Damage, Loss, and Needs Assessment for Disaster Recovery and Reconstruction after the 2008 Cyclone Season in Madagascar

Cyclone Fame, Ivan and Jokwe in Madagascar

Antananarivo
May 2008

A Report prepared by the Government of Madagascar with the support of the United Nations and The World Bank

Foreword

On February 17, 2008, the eastern coast of Madagascar was hit by cyclone Ivan, a category 4 cyclone,[1] less than a month after cyclone Fame and a few weeks before cyclone Jokwe, which affected the west coast. With winds exceeding 230 km/h, Ivan first made landfall on the island of Sainte-Marie before reaching the coast of the Big Island in the district of Fénérive-Est, located 90 km from Tamatave[2] and home to over 200,000 people. The cyclone then moved towards the capital, Antananarivo, and continued southward, traversing the towns of Tuléar and Morondava before leaving the country behind on Wednesday, February 20.

On February 22, the Government officially declared a disaster and issued an international appeal for help in dealing with the crisis, based on the National Contingency Plan prepared in October 2007 by the disaster preparedness committee (Comité de Réflexion des Intervenants en cas de Catastrophes, CRIC), the local humanitarian aid platform managed by the national risk management bureau (Bureau National de Gestion des Risques et des Catastrophes, BNGRC).

In response to this request, the UN Resident Coordinator decided to mount a Flash Appeal to raise the required amount of US$36,476,586, along with an appeal to the Central Emergency Response Fund (CERF) to cover the emergency period and its priority needs. This combined use of the two fund mobilization mechanisms made it possible to rapidly stabilize the crisis and also enabled the Government, in collaboration with the World Bank and the United Nations System, to focus, beginning in March, on early recovery and longer-term reconstruction issues.

In order to avoid the funding gap that often occurs between the emergency phase and the resumption of development activities, a decision was made to initiate a supplemental appeal focused on Early Recovery. On March 11, 2008, the Prime Minister asked the Global Facility for Disaster Reduction and Recovery (GFDRR) to expedite an appraisal process for the recovery period, followed by a Call for Funds for the recovery period within the framework of Track III. The Government decided to merge these two processes under the management of the BNGRC and the disaster preparedness unit (Cellule de Prévention et de Gestion des Urgences, CPGU), with the participation of the World Bank, the United Nations System, the European Union, and the CRIC partners.

The purpose of this appraisal was to identify priority interventions—especially early recovery efforts—that would assist the Government of Madagascar during this transition phase and help communities resume their development quickly and at the same time rebuild with greated wisdom, and also to look at longer-term rehabilitation and reconstruction issues.

The methodology used makes it possible to estimate damage caused to facilities, changes in economic flows, their impacts upon the population's social and economic living conditions, and the geographic zones affected. These estimates are therefore based on quantitative data gathered in the field by the Government of Madagascar and all development partners since the most recent 2008 cyclone. This data is also supplemented by the results of ongoing field

[1] On the Saffir-Simpson scale

[2] Tamatave is the country's second largest city and main port

evaluations conducted by the BNGRC, the United Nations System, and the CRIC. These entities, in addition to quantitative data, lend a more qualitative needs perspective that also accommodates cross-cutting challenges, such as governance (or, more specifically, coordination of the transition phase), the environment, gender and diversity, and risk management.

Cyclones are seasonal and thus have a potential social and/or economic impact on the country's long-term development. This study shows that the Government's efforts in recent years in the area of risk and disaster management still require the attention of the Government, donors, the United Nations System, and all development partners in the private humanitarian sector, in order to viably reduce the country's vulnerability to these disasters, and at the same time incorporate issues associated with climate change.

The analysis contained in this report identifies and quantifies all that is needed in order to formulate strategies, action plans, and projects involving early recovery, medium-term rehabilitation, and long-term reconstruction.

This report was prepared jointly by the Government of Madagascar, through its national risk management bureau (BNGRC), the disaster preparedness unit (CPGU), and its key ministries under the overall coordination of the Prime Minister's Office and the Ministry of Interior. The Government also received assistance from the World Bank, the United Nations System, and all of Madagascar's development partners.

It is hoped that this report, prepared by the Government of Madagascar and its development partners in a spirit of effective collaboration, will be used worldwide in discussions of the protocols to be developed in order to launch integrated responses to natural disasters and other crises.

Finally, this report provides the elements needed to define the international support required by the Government of Madagascar to ensure the success of this post-disaster transition through socioeconomic parameters over the short-, medium-, and long-terms.

Charles RABEMANANJARA Prime Minister Chief of Government	Dr Xavier LEUS United Nations Resident Coordinator Madagascar	Robert BLAKE World Bank Country Manager Madagascar

Acknowledgements

This report was prepared by a joint team comprising the Government of Madagascar and members of the International Community, including The World Bank and United Nations Agencies.

In the weeks following Cyclone Fame and Ivan, initial damage assessments were conducted by the Government of Madagascar, UN agencies, and NGOs as a basis for the immediate response and short-term recovery. The authors of this Joint Damage, Losses and Needs Assessment (JDLNA) report worked closely with the involved actors. This report builds on their figures and documents of Cyclone Fame and Ivan's impacts. The JDLNA greatly benefited from the initial evaluations and the team would like to express their thanks and appreciation.

The management team composed by Government team leaders and International community team leaders coordinated the JDLNA.

The team from the Government of Madagascar was led by Colonel Jean Rakotomalala (BNGRC, within the Ministry of Interior) and Lt Colonel Mamy Razakanaivo (CPGU, within the Prime Minister's Office).

The international community team for the JDLNA was led by Sofia Bettencourt (World Bank), Roberto Jovel (GFDRR) and Jean Marie Stratigos (UN/OCHA/UNDP-BCPR). The management team was supported by a Secretariat that included: Dia Styvanley Soa (BNGRC), Haja Aimé Andriamialiharison (CPGU), Hasimahery Randrianasolo (World Bank), Tiana Mahefasoa Randrianalijaona (World Bank), Andoniaina Ratsimamanga (World Bank), and Rija Rakotoson (UN/OCHA).

The international community core team included: Francis Muraya (GFDRR), Doekle Wielinga (GFDRR), Christophe Legrand (UNDP/BCPR), Antonio Cruciani (ILO), Mukhul Bhola (ILO), Mito Tsukamoto (ILO), Jahal de Meritens (United Development Program-UNDP/ Bureau for Crisis Prevention and Recovery-BCPR), Houssein Khalali (UNDP/BCPR), Georges Lamoure (World Bank), Martien Van der Wal (CPGU), and John Harding (United Nations International Strategy for Disaster Reduction-UNISDR).

