Madagascar, a country resilient to the effects of hazards and protected from damage for sustainable development

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Abstract

Madagascar is a country highly exposed to many hazards such as cyclones, floods and drought because of its geographical situation and its climatic conditions. Its location in the Southwestern Indian Ocean basin puts the country in a first position of nation most exposed to cyclones in the African continent. Every year, the damage and losses caused by disasters have negative impacts on the country's development. In view of this situation and in order to comply with the new international guidelines on disaster risk reduction, the government of Madagascar has amended the national disaster risk management act wich lays out the government's new policy to disaster risk management and updated the national disaster risk management strategy, with a view to consistency with the national development plan and its implementation plan. This updated strategy sets new goals and upholds a holistic vision, which are focused on reducing existing risk and strengthening resilience. It is also aligned with the goals of the Sendai Framework and takes into account not only the prevention of new risks related environmental, technological and biological hazards and risks, but also to climate change and the gender – sensitive approach. It is a framework document which presents an opportunity from which we can develop and ensure better and effective implementation and coordination and harmonization of strategic actions for disaster risk reduction and building resilience of the Malagasy population. In addition, in order to building spatial, sectoral, community and infrastructure resilience to the climate change impacts, Madagascar has also developed and implemented the Strategic Program for Climate Resilience (PPCR). Finally, the disaster risk financing mechanism for drought with the African Risk Capacity (ARC) is already operational to cover the population affected by drought in the far south of the country.

Creating the national and local conditions to manage risk:

The National scoping documents to manage risks

In order to reduce the effects of climate phenomena, initiatives have been taken by the Malagasy government since 2003 to build the mechanisms of risk management and disasters in Madagascar. This is how the national policy for disaster risk management act[1] and the first national strategy for disaster risk management were developed, taking into account the provisions of the Hyogo Framework for Action (2005-2015). This strategic document is annexed to this act. The actions and interventions implemented by all the stakeholders in this strategic document were mainly focused on saving lives and the emergency response and did not take into account climate change. However, it is already adopting the integrated and participatory approach. This former strategy was largely confined to the effects of cyclones, floods, drought and locust invasions; as new risks have emerged, including the impacts of climate change. However, it already takes into account the multi-hazard and multi-risk aspects. It has not been the subject of a well-coordinated action plan for lack of funding planning and good stakeholder coordination[2]. However, the contexts of disaster risk management both internationally and nationally have evolved. In addition, the issues of decentralization have evolved. Otherwise, the national development plan, in its strategic axis n ° 5, affirms *"the valorization of natural capital and the reinforcement of the resilience to the risks of catastrophe"* and insists the establishment of the appropriate strategies to reinforce the resilience of the negative impacts of climate change and the adverse effects of hazards.

Mindful of this situation, in view of the changing national context and taking into consideration the new international guidelines on disaster risk management, the Malagasy government with the support of the United Nations Development Program has updated the national policy disaster risk management (PNGRC) by amending national disaster risk management act, moving from 2003-010 of 5th September 2001 to n°2015-031 of 12th February 2016[3]. Subsequently, the national strategy for disaster risk management (SNGRC) was also updated in a participatory and inclusive approach, marked notably by the involvement of all stakeholders working in the field of

[1] Act No. 2003 - 010 on the national policy of disaster risk management of 05th September 2003
[2] Report on the national strategy for disaster risk management workshop in October 2012
[3] Act No. 2015-031 on the national policy disaster risk management of 12th February 2016

in Disaster Risk Reduction in Madagascar. These national disaster risk management framework documents are consistent with the general state policy and the national development plan.

The new disaster risk management act introduces/explains in detail the mechanism and the priority actions of the disaster risk reduction on the economic, social and environmental level. The climate change and the building resilience of the population who face the effects of occurring hazards are also highlighted in this act. In addition, it strengthens the decentralization process of disaster risk governance because this act involves all the decentralized collectivities to ensure the effectiveness of the disaster risk reduction in the country. The act provides further details on the structural, organizational and functional aspects as well as clearer definitions of the missions and interactions of the constituent entities of the national mechanism of the disaster risk management in Madagascar. It takes care to maintain and strengthen the solidarity and the will of the populations to cope with the effects of the disasters and to take into consideration the risk prevention including the prevention of new risks. Its principles are to integrate the disaster risk reduction in all development planning processes and build community resilience. This act also describes the structure of the disaster risk management in Madagascar at a strategic level and an operational level. The strategic level is composed of (i) the national council for risk and disaster management which is a consultation and decision-making structure at the highest national level led by the Prime Minister, (ii) a conception structure, technical and strategic[4] support for Disaster Risk Reduction, and (iii) the national platform for disaster risk reduction, which serves as a forum for the exchange and sharing of information among the actors in the Disaster Risk Management in the sectors of agriculture, education, health, food security and nutrition, shelter, road, water, sanitation and hygiene. The operational level has (i) a central operational structure[5] responsible for the organization, conduct, coordination of activities related to emergency preparedness, humanitarian response and early recovery, (ii) a disaster response committee, whose members comes from different organisations and agencies which belong to different sectors. It provides technical assistance to the

