gauge #1138 Bagarila	
Rain gauge #279 Ngauma	
Rain gauge #750 Mataca	US$3,529
Rain gauge #231 Confluence of Lugenda, Lureco	
Rain gauge #1198 Nova Beira	
Rain gauge #202 Marrupa-Mecula road, Lugenda	
5 weather station shelters, maximum temperature thermometer, computer and power source	US$14,799
Wind sensor	US$13,235
Anemograph	US$20,221
TOTAL	**US$104,430**

Fig. 50. Table: Damages to hydro-meteorological equipment

2.2. Productive Sectors

2.2.1. Rain-Fed Agriculture and Food Security

Rain-fed agriculture does not require any infrastructure to be practiced; therefore, the damages reported are limited to about US$150,000 for tools (hoes, machetes, sickles), livestock infrastructures (corrals, piggeries, aviary) and warehouses.

Losses, however, have been very important and have been included in the overall figures in the report. 104,430 ha (3.7 percent of the sown land) of crops have been lost, for an equivalent of US$70.8 million. A total of about 65,000 families have been affected by crop losses.

In terms of livestock, a total of 785 animals (cattle, goats, swine) and 1,626 poultry (chickens and ducks) died or disappeared, and about 23,000 ha of pasture were flooded. The losses in monetary terms have not been estimated yet.

The excessive rains affected the agriculture sector in eight provinces and 60 districts, including five districts in Nampula, five districts in Niassa and 21 districts in Zambezia. The most affected province was Zambezia with 102,593 ha affected, representing 5.6 percent of the sown land, while Nampula and Niassa had 0.6 percent and 0.5 percent of their sown land affected, respectively. Rice, corn, beans, cassava, sweet potatoes and various vegetables were the most affected cultures.

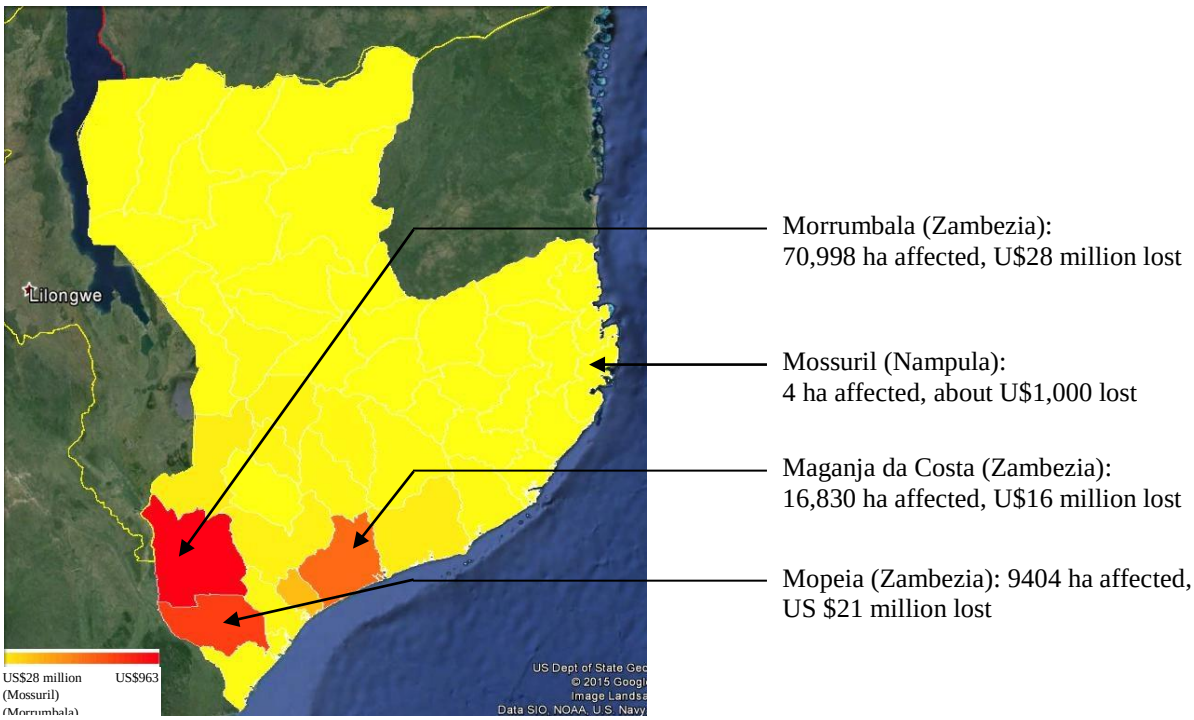


Fig. 51. Map: Losses from flooded crops per district

As illustrated in the table below, total agriculture losses in the three provinces is estimated at about US$70.8 million.

Province	Affected area (ha)	Affected Crops (ha)					Losses ($US)
		Maize	Rice	Beans	Cassava	Sweet-potato	
Nampula	990	800	-	97	373	-	541,789
Niassa	847	560	-	279	9	-	603,729
Zambezia	102,593	60,723	52,170	5,300	14,441	4,885	69,622,940
Total	104,430	62,083	52,170	5,676	14,823	4,885	70,768,458

Fig. 52. Table: Crop losses

Fig. 53. Picture: Flooded crop fields in Maganja da Costa (Source: WFP)

A multidisciplinary Rapid Qualitative Emergency Food Security Assessment was conducted in February in Nampula, Niassa and Zambezia, under coordination of SETSAN. In visited communities, there were households with crop fields and houses totally and partially flooded and damaged, and flooded crop fields or houses. About 54 percent of households in flood-affected areas lost their crops and food reserves and 68 percent of communities lost agricultural inputs. An estimated 23 percent of people reduced their number of meals as a coping mechanism. The most affected income sources are agriculture production, fisheries and casual labor.

2.2.2. Fisheries

In the fisheries sector, intense rainfall and flooding adversely impacted fish ponds, vessels and

fishing gear, affecting private and family-own livelihoods sectors, mainly artisanal fishermen and fish farmers.

According to a preliminary assessment conducted by the ministry in charge of fisheries, 13 districts were affected in Zambezia (Maganja da Costa, Namacurra, Morrumbala, Alto Molocue, Gurue, Namarroi, Milange, Ile, Mocuba, Nicoadala, Quelimane, Pebane and Mopeia) and one in Nampula (Moma). Preliminary estimates indicate almost US$340,000 in lost production and physical damages (boats, warehouses and water ponds) as a result of the disaster. A total of 176 fish ponds have been impacted.

	Zambezia		**Nampula**		**Total**	
	Cost	**#**	**Cost**	**#**	**Cost**	**#**
Fish ponds	US$311,000	176	-	-	US$311,000	176
Vessels & fishing gear	US$23,200	41	US$5,600	10	US$28,800	51
Total	**US$334,200**	**217**	**US$5,600**	**10**	**US$339,800**	**227**

Fig. 54. Table: Damages to fishery infrastructures

2.2.3. Industry and Commerce

As per the National Institute for Risk Management (INGC) preliminary report of February 20, flooding, high winds and electrical blackout have had a devastating effect on industry and commerce. Initial survey in the districts of Cuamba, Mocuba, Morrumbala, Nampula-City and Nacala-Porto, indicated that industrial units, shops, warehouses, stalls, markets and tourist establishments were affected, in addition to the loss of commercial merchandise.

The detail of damages to public markets is listed in the table below:

Location	**Description of proposed works**	**Value**
Market of Cuamba (Niassa province)	51 small stands	US$36,412
Market of Mocuba (Zambezia province)	6 small shops	US$891,176
Market of Morrumbala (Zambezia province)	7 stands	US$25,088
Market of Nampula (Nampula province)	2 touristic infrastructures	US $11,765
	TOTAL	**US$964,441**

Fig. 55. Table: Damages to markets

Fig. 56. Picture: Market stalls in Mocuba

Although the basket of goods are different among provinces, according to the Markets Information System (SIMA) price monitoring service of the Ministry of Agriculture, wholesale price of selected basic food items (common to all) registered from early January 7 to March 5, has increased sharply for some items, while there has been no price variation or a slight decrease on price for others. This fluctuation of prices before and after the heavy rains is due to a combination of variations on supply and demand in local markets, and intrinsically related to the damage on the road network that disrupted normal transit of cargo. The figure below presents price variations in monitored main markets (districts) of Nampula, Niassa and Zambezia, of basic food products.

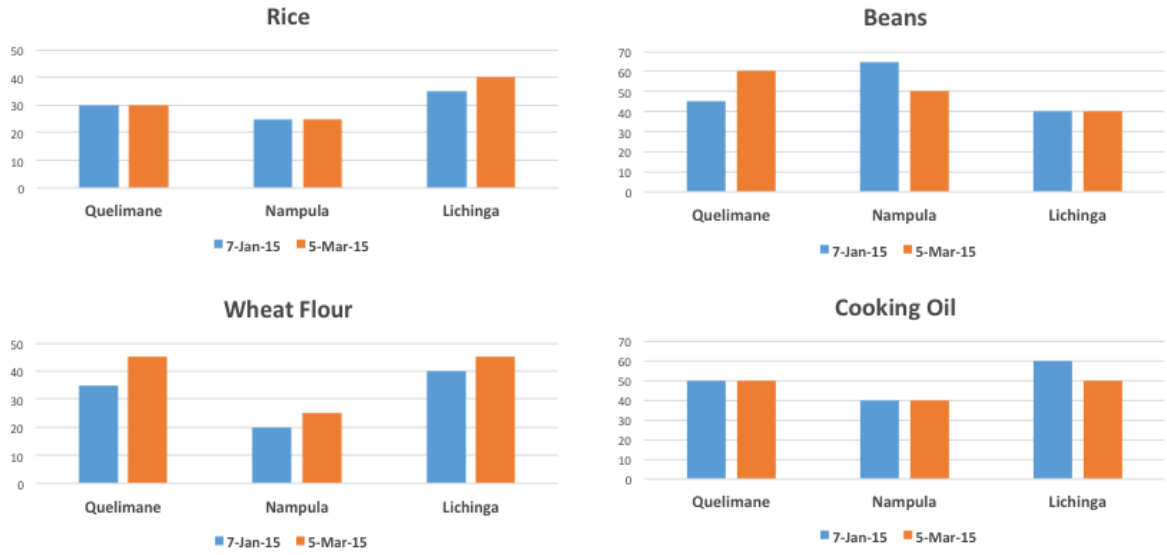


Fig. 57. Graph: Variation of basic food price after flooding in Quelimane (Zambezia), Nampula City (Nampula) and Lichinga (Niassa) (Source: SIMA – Ministry of Agriculture)

On the other hand, the consumer price surveillance service of the Ministry of Industry and Commerce indicates a sharp price variation of selected basic food items from early December 2014 to March 2015. The table below compiles the information on food price variation in Zambezia, as this province accounted for almost 90 percent of infrastructure damage. Nevertheless, it is important to note that for some items, the price variation in local markets reached typical crisis peak, among them the price for produce and industrial goods increased by over 100 percent. This behavior is explained by the limited stock availability and disruption of transit from countryside producing areas and distribution centers, which ultimately has increased the transportation cost from Maputo and Beira to almost 100 percent. The figure below presents the average variation of consumer prices on the heavily flood-affected districts of Gurue, Ile, Pebane, Namarroi and Lugela.

Product	Quant.	Before the emergency US$	During the emergency US$	Variation %	After the emergency* US$	Variation %
Corn flour	25 Kg	14.26 to 17.65	23.53 to 35.29	65 to 100	14.71 to 16.91	60 to 109
Wheat flour	25 Kg	13.24	17.65	33	13.24	-25
Rice	25 Kg	14.12 to 22.21	14.12 to 22.21	0	14.12 to 22.21	0
Sugar	1 Kg	1.03	1.18	14	1.18	0
Cooking oil	1 L	1.24	1.24	0	1.24	0
Frozen chicken	1,2 Kg	3.82	4.41	15	3.97	-10
Brown beans	1 Kg	1.47	1.76 to 2.35	20 to 60	1.32 to 1.76	33
Fish type 2	1 Kg	2.35	2.35	0	2.35	0
Eggs	1 dozen	5.15	6.76	31	5.00	-26
Tomato	1 Kg	1.47	2.35	60	2.94	25
Onion	1 Kg	0.74	1.18	60	1.18	0
Potato	1 Kg	0.74	1.18	60	1.18	0

* Reestablishment of power supply and transportation by early March 2015

Fig. 58. Table: Variation of prices of provincial basket of goods in Zambezia (Source: Ministry of Industry and Commerce)

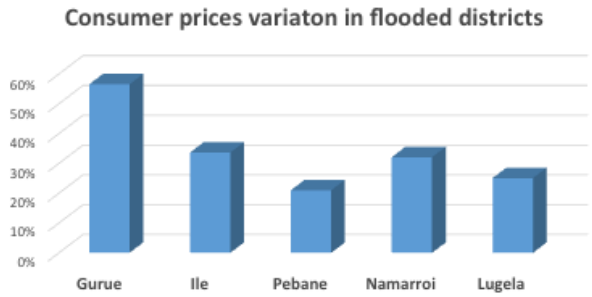


Fig. 59. Graph: Variation of consumer prices in flooded districts (Source: Ministry of Industry and Commerce)

When comparing consumer and wholesale prices registered during the period, some conclusions can be drawn regarding their behavior. It is clear that those food items locally produced have not experienced considerable variations, whereas those produced in other regions, even in the same province, sharply increased. Since the overall agriculture production

of the region seemed not to be heavily impacted, the price variation can be attributed to the disruption of the transport system, which has prevented the normal circulation of goods to local markets as well as to southern provinces.