The team from the Government of Madagascar, fully involved in the field assessment and the report writing, included: Rakotosamimanana (Fund of Investment for Development-FID), Eloi Ramarovelo, Jean de Matha Rakotoarivo (Ministry of Transport), Andry Avotraniaina Rabearivelo, Evariste Andriamamonjy (Ministry of Transport/Madagascar Road Authority), Razafimahafaly (Ministry of Public Works and Meterology), Harisoa Rateloson (Ministry of Decentralization and Territorial Management attached to the Presidency), Rajaonirina Ranarifidy (Water and Electricity of Madagascar-JIRAMA), Dominique Randriamamory (Ministry of Energy and Mining), Hery Ramananjanahary (Ministry of Post Office, Telecommunication and Communication), François Randriamialison (Ministry of Education and Scientific Research), Honoré Razafindrakoto, Vololoniaina Manuella, Jacqueline Ravaoharisoa (Ministry of Health, Family Planning and Social Protection), Josia Rajaobelison (National Nutrition Office-ONN), Victor Randriana (Ministry of Agriculture, Livestock and Fisheries), Alfredo Tsaramody (Ministry of Economy, Commerce and Industry), Lalanirina Ranaivoharisoa (Ministry of Environment, Water, Forestry and Tourism-Directorate General of Tourism), Herivololona Ralalarimanana (Ministry of Environment, Water, Forestry and Tourism), Régis Rakotomanana Andrianaivo, Lanto Rasoloelison, Onintsoa Raoelison, Bako Ravelonanosy (Ministry of Finance and Budget), Raymond Randriatahina, Lantosoa Rasolondrazao, Jaotiana Rasolomamonjy,

Avotraina, Camille Rakotondrazaka (BNGRC / Ministry of Interior), Harisoa Rajaobelison (Permanent Steering Committee for the Action Plan for Rural Development - EPP/PADR at Prime Minister's Office), Nimbol Raelinera, Sahondrarilala Raveloarisoa, Marie Louise Rakotondrafara (Ministry of Public Works and Meteorology), Misa Ralijaona (CPGU / Prime Ministers Office), Hantarimino Rakotomanana (National Environment Office-ONE), Delphin Rakotomanana Andriamihaja (National Institute of Statistics-INSTAT), Colonel Edmond Randriamanantsoa (Ministry of Interior) and Victor Randrianandrasana (Malagasy Red Cross).

An international multi-agency group fully participated also in the JDNLA exercise and contributed to the report: Jacky Roland Randimbiarison, Andréa Cippa (United Nations Children's Fund-UNICEF), Arthur Lamina (World Health Organization-WHO), Marson Rafaliarivo (United Nations Industrial Development Organization-UNIDO), Haingo Rajaobelison (Food and Agriculture Organization-FAO), Tojo Ramanankirahina, Olivier Jenn-Treyer, Patrice Rakotoniaina, Bienvenu Rajaonson, Stefano Paternostro, Laza Razafiarison, Noro Aina Andriamihaja, Ando Raobelison, Pierre Graftieaux, Patrick Ramanantoanina (World Bank).

The core team is very grateful to all of the above mentioned contributors as well as the Regional and District authorities, the decentralized ministry departments, and the members of the CRIC for their inputs. The team also benefited the insight of staff from various other line ministries and agencies: Fridah Raveloson (Ministry of Energy and Mining), Isabelle Andriamanalina (Ministry of Health, Family Planning and Social Protection), Julien Andriamahazo, Rakotonarivo Andrianandrasana (Ministry of Agriculture, Livestock and Fisheries), Randriamanana Andrianapizato (Society of Equipment and Real Estate of Madagascar-SEIMAD), Joachim Rasolofonirina (National Association for the Management of Protected Area-ANGAP), Louis Razanajoelina (CARITAS NGO), Lalaina Rabemananjara (National Tourism Office), Jenny R. (National Nutrition Office), Maherisoa Rakotonindrainy (World Food Program-WFP), Patricia Ramarojaona (United Nations Development Program-UNDP), Tahiry Ramanantsoa (UN Habitat), Dominique Brunet (United Nations Children's Fund-UNICEF), Jacqueline Uwamwiza (European Commission), Solonirina Ranaivojaona (United States Agency for International Development-USAID).

The team is also grateful to Rondro Rajaobelison, Olivier Andrianavalona, Hery Rakotondrazaka, and Andry Ranarivelo for their administrative and logistical support during the JDLNA mission.

Finally, the team wishes to express their sincere appreciation to Xavier Leus, Resident Coordinator of the UN System in Madagascar, and to Robert Blake, World Bank Country Manager for Madagascar. Their strong and joint support for the JDLNA was essential to ensuring its ultimate success.

Photographs used in this publication are taken by the JDLNA Team and Government staff.

Special appreciation goes out to the Government of Norway for the financial support to the JDLNA.

Table of Contents

List of Tables

List of Figures

Glossary

ADB	Asian Development Bank
AUE	Associations des Usagers d'Eaux
APMF	Agence Portuaire, Maritime et Fluviale
ADEMA	Aéroports de Madagascar
ACM	Aviation Civile de Madagascar
AP	Air Protégé
ANGAP	Association National de Gestion des Aires Protégées
BCPR	Bureau for Crisis Prevention and Recovery
BNGRC	Bureau National de Gestion des Risques et des Catastrophes
BOP	Balance of Payment
CSB	Centre de Santé de Base
CEG	Collège d'Enseignement General
CISCO	Circonscription Scolaire
CU	Coût Unitaire
CR	Commune Rurale
CIREEF	Circonscription de l'Environnement des Eaux et Forêts
CHL	Coastal and Hydraulics Laboratory
CA	Chiffre d'Affaire
CFP	Centre de Formation Professionnelle)
CNGRC	Conseil National de Gestion des Risques et Catastrophes
CRIC	Comité de Réflexion des Intervenants en Cas de Catastrophes
CRMG	Commodity Risk Management Group
CPGU	Cellule de Prévention et de Gestion des Urgences
CRENA	Centre de Récupération Nutritionnelle Ambulatoire
CRENI	Centre de Récupération Nutritionnelle Intensive
DREN	Directions Régionales de l'Education Nationale
DWCT	Durrel Wildlife Conservation Trust
DGEEF	Direction Générale de l'Environnement, des Eaux et Forêts
DTS	Droit de Tirage Spécial
DREEFT	Direction Régionale de l'Environnement des Eaux et Forêts et du Tourisme
EDSMD	Enquête Démographique et de Santé de Madagascar
EPP	Ecole Primaire Public
EPP-PADR	Equipe Permanente de Pilotage pour le Plan d'Action pour le Développement Rural
EIMA	Evaluation Initiale Multi- Alea
FAO	Food and Agriculture Organisation
FCE	Fianarantsoa Côte Est
FID	Fond d'Intervention pour le Développement
FERHA	Fonds d'Entretien des Réseaux Hydro Agricoles
GFDRR	Global Facility for Disaster Reduction and Recovery
GRC	Gestion des Risques et des Catastrophes
HIMO	Haute Intensité de Main d'Oeuvre
HYDRO	Hydrocarbures