[4] This structure is the prevention and emergency management unit and it's also attached to the Prime Minister's office
[5] This structure is the national disaster and risk management office and it's attached to the Ministry of the Interior.

central operational structure, and support the national disaster and risk management office in planning and implementing humanitarian response in case of disaster and recovery activities.

United Nations agencies in Madagascar also have a disaster risk management structure similar to that of the Malagasy government. This structure is directed and coordinated by UN-OCHA and supports the government structure in the implementation of its activities. In addition, the private sector humanitarian platform[6] bringing together private companies, was created in 2016 and has participated in the implementation of humanitarian activities with the other traditional humanitarian actors. It is already operational in order to facilitate the coordination of the humanitarian actions of its members, in correlation with the directives of the governmental cluster lead, with a view to improved effectiveness of actions during the emergency period. These two structures are included in the disaster response committee.

As for the updated national strategy for the disaster risk management, it gathers the short, medium and long term priority actions aimed at increasing the resilience of the Malagasy population with a view to ensuring their acceptable and secure living conditions. This strategy has been developed with a view to putting in place all the devices and basic mechanisms for disaster risk management that are relevant and adapted to the national and international context while being coherent and in correlation with the principles and strategies of the Sendai framework. It serves as a framework document from which we can develop and ensure better coordination and harmonization of strategic actions for disaster risk reduction in Madagascar. It represents the global objective, the specific objectives and the strategic axes with regard to disaster risk reduction in our country. It constitutes the various activities to be implemented at the national level in order to reduce the scale of damage caused by hazards and the effects of climate change. This strategy document also serves as a baseline for all disaster risk reduction and development sectoral activities for the period 2016 to 2030.

[6] http://pshp-mada.org/

Capacity building of actors in disaster preparedness, response and early recovery

In order to strengthen the resilience of Madagascar that face various hazards and effects of climate change, the government has already implemented some activities considered as priorities in this national strategy, through the project PUPIRV-A3 financed by the World Bank (WB) and executed by the prevention and emergency management unit by the Prime Minister's office. The overall purpose of this project is to improve preparedness for disasters and build resilience to natural and anthropic hazards[7]. The project has strengthened the hydro meteorological monitoring network and improved early warning systems in municipalities most vulnerable to cyclones and floods[8]. Thus, equipment and tools for the cyclone early warning system, flood prevision and warning system, for the 172 municipalities vulnerable to these hazards, were carried out within the framework of this project. Capacity building on the use of the early warning system tools was realized to the technicians of the beneficiary communes in order to make the diffusion of alerts more effective before, during and after the passage of hazards in the impacted zones. The prevention and emergency management unit by the Prime Minister's office has also supported existing response structures at the regional level that have sufficient resources for asset management and the capacity needed for emergency response. The four relief structures of emergency beneficiaries of emergency relief materials were: the first light brigade of intervention of the engineering in Sambava, the second light brigade of intervention of the engineering in Fénérive-East, the second unit of civil protection in Manakara, and the firemen-firefighters in Mahajanga. The endowment was followed by capacity building of the elements of the emergency relief structures on the use of these materials in order to make the interventions more effective before, during and after the passage of the hazards in the impacted zones.

[7] According to national strategy for disaster risk management the prevention and emergency management unit by the Prime Minister's office
[8] Project Technical Report PUPIRV-A3