In addition, the road network damage has directly impacted the transportation cost of people in the affected area. Notably, based on reports from the local delegation of the Ministry of Industry and Commerce, due to falling of bridges, the travel cost between Cuamba and Quelimane increased from 65 to 1000 meticais. Likewise, the cost of crossing the Licungo River by canoe, after the falling of the bridge at the National Road EN324, connecting Malei and Maganja da Costa, is now 90 meticais. This imposes a greater economic toll on the affected community.

2.3. Livelihood and Social Sectors

About 326,000 people were affected; 140 were killed; about 30,000 houses, 2,362 classrooms and 17 health units were either partially or totally destroyed. 104,430 ha of crops have been lost during the event, impacting 102,000 farmer households.

2.3.1. Environment and Natural Resources

Strong erosion of riverbanks, due to high speed and water flow rates, caused loss of vegetation and dragged eroded soil. Overall, it is estimated that several million cubic meters of cultivated soil have been lost.

The gallery forest that grows along streams was severely affected; these forests maintain the microclimate in the area and ensure waterways protection. In many areas of the assessment zone, these forests persist only in a very fragmented form and are increasingly anthropic. On top of the negative effect of the flooding, these trees have been cut in order to clear space for annual crops that are subsequently abandoned a few years later. This will not only increase the vulnerability of areas to climate hazards, but also contributes to the disappearance of fauna and flora biodiversity.

2.3.2. Education

The total damage of the education sector has reached US$6 million, where community-built schools, mostly developed with precarious material (straw-bale, haystack, timber poles and raw mud as wall finishing), were the most impacted, with US$4.3 million in damages. While conventional school structures (built with bricks and concrete) were able to resist the intensity of rainfall and winds, some roof covers were destroyed or heavily damaged by strong winds for a total damage of US$1.7 million. In spite of flooding in many schools, the Ministry of Education reported that those conventional structures would be fully recovered once the water dries out.

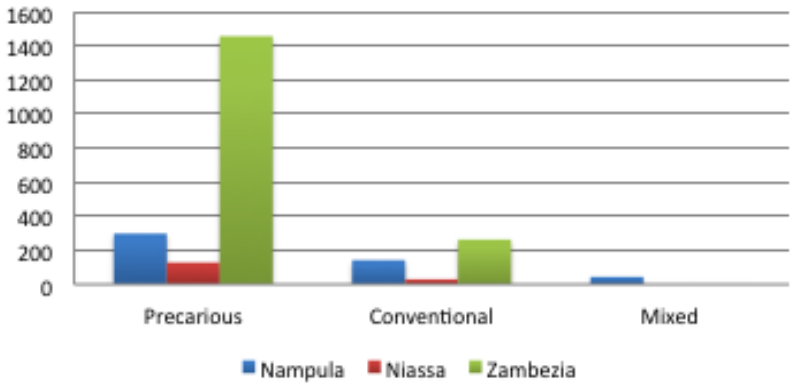


Fig. 60. Graph: Number of damaged classrooms by type of construction and by province

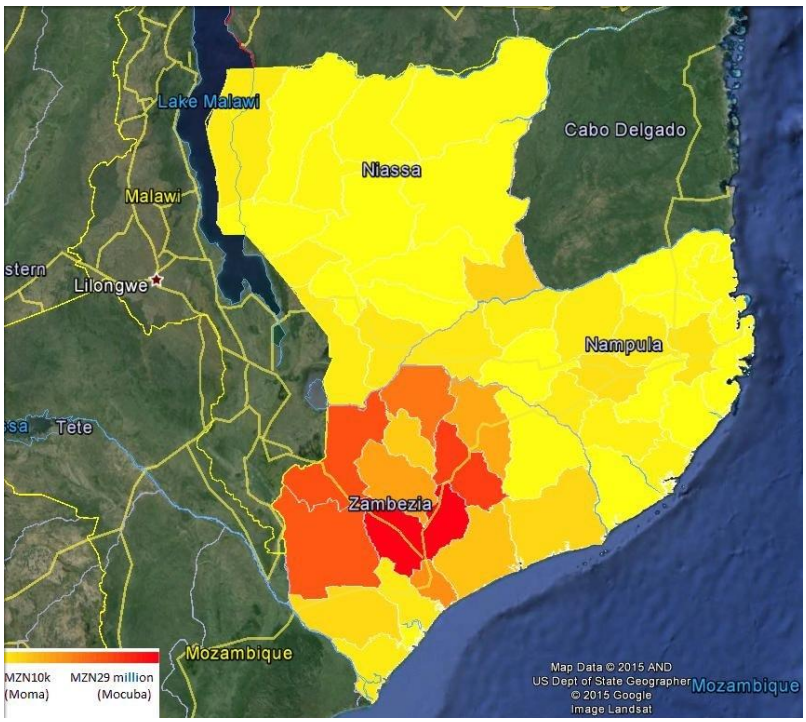


Fig. 61. Map: Damage to classrooms by district

School infrastructure damage affected 2,362 classroom units as reported by the Ministry of Education. These classrooms are classified by the type of material used for their construction: (i) precarious, (ii) conventional and (iii) mixed, for a combination of both, are considered as categories. The figure above presents the distribution of damages by provinces, where notably Zambezia holds the largest amount of precariously damaged classrooms with 1,457 units, and Nampula is the only province with units built with mixed materials. Some 44 were damaged.

Fig. 62. Picture: Damaged classroom roof in Diba primary school - Maganja da Costa District (Source: UN-Habitat)

2.3.3. Health

The damages estimated by the Ministry of Health are accurate for Zambezia and indicative for Nampula and Niassa, where a detailed damage assessment will be undertaken after the rapid assessment process.

In total, 17 health units were destroyed in Zambezia, of which one was type I, 15 were type II, one was a health post, and 64 were houses for staff. Medical equipment, medicines and furniture were also lost. Like in the education sector, health facilities are built in conventional and non-conventional materials, where the latter is equivalent to "precarious" as previously defined.

Damages to health are summarized in the table below:

Type of unit	Number	Damage Cost
Health center completely destroyed – conventional	4	US$800,000
Health center partially destroyed – conventional	6	US$600,000
Health center completely destroyed – non conventional	2	US$4,412
Health center partially destroyed – non conventional	4	US$35,294
Health post completely destroyed - conventional	1	US$50,000
TOTAL	**17**	**US$1,489,706**

Fig. 63. Table: Damages to health facilities

2.3.4. Community Development and Rural Housing

Fig. 64. Picture: Examples of damaged rural houses (Source: Danish Red Cross)

Damage to infrastructure affecting rural community development and housing in rural areas, due to its cross-cutting nature, has been documented in this report in other specific sectors, including: roads and bridges; energy; flood protection and dikes; irrigated schemes; rainwater drainage; telecommunication; drinking water supply; and sanitation.

As per housing, the most impacted structural elements were roofing and other parts naturally exposed to the action of the winds, such as windows, doors, etc. Roofs showing a greater slope or secured with ropes and stones were generally less affected. Traditional houses built using reed and straw were quite resistant due to their circular shape and the inherent "filtering" effect of the used materials. Nevertheless, buildings with poor foundations were completely destroyed; such effects were exacerbated by the sandy soil.

Fig. 65. Picture: Damaged rural houses on January 20 (Source: Lenyaro Sello/eNCA)

The estimate of damages has been undertaken considering an average cost for the destruction of a house of about US$3,000, while the price for construction is about US$12,000. The table below provides the estimated amount for each district, based upon the overview developed by CTGC on April 3.

		Houses partially destroyed	Houses totally destroyed	Estimated cost
Nampula	Angoche	91	171	US$502,941
	C. Nampula	129	57	US$167,647
	Larde	127	714	US$2,100,000
	Meconta	5	4	US$11,765
	Mecuburi	114	17	US$50,000
	Memba	2		-
	Moma	1090	547	US$1,608,824
	Monapo	80	4	US$11,765
	Murrupula	9	902	US$2,652,941
	Mussoril	245	1	US$2,941
	Nacala Porto	333	392	US$1,152,941
	Nacala-a-Velha	34	23	US$67,647
	Rapale	317	0	-
	Ribaue		3474	US$10,217,647
Niassa	Cidade de Lichinga	1	8	US$23,529
	Cuamba	165	3499	US$10,291,176
	Lago	40	18	US$52,941
	Mandimba		31	US$91,176
	Marrupa		21	US$61,765
	Mavago	6		-
	Mecanhelas	48	76	US$223,529
	Metaricas		231	US$679,412
	Muembe		44	US$129,412
	Ngauma		12	US$35,294
	Nipepe		9	US$26,471
Zambezia	Alto Molocue	189	29	US$85,294
	Chinde	141	69	US$202,941
	Derre	178	213	US$626,471
	Gile	0	376	US$1,105,882
	Gurue	52	37	US$108,824
	Ile	0	599	US$1,761,765
	Inhassunge	0	8	US$23,529
	Luabo	36	0	-
	Lugela	0	35	US$102,941
	Maganja da Costa	177	3260	US$9,588,235

	Milange	3371	36	US$105,882
	Mocuba	661	900	US$2,647,059
	Mocubela	203	268	US$788,235
	Molumbo	200	332	US$976,471
	Mopeia	4	23	US$67,647
	Morrumbala	1032	595	US$1,750,000
	Mulevala	0	398	US$1,170,588
	Namacurra	0	0	-
	Namarroi	0	1289	US$3,791,176
	Nicoadala	915	230	US$676,471
	Pebane	0	1	US$2,941

Fig. 66. Damages to the housing sector

2.3.5. Urban Development and Housing

Damage to infrastructures affecting urban development, due to its cross-cutting nature, has been documented in this assessment in other specific sectors, including: roads and bridges; energy; flood protection and dikes; rainwater drainage; telecommunication; drinking water supply; and sanitation.

3. Early Recovery and Resilient Reconstruction Framework

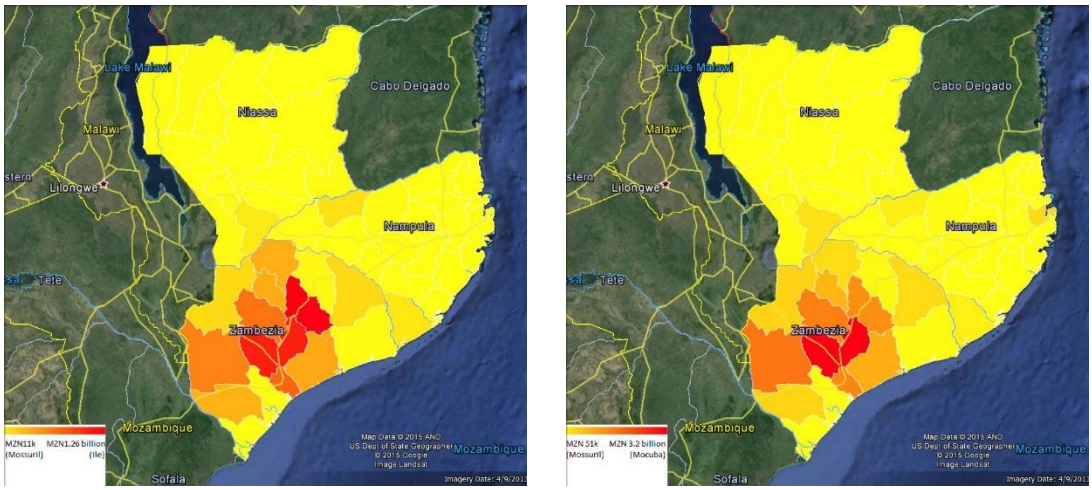


Fig. 67. Maps: Damage (left) and sustainable recovery / reconstruction priorities (right): cost by district

Section 3/3 of the report

3.1. Public Infrastructures

3.1.1. Roads and Bridges

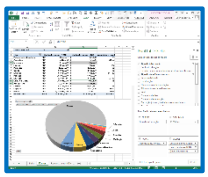
Although ANE has already started some early recovery works to reestablish the transit within the main roads serving Nampula, Niassa and Zambezia, additional works to resurface damaged roads and reinforce safe movement of vehicles and pedestrians, are needed in the short term (6–12 months), while the overall sector needs to address additional challenges in terms of resilience to disaster risks in the longer term.