HJ/ha	Homme par Jour/Hectare
IEC	Information – Education- Communication
IRA	Infections Respiratoires Aigues
IST	Infection Sexuellement Transmissible
IEFN	Inventaire Ecologique Forestier National
INSTAT	Institut National de la Statistique
ISDR	International Strategy for Disaster Reduction
JIRAMA	Jiro sy Rano Malagasy
Kar	Kilowatt- Ariary
KWH	Kilowatt- Heure
LTP	Lycée Technique et Professionnel
MCA	Millenium Challenge Account
M/S	Marchandises sèches
MEM	Ministère de l'Energie et des Mines
MDAT	Ministère auprès de la Présidence de la République chargé de Décentralisation et de l'Aménagement du Territoire
MT	Ministère du Transport
MTPM	Ministère des Travaux Publiques et de la Météorologie
MEM	Ministère de l'Energie et des Mines
MPTC	Ministère des Postes, Télécommunications et de la Communication
MENRS	Ministère de l'Education Nationale et de la Recherche Scientifique
MAEP	Ministère de l'Agriculture, de l'Elevage et de la Pêche
MECI	Ministère de l'Economie, du Commerce et de l'Industrie
MEEFT	Ministère de l'Environnement, des Eaux et Forêts, et du Tourisme
MFB	Ministère des Finances et du Budget
MAP	Madagascar Action Plan
NMSP	Numerical Model Support Program
NTIC	Nouvelle Technologie de l'Information et de la Communication
NAP	Nouvelles Aires Protégées
ONG	Organisation Non- Gouvernementale
ONN	Office Nationale de la Nutrition
OMS	Organisation Mondial de la Santé
ONE	Office National de l'Environnement
OCHA	Office for Coordination of Humanitarian Affairs
ODM	Objectifs de Développement du Millénaire
ONN	Office National de Nutrition
ONT	Office National du Tourisme
PEC	Prise en Charge
PSDR	Projet de Soutien au Développement Rural
PN	Parc National
PMI/PME	Petite et Moyenne Entreprise/Petite et Moyenne Industrie
PK	Point Kilométrique
PRD	Plan Régional de Développement
PPN	Produit de Première Nécessité
PNUD	Programme des Nations Unies pour le Developpement

PRSP	Poverty Reduction Strategy Paper
RN	Route Nationale
RNCFM	Réseu National des Chemins de Fer de Madagascar
RNI	Rayonnement Non- Ionisant
RS	Reserve Spéciale
SA	Société Anonyme
SAC	Standard Anticyclonique
SPSM	Société de Pêche de Sainte Marie
SAPM	Système d'Aire Protégées de Madagascar
SSME	Semaines de la Santé de la Mère et de l'Enfant
TA	Tananarive – Antsirabe
TBER	Tableau de Bord Environnemental et Régional
TCE	Tananarive Côte Est
TIP	Taux d'Insuffisance Pondérale
TC	Travail Communautaire
UNESCO-IHE	United Nations Educational, Scientific and Cultural Organization-International Institute for Infrastructural, Hydraulic and Environmental Engineering
Vit A	Vitamine A
VA	Valeur Ajoutée
VCT	Vivre Contre Travail
VIH	Virus de l'Immunodéficience Humaine
WCS	Wildlife Conservation Society
ZAP	Zones d'Appui Pédagogique

Executive Summary

In the first few months of 2008, three consecutive cyclones struck Madagascar affecting 17 of 22 regions. The paths of Fame and Ivan crossed in the central plain around the capital of Antananarivo, while Jokwe grazed the northern tip of the island. These cyclones were accompanied by heavy rainfall, especially in the northeast and northwest.

These category three and four storms caused extensive physical destruction to infrastructure, and affected the livelihoods of an already struggling population. Madagascar remains a country that is extremely vulnerable to natural disasters, and this problem stands to be exacerbated by issues of climate change in the future.

The conjunction of these events affected 342,000 people out of a total population estimated in 2008 at over 19 million. Among those affected, 191,404 lost their homes and over 100 people died.

It is not unusual for Madagascar to be struck by tropical cyclones: the island is hit by three or four in an average year. Over 60 percent of tropical cyclones that develop in the Indian Ocean affect Madagascar, most of them arriving from the east. All 22 regions of the island are at risk, although districts located in the high plateau and in the south tend to be less affected. Studies have shown that Madagascar will continue to be at high risk for tropical cyclones, and that these cyclones stand to increase in intensity in the future.

Damage and Losses

In the wake of the disasters, the Government of Madagascar, together with international experts, undertook a comprehensive damage and loss and needs assessment to ascertain the extent of the damages caused by the storms, and to define a comprehensive and feasible recovery plan.

This Damage, Loss, and Needs Assessment (DNLA) estimated the total damage and losses caused by the cyclones to be Malagasy Ariary (Ar.) 549.4 billion (US$ 333.0 million). Table 1 presents an overall summary of the damage and losses broken down by sector.

Damage and losses were concentrated in the agriculture, fisheries and livestock sector (Ar. 170.0 billion or US$ 103.0 million), the housing and public administration sector (Ar. 210.5 billion or U$ 127.6 million) and the transport sector (Ar. 75.5 billion or US$ 45.7 million). The housing sector sustained primarily damages, whereas the agricultural sector saw an overwhelming majority as losses. These sectors are crucial to the livelihoods of the poor in Madagascar, and the impact from the storms has increased the vulnerabilities of large portions of the population.

Since two of the three cyclones struck the eastern coast of the country, the damages and losses were concentrated primarily in the coastal regions of Analanjirofo and Atsinanana, where 63 percent of the total damages and losses were sustained. Other regions that were affected included Menabe, Alaotra Mangoro, Boeny, Melaky, Atsimo Atsinanana, and Sofia.

Table 1: Overall Summary of Damage and Losses (Ar. Millions and USD million)

		Disaster Effects, million Ariary			Disaster Effects, USD million		
		Damage	**Losses**	**Total**	**Damage**	**Losses**	**Total**
Social Sectors		**212,193.20**	**24,425.60**	**236,618.80**	**128.60**	**14.80**	**143.41**
	Education	5,276.60	1,059.90	6,336.50	3.20	0.64	3.84
	Health	11,230.00	5,690.50	16,920.50	6.81	3.45	10.25
	Nutrition	1,314.30	1,575.70	2,890.00	0.80	0.95	1.75
	Housing and Public Administration buildings	194,372.30	16,099.50	210,471.80	117.80	9.76	127.56
Productive Sectors		**13,974.8**	**212,216.10**	**226,190.80**	**8.47**	**128.62**	**137.09**
	Agriculture, livestock and fisheries	10,461.10	159,564.30	170,025.40	6.34	96.71	103.05
	Industry and Commerce	2,849.5	27,423.8	30,273.2	1.73	16.62	18.35
	Tourism	664.20	25,228.00	25,892.20	0.40	15.29	15.69
Infrastructure		**60,792.10**	**24,954.90**	**85,747.00**	**36.84**	**15.12**	**51.97**
	Electricity	3,502.40	2,957.60	6,460.00	2.12	1.79	3.92
	Water and Sanitation	616.80	1,729.00	2,345.80	0.37	1.05	1.42
	Transport	55,383.60	20,083.60	75,467.20	33.57	12.17	45.74
	Telecommunications	1,289.30	184.70	1,474.00	0.78	0.11	0.89
Cross-Sectoral		**356.60**	**475.80**	**832.40**	**0.22**	**0.29**	**0.50**
	Environment	356.60	475.80	832.40	0.22	0.29	0.50
TOTAL		**287,316.70**	**262,072.40**	**549,389.00**	**174.13**	**158.83**	**333.00**

The Impact

The cyclones' estimated impact was equivalent to about 4.0 percent of the Gross Domestic Product (GDP). Overall, the disaster contributed to a decline of 0.3 percent in the real GDP growth in 2008, and a 38 percent decline in the current account of the balance of payments (from 114.3 million to 71.3 million SDR[3]), primarily due to a reduction in agriculture exports, an increase on imports of goods, and a reduction of tourism services income.