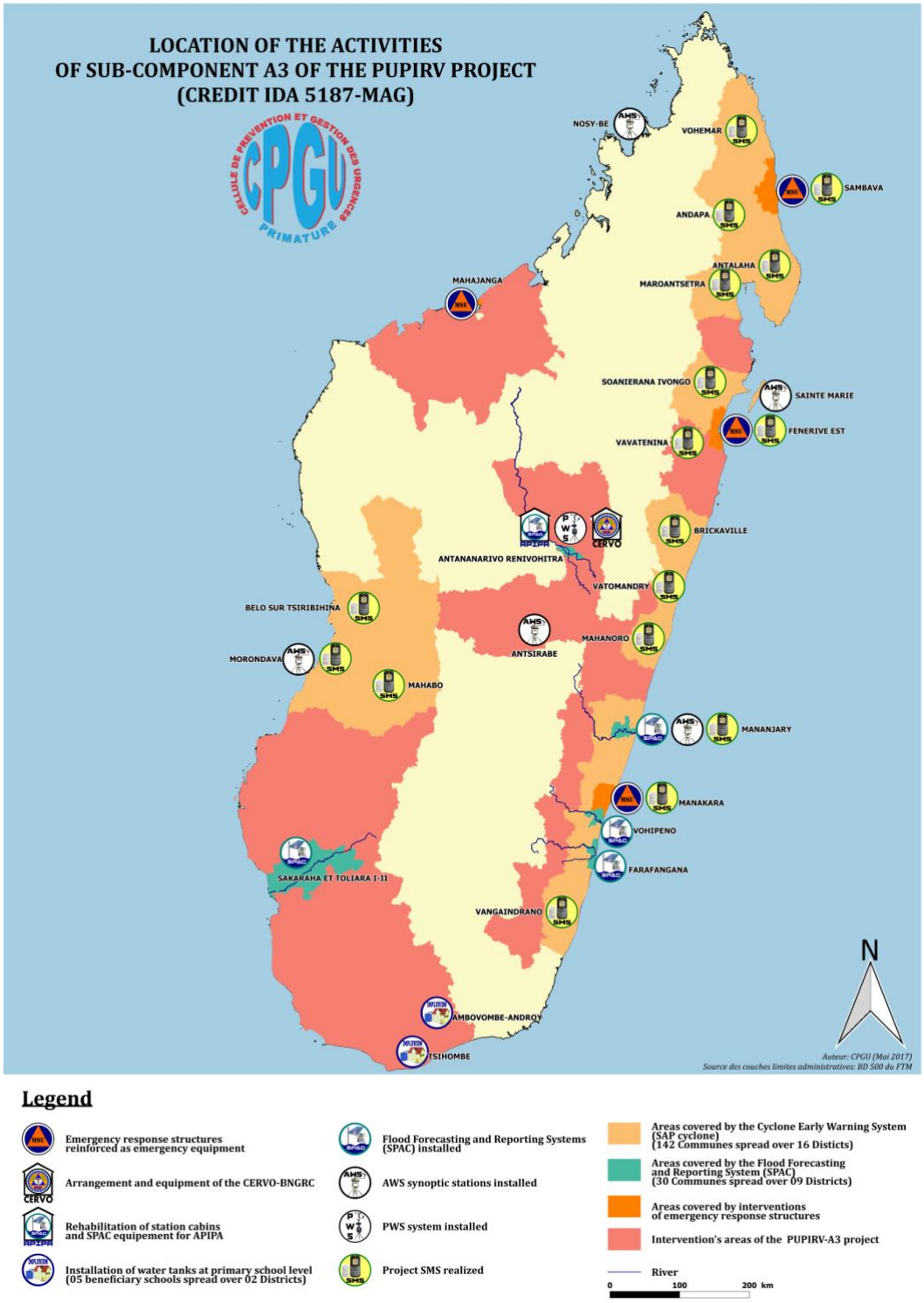

Figure 1 : Activities localization map of project PUPIRV-A3[9]

In response to the Sendai Framework's priority 4 recommendations[10], the Malagasy state has also decided to install from each region, operational centers for disaster risk management to enhance the capacities of the national disaster and risk management office in terms of emergency response. This initiative was supported by

South Korea state in the framework of a bilateral cooperation with Madagascar. A donation consisting of 22 excavators, 22 wheel loaders, 22 dump trucks, 22 ambulances, 22 firefighting vehicles named aerial work platform, 22 large-capacity motor pumps, and 11 mobile command center were acquired by the government of Madagascar to create the disaster risk management center in the 22 regions and begin the deconcentration of the national disaster and risk management office. These materials, equipment and vehicles were in order to strengthen its capacity to coordinate response actions and emergency relief in the 22 regions of Madagascar. Training was provided for the users of these machines and equipment, and capacity building at all levels was also carried out to allow optimal use.

The cyclone warning diffusion manual

The government has prioritized the development of a cyclone warning diffusion manual in order to improve the implementation of a cyclone warning system in Madagascar. The purpose of this manual is to clearly define the roles and responsibilities of the different entities at all levels and at different stages of the cyclone warning system mechanism, and to propose the characteristics of the necessary equipment relating to them (color-coded flags, megaphones, hand crank radio, hand crank siren, electric siren, single-sideband modulation (SSB), signal buoy)[11]. In this sense and in order to avoid any encroachment or wait-and-see attitude in the decision-making and implementation of emergency activities, it is appropriate that the notions of vigilance and warning are distinguished. The manual also specifies all the general mechanisms relating to the measures of preparation and the measures to be taken before the cyclone threat, the imminence of the danger and the maintenance of the vigilance after the passage of the hazard.