In order to restore normalcy and repair the damage to the roads, short-term priority actions have been carried out either as a temporary infrastructure or partial repair, including installation of temporary metallic bridges, reconstruction of embankments for connecting bridges and repositioning of bridge platforms; debris cleaning; construction lined ditches; erosion repair; slope protection reinforcement; and increasing wall protection. This work, amounting to US$8 million, were carried out in the districts of: Mocuba and Molócué in Zambezia; Murrupula, Rapale and Angoche in Nampula; and in Cuamba, Lalaua, Lago, Lichinga, Mandimba and Marrupa in Niassa. It should be noted that this work was largely funded by a regular road maintenance budget and authorized advances of resources by the European Union Road project and Nampula-Quamba project.

Priority investments include:

- Early Recovery: 77 interventions for emergency repairs, such as extension of temporary metallic bridges; protecting embankments with raw material; filling gaps for restricted access; and cleaning of drainage infrastructure, for a total of US$117 million, out of which US$5.6 million has already been carried out at the time of the assessment;
- Post-Disaster Recovery: 45 interventions, in total, for reconstruction of the system of bridges over the Licungo River in Namacurra; extension of the bridge in Mocuba; 28 other interventions on bridges and 16 on roads; and rehabilitation and enhancement of drainage infrastructure for a total amount of US$153 million, out of which US$2.9 million has already been carried out at the time of the assessment; and
- Vulnerability Reduction: Three interventions – construction of new bridges, for a total of US$11.5 million.

The details of the 229 recommended activities as priorities are available from the multi-sector spreadsheet:



Multi-sector pivot tables for damages and recommendations:

https://www.dropbox.com/s/hcrwvv7bfv8cjk4/Data-CrossTable-PT.xlsx?dl=0 or http://goo.gl/IJcrSC

Fig. 68. Picture: Early recovery works on the southern access of Mocuba bridge

It should be noted that most destroyed large bridges have been built on average over 40 years ago, which indicates that serious retrofit investment was overdue for these infrastructures. Therefore, both planned early recovery and reconstruction works carry vulnerability reduction measures, and amount to US$269.7 million.

As per main reconstruction works, these include bridge reconstruction, drainage works, culverts and retaining structures repair, for a total of 33 km of bridge systems (composed by the bridge structure and connectors to riverbanks) distributed over several basins. The road network reconstruction stretches for 56 km over 700 km of road system combined by primary and secondary roads. The main works to be carried out include erosion repair, emergency drainage system, elevation of roadbed and pavement and re-compact of dirt roads.

Item	Roads		Bridges		Total	
	Cost (US$ million)	Length (km)	Cost (US$ million)	Length (km)	Cost (US$ million)	Length (km)
Installation of a temporary structure	-	-	0.3	0.2	0.3	0.2
Total reconstruction of damaged structure	0.5	4.0	116.0	1.8	116.5	5.8
Partial reconstruction of damaged structure	1.6	48.0	34.7	0.4	36.3	48.4
Total	**2.1**	**52.0**	**151.0**	**2.4**	**153.1**	**54.4**

Fig. 69. Table: Distribution of roads and bridges recovery and reconstruction priorities by type of intervention

The table above presents a distribution of the type of intervention for reconstruction. It is important to be noted that due to the fact that several roads and bridges were under-designed according to contemporary hydrological conditions in Mozambique, in several cases, the

proposed reconstruction includes vulnerability reduction and building back better measures. A detailed list of works to be carried out is available in ANE's report and the compiled data table is in the share folder of this Assessment.

3.1.2. Energy

Fig. 70. Picture: Emergency works on high voltage power line in Mocuba

Priority investments include:

- Early Recovery: temporary repositioning of high voltage lines (110 kV and 220 kV) with wooden poles, for an amount of US$6.7 million; at the time of the assessment mission, works in districts of Mocuba and Gilé (total US$4.9 million) were completed while works in Moma (US$1.8 million) were yet to be performed;

- Post-Disaster Recovery: Replacement of high voltage towers, 13 transformer stations, and of about 54 km of distribution lines, out of which 44 km in Mocuba district, for an amount of US$7.6 million;
- Vulnerability Reduction: Strengthening the foundations for high voltage towers crossing rivers, for a total of US$200,000.

The detail of priorities is listed in the table below, for respective sites and types:

EARLY RECOVERY	Nampula : Moma : High Voltage 110 kV	Temporary reconstruction with wooden poles in replacement of the three towers + one wooden pole	US$1,849,433
	Zambezia : Gilé : 33kV Marropino	Temporary reconstruction with mix of wooden and steel poles in replacement of the 25 destroyed steel poles	US$150,000
	Zambezia : Mocuba : High Voltage 220 kV	Temporary reconstruction with wooden poles in replacement of the 10 towers and two crossing towers	US$4,743,582
	TOTAL EARLY RECOVERY		**US$6,743,015**
POST-DISASTER RECOVERY	Nampula : Moma : High Voltage 110 kV	Reconstruction of four towers	US$1,800,000
	Zambezia : Gilé : 33kV Marropino	Substitution of steel posts	US$30,000
	Zambezia : Lugela : 33KV Lugela	Replacement of 50 wooden poles of and two transformer stations	US$206,000
	Zambezia : Maganja da Costa : 33kV	Replacement of 25 wooden poles and three 33kV transformer stations	US$144,000
	Zambezia : Mocuba : High Voltage 220 kV	Reconstruction of 10 towers and two crossing towers	US$3,900,000
	Zambezia : Mocuba : Distribution network of Mocuba district	Replacement of six transformer stations and 44 km of distribution line with wooden poles	US$1,488,000
	TOTAL POST-DISASTER RECOVERY		**US$7,568,000**
	Zambezia : Mocuba : High Voltage 220 kV	Strengthening the foundations for two crossing towers	US$200,000
	TOTAL VULNERABILITY REDUCTION		**US$200,000**
TOTAL RECOVERY AND RECONSTRUCTION			**US$14,511,015**

Fig. 71. Table: Recovery and reconstruction priorities for the energy sector

3.1.3. Irrigated Schemes

Estimates for recovery and reconstruction costs on irrigation are still preliminary since many schemes are still under water. The Government has only begun to identify and determine the costs of post-disaster recovery efforts in affected areas. The National Institute for Irrigation is planning to undertake detailed assessments to restore the functionality of damaged infrastructure. In the post-disaster recovery phase, these will consist of rehabilitation work, and the reconstruction of dikes and roads to restore access to affected areas.

Priority investments include:

- Post-Disaster Recovery: rehabilitation of dikes, irrigation networks and pumping stations for 1,850 ha of flooded irrigated schemes, for a total of US$14.2 million.

The details of the investments are listed in the table below:

Location	Works	Area (ha)	Cost
Munda Munda irrigation scheme (Maganja da Costa)	Sustainable dike rehabilitation on 1 km, with assumption that 30 percent of the dike has to be rebuilt with an average 27 sq m cross section	400	US$405,000
	Strengthening of the dike (FOR FUTURE EVALUATION)		US$81,000
Ntabo irrigation scheme (Maganja da Costa)	Rehabilitation works on the dike and pumping stations	300	US$2,941,176
Thewe irrigation scheme (Mopeia)	Rehabilitation works on the dike, pumping stations and distribution system (primary and secondary channels)	300	US$10,588,235
Mziva irrigation scheme (Nicoadala)	Rehabilitation works on the dike and pumping stations	400	US$275,294
Mucelo irrigation scheme (Nicoadala)	Works to be identified at a later stage	250	Amounts remain to be estimated
Morire irrigation scheme (Morrumbala)		200	
	Total	**1,850**	**US$14,209,705**

Fig. 72. Table: Recovery and reconstruction priorities for irrigated schemes

3.1.4. Flood Protection and Dikes

A joint mission by DNA, the Government of Netherlands and the World Bank is visiting the affected dikes on April 14-21, in order to provide more specific and focused recommendations. The report was prepared on the basis of preliminary information available. Priority investments include:

- Early Recovery: US$1.3 million for filling of gaps and temporary reinforcement of Nante and Luabo dikes;
- Post-Disaster Recovery: US$6.7 million for rehabilitation of of Nante and Luabo dikes; and
- Vulnerability Reduction: US$4.1 million for strengthening of dikes with an average additional height of 1 meter

The details of the recommended investments are listed in the table below, for respective sites and types:

Location	Type	Description of proposed works	Value
Dike of Bacia de Licungo (Nante)	Early Recovery	Emergency works to prevent further damages and hydrological corrections	US$1,215,000
	Post-Disaster Recovery	Sustainable dike rehabilitation on 15 km, with assumption that 30 percent of the dike has to be rebuilt with an average 27 sq m cross section	US$6,075,000
	Vulnerability Reduction	Strengthening of the dike (1m additional height on 15 km with a 5 sq m cross section)	US$3,750,000
Dike of Bacia de Zambezia (Luabo)	Early Recovery	Emergency works to prevent further damages	US$121,500
	Post-Disaster Recovery	Sustainable dike rehabilitation on 1.5 km, with assumption that 30 percent of the dike has to be rebuilt with an average 27 sq m cross section	US$607,500
	Vulnerability Reduction	Strengthening of the dike (1m additional height on 1.5 km with a 5 sq m cross section)	US$375,000
		TOTAL	**US$12,144,000**

Fig. 73. Table: Recovery and reconstruction priorities for flood protection and dikes

3.1.5. Railways

Further work should be done to the tracks in order to restore the capacity for circulation of trains transporting population and cargo. An update issued on March 31 by the Ministry of Economy and Finance indicates reconstruction needs of about US$24 million, which the private sector will incur. However, information regarding whether the damages are insured is not yet available.

3.1.6. Telecommunication

An update issued on March 31 by the Ministry of Economy and Finance indicates reconstruction needs of about US$375,000.

The details of the investments are listed in the table below, for respective sites and types:

Districts	Description of proposed works	Value
Nampula : Memba, Moma, Namapa - Eráti, Nampula – Distrito	Rehabilitation of 19 wooden poles, 3.2 km of optic fiber cable, 6 km of copper cable, one car	US$214,224
Niassa : Majune, Marrupa, N'Gauma, Sanga	Rehabilitation of 14 wooden poles, 1.55 km of optic fiber cable, 0.6 km of copper cable	US$39,857
Zambezia : Alto Molócué, Gilé, Gurué, Ile, Milange, Mocuba, Namarroi	Rehabilitation of 60 wooden poles, 2.2 km of optic fiber cable	US$121,706
	TOTAL	**US$375,787**

Fig. 74. Table: Recovery and reconstruction priorities for telecommunication

3.1.7. Drinking Water Supply and Sanitation

Priority investments include:

- Early Recovery: Cleaning and temporary repairs to water pipes, rental and acquisition of generators and fuel, for a total of US$0.9 million;
- Post-Disaster Recovery: Replacement and rehabilitation of pipes, boreholes, reservoirs, pumps, treatment and distribution systems, for a total of US$5.9 million; and
- Vulnerability Reduction: Creating redundancy in the electrical system for emergency periods; strengthening reservoirs; construction of a new distribution center for Mocuba and extension of the distribution networks; disinfection and installation of new rural community drinking water supply; and capacity building for better sanitation on resettled areas, for a total of US$60.1 million

Data on vulnerability reduction needs are still limited:Some systems are not accessible and others require further study to better determine the needs. It should be noted that Mocuba system alone accounts for around US$40 million of the total amount for vulnerability reduction. This project is currently under consideration to be financed under the WASIS project.