The overall budget deficit is estimated to have increased from -4.9 to -5.6 percent of GDP in 2008. Overall losses to the treasury were estimated at Ar. 118.4 billion, primarily from lower revenues from destroyed health facilities (Ar. 5.7 billion), and higher public expenditures in transport infrastructure (Ar. 63.9 billion), public administration buildings (Ar. 23.0 billion), nutrition (Ar. 5.0 billion), water and sanitation (Ar. 3.0 billion), power (Ar. 3.0 billion) and education (Ar. 2.3 billion). The deficit in the productive sectors was limited primarily to irrigation infrastructure (Ar. 10.4 billion) and tourism (Ar. 2.0 billion) (Table 2).

The macro economic impact tends to underestimate the true effect of the disasters, since Madagascar suffers from cyclones on an annual basis. In fact, these recurrent natural disasters undermine efforts at development and lead to a challenging environment for economic growth.

[3] Standard Drawing Rights.

A better indication of the devastation sustained can be found on the household level, where livelihoods were severely affected. The cyclones resulted in the loss of an estimated 6.2 million working days of labor, primarily in the agriculture and fisheries sectors, equivalent to a loss in earnings of Ar. 11.2 billion (US$ 6.8 million) at the current minimum unskilled labor wage.[4] About 125,000 households (4.3 percent of the total population living in the affected regions) were affected by the cyclones, either through the disappearance of a family member, partial damage or destruction of their house, or by the loss of assets and tools. Some 2.0 percent of the commerce establishments (including 3,551 micro-enterprises) and 1.9 percent of the industrial enterprises were affected.

The impact of the cyclones on households and individuals was also uneven: persons living in Analanjirofo, for example, suffered damages and losses averaging more than Ar. 200,000 per capita (US$ 120); in Atsinanana and Menabe, nearly Ar. 100,000 per capita, and in Melaky, about Ar. 50,000 (US$ 30), a substantial amount for a country with a poverty headcount of 63 percent and a GDP per capita of only US$ 375 in 2007.

The vast majority of the cyclones' impact (Ar. 427.9 billion or over US$ 259.3 million) fell on the private sector (Table 2). Damages and losses to public assets amounted to about 22 percent of the total, or an estimated Ar. 121.5 billion (US$ 73.6 million).

Table 2: Ownership of Disaster Effects and Impact on Fiscal Sector , in Millions of Ariary

		Disaster Effects			Ownership by Sector		Effects on:
		Damage	Losses	Total	Public	Private	Fiscal Sector
Social Sectors		**212,193.20**	**24,425.60**	**236,618.80**	**48,280.98**	**188,337.76**	**35,934.80**
	Education	5,276.60	1,059.90	6,336.50	6,055.48	281.06	2,288.90
	Health	11,230.00	5,690.50	16,920.50	16,920.50	0.00	5,690.50
	Nutrition	1,314.30	1,575.70	2,890.00	2,890.0	0.00	5,000.00
	Housing and Public Administration Buildings	194,372.30	16,099.50	210,471.80	22,415.00	188,056.70	22,955.40
Productive Sectors		**13,974.8**	**212,216.10**	**226,190.80**	**9,515.00**	**216,676.2**	**12,489.9**
	Agriculture, livestock and fisheries	10,461.10	159,564.30	170,025.40	9,314.50	160,711.3	10,407.0
	Industry and Commerce	2,849.5	27,423.8	30,273.2	0.00	30,273.2	64.70
	Tourism	664.20	25,228.00	25,892.20	200.50	25,691.70	2,018.20
Infrastructure		**60,792.10**	**24,954.90**	**85,747.00**	**63,681.80**	**22,065.20**	**69,970.40**
	Electricity	3,502.40	2,957.60	6,460.00	6,460.00		2,957.60
	Water and Sanitation	616.80	1,729.00	2,345.80	1,155.00	1,190.80	3,000.00
	Transport	55,383.60	20,083.60	75,467.20	55,383.60	20,083.60	63,899.00
	Telecommunications	1,289.30	184.70	1,474.00	683.20	790.80	113.80
Cross-Sectoral		**356.60**	**475.80**	**832.40**	**0.00**	**832.40**	**0.00**
	Environment	356.60	475.80	832.40		832.40	
TOTAL		**287,316.70**	**262,072.40**	**549,389.00**	**121,477.78**	**427,911.56**	**118,395.10**

[4] (Andrianjaka and Milazzo 2008)

Recovery and Reconstruction Requirements

An integrated, multi-pronged approach for the economic recovery of the affected area, and for the reconstruction of destroyed physical assets, is required to ensure the protection of the most vulnerable members of society and to resume socio-economic development in the affected regions.

Financial requirements to address the most immediate as well as the longer term recovery and reconstruction needs are assessed at Ar 255.4 billion (US$ 154.8 million). A total of Ar. 31.2 billion (US$ 18.9 million) is required for immediate recovery activities, while Ar. 224.2 billion (US$ 135.9 million) is needed in the medium-to-long term recovery and reconstruction phases.

This strategy considers primarily public sector investment needs – private sector recovery and reconstruction needs are, for the most cases, not included in the estimate. Risk management measures and the costs of building back better are, however, mainstreamed in this estimate in order to mitigate the effect of future cyclones.

Table 3: Summary of Recovery and Reconstruction Needs (Ar. Millions)

	Early recovery	Medium/ Long Term	TOTAL	US$ Millions
Social Sectors	**13,924.30**	**72,810.80**	**86,735.10**	**52.56**
Education	3,912.60	22,889.50	26,802.10	16.24
Health	10,011.70	21,473.50	31,485.20	19.08
Food Security and Nutrition	0.00	5,492.40	5,492.40	3.33
Housing and Public Administration Buildings	0.00	22,955.40	22,955.40	13.91
Productive Sectors	**5,321.95**	**11,791.57**	**17,113.47**	**10.37**
Agriculture, Fisheries and Livestock	5,036.50	10,841.5	15,877.95	9.62
Industry and Commerce	0.00	950.07	950.07	0.58
Tourism	285.45	0.00	285.45	0.17
Infrastructure	**6,813.70**	**125,337.78**	**132,151.48**	**80.09**
Electricity	0.00	6,157.97	6,157.97	3.73
Water and Sanitation	6,236.20	8,839.52	15,075.72	9.14
Transport	577.50	110,323.29	110,900.79	67.21
Telecommunications	0.00	17.0	17.0	0.01
Cross-Sectoral	**5,137.90**	**14,308.07**	**19,445.97**	**11.79**
Environment	847.9	350.0	1,197.90	0.73
Risk Management	495.00	10,635.57	11,130.57	6.75
Livelihoods	3,795.00	3,322.50	7,117.50	4.31
TOTAL	**31,197.85**	**224,248.22**	**255,446.07**	**154.82**

The Government is expected to meet about 13 percent of total needs (Ar. 33.6 billion or US$ 20.3 million). Donor contributions through on-going sectoral programs or projects are expected to fund about 28 percent (Ar. 70.3 billion or US$42.6 million). Some 23 percent (Ar. 59.2 billion or US$35.9 million) are considered to be of lower priority for donor financing and remain as financing gap.