[9] Autor : Prevention and emergency management unit by the Prime Minister's office
[10] Priority 4 of the Sendai Framework: Enhancing disaster preparedness for effective response and to "Build Back Better" in recovery, rehabilitation and reconstruction
[11] Cyclone warning diffusion manual in Madagascar by prevention and emergency management unit by the Prime Minister's office, national disaster and risk management office, general direction of meteorology, world bank

The Standards and guidelines for key infrastructure

The catastrophic effects of natural hazards and climate change most often result in tangible physical and material damage resulting in economic losses and intangible effects such as the suffering borne by the victims. Infrastructure, such as agriculture, road, housing, drinking water supply, electricity and telecommunications are the sectors most vulnerable to the effects of climate change in Madagascar. Thus, they are identified as priority sectors for building standards resilient to climate hazards[12]. These tools provide guidelines for the construction, rehabilitation, reconstruction, maintenance and monitoring of infrastructure based on climate risks. At the moment, 6 norms have been elaborated of which 4 have decree taken in the council of government, in order to give them a binding character and to legitimize the implementation of their provisions. These are: the rules and booklets for the construction of the buildings para the national directive for the construction of community-wide drinking water supply infrastructures, the Malagasy norms for the construction of agricultural hydro infrastructures against floods and the guide for road protection against water and flood in Madagascar. For the other 2 recently developed reference guides including the construction of traditional huts and cyclone-resistant electrical/telecommunications facilities, the documents are waiting for the application text before their outreach.

The Geonode and Desinventar data sharing platforms

Since 2015, the joint project ISLANDS - United Nations office for disaster reduction risk (UNISDR) - Global Facility for Disaster Reduction and Recovery (GFDRR) aims to put in place a mechanism for disaster risk financing[13] in the future through better advanced risk assessment and risk financing solutions at the national and regional

[12] Priority 3 of the Sendai Framework: Investing in disaster risk reduction for resilience. (h) To encourage the revision of existing or the development of new building codes and standards and rehabilitation and reconstruction practices at the national or local levels (…)
[13] Priority 3 of Sendai Framework: Investing in disaster risk reduction for resilience.

level. This is the Risk Assessment and Financing Program in the South West Indian Ocean (SWIO RAFI). The prevention and emergency management unit by the Prime Minister's office and the Ministry of Finance and Budget are the two "host agency" of this project in Madagascar. As part of this SWIO-RAFI program, the World Bank and the Global Facility for Disaster Reduction and Recovery (GFDRR) launched the OpenDRI subproject to improve public access to risk information and to make effective assessment of these risks[14]. OpenDRI provides technical solutions for the government and assistance in the implementation of risk reduction activities through GeoNode which is a platform for open geospatial data sharing. Since the implementation of this OpenDRI subproject, approximately 35 technicians from the 29 institutions have benefited from capacity building training on the use and management of the GeoNode platform. The platform currently has 78 layers and 35 documents[15]. Madagascar's disaster risk profile was also developed as part of the SWIO-RAFI project. The profile is based on risk modeling for cyclones, floods and earthquakes. This profile is complementary to the historical risk profile of Madagascar through Desinventar platform, developed by the ISLANDS program since August 2013. The Desinventar[16] platform gathers historical data on damage and losses caused by all hazards. The combination of these two risk profiles will therefore lead Madagascar to the development of risk transfer and financing mechanisms, the strengthening climate resilience and the disasters risks reduction in the country's investment and the planning system of the country development.

Disaster risk reduction integrated in climate adaptation strategies and plans:

The Strategic Program for Climate Resilience (SPCR) - Madagascar

Madagascar is currently at a critical juncture for integrating the climate risk reduction into its development policies and reforms. Accordingly, the country was chosen from among the 10 new countries receiving technical assistance through the pilot program for climate resilience. This World Bank program will serve the Malagasy state

[14] Priority 1 of the Sendai Framework: Understanding disaster risk
[15] www.resiliencemada.gov.mg
[16] https://www.desinventar.net/DesInventar/profiletab.jsp?countrycode=mdg&lang=FR

to prepare the country's strategic investment plan for climate resilience and build national capacity in this area. Indeed, the objective of this program is to support the country's efforts to integrate risk reduction and climate resilience into national and sectoral development planning. A paper on the strategic program for climate resilience of Madagascar accompanied by its priority investment plan was approved by the government council and validated by the World Bank through the Pilot Program for Climate Resilience subcommittee in Washington in December 2017[17].