The details of the investments are listed in the table below, for respective sites and types:

EARLY RECOVERY	Intake, treatment and distribution systems of Nampula	Purchase of emergency generators, lubricants and fuel for the emergency system operation and to prevent the proliferation of waterborne diseases.	US$378,794
	Intake, treatment, transportation and distribution systems of Nacala-Porto	Provisional repair of the main water pipe. Emergency generator replacement and rental for R3 Water Distribution Centre. Fuel acquisition for the emergency system operation and to prevent the proliferation of waterborne diseases.	US$26,353
	Intake, treatment, transportation and distribution systems of Quelimane	Power line replacement for boreholes in the area of Licuari. Replacement in the aqueduct crossing the bridge at Licuari.	US$35,294
	Intake and distribution systems of Angoche	Fuel acquisition for the emergency system operation and to prevent the proliferation of waterborne diseases.	US$7,375
	Intake and distribution systems of Lichinga	Fuel acquisition for the emergency system operation and to prevent the proliferation of waterborne diseases.	US$17,647
	Intake, treatment and distribution systems of Cuamba	Temporary replacement of damaged pipe	US$1,129,876
	Intake, adduction, treatment systems, reservoirs and distribution network of Mocuba	Replacement the Mocuba intake system (cleaning the well filtering channel, two pumps, pipeline 100m, coverage in the engine kennel and two generators)	US$3,529,412
	Wells in the Lower Licungo region	Cleaning and development in 10 boreholes	US$44,118
POST-DISASTER RECOVERY	Intake, treatment and distribution systems of Nampula	Replacement of electrical accessories for operation of the telemetry system	US$5,353
	Intake, treatment, transportation and distribution systems of Nacala-Porto	Replacement of about 8 km of pipeline. Acquisition of emergency generators for the water supply system of Nacala	US$647,059
	Intake and distribution systems of Lichinga	Acquisition of emergency generators for the water supply system in Lichinga	US$17,647

	Intake, treatment and distribution systems of Cuamba	Acquisition of emergency generators for the water treatment, water supply and distribution systems of Cuamba	US$1,129,876
	Intake, adduction, treatment systems, reservoirs and distribution network of Mocuba	Replacement of the water intake of the Mocuba system (dredging the canal; cleaning the well capture protection channel; rehabilitating the well and capture tower; mounting two submersible and two floating pumps; well protection wall; rehabilitation of technical unit building and machines; replacement of 150 m of pipeline; repair in water treatment reservoirs and distribution network	US$3,529,412
	Intake, adduction, treatment systems, reservoirs and distribution network of Alto Molocue	Restoring existing infrastructure	US$200,000
	Intake system of Ile district	Repairs to the distribution tower and pumping equipment to restore normal operation of the two springs; rehabilitate the reservoir infrastructure; treatment and distribution; replacement and stabilization of pipeline portions.	US$617,647
VULNERABILITY REDUCTION	Intake, treatment, transportation and distribution systems of Nacala-Porto	Replacement of some 30 km of fiber cement pipeline	US$12,000,000
	Intake system of Ile district	Strengthen the two springs and identify alternative water intakes; increase the capacity of the reservoir, water supply, treatment and distribution.	US$2,720,000
	Intake, treatment and distribution systems of Cuamba	Replacement of some 30 km of pipeline	US$4,534,240
	Intake, adduction, treatment systems, reservoirs and distribution network of Mocuba	Rehabilitation of infrastructure in the existing distribution center; construction of a new intake in Licungo River; increase reserve capacity; construction of a new distribution center and extension of the distribution network.	US$39,870,884

	Rural community drinking water supply	New rural drinking water supply to be installed in resettlement areas of the Nicoadala; Maganja da Costa; Morrumbala; Namacurra; Mopeia; Mocuba; Lugela; Chinde; and disinfection of installations in Quelimane.	US$697,500
	Intake, adduction, treatment systems, reservoirs and distribution network of Mocuba	Rehabilitation of infrastructure in the existing distribution center, increase reserve capacity and extension of the distribution network.	US$5,000,000
	Capacity building in sanitation	Sanitation promotion training including water committee and hand pump maintenance training to resettled communities in Nicoadala; Maganja da Costa; Morrumbala; Namacurra; Mopeia; Mocuba; Lugela; Chinde; and Quelimane.	US$296,000
		TOTAL	**US$67,207,274**

Fig. 75. Table: Recovery and reconstruction priorities for drinking water supply and sanitation

Overall, the priority investments to rehabilitate and improve resilience in urban drinking water and installations is US$66 million, particularly through the affected districts of Mocuba and Nacala.

Most rural communities having suffered damages to the drinking water supply equipment have been evacuated from the flooded zone, and investments are needed to ensure appropriate access to water and sanitation facilities in resettlements. The graph below presents a location of urban and rural works recommended.

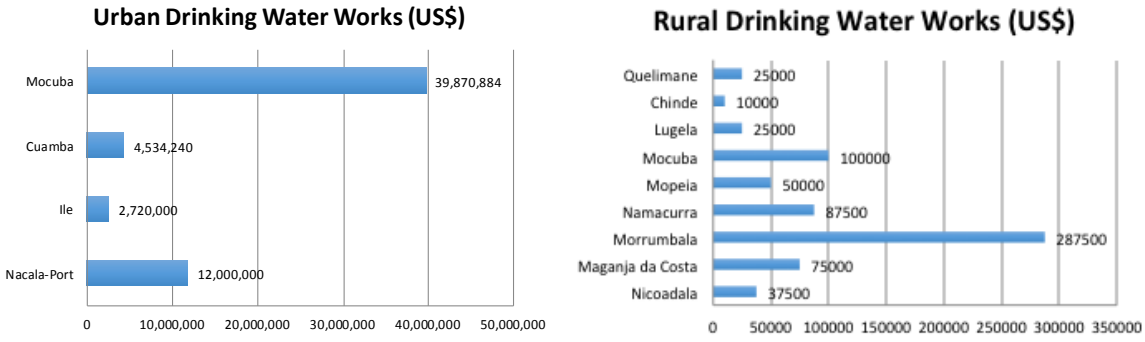


Fig. 76. Graph: Costs for drinking water and sanitation in urban and rural areas

3.1.8. Meteorological and Hydrological Networks

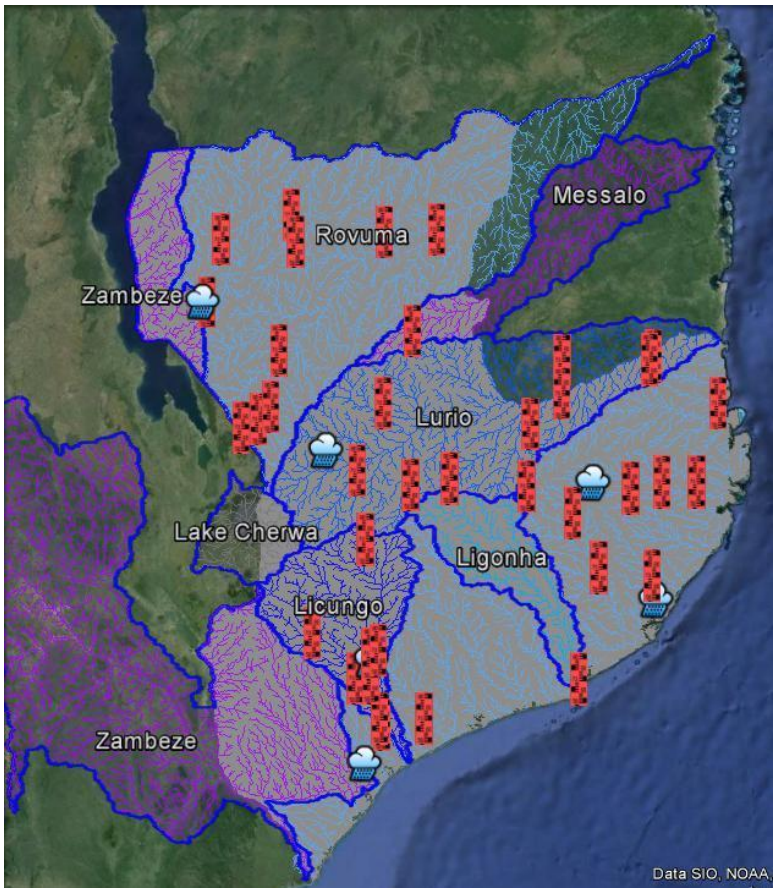


Fig. 77. Map: Proposed investments for hydro-meteorological networks

Priority investments include:

- Early Recovery: replacement of portions of hydrological scales to ensure continuity in the monitoring of hydrological monitoring, for a total of US$13,000;
- Post-Disaster Recovery: replacement of 41 complete hydrological stations, for a total of US$105,000; and
- Vulnerability Reduction: equipment in automated hydrological stations in the Licungo watershed, automated meteorological stations, for a total of US$206,000.

The details of the investments is listed in the table below:

Early Recovery	Emergency repairs on 37 hydrological stations (already implemented with existing stocks)	US$12,647
Post-Disaster Recovery	Replacement of 37 hydrological stations (at the end of the dry season)	US$52,647
	Replacement of seven rain gauges	US$3,529
	Replacement of six weather station shelters (Madjedje, Cuamba, Marrupa, Lichinga, Miconda, Mocuba), maximum temperature thermometer, computer and power source in Mocuba	US$14,799

	Replacement of a wind sensor in Nampula	US$13,235
	Replacement of an anemograph in Angoche	US$20,221
Vulnerability Reduction	Installation of a real-time telemetric hydrological monitoring system coupled with flood modelling and early warning in the Licungo watershed	US$205,882
	TOTAL	**US$322,960**

Fig. 78. Table: Recovery and reconstruction priorities for hydro-meteorological equipment

3.2. Productive Sectors

3.2.1. Rain-Fed Agriculture and Livestock

The Ministry of Agriculture and Food Security (MASA) is working, in the short-term, to recover agricultural production through the distribution of basic agricultural inputs (mainly seeds), in collaboration with other agencies. Seed distribution is necessary to reduce the impact of the emergency situation and enhance the productivity of the second agricultural season in the affected provinces. The needs stand to about 539 tons of maize, 372 tons of beans and 1.5 tons of various vegetables. Based on the death of livestock and potential spread of diseases, epidemiology surveillance should be reinforced to determine the need for a livestock vaccination campaign.

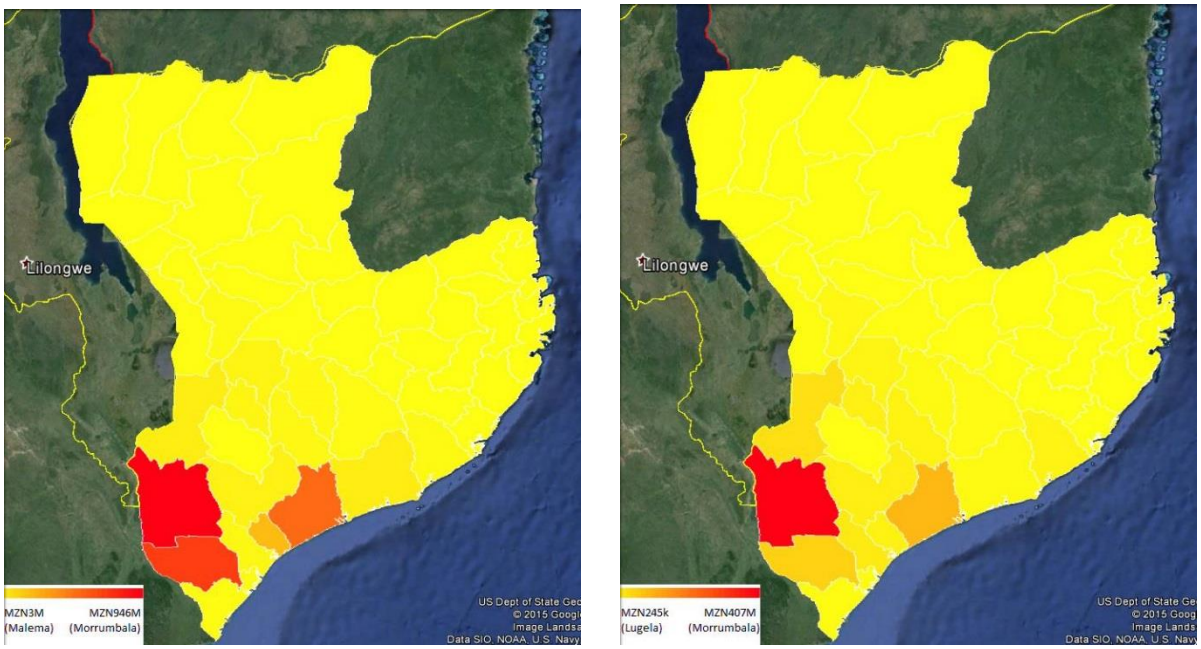


Fig. 79. Map: Agricultural losses (left) and early recovery recommendations (right) in MZN per district

Priority investments include:

- Early Recovery: provision of seeds, hoes, machetes and sickles to enable the start of the next growing season on a total of 62,000 ha, with an indicative amount of US$19.1 million; and
- Vulnerability Reduction: development of an agro-meteorological information system and local seed production and maintenance facilities, for an indicative amount of US$1.1 million.