The proposed Call for Funds to the Global Facility for Disaster Reduction and Recovery would amount to Ar. 71.3 billion (US$43.1 million) covering 28 percent of the estimated assessment needs. Approximately 8 percent (Ar. 21.1 billion, or US$12.8 million) in early recovery needs would be included in a separate UN Call for Funds[5].

Disaster Risk Management

Given the recurrent occurrence of cyclones in Madagascar, disaster risk reduction (i.e. prevention efforts) becomes of primordial importance. Neither the Government, nor the people of Madagascar, nor yet the donors can afford expenditures approaching US$330 million per disaster when the events occur with near annual frequency.

Five priorities have therefore been identified to reduce disaster risk:

1. A National Plan for Disaster Risk Management
2. Strengthened Risk Assessment
3. Strengthened Early Warning Systems and Disaster Preparedness
4. Development of Cyclone Norms and Standards and Integration of Risk Management into Sectoral Programs
5. Catastrophe Risk Financing and Transfer

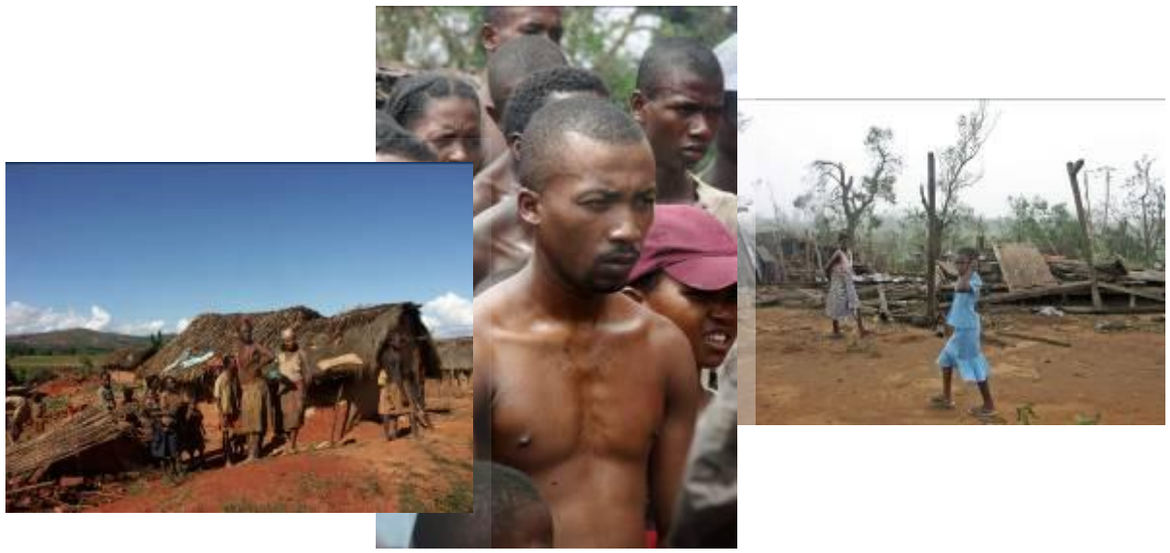
The JDLNA assessment process allowed for the gradual mainstreaming of risk reduction solutions into sectoral recovery and rehabilitation strategies. The estimated total needs for risk reduction which are not already included in other program priorities are summarized on table below. They include the costs of development of cyclone-proof norms and standards (Ar. 584.4 million or US$354,200), and the costs of training and early warning materials at the commune and Fokontany levels (Ar. 10.1 billion or US$6.1 million). The remaining Ar. 0.5 billion Ar. (US$0.3 million) involve coordination of the early recovery program at the national, regional and local levels.

Table 4 Summary Incremental Costs Disaster Risk Reduction Needs

Item	Ar. Million	US$'000
1. Development of National Cyclone Proof Norms for Transport and Irrigation Infrastructure	469.4	284.5
2. Development of National Cyclone Proof Norms for Habitat Infrastructure	115.0	69.7
3. Training and Materials for Early Warning System	10,051.2	6,091.6
4. Coordination of Early Recovery	495.0	300.0
TOTAL	11,130.6	6,745.8

[5] The UN Call for Funds will include also US$ 16.14 million in early recovery private needs in agriculture and habitat.

Part A: Impact of the Disaster



Section I: The Disaster

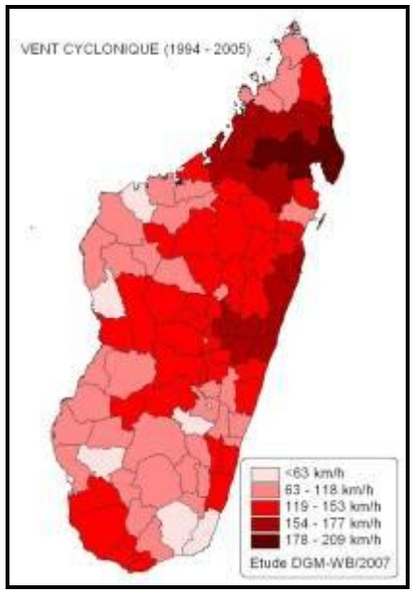
Tropical Cyclones Fame, Ivan and Jokwe

The 2007-2008 cyclone season saw three tropical cyclones hit Madagascar: Fame, Ivan (rated category 4 on the Saffir Simpson scale), and Jokwe. The cyclone season typically begins in mid-November and ends in April. Tropical cyclones in the Indian Ocean are monitored by the Regional Specialized Meteorological Centre in Réunion.

It is not unusual for Madagascar to be struck by tropical cyclones: the island is hit by three or four in an average year. Over 60 percent of tropical cyclones that develop in the Indian Ocean affect Madagascar, most of them arriving from the east. All 22 regions of the island are at risk, as shown on the cyclonic wind map (1994-2005) in Figure 1, with the east coast particularly affected.