Disaster risk reduction strategies developed in fragile contexts:

The panafrican risk management mutual - African Risk Capacity (ARC)

The great south, composed of three regions, Atsimo Andrefana, Androy and Anosy, is an arid zone that receives only an average annual 500 mm of rainfall[18]. The lack of precipitation and the prolonged deficit of the rains caused by the El Nino phenomenon during the 2014-2016 period accentuate the drought in this part of Madagascar. This climatic phenomenon has strongly affected the great south and further deteriorated livelihoods and household food and nutrition insecurity.

The evaluation conducted in the great south in February 2016 concluded that 1,140,000 people experienced food insecurity[19]. The IPC analysis carried by the national disaster and risk management office out between September and October 2016 shows that 845.000 people were affected. This was split between 330,000 in the emergency phase (phase 4) and 515.000 in crisis (phase 3). The districts of Tsihombe, Beloha and Amboasary are classified in the emergency phase (IPC4)[20].

[17] Strategic program for climate resilience: Madagascar pilot program for climate resilience
[18] Recovery and resilience plan for the districts most affected by the drought caused by El Niño in the Great South of Madagascar, 2016
[19] Recovery and resilience plan for the districts most affected by the drought caused by El Niño in the Great South of Madagascar, 2016
[20] Humanitarian plan of strategic response Madagascar Great South, 2016-2017

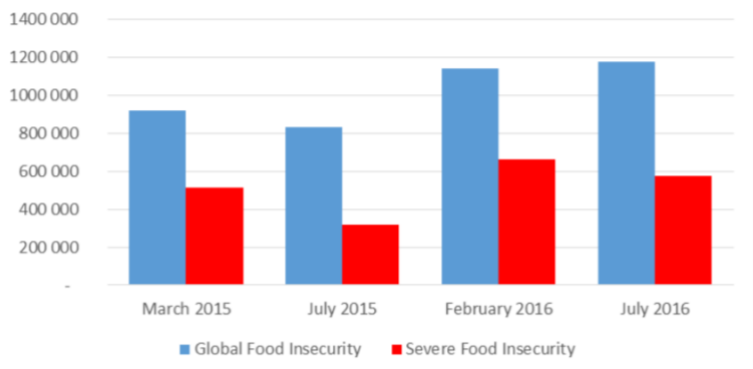

Figure 2 : People in global and severe food insecure[21]

Faced with this situation, the Malagasy government has been willing to develop a financial protection mechanism[22] in order to improve responses to the impacts of this phenomenon. The panafrican risk management mutual - African Risk Capacity (ARC) is a great opportunity for our country to strengthen the resilience of the population in the Far South in the face of drought and to improve emergency response. ARC Mutual Insurance uses advanced technology (the Africa RiskView software) for early warning systems and modern financial tools to provide governments with fast cash disbursements for disaster response. To this end, the Malagasy government signed a memorandum of understanding with ARC in 2014 in order to reinforce the capacity of DRR experts and officers in the government and NGOs in using the framework of risk profiling drought and development of operational plan. Since 2015, a capacity building process has been conducted to support DRR experts and officers in the government and NGOs to develop the drought risk profile, to establish the operational plan and to quantify the risks to be transferred as well as the use of the monitoring software Africa Risk View (ARV). An organizational structure has been put in place to carry out this program of capacity building and accompaniment of Madagascar in this mutual insurance company. The prevention and emergency management unit by the Prime Minister's office is designated as the host agency of the program and a multisectoral technical working group has been created led by a coordinator. Currently, Madagascar is already preparing for membership in the African Risk Capacity insurance mutual through the finalization of its operational plan and the customization report of ARV monitoring software

[21] Humanitarian plan of strategic response Madagascar Great South, 2016-2017
[22] Sendai Framework Priority 3: Investing in disaster risk reduction for resilience

configuration. Act No.2018-012 authorizing the ratification of the agreement establishing the institution of the African Risk Capacity was enacted on 11th July 2018 and the process for the signing of the insurance policy is currently underway.