3.2.2. Fisheries

The Ministry of Fisheries is planning to develop recovery interventions to reestablish the level of normalcy in the sector activities. These will consist of rebuilding fish ponds and repopulating them to begin a new growth cycle.

Priority investments for fisheries are listed in the table below:

Description of proposed activities	Value
Replacement of destroyed fishing equipment and boats in Zambezia (Maganja da Costa, Namacurra, Morrumbala) and Nampula (Moma)	US$130,000
Rehabilitation of 176 fish ponds in 13 districts of Zambezia	US$145,000
TOTAL	US$275,000

Fig. 80. Table: Recovery and reconstruction priorities for fisheries

In the longer-term, and in order to reduce the vulnerability of the sector to climate change and disaster risks, three types of interventions are proposed, which still require the need to be further explored and estimated financially: (i) spatial planning, adapted infrastructure design and strengthening of natural protections (mangrove) could reduce the vulnerability of aquaculture infrastructures; (ii) early warning systems are part of the a cross-cutting solution already detailed in section 3.4.1, that could be tailored for the fisheries and aquaculture sectors, coupled with a safety at sea system for the fishers; and (iii) development of specific insurance schemes for fisher and fish-farmers could improve business continuity by supporting costs related to replacing lost equipment, damages to infrastructures, initial exploitation losses, losses of inputs (e.g., feed) and fish stocks. These insurance schemes could be progressive, with coverage depending upon risk reduction measures such as infrastructure strengthening, access to an early warning system in order to reduce losses, positioning of equipment and feed/fish stocks in less vulnerable locations, etc.

3.2.3. Industry and Commerce

Markets play a primordial role for the region's economic development. The priorities identified by INGC on February 20 for the reconstruction of market infrastructures is US$1.3 million, of which US$1.28 million is for reconstruction of infrastructure and the remaining funds for supervision and monitoring activities. This is to ensure the proper operation of

markets in the post-flood periods and avoid sale of damaged products, price speculation and the disruption of stock of commodities. Nevertheless, it should be noted that this estimation is preliminary and limited to the districts monitored by INGC, including Cuamba, Mocuba, Morrumbala, Nampula City and Nacala Port. By the time of the preparation of this report, there were still affected districts to be monitored, as well as isolated communities with little to no road access.

The details of the investments is listed in the table below, for respective sites and types:

Location	Description of proposed works	Value
Market of Cuamba (Niassa)	Reconstruction of 51 small stands	US$36,412
Market of Mocuba (Zambezia)	Reconstruction of six small shops	US$891,176
Market of Morrumbala (Zambezia)	Reconstruction of seven stands	US$25,088
Market of Nampula (Nampula)	Reconstruction of two touristic infrastructures	US $11,765
	TOTAL	**US$964,441**

Fig. 81. Table: Recovery and reconstruction priorities for markets

3.3. Livelihood and Social Sectors

3.3.1. Environment and Watershed Management

Overall an improved system for management and governance of land resources is needed. It is critical to be able to respond in a systematic and integrated manner to this key development challenge. For that, sustainable land management (SLM), as a comprehensive approach, can potentially make very significant and lasting interventions with clear benefits at short- and long- terms. Along these lines, a series of investments, for a total amount of US$10 million in Nampula, Niassa and Zambezia, can improve the land management, including:

- Sustainable planted forest management for commercial, environmental / protective use or for rehabilitation of degraded areas;
- Agroforestry, by combining wood perennials with agricultural crops and / or animals for better use of soil and water resources, fodder and food products and habitat for associated species;
- Integrated soil fertility management for a combined use of organic and inorganic plant nutrients in crop production;
- Sustainable land management, forest protection, reforestation and agroforestry and fighting against bush fire; and

– River bank stabilization (engineering works), including gallery forest rehabilitation and reforestation.

A range of possible measures are presented in the Sustainable Land and Water Management in Practice book, in relation with their contribution to disaster risk reduction.

Specific investments identified as priorities include:

Term	Description of proposed works	Cost
Mid-term	Sustainable planted forest management for commercial, environmental / protective use or for rehabilitation of degraded areas	US$1.2 million
	Agroforestry, by combining wood perennials with agricultural crops and / or animals for better use of soil and water resources, fodder and food products and habitat for associated species	US$1.5 million
	Integrated soil fertility management for a combined use of organic and inorganic plant nutrients in crop production	US$1.3 million
Long-term	Sustainable land management, forest protection, reforestation and agroforestry and fighting against bush fire	US$2 million
	River bank stabilization (engineering works), including gallery forest rehabilitation and reforestation	US$4 million
	TOTAL	**US$10 million**

Fig. 82. Table: Proposed investments for environment, sustainable land and water management and integrated watershed management

3.3.2. Education

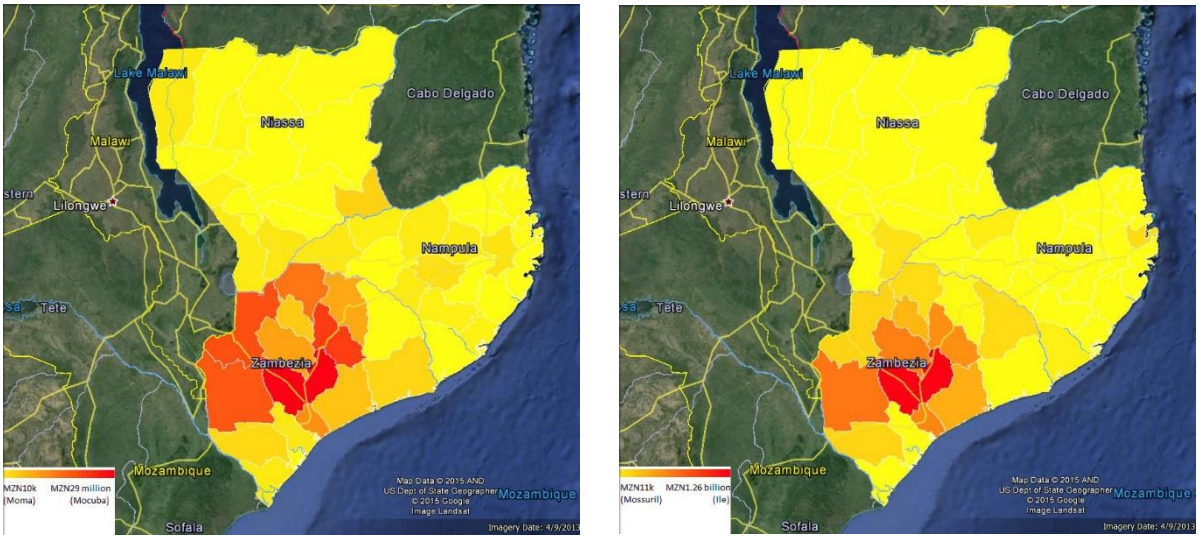


Fig. 83. Maps: Damage (left) and recovery and reconstruction priorities (right) for the education sector, by district

The Ministry of Education has reported the plan to rehabilitate or reconstruct a total of 2,045 classrooms in the affected area, 435 with conventional material and 1,585 with mixed materials, for a total cost of US$11.3 million. The figure below presents the distribution of interventions by province, where 1,457 classrooms alone are planned to be built, rehabilitated or retrofitted in Zambezia.

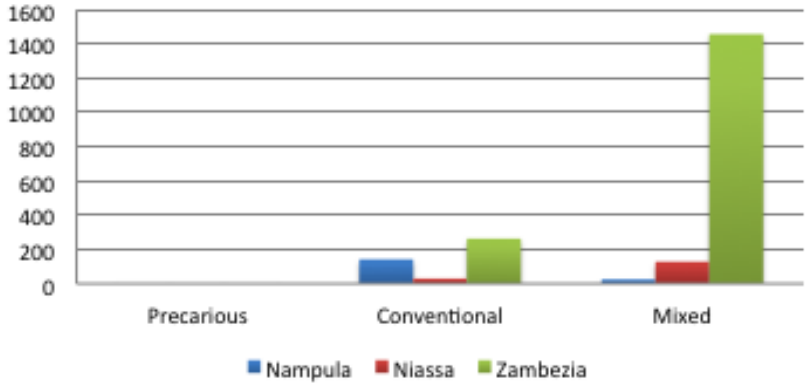


Fig. 84. Graph: Priorities for classroom reconstruction by type of construction and by province

The reconstruction of the damaged infrastructures will need to give due consideration to non-conventional or community school construction, which represents a large potential in Mozambique. A new typology based upon the use of a combination of precarious and conventional materials has recently been developed through a partnership between UN-Habitat and the Ministry of Education. It combines storm-resistant concrete and steel structures and roofing with traditional materials with community participation in order to finalize the walls. The figure below illustrates the proposed structure that brings high cost savings, with a price of construction of about US$3,000 compared to US$20,000 for a conventional classroom. A high rate of vulnerability reduction will be enabled by replacing 1,585 precariously destroyed classrooms with more resilient structures. The participation of the community during the construction also has proven to generate ownership and allows better participation in maintenance and risk management. The Ministry of Education considers this option as a sustainable solution; nevertheless, it is imperative for the suitable choice of locations for new units to mitigate the impacts of natural hazards.

Fig. 85. UN-Habitat mixed material school design (Source: "Classroom construction with non-conventional materials" project)

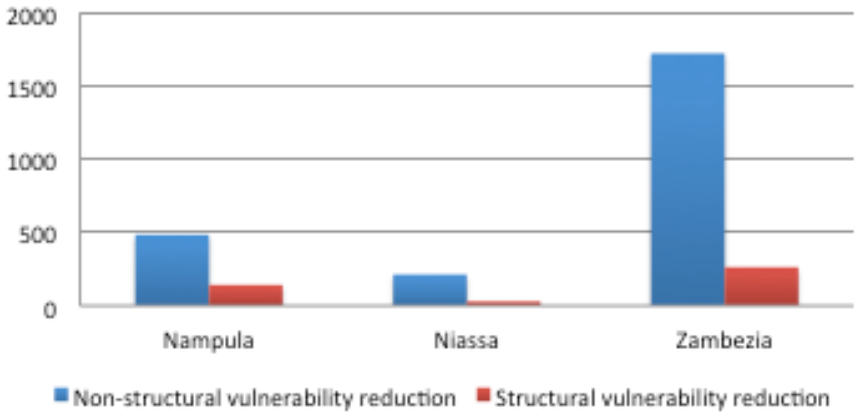


Fig. 86. Graph: Vulnerability reduction interventions by type and by province

The figure above presents the number of activities per province. The Ministry of Education plans to substitute damaged precarious classrooms in the area with mixed materials. Most of the vulnerability reduction structural activities will be concentrated in Nampula and Zambezia.

In addition to the emergency repair and replacement of damaged classrooms, a series of structural and non-structural interventions are proposed in order to reduce the vulnerability, totaling US$3.3 million. These activities include structural interventions, such as retrofitting of existing classrooms, in order to strengthen the resistance of the roofs to strong winds; and a series of non-structural interventions, including: (i) development of basic school emergency plans; (ii) training of teachers and school boards in disaster risk reduction and emergency management; (iii) purchase and storage of tents and school kits at the local delegation of the Ministry of Education; (iv) training of school board members in first aid; and (v) acquisition of first aid kits for school emergency management.