According to expert reviews of the Fourth Assessment Report of the Inter-governmental Panel on Climate Change (IPCC/AR4 2007), the intensity of tropical cyclones will increase over all oceans, while frequencies and trajectories will vary depending on the region. Initial studies for Madagascar indicate that the intensity of tropical cyclones for the country is increasing, with trajectories shifting slightly northward (DGM 2008). In addition, 14 tropical storms formed this year, instead of the usual 11.8[6] predicted for this season, a figure that already exceeded the 9.9 average for the basin.[7]

Figure 1: Cyclonic Wind Map from 1994 to 2005



Fame

On January 24 2008, an area of disturbed weather formed north of Madagascar. By January 26, the system had reached tropical cyclone stage and was named Fame just prior to its arrival near Besalampy on January 27. It dissipated early on January 28. The system regained strength on January 29, however, as it re-emerged over water and once more became a tropical depression.

[6] European Centre for Medium-range Weather Forecasting: Prediction for the South West Indian Ocean Basin.

[7] World Meteorological Centre Regional Specialized Meteorological Centre-Pretoria for SADC, hosted by the South African WeatherService.

Ivan

On February 7, the Joint Typhoon Warning Center (JTWC) began issuing advisories on an area of convection that quickly strengthened into Tropical Storm Ivan. Early on February 9, based on the overall favorable environment, the JTWC upgraded Ivan to tropical cyclone status (i.e., winds greater than 119 km/h).

Figure 2: Cyclone Ivan approaching Madagascar

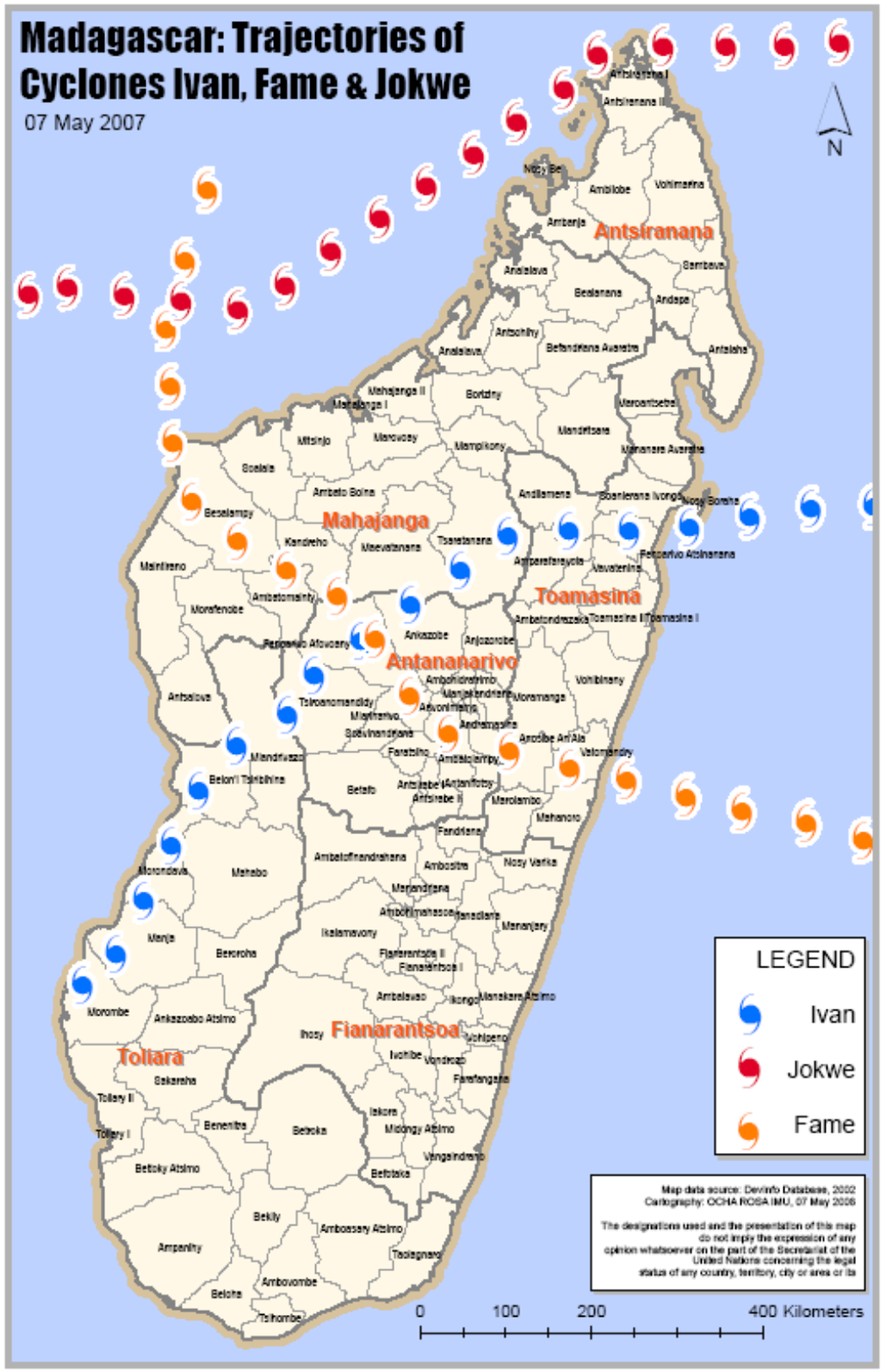
Ivan made landfall north of Fanoarivo, initially striking the Island of Sainte-Marie on February 17. Ivan traversed Madagascar, heading southwest towards Antananarivo and affecting the cities of Tulear and Morondava on 20 February. It generated winds of 215 km/h and the lowest pressure measured was 930 hPa. Ivan's remnants went back out over water on February 21.

Jokwe

On March 4, the JTWC issued a Tropical Cyclone Formation Alert on an area of disturbed weather developing northeast of Madagascar. On March 6, after a bout of rapid intensification, Jokwe was upgraded to a tropical cyclone. Jokwe made landfall between Mozambique Island and Angoche Island early on March 8.

Figure 3 provides a detailed map of the trajectory of the three cyclones mentioned above.

Figure 3: Trajectory of the three cyclones



The Human Toll

The 2007-2008 cyclone season was a very active one, with 14 identified tropical systems and three cyclones - Fame (January 28), Ivan (February 17), and Jokwe (March 5) – striking Madagascar hard, affecting 17 out of 22 regions. The paths of Fame and Ivan crossed in the central plain around the capital of Antananarivo, while Jokwe grazed the northern tip of the island. These cyclones were accompanied by heavy rainfall, especially in the northeast and northwest.

The conjunction of these events affected 342,000 people out of a total population estimated in 2008 at over 19 million.[8] Among those affected, 191,404 lost their homes. The Government also determined that over 100 people died. Table 5 summarizes this data by cyclone.

Table 5: Summary of Key Data by Cyclone

Cyclone	Deaths	Persons displaced	Homeless
JOKWE		400	
IVAN	93	331,010	190,218
FAME	13	11,513	1,186
TOTAL :	**106**	**342,923**	**191,404**

Source: BNGRC March 10, 2008

To warn populations at risk, Madagascar uses local and national radio stations to relay bulletins from the National Meteorological Service. Despite this mechanism, however, and the introduction of educational campaigns on risk prevention and mitigation in schools and the ongoing training of local authorities, cyclones continue to have a major impact on the lives of the populations concerned. Several factors may be involved, including a) the intensification of cyclonic activity in the Indian Ocean basin, possibly linked to climate change;[9] b) population growth;[10] c) changes in cyclonic paths, which are touching new zones in which the population has not yet assimilated prevention and mitigation concepts; and (d) the lack of widespread adoption of cyclone norms on key infrastructure.