Stand-alone disaster risk reduction strategies and plans:

The Intervention plans

The coordination of activities related to emergency preparedness, relief operations and humanitarian responses requires appropriate disaster response tools. In fact, the national office for disaster and risk management, in collaboration with the United Nations agencies and NGOs, has drawn up the national multi-risk and multi-hazard contingency plan. This plan outlines the potential risks to the country and its vulnerability to these risks as well as the institutional and physical capacities that the country has to cope with these risks. The reasons for the choice of risks, the production of scenarios and the coordination of emergency response actions and the early recovery process are the subject of the plan. In addition, in order to put in place the mechanism for coordinating interventions at every administrative level in Madagascar, the Malagasy government with the support of the United Nations agencies and the NGOs working in the field of disaster risk management has developed five multi-risk and multi-hazard regional contingency plans for the five regions[23] most vulnerable to major hazards[24] in Madagascar. These planning instruments have been established using a community and consensus approach. Scenario models are implemented in these plans in order to have an order of magnitude, the possible impacts of hazards and to propose the activities of responses and early surveys.

[23] These are the regions of Antsimo Andrefana, Atsimo Atsinanana, Melaky, Menabe and SAVA
[24] Major hazards in Madagascar: cyclones, floods, epidemics, drought, locust invasion, chemical accident

Disaster risk reduction integrated in development strategies and plans:

1-Integrating Disaster Risk Reduction at the education sector

Thanks to the collaboration between the ministry of national education and the United Nations Agencies, Madagascar is one of the first 5 countries that have integrated disaster risk reduction within the education system. In 2006, a student manual and a teacher's guide on integrating Disaster Risk Reduction into the school curriculum were developed. The purpose of the development of these documents is to establish a culture of prevention and behavioral reflex in students to reduce the negative effects of hazards at the individual level[25]. Integrating Disaster Risk Reduction into the school curriculum can enhance community resilience to hazards as students play a role as a vector of message transmission in the household and in society. Training sessions for pedagogical managers in the areas vulnerable to major hazards were also realized. Currently, the student manual and a teacher's guide on integrating disaster risk reduction into the school are being improved within the national and international context of disaster risk management. The improvement of the quality of educational curricula incorporating the disaster risk management component and of the strategy adopted for this purpose is provided by the prevention and emergency management unit by the Prime Minister's office and the national office for disaster risk management, with the support of UNDP and UNICEF.

In addition, the ministry of national education is strongly committed to strengthening the resilience of the education system[26] to different types of hazards. Thus, the Department has a disaster risk management service within the directorate of educational planning. In addition, the ministry of national education in disaster risk reduction undertook a process of capacity building of the various heads of the regional directorates of national education on the integration of disaster risk reduction in educational planning in order to increase resilience of the Malagasy education system. This process was supported by UNESCO, UNICEF and government institutions

[25] Expected Result (R 3.1 "Culture of risk is inculcated to the population") of the national strategy for disaster risk management
[26] Expected result (R 4.1 "DRR is taken into account in education and research systems") of strategic axis 4 of the national strategy for risk and disaster management

including the prevention and emergency management unit by the Prime Minister's office and the national disaster and risk management office.

Best practice

Average annual losses caused by natural hazard damage in Madagascar are estimated at more than $100 million. Each year, there is a 10% and 5% probability that damage will exceed $240 million and $600 million respectively[27]. Cyclones cause the largest losses (85% of average annual losses), followed by floods (13%). The residential sector suffers the most serious losses (75% of losses combined) and the Toamasina region is the most exposed.

Peril	**Average Annual Loss**		**100-Year Return Period Loss**	
	Total Direct Losses	Emergency Costs	Total Direct Losses	Emergency Costs
Earthquakes	$1.3 million	$200,000	$15 million	$2.3 million
Floods	$13 million	$3.1 million	$120 million	$27 million
Tropical Cyclones	$87 million	$20 million	$810 million	$190 million

Table 1 : Average annual loss and 100 year period loss (by Disaster risk profile of Madagascar – GFDRR, WBG 2016)

The cyclone "Enawo" accompanied by windstorms and heavy rains in Madagascar in 2017 caused side effects, including floods, landslides and ruptures of dikes. Some municipalities have been totally submerged by

[27] http://documents.worldbank.org/curated/en/262521494235299571/pdf/114366-FRENCH-WP-PUBLIC-drp-madagascar-fr.pdf

water and the number of people affected and destroyed public and private infrastructure are enormous. The Eastern and North-Eastern parts of Madagascar were the most affected by this cyclone. The assessment reports 81 dead, 437,405 affected and 247,219 displaced, 41,453 damaged homes, 40,520 homes destroyed and 27,660ha flooded rice paddies[28]. To this end, the livelihoods and sanitary conditions of the population living in the areas most affected by this cyclone have been threatened. The World Bank reports that the estimation of economic losses due to the cyclone Enawo in 2017, was $415 million or about 4% of GDP[29]. This report also noted that it was the habitat sector that was most affected by this cyclone, accounting for 74.1% of the total loss from damaged homes. In addition, agricultural sector modeling estimated losses of about $207 million, of which $164 million is from vanilla plantations in the Sava and Diana regions.