In summary, investments identified as priorities in Nampula, Niassa and Zambezia include:

Category	Description of proposed works	Value
Early Recovery	Emergency repairs in 445 classrooms	US$299,948
Post-disaster Recovery	Structural repairs (conventional) with build back better approaches in 460 classrooms	US$1,331,472
	Construction of 1,585 new classrooms with mixed techniques	US$5,921,324
Vulnerability Reduction	Retrofitting of 435 existing classrooms	US$3,319,014
	Non-structural interventions in 2,362 classrooms	US$409,000
	TOTAL	**US$11,280,758**

Fig. 87. Table: Proposed investments for the education sector

It is important to note that new schools will be built considering location safety recommendations. Nevertheless, if a school infrastructure cannot be relocated in a high and safe area, additional work should be carried out to ensure its safety, including: (i) deepen foundations and reinforcement of walls to support the lateral load of water force; (ii) transfer the loads directly to the ground by pillars or bearing walls; (iii) power connections between the components foundation and wall covering; and (v) enhance the capacity of withstanding overload in case of emergency.

The ECHO-GFDRR-UN-Habitat Safer School project has indicated that producing good architectural designs, engineering solutions and norms is relatively simple for school buildings; however, ensuring that the proposed designs, solutions and norms are approved, enthusiastically accepted and broadly acted upon constitutes a challenge that could be overcome, with the next phase of the Safer Schools project, with on-the-job trainings conducted in parallel to the improvement of norms at the national level.

3.3.3. Health

Priority investments in the health sector include:

- Early Recovery: the Ministry of Health is working with several partners, including the UN and NGOs, to provide emergency and routine care in relocation sites and elsewhere in affected areas. Minor preliminary interventions were undertaken to restore some level of functionality to damaged infrastructure. The Ministry of Health will seek technical assistance to develop a more precise assessment of damage to affected health facilities as well as detailed designs for rehabilitation and reconstruction, taking into account measures for vulnerability reduction; and
- Post-Disaster Recovery and Vulnerability Reduction: The priorities for post-disaster recovery are inclusive of vulnerability reduction measures. The total estimate of US$5.5 million needed to sustainably restore health services includes US$1.8 million to compensate the damages and US$3.7 million, which will contribute to reduce the vulnerability of the sector overall. All precariously destroyed facilities will be replaced

by medium-sized conventional health facilities, with attention to improved positioning and orientation of infrastructures, enhanced design and use of resilient materials.

The details of priorities for rehabilitation and vulnerability reduction are listed in the table below:

Type of works	**Cost**
Zambezia : Mocuba - Construction of a conventional health unit in the administrative post of Namagoa	US$850,000
Construction of nine medium-sized conventional health units in the administrative posts of Chimuarra (Zambezia : Mopeia); Regone T2 (Zambezia : Namarroi); Pele Pele (Zambezia : Pebane); Vila Valdez T2 (Zambezia : Maganja da Costa); Majaua T2 (Zambezia : Milange); and Niassa (district of Cuamba and Lago)	US$4,041,176
Rehabilitation of six conventional health units in the administrative posts of Chire T1; Chilomo T2 (Zambezia : Morrumbala); Mbaua T2; Mexixine T2; Mugobia T2; and Lugela T2	US$600,000
TOTAL	**US$5,491,176**

Fig. 88. Table: Recovery and reconstruction priorities for the health sector

3.3.4. Food Security and Nutrition

The majority of the affected community households has no resources to recover from damages and losses. The information collected indicates that food assistance for recovery of community and households is needed besides the current food assistance in accommodation and resettlement centers.

Fig. 89. Photo: Delivery of food security humanitarian assistance (Source: WFP)

An In-Depth Emergency Food Security Assessment (In-Depth EFSA) has to be conducted (usually conducted before ending the emergency relief phase, about three to four months after

the disaster occurs), as a quantitative survey to estimate the damages and losses of households and communities; the percentage of people affected at different levels of severity; their vulnerability to food insecurity; and their recovery capacity and needs for a period of up to 12 months.

The Ministry of Agriculture and Food Security is planning to provide two types of assistance to the most affected and vulnerable households in Zambezia, in addition to the provision of tools and seeds that will boost the sowing for the next season: (i) food distribution and (ii) food assistance for assets programs.

The costs are listed in the table below, for the respective provinces:

Description of proposed works	Quantity	Value
Food distribution	73,200 people in Zambezia	US$3.3 million
Food assistance for assets programs	99,700 people in Zambezia	US$2.6 million
Food assistance for assets programs	70,600 people in Nampula	US$1.8 million
	TOTAL	**US$7.7 million**

Fig. 90. Table: Priorities for food security and nutrition

3.3.5. Community Development and Rural Housing

In response to the large number of houses damaged and destroyed, the Government-led recovery process will support reconstruction of houses for households headed by elderly people and children, in the number of at least 510.

The details of investments are listed in the table below, for respective provinces:

Description of proposed works	Province	Value
Reconstruction of damaged houses	10 in Nampula	US$117,647
	100 in Niassa	US$1,176,471
	400 Zambezia	US$4,705,882
	TOTAL	**US$6,000,000**

Fig. 91. Table: Recovery and reconstruction priorities for community development and rural housing

Reducing the vulnerability of communities in rural areas implies the implementation of an overarching program that combines economic reactivation and access to social services, while ensuring land tenure and promoting climate adaptation and resilience building.

The use of architectural solutions adapted to flood-prone areas and more resistant materials could be promoted, as well as a participatory planning approach where community, local authorities and key stakeholders are represented, with open discussions and mutual commitments.

3.3.6. Urban Development and Housing

Infrastructure investments required to enhance the resilience of urban development and housing, due to its cross-cutting nature, have been accounted by this report in other specific sectors, including: roads and bridges; energy; flood protection and dikes; rainwater drainage; telecommunication; drinking water supply; and sanitation.

In many cities and towns, environmental and spatial planning, complemented by improved land use management, are critical elements of municipal adaptation to minimize the impacts of climate-related flooding and erosion. In some cities, areas of unregulated development and informal settlements may cover as much as 90 percent of municipal territory. Many informal settlements developed during the almost two decades of civil war and in the period of rapid urbanization since the Peace Agreement of 1992, are located in low-lying flood- or erosion-prone areas.

Improved planning and land use regulation, based on instruments (such as exposure and vulnerability maps, urban development and adaptation plans, sanitation and drainage master plans) are greatly needed to assist municipalities in reducing or minimizing flooding and erosion risks. Drainage master plans, specifically, are key to municipalities in targeting scarce investment capital budgets to fund strategic investments. Land registration and regularization are essential to support better land use regulation and strengthen incentives for municipal-community partnerships to better maintain drainage flows - whether through fallow areas, roadside gutters or dedicated drainage canals - in the collective interest of risk reduction.

Some cost estimates are available for the development of drainage networks, reflected in section 3.1.5.

3.4. Cross-cutting Considerations

3.4.1. Disaster Risk Management

Mozambique experiences some of southern Africa's most variable hydrological and meteorological (hydro-met) conditions. Tropical to sub-tropical climates prevail in the northern and central regions, whereas the south is predominantly arid. The oscillations of the Inter-Tropical Convergence Zone (referred to as El Niño/La Niña phenomena) influence the timing and magnitude of rainy (October to March) and dry seasons (April to September). With a low-lying topography and a coastline of 2,470 km, Mozambique is particularly exposed to tropical cyclones, often generated over the Indian Ocean and in the Mozambique Channel and moving westward toward the mainland. Cyclones bring heavy downpours, wind gusts that can reach 300km/hr in velocity and some storm surges and tidal waves.

Mozambique is the third country most at risk from water and weather-related hazards in Africa, according to the Global Facility for Disaster Reduction and Recovery (GFDRR) Mozambique Country Profile (2009). 58 percent of the population and more than 37 percent of GDP are exposed to two or more natural hazards - translating into 1.1 percent annual

average loss in GDP. In 2000, Cyclone Eline hit southern Mozambique and caused a loss of lives and livelihoods, and damages equivalent to 20 percent of GDP. With most of the Mozambican population living in low-lying, topographically flat areas and in coastal zones, exposure to floods and cyclones is high and small changes in sea level or river flow have far reaching impacts. In economic terms, floods cause annual average losses in the order of US$17.5 million in damage to household housing, US$0.7 million in damage to roads and bridges and US$42.5 million of loss in maize.

Scenarios developed through the Inter-Governmental Panel on Climate Change (IPCC) and the Global Circulation Models predict significant changes in climate patterns in Mozambique. In some locations, rainfall may decrease by 31 percent, and in others may increase by 16 percent. Climate change could result in GDP losses of 4-14 percent by the year 2050.

The Government of Mozambique is currently developing its legal framework for disaster risk management. The Disaster Management Law 15/2014 was passed on June 20, 2014 by the Parliament but its full implementation still requires additional regulation by the Government. In the meantime, the Master Plan for Natural Disaster Prevention and Mitigation (2006-2014) remains the key operational reference. It clearly links disaster mitigation and recovery with poverty and vulnerability reduction in an agriculture-based economy. Food security considerations extend beyond strategic reserves of seeds and emergency rations, to advocate for introduction of drought-resistant plants that can be used industrially to alter the structure of the rural economy in semi-arid areas. Disaster readiness is based on early warning, information management, communication and trained capacity for search and rescue. The implementation strategy for this plan is decentralized, so that local and traditional governments, as well as civil society, are engaged as primary managers of information and risk. INGC has been updating this plan for disaster risk management since 2013.

In 2011 and 2012, INGC commissioned important studies on climate change in Mozambique and its relationship with disaster risk management: several background documents spanning from coastal protection to oceanic extremes were prepared and used as building blocks of a Strategy of Disaster Risk Management and Climate Change Adaptation. This strategy was not officially endorsed by the Government mainly due to institutional reasons; instead, a Climate Change Strategy prepared under the leadership of the Ministry of Environment (MICOA) was approved in November 2012. This led to an institutional framework where disaster risk management and climate change adaptation activities follow different lines of decision, a situation requiring strong government coordination.

3.4.1.1. Risk and Impact Evaluation and Monitoring at the National Level

With the goal of providing quality information on historical and future impacts of natural hazards, the mission recommends that a comprehensive disaster risk evaluation program be developed with a number of priority sectors, which could comprise as pilot education, agriculture, transportation and energy. Such disaster risk evaluation would combine (i) physical modeling with a probabilistic approach (e.g. CAPRA) and (ii) deterministic mapping of risks based on feedback from previous disasters (e.g. DESINVENTAR). The

empirical information from past events would be used to identify risk hotspots as well as to provide a baseline for risk models which could provide an overview of future risks on the basis of different scenarios of soil conservation practices, urban development, sector-specific strategies or climate change.

Risk knowledge can only be developed over time with a phased work. It is advisable to start focusing the work on cyclones, floods and earthquake hazards, with higher resolution in areas concentrating larger shares of population, assets or potential for growth. Existing knowledge will constitute a baseline and will have to be collected and converted into a harmonized framework in order to gradually exploit and develop knowledge as a parallel process. The first phase of the project could thus develop the following products:

1. Geo-referenced dynamic database on historical hazards and their impacts. This impacts database could be developed following the "DesInventar" methodology while improving the connection between the database and a geographic information system, in order to capture the underlying risk factors with a better resolution than the administrative boundaries. The process will lead to the use of a unique identifier assigned to each event; thus, enabling overlaying and cross analysis of data available in the different administrations, some focused primarily on hazards and others on impacts.
2. Organizing existing cartographic resources relevant to disaster risk reduction and climate adaptation under a common framework (e.g. Geonode), and developing additional information layers as needed (land use, topography, administrative boundaries, areas of expertise / influence of the different members of the platform, etc.);
3. Gradual improvement in the analysis and mapping of hazards (zoning, return period for different intensities, metadata including dates of past events and key physical parameters) to high winds, heavy rains, river floods, flash floods, urban runoff, overflow of dams and dikes, agricultural drought and earthquake risks;
4. Mapping of key exposed elements and vulnerable areas with preliminary classification of vulnerability (populated areas, areas of environmental, social or economic interest, key infrastructures) for each hazard and select sectors; mapping of good practices in the field of disaster risk reduction of climate change adaptation; mapping of the main elements of interest in the emergency response in order to support the contingency planning and emergency response phases (logistics, transport, potential shelters, potential supplies in water, fuel, food, pharmaceuticals products, etc.);
5. Risk atlas identifying potential impacts of different hazards on various sectors (for current conditions and future projections based upon demographic, economic and climate scenarios); and
6. Training and knowledge sharing activities – including South-South exchanges with other countries – for all institutions contributing to prevention and disaster management.