[8] Source: Instat
[9] Source: Météorologie Nationale Malgache
[10] Source: Instat

The Immediate Response

When tropical systems form over the Indian Ocean basin, the Malagasy meteorological services follow their protocols and inform the public by means of daily bulletins on national television and radio, as well on local radio stations. As soon as a system is deemed to pose a risk for the country, alerts are issued and disseminated every three hours. When the danger is imminent, the bulletins are issued hourly and are accompanied by safety directives. Undoubtfully, the stronger early warning system set up in recent years has helped save lives.

After the passage of every cyclone, the National Bureau for the Management of Risks and Disasters (BNGRC) deploys its teams to the field in support of local operations. In some regions, the regional risk management committees (CRGRC) organized within the framework of the National Strategy are operational, while in others they are still a work in progress. This campaign of cyclone response has demonstrated the importance of ensuring that they are operational in all locations. At the same time, the disaster preparedness committee (CRIC), the local humanitarian platform, immediately organizes rapid multisectoral assessments in each of the affected regions, under the supervision of the BNGRC and with the support of the United Nations System. Local authorities simultaneously collect initial data using the Multisectoral Disaster Reporting Form (fiche d'évaluation initiale multi aléas, EIMA), which are at the ready in each municipality. It should be noted that the use of these forms is not yet standardized and needs to be improved.

The speed with which the assessments are initiated, and the smoothness of the initial response can be attributed to four factors: a) establishment of sectoral groups headed by the relevant technical ministries, as a result of the merging of clusters of the international humanitarian community and the BNGRC committees; b) preparation of a contingency plan shared by the Government and the Inter-Agency Standing Committee; c) establishment of a simulation exercise based on the main scenario of the BNGRC contingency plan and involving members of the humanitarian platform (United Nations System, NGOs, Red Cross Movement, private sector partners, technical ministries, and government agencies); and d) the prepositioning of food and other supplies by the BNGRC and its partners.

In the aftermath of these cyclones and based on available information, the BNGRC and its CRIC partners focused their efforts on food and nutritional security, access to safe water and appropriate health care, improved hygiene conditions, prevention of epidemics, enhancement of national emergency capacities in the area of health care, attention to those left homeless, and unobstructed movement for the affected populations.

On February 22, 2008, i.e., five days after the passage of cyclone Ivan, the Government of Madagascar realized that the needs created by the two successive cyclones exceeded national capacities as well as those of the humanitarian organizations active in the country, and therefore decided, in the presence of the United Nations System and the diplomatic community, to launch an appeal for international assistance and solidarity.

In support of the Government, the humanitarian community solicited donors through a Flash Appeal for US$36,476,586, of which 4.6 million was immediately covered by the Central

Emergency Response Fund (CERF). To date, 46 percent of the requested funds have been provided as indicated in Table 6 below.

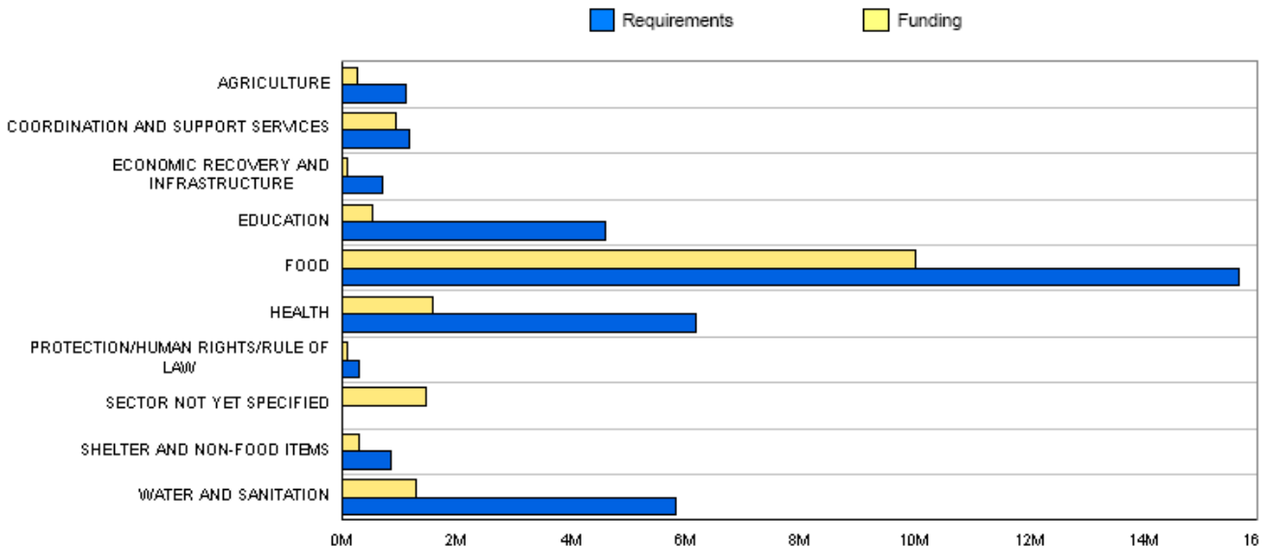
Table 6: Flash Appeal Status

FINANCIAL TRACKING SERVICE (FTS)
TRACKING GLOBAL HUMANITARIAN AID FLOWS

Flash Appeal: Madagascar Flash Appeal 2008
Table D: Requirements, Commitments/Contributions and Pledges per Sector
Report as of 23-June-2008 *(Appeal launched on 01-March-2008)*
http://www.reliefweb.int/fts *(Table ref: R3sum)*

Compiled by OCHA on the basis of information provided by donors and appealing organizations.

	Original requirements	Revised requirements	Funding	% Covered	Unmet requirements	*Uncommitted pledges*
	A	*B*	*C*	*C/B*	*B-C*	*D*
AGRICULTURE	1,125,000	1,125,000	265,662	24%	859,338	*0*
COORDINATION AND SUPPORT SERVICES	1,185,323	1,185,323	955,323	81%	230,000	*0*
ECONOMIC RECOVERY AND INFRASTRUCTURE	700,000	700,000	100,000	14%	600,000	*0*
EDUCATION	4,607,485	4,607,485	538,865	12%	4,068,620	*0*
FOOD	15,667,076	15,667,076	10,015,132	64%	5,651,944	*1,262,208*
HEALTH	6,195,850	6,195,850	1,580,759	26%	4,615,091	*0*
PROTECTION/HUMAN RIGHTS/RULE OF LAW	300,000	300,000	100,000	33%	200,000	*0*
SECTOR NOT YET SPECIFIED	0	0	1,483,924	0%	-1,483,924	*0*
SHELTER AND NON-FOOD ITEMS	863,148	863,148	290,669	34%	572,479	*0*
WATER AND SANITATION	5,832,704	5,832,704	1,307,729	22%	4,524,975	*0*
Grand Total:	**36,476,586**	**36,476,586**	**16,638,063**	**46%**	**19,838,523**	***1,262,208***



NOTE: "Funding" means Contributions + Commitments + Carry-over

Pledge: a non-binding announcement of an intended contribution or allocation by the donor. ("Uncommitted pledge" on these tables indicates the balance of original pledges not yet committed.)
Commitment: creation of a legal, contractual obligation between the donor and recipient entity, specifying the amount to be contributed.
Contribution: the actual payment of funds or transfer of in-kind goods from the donor to the recipient entity.