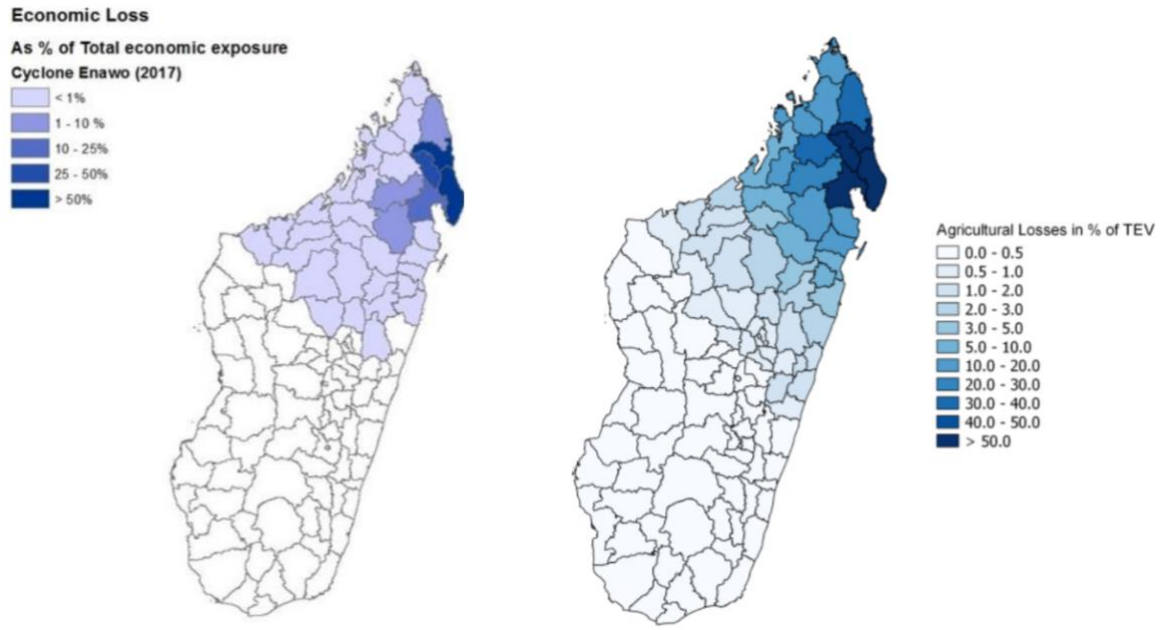

Figure 3 : Percentage of agricultural losses caused by Enawo cyclone[30]

Due to the heavy loss of human life, the amount of infrastructure destroyed, and the lack of resources to meet the basic livelihood needs of the people affected by the cyclone Enawo, the government declared a national

[28] Desinventar Historical Risk Profile: the national disaster and risk management office as the main data source
[29] Report on the estimation of economic losses, World Bank, march 2017
[30] Report on the estimation of economic losses, World Bank, march 2017

emergency situation on 14th March 2017 and launched an appeal for international partners and assistance to help the Malagasy people for emergency relief and early recovery activities. The financial requirements for these humanitarian and early recovery activities were $20,067,549.