The estimated cost for this activity is US$3.5 million distributed as follows:

- First year: update and strengthen the impacts database (DesInventar, 5214 data sheets available for 1979-2012); update of the dedicated DRR-CCA mapping service (GeoNode); collection and harmonization of information layers available; identification of areas that would benefit from enhanced hazard information in relation to risk of wind, flooding and earthquake;
- Second year: establishment of a preliminary probabilistic risk model (CAPRA) with a multi-hazard and multi-sector approach; comparison of first model outputs with historical impacts;
- Third year: development of a dynamic risk atlas providing current risk estimates and projections based upon different scenarios (public policies, economic and social orientations, rural development, urban planning, water management, sustainable land management practices, climate change, etc.);
- Fourth year onwards: continuous improvements in the baseline information (hazard, exposure and vulnerability input information, historical damages and losses information) and in the modelling tools.

In addition to this technical assistance, larger investments are needed in parallel to develop the baseline information. For example, a project of EUR6.54 million is ongoing, funded by GFDRR and implemented by ARA-Sul and ARA-Zambezi, to enhance spatial data for flood risk management in the Limpopo and Zambezi river basins. This includes (i) Lidar survey; (ii) integration of Lidar data into existing models and decision support systems, and establishment of new ones such as disaster risk evaluation tools; (iii) information management systems to ensure long-term accessibility and use of Lidar data and derivative products; and (iii) training and capacity building for technical staff in ARA-Sul, ARA-Zambezi, DNA, INGC and associated agencies.

3.4.1.2. Risk-Proofing Local Development Processes

The risk information mentioned in the previous paragraph is only useful if developed through a collaborative process involving risk evaluation specialists together with sector specialists and decision-makers. This information can have several purposes, one of which is identification of optimal realistic investment scenarios relevant for medium- and long-term planning. Resilient development often comes at an additional cost in the short term, but also pays off and can be an opportunity to identify innovative and sustainable solutions.

The consideration of risks in education; transportation; energy; urban development and sanitation master plans; mining; sustainable land; and water management, is identified as a priority. As an example, a support of US$1 million is currently in the pipeline for Safer Schools, and will focus on (i) enhancing the policy and regulatory environment for hazard zoning and school construction; (ii) understanding disaster and climate risks relevant to school construction; and (iii) improving the implementation of resilient school construction at a local level through on-the-job trainings - targeting two delivery streams: conventional (government) and non-conventional (community).

It is proposed to support the technical assistance required for the consideration of risk in investment projects in the transportation, urban planning, sanitation and the exploitation of natural resources, with an envelope for three years of **US$2 million,** out of which US$1 million is funded by GFDRR for education.

3.4.1.3. Early Warning and Response in the Northern and Central Regions

Mozambique accounts for around 1,000 operational local Disaster Risk Management Committees mostly in areas prone to flooding and cyclones; they play an important role in sensitizing the population to disaster warnings and implementing evacuation procedures, as needed. In affected provinces, there are 350, of which 90 percent of them are trained by INGC. An early warning system for floods in Licungo basin was established and activated in this event; however, experience revealed technical and institutional gaps:

- The meteorological and hydrological information systems were unable to provide accurate information about the upcoming floods due to technical fragilities of services;
- Warning of affected communities failed to transmit information about the magnitude of the event and possible impacts, and was largely ignored, resulting in many fatalities.

Taking into account that Licungo is one the riskiest basins in Mozambique, enhancing the flood monitoring and warning system is a key priority. A project is proposed to identify, design, implement and monitor a flood warning system in Licungo and in a close basin in Nampula (Meluli). This would entail, among others:

- A study of the whole basin to identify key features relevant to an EWS;
- Assess the current hydro-met information system and ensure coordination of the proposed new investments;
- Link up investments in hydro-met with potential data to be supplied by the meteorological radar of Beira, now being rehabilitated;
- Explore regional cooperation in meteorology (South Africa, France and others) to access and utilize data appropriate to timely and accurate forecasts;
- Invest in the hydro-met network with some automatic stations for real-time monitoring;
- Train and equip local authorities and local committees to take benefit from enhanced access to monitoring and forecasting of local risks;
- A topographic survey of the basin linked to hydrological and hydraulic modeling of floods;
- The mapping of exposure and vulnerability along the basin;
- The establishment of a shared information system, where public and private institutions share relevant risk information that can partially be used by the public;
- Training of institutions and local committees on the use of information; and

- Simulation exercises and monitoring.

A budget of **US$2,500,000** is proposed for this activity.

3.4.1.4. Risk Financing

Due to the variety of hazards present, damages and losses in Mozambique impact all sectors, principally from: (i) direct damage to buildings and infrastructure arising from flood, high winds from cyclones and seismic activity; (ii) direct losses of crop and livestock resulting from drought and flood; and (iii) loss of income (personal, commercial or fiscal) resulting from damage to premises, stock or failure along the supply chain arising from the direct damages and losses described in the points above.

As pointed out by the 2012 Disaster Risk Financing and Insurance Country Note prepared by GFDRR, disaster costs to the national economy are estimated at US$1.74 billion from 1980-2003, but this is likely to be a significant underestimate. The limited diversification in the economy creates concentrations of exposure, increasing the possibility of severe damages and losses arising from a single disaster event.

The impacts of disaster events are multiplied by limitations in the agricultural supply chain. Producers experience difficulties in storage, processing, marketing and transporting surpluses in good years, preventing Mozambique from smoothing production volatility across the country. Food insecurity is particularly amplified by the difficulties of connecting regions. The large distances between the surplus producing regions in the north and the south where the risk of production deficits is highest, combined with the poor state of the road network and high transport costs, hinders the movement of surpluses between regions, as evidenced by the flooding caused by the 2015 heavy rains. In addition, high levels of poverty and low financial services penetration limit the coping strategies available to the population in the event of a disaster, and thereby increase the need for post-disaster assistance.

While disaster risk financing and insurance instruments are valuable tools for disaster risk management, the development of resilience in Mozambique will depend on an integrated approach involving parallel development of the agricultural market, improvements in infrastructure (particularly the transport network) and building construction quality and sensitization of the population to encourage risk-averse behavior.

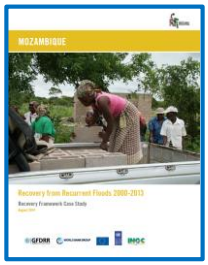
It should be noted that the government has provisioned a number of disaster risk financing and insurance (DRFI)-related goals in its strategic planning documents: notably the Master Plan for the Prevention and Mitigation of Natural Disasters, and the Action Plan for Poverty Reduction plus the 5-year Plan (2015-2019). Nevertheless, some short-term actions should be carried out to effectively develop the government's financial capacity to respond to disasters, among them:

- Create a shared database on exposed assets, covering private buildings, crops and infrastructure with characteristics including location, replacement value and type of construction/crop;

- Establish formalized agreements between INGC and the other agencies and sector ministries that collect data on disaster risk loss and exposure, to ensure the sharing of this data and its consolidation at one central point;
- Promote local leadership of initiatives in disaster risk information (databases, models, maps), potentially through partnership with international agencies;
- Conduct a comprehensive fiscal disaster risk assessment using a probabilistic framework to identify contingent public expenditure during: (i) the response and early recovery; and (ii) the longer-term recovery and reconstruction costs;
- Establish initiatives to develop domestic insurer capacity to underwrite agricultural risks, and support the insurance regulator in the development of regulation of index-linked insurance.

A budget of **US$1.5 million** is proposed for this activity.

3.4.1.5. Recovery and Reconstruction



GFDRR - Recovery Framework Case Study
Mozambique: Recovery from Recurrent Floods 2000-2013:

https://www.gfdrr.org/sites/gfdrr/files/publication/Mozambique%20August%202014.pdf

As indicated in the GFDRR Recovery Framework Case Study, the following recommendations are suggested for capacity development in recovery and reconstruction:

- Re-examine the national disaster management system to clarify competencies and authority of different government entities for recovery.
- Establish a coordinating body (the equivalent to CENOE, but specifically for recovery) to monitor recovery activities. This body should be staffed with trained personnel from key sectors familiar with damages and losses assessment techniques and with planning and budgeting procedures and reporting to MEF;
- Clarify the responsibilities of INGC and MEF/ Planning and Development Directorate regarding recovery;
- Train national and local authorities to improve readiness for recovery. This should be combined with the development of a consolidated multi-sectoral report on recovery priorities and implementation framework that harmonizes the preliminary needs assessment coordinated by CENOE with the MEF/ Planning and Development Directorate post-disaster damage assessment, as well as assessments used by key partners and NGOs; and
- Develop multi-annual contingency plans that include projected reconstruction needs and costs to refine the needs assessment that follows a disaster.

- Facilitate monitoring of recovery activities, labelling funding for recovery in its own category in e-Sistafe[1], regardless of the source of funding, so that the implementation could be monitored against the reconstruction budget, prepared by the Government as a result of post-disaster assessments.

A budget of **US$500,000** would be necessary for this activity.

3.4.2. Implementation and Monitoring Arrangements for the Recovery and Reconstruction Framework

Mozambique's strategy for long-term disaster risk reduction is well articulated within the Government's legal framework and policy documents, but there is still the need to clearly define and formalize the roles and responsibilities for implementation and monitoring of recovery and reconstruction.

The responsibility to coordinate and implement recovery is spread between INGC/CENOE, the MEF/Planning & Development Directorate and sector ministries. INGC clearly leads the response phase and preliminary needs assessment and the MEF/Planning & Development Directorate leads the post-disaster assessment, planning and reconstruction phases. The implementation of recovery activities becomes a responsibility of the respective sector ministries.

Long-term recovery needs are not explicitly labeled as such when defining government development priorities and socio-economic plans. Budgets for long-term recovery are usually folded into the rolling national development plan and macro-economic framework, as articulated in the Medium-Term Fiscal Scenario (CFMP). In this way, reconstruction needs are incorporated into the regular budget cycle and managed as medium- to long-term development projects through existing mechanisms. They are not labeled as post-disaster recovery projects per se and therefore, there is no clear distinction between investments in damaged or lost assets and investments in development and often, during the budgeting, they fall behind new identified priorities.

Insufficient financing for the rehabilitation of major infrastructure, such as dykes and dams, has resulted in increased damages from flooding that could have been avoided. Also, when funding for infrastructure is sourced through budget reallocations, it is unlikely to cover building back better interventions, required to increase the resilience of infrastructure to the next disaster of equal or greater magnitude.

With the approval of the Disaster Management Law in April 2014 that mandates every sector or stakeholder to take action for disaster risk management, a window of opportunity was opened to clarify policies and responsibilities for disaster recovery, including recovery activities that follow resource mobilization.

[1] National system for financial administration accessible online, created to provide transparency in the management of public revenues

Considering Mozambique's geographic location, its disaster history and future climate predictions, hazards will continue to affect the country frequently. The development of a sound implementation and monitoring mechanism for recovery is therefore critical for the country. Additional consultations among government institutions and partners are needed to identify concrete steps to kick start this process.

It is recommended that:

- Post-disaster recovery and reconstruction activities are properly labeled during planning and budgeting processes to make it easy to distinguish them from development investment and facilitate monitoring; and
- Implementation of recovery and reconstruction by line ministries should be monitored by the body proposed in paragraph 3.4.1.6. This body should be tasked to report on a regular basis to MEF and at least once a year to CTGC (and its report should be included as part of the annual Contingency Plan submitted by CTGC to the Cabinet).

Annex 1 – Official Request

REPÚBLICA DE MOÇAMBIQUE
MINISTERIO DA ECONOMIA E FINANCAS
DIRECCAO DE INVESTIMENTO E COOPERACAO

Ofício nº20 /MPD/DIC/2015

Assunto: **Missão do Banco Mundial para Assistência na Avaliação do Impacto das Cheias (2015)**

Sra Isabel Soares,

Desde meados de Janeiro do corrente ano que Moçambique enfrenta os efeitos da época chuvosa, que afectou com maior incidência as bacias dos rios Licungo, Lúrio e Ligonha, causando perdas humanas e destruição de infra-estruturas, com enfoque nas estradas e de transporte de energia. A resposta do Governo de Moçambique, coordenada pelo Instituto Nacional de Gestão das Calamidades, permitiu controlar os danos, decorrendo ainda o levantamento e quantificação dos danos.

Neste contexto, O Governo de Moçambique acolhe a disponibilidade do Banco Mundial de enviar uma missão para apoiar no levantamento dos danos e quantificações dos recursos financeiros para a reabilitação de infra-estruturas afectadas bem como possíveis fontes de financiamento, com base nos Termos de Referencia em anexo e em coordenação com o Instituto Nacional e Gestão das Calamidades.