Social and Economic Background of the Affected Area

Geography and Population

The 2008 cyclones affected almost the entire country. Only small areas of the north-east, the south-east and the center of the country were spared. With a total area of 495,001 square km, the 17 affected regions represent 83.7 percent of the total area of Madagascar.

The population density of 8 of the 17 affected regions is higher than the national population density, which is 31.9 persons per sq km. The three most affected regions, Analanjirofo and Atsinanana in the eastern part of the country, and Menabe in the south west, have a population of 948,392, 1,230,460 and 425,751, with a population density of 43.4, 55.6 and 8.7 persons per sq km, respectively.

About 14 million people, or 76.6 percent of the population of Madagascar, are located in the 17 affected regions, with an average density of 29.2 persons per sq km. Table 7 presents a brief demographic summary for the affected regions.

Table 7: Demographic Summary for 17 Affected Regions

REGION	Estimated Population 2007	Area sq. km.	Population density per sq. km.	% Population of Madagascar
ANALANJIROFO	948,392	21,830.7	43.4	5.0
ATSINANANA	1,230,460	22,133.1	55.6	6.5
MENABE	425,751	49,206.3	8.7	2.3
MELAKY	192,187	40,881.5	4.7	1.0
BOENY	594,820	30,305.2	19.6	3.2
DIANA	527,056	20,139.1	26.2	2.8
ATSIMO ATSINANANA (south east)	689,582	16,564.9	41.6	3.7
ALAOTRA MANGORO	967,064	27,252.2	35.5	5.1
SOFIA	1,030,029	51,214.9	20.1	5.5
AMORON'I MANIA	769,189	16,496.7	46.6	4.1
VATOVAVY FITOVINANY	1,218,334	20,723.6	58.8	6.5
HAUTE MATSIATRA	1,252,832	20,194.5	62.0	6.6
ATSIMO ANDREFANA	1,109,470	67,178.8	16.5	5.9
IHOROMBE	210,143	26,098.2	8.1	1.1
BONGOLAVA	355,178	17,896.1	19.8	1.9
ANALAMANGA	2,657,425	17,323.1	153.4	14.1
BETSIBOKA	258,838	29,565.3	8.8	1.4
17 REGIONS	14,436,750	495,004.1	29.2	76.6
MADAGASCAR	18,850,195	591,501	31.9	100

Source: INSTAT and Staff estimation

Economic Framework

Per capita Gross Domestic Product (GDP) in Madagascar was USD 375 in 2007. Growth rate was 6.2 percent in 2007. GDP records are not yet available on a regional level.

Poverty

The national poverty level in Madagascar was 63.3 percent in 2007. In 2005, the latest year for which regional poverty data were available, the national poverty rate was 68.8 percent. The poor population within the 17 affected regions represented 50.98 percent of the total population of Madagascar.

The two most affected regions, Analanjirofo and Atsinanana, had poverty levels that were higher than the national average, 79.3 and 79.0, respectively. The number of poor within those two most affected regions was about 1.5 million, representing 7.8 percent of the total population of Madagascar. Table 8 presents a brief summary of poverty levels in the 17 affected regions in 2005.

Table 8: Poverty Levels by affected Region (2005).

	Poverty Headcount Rate (%)	Number of Poor	% Population of Madagascar
Analanjirofo	79.3	507,794	2.69
Atsinanana	79.0	967,109	5.12
Menabe	61.7	255,870	1.36
Melaky	62.7	129,904	0.69
Boeny	48.9	230,188	1.22
Diana	49.2	176,052	0.93
Atsimo Atsinanana	83.9	490,089	2.60
Alaotra Mangoro	57.6	532,133	2.82
Sofia	80.7	882,300	4.67
Amoron'I Mania	78.2	707,209	3.75
Vatovavy Fitovinany	80.8	989,642	5.24
Mahatsiatra Ambony	72.1	1,072,559	5.68
Atsimo Andrefana	75.3	751,818	3.98
Ihorombe	78.0	220,438	1.17
Bongolava	64.1	289,802	1.54
Analamanga	42.9	1,170,900	6.20
Betsiboka	70.0	250,690	1.33
17 Régions		9,624,497	50.98
Madagascar	68.7	12,978,580	68.75

Source: INSTAT/Household Survey 2005 and Staff estimation

Section II: Estimation of Damage and Losses

Methodology

As a result of the assessment, estimates have been made of the value of damage to physical assets and of the resulting losses in the economy of Madagascar during the 2008 Cyclone Season, which will lead to the subsequent estimation of financial needs to achieve economic recovery and reconstruction in the affected areas.

In this regard, damage is a first indication of the requirements for reconstruction, and losses represent the reductions or decline in economic activity and in personal and household income arising from the disasters.

These estimations were made through the application of the damage and loss assessment methodology developed since the 1970s by the United Nations Economic Commission for Latin America and the Caribbean (ECLAC) [11], that has been in continuing updating and expansion and which is being systematically customized and simplified for application in different regions of the world (See Box 1).

Box 1: The estimation of damage and losses — The ECLAC Methodology

For the estimation of the effects and impact of the Madagascar Cyclone disaster, use was made of the methodological tool developed since the early 1970s by the United Nationals Economic Commission for Latin America and the Caribbean (UN-ECLAC), which has been strengthened, simplified and customized over the years for application in different areas of the world.

This methodology enables the assessment of disaster impacts on the overall economy of the affected country as well as on family or household levels, and constitutes a basis for defining the needs for recovery and reconstruction following any disaster.

The assessment provides for the estimation of:

Damage as the replacement value of totally or partially destroyed physical assets, constructed to the same standards that prevailed before the disaster;
Losses in the flows of the economy that arise from the temporary absence of the damaged assets; and
The resulting impact on post-disaster economic performance, with special reference to economic growth, the fiscal position and the balance of payments.

Baseline data for existing assets and for the performance of the economy of Madagascar were collected for use in combination with damage and loss information derived by the assessment teams during and after field trips to areas affected by the disaster. Full, comprehensive and detailed assessments of damage and losses were conducted in representative areas selected for field visits carried out by the assessment team. Results of these detailed assessments were then expanded to include the other affected areas on the basis of available quantitative baseline and damage data.

11 Handbook for Estimating the Socio-Economic and Environmental Impact of Disasters, Economic Commission for Latin America and the Caribbean, 2003.

Summary of Damage and Losses

Results of the assessment indicate that the 2008 Cyclone Season in Madagascar caused damage and losses to an amount of