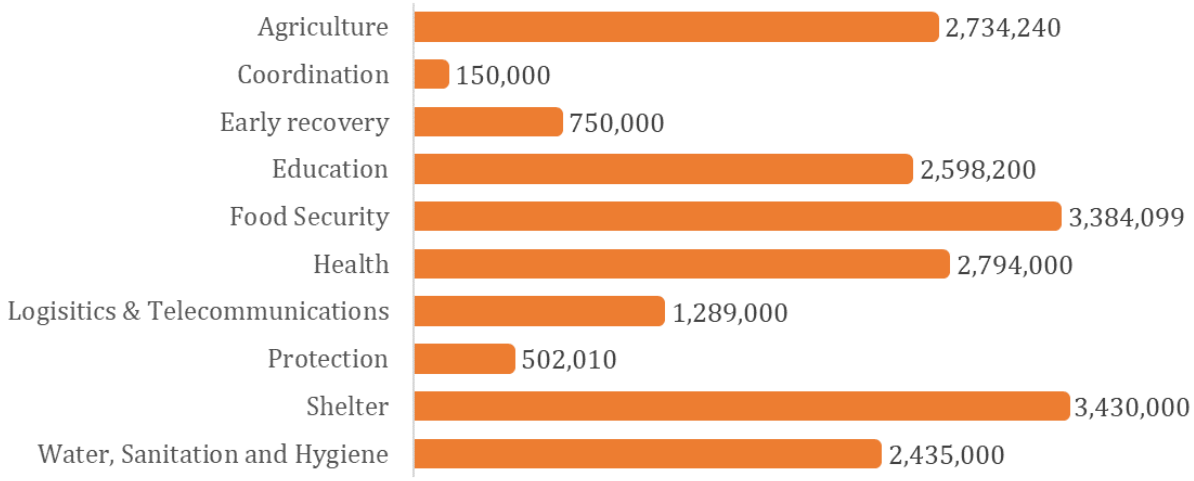

Figure 4 : Financial requirements per Cluster (USD million)[31]

In order to better rebuild the infrastructure destroyed by the cyclone Enawo, the Prime Minister has given a directive to carry out a thorough assessment of reconstruction needs in the areas affected by this cyclone. Thus, the prevention and emergency management unit by the Prime Minister's office has conducted in-depth assessment missions in districts most affected by Enawo in order to know the state of play and to estimate reconstruction needs related to key infrastructures (public and administrative buildings, schools and hospitals, roads and roadworks, drinking water supply, hydro-agricultural). The observation of the extent of the damage left by the passage of cyclone Enawo has shown that the most affected infrastructure were old and those that were not compliant with the cyclone-resistant construction standards. Despite NGo (MEDAIR, FID, UNICEF, Handicap International, TELMA etc) contributing to the reconstruction and rehabilitation work, the current needs for reconstruction are still rising to $21,092,000[32]. The good lesson to be drawn from this evaluation is to follow and apply the standards of

[31] Flash appeal for Madagascar : Intense tropical cyclone Enawo
[32] Post-disaster thorough assessment mission report by the prevention and emergency management unit by the Prime Minister's office

construction of infrastructures already developed, and especially to be able to make suggestions to the prioritization of reconstruction in relation to this damage.

Sector	Amount of reconstruction needs in USD
Public building	184,600
Water, sanitation and hygiene	84,900
Education	18,064,600
Hydro-agricultural infrastructure	1,574,000
Road	183,900
Health	1,000,000
TOTAL in USD	21,092,000

Table 2 : Summary of sustainable reconstruction needs by sector

Moreover, the passage of cyclone Enawo during this cyclonic season 2016-2017 was also a great opportunity to evaluate and verify the effectiveness of emergency response interventions as well as the relevance of the use of the systems put in places to cope with cyclonic events. Thus, the assessment mission conducted by the prevention and emergency management unit by the Prime Minister's office showed that about 90%[33] of the population of the municipalities evaluated received warning notices and adopted the safeguarding behaviors. The

[33] Post-disaster thorough assessment mission report by the prevention and emergency management unit by the Prime Minister's office

different measures to be followed at each warning level have become behavioral reflexes for the population during cyclone seasons. With regard to emergency rescue materials, these materials were used wisely by emergency rescue structures during the Enawo cyclone. Tree slaughtering, force maneuvers and opening roads were the main interventions of these structures. The optimal use of these emergency rescue equipment has allowed the teams of these four relief structures of emergency to accelerate their interventions.

At the beginning of 2018, Madagascar was hit by the cyclone Ava and the assessment reported 51 dead, 161,328 victims and 54,827 displaced people. Just two months after hurricane Ava, the strong tropical storm Eliakim ravaged the Northern part of the island and caused 21 deaths, 50,872 people were affected and 19,439 displaced[34]. However, the proximity coordination of emergency response was noted during the passage of these two cyclones through the use of mobile stations equipped by the national office for disaster risk management. The materials, machinery and equipment distributed by the national disaster and risk management office also made it possible to ensure the on-site management and securing of medical evacuation for the wounded in the regions affected by these two cyclones.

Conclusion

Since the updating of these framework documents in Madagascar's disaster risk management, the government has already implemented certain activities deemed a priority for Disaster Risk Reduction. Efforts are currently focused on implementation of favorable structural and organizational conditions for strengthening the resilience of the population to the effects of hazards and climate change. Several capacity building for disaster preparedness to ensure more effective interventions have already been made, especially for the structures and actors working in the most vulnerable zones to natural hazards and climate change in Madagascar. Even though the Malagasy government is on the right track in strengthening emergency preparedness and response, much remains to be done to ensure Madagascar is truly resilient to natural hazards and climate change.

[34] Desinventar historical risk profile: the national disaster and risk management office as the main data source

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