Com os melhores cumprimentos

Maputo, aos 25 de Fevereiro de 2015
O Director Nacional

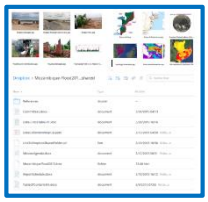
Adriano Ubisse

Exma. Senhora
Isabel Soares, *Senior Operations Officer*
Missão Residente do Banco Mundial
Maputo

CC: Exmos:
- *Director Geral do Instituto Nacional de Gestão das Calamidades, MAEFP*
- *Director Nacional de Planificação, MEF*
- *Chefe do Gabinete do Ministro, MEF*

Av. Ahmed Sekou Touré nº21, 3º Andar, Flat 34 Telefone 21 492705/ Fax: 21 490146

Annex 2 – References

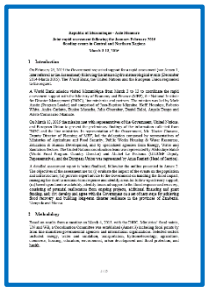


Shared folder with all documents produced and references used for the development of the report (reports, maps, pictures, etc.)

https://www.dropbox.com/sh/u591ntb24j7kd0y/AACIkjDmr22x5IYDX-r7RBiKa?dl=0 or http://goo.gl/yBmkCQ

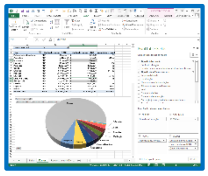
Government request for support for a rapid assessment

https://www.dropbox.com/s/qfigid0pt37073j/150225_GovernmentRequest.pdf?dl=0



Aide-memoire of the joint mission 3-13 March, 2015

https://www.dropbox.com/s/4oyyf2s86vgl8g4/AideMemoire.docx?dl=0
and
https://www.dropbox.com/s/pncxb1zlzsqc7we/AideMemoireTransmissionLetter%28signed%29.pdf?dl=0



Multi-sector pivot tables for damages and recommendations

https://www.dropbox.com/s/hcrwvv7bfv8cjk4/Data-CrossTable-PT.xlsx?dl=0 or http://goo.gl/IJcrSC

GoogleEarth maps with major damages and recommendations

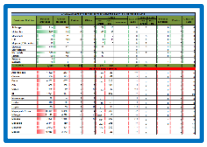
https://www.dropbox.com/s/4qeynvx66vtqnm3/MozambiqueFlood2015.kmz?dl=0 or http://goo.gl/xHVVM5

INGC, Preliminary assessment of post-disaster recovery priorities, as of February 20, 2015

https://www.dropbox.com/s/o3tsw9yhvrggkcm/150220-INGC-PreliminaryDamageAssessment.docx?dl=0

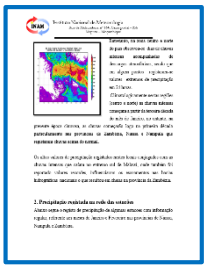
MEF, Information about the preliminary assessment of post-disaster recovery priorities, as of March 31, 2015

https://www.dropbox.com/s/ykp3x0r18rf5i0z/150331_MEF_DiagnosticoPreliminarCalamidades2015.docx?dl=0



CTGC, Impacts by district from October 1, 2014 to March 17, 2015, including during the institutional red alert

https://www.dropbox.com/s/8qhdvcvithp72fk/150403_CTGC_DanosEAfectados.xls?dl=0



INAM, Meteorological characterization, March 29, 2015

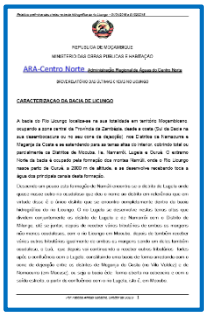
https://www.dropbox.com/s/97qp853bn52x911/150329_INAM_CaracterizacaoDoFenomeno.docx?dl=0

DNA, Hydrological characterization, January 31, 2015

https://www.dropbox.com/s/79l75cxm8elg580/150131_DNA_FloodCharacterisation.docx?dl=0

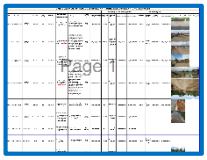
DNA, Hydrological situation, March 31, 2015

https://www.dropbox.com/s/h65t1eww0cqz02e/150331_DNA_SituacaoHidrologica.pptx?dl=0



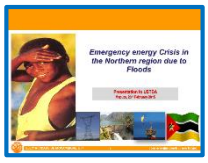
ARA Center and North, Report on the Licungo flooding, February 1, 2015

https://www.dropbox.com/s/0jzs9bfrwhlmltq/150201_ARA_BaciaDoLicungo.docx?dl=0



ANE, Assessment of damages and priorities for roads and bridges

https://www.dropbox.com/s/21st1sz0h5i7kor/150302_ANE_DamageRoadsBridges.xlsx?dl=0



EDM, Assessment of damages and priorities for electricity

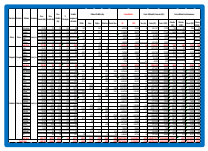
https://www.dropbox.com/s/qmqy2y50clk8yh5/150223_EDM_Energy.pptx?dl=0

AIAS, Assessment of flood damages to water supply

https://www.dropbox.com/s/4ribjwaq7xdzgoe/150306_AIAS_WaterSanitation.pdf?dl=0

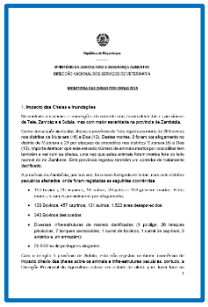
INIR, Assessment of flood damages to irrigated schemes

https://www.dropbox.com/s/msbt9yhp1vvzi98/150309_INIR_Irrigacao-CheiasZambezia.pdf?dl=0



MASA, Assessment of losses and priorities for agriculture

https://www.dropbox.com/s/5wc2w9hwusy7otr/150324_MASA_AgriculturalLosses.docx?dl=0



MASA, Monitoring of flooding impacts on livestock

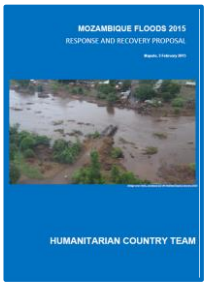
https://www.dropbox.com/s/6zwh4b5k8h1m327/150326_MASA_Livestock.docx?dl=0

SETSAN, Priorities for food security

https://www.dropbox.com/s/8g0bh68dzvivbc2/150325_SETSAN_FoodSecurity.docx?dl=0

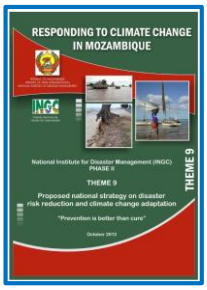
Office of the Resident Coordinator, Situation Report No. 5
(as of March 13, 2015)

http://reliefweb.int/sites/reliefweb.int/files/resources/Mozambique-UNRCO-Situation%20Report%205_Final.pdf



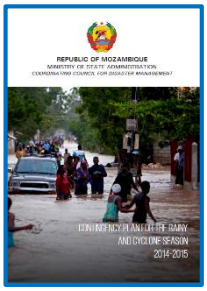
Humanitarian Country Team, Response and Recovery Proposal
as of February 5, 2015

http://reliefweb.int/sites/reliefweb.int/files/resources/Response%20and%20Recovery%20Proposal%20to%20Floods%20in%20Mozambique%202015_Final.pdf



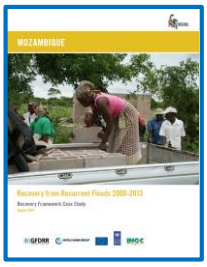
Proposed National Strategy on Disaster Risk Reduction and Climate Change Adaptation, Oct 2012

http://www.undp-aap.org/sites/undp-aap.org/files/Theme%209%20Strategy%20ENG.pdf



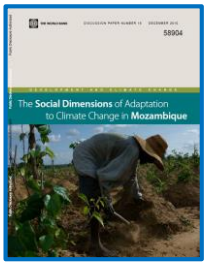
INGC, Contingency Plan for the Rainy and Cyclone Season 2014-2015, updated in October 2014

https://www.dropbox.com/s/9ba1npqxd4mk4vi/141000_INGC_ContigencyPlan2014-2015.pdf?dl=0



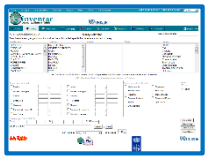
GFDRR - Recovery Framework Case Study
Mozambique: Recovery from Recurrent Floods 2000-2013

https://www.gfdrr.org/sites/gfdrr/files/publication/Mozambique%20August%202014.pdf



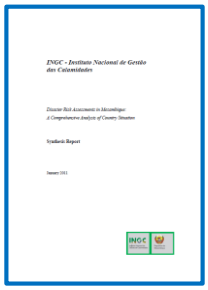
The Social Dimensions of Adaptation to Climate Change in Mozambique

http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2011/01/11/000333037_20110111031230/Rendered/PDF/589040NWP0moza10Box353823B01public1.pdf



Desinventar Database

http://www.desinventar.net/DesInventar/main.jsp?countrycode=moz



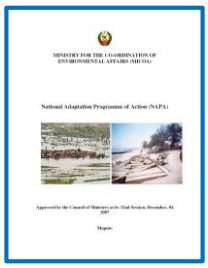
Disaster Risk Assessments in Mozambique

http://www.gripweb.org/gripweb/sites/default/files/CSA_Report_MOZ_Vol1_Final_2011-01-20.pdf

http://www.gripweb.org/gripweb/sites/default/files/CSA_Report_MOZ_Vol2_Final_2011-01-22.pdf

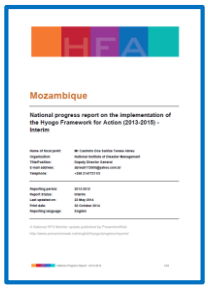
Lei n. 15/2014 - Regime jurídico da gestão das calamidades

http://www.preventionweb.net/files/39063_mozambiquelawondisastermanagement1.pdf



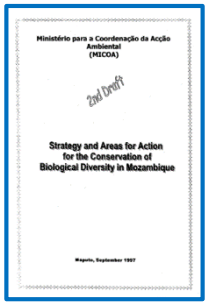
National Adaptation Plan of Action (NAPA)

http://unfccc.int/resource/docs/napa/moz01.pdf



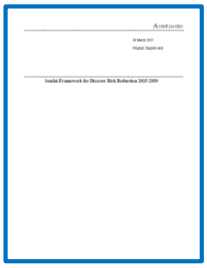
National progress report on the implementation of the Hyogo Framework for Action (2013-2015)

http://www.preventionweb.net/files/38970_MOZ_NationalHFAprogress_2013-15.pdf



MICOA, Strategy and Areas of Action for the Conservation of Biological Diversity in Mozambique, 1997

https://www.dropbox.com/s/ohx7udidxfazr8k/009709_MICOA_StrategyBiologicalDiversity.pdf?dl=0



Sendai Framework for Disaster Risk Reduction 2015-2030

http://www.wcdrr.org/uploads/Sendai_Framework_for_Disaster_Risk_Reduction_2015-2030.pdf

Triangular Cooperation Program between Mozambique, Brazil and Germany

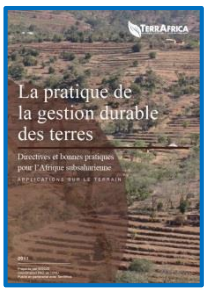
http://www.preventionweb.net/files/33055_33055giz201301553entriangularcooper.pdf

Disaster risk reduction as the basis for climate change adaptation

http://www.preventionweb.net/files/32970_32970giz20110501enmozambiquedisaste.pdf

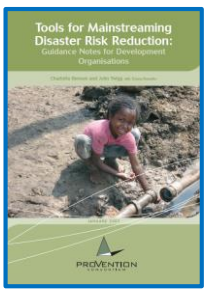
Environment and Climate Change Policy Brief

http://sidaenvironmenthelpdesk.se/wordpress/wp-content/uploads/2012/01/Mozambique-Env-and-CC-Policy-Brief_20111.pdf



Sustainable Land Management

http://www.fao.org/docrep/014/i1861e/i1861e.pdf



Tools for Mainstreaming Disaster Risk Reduction

http://www.preventionweb.net/files/1066_toolsformainstreamingDRR.pdf

Early Warning System: a Checklist

http://www.unisdr.org/2006/ppew/info-resources/ewc3/checklist/English.pdf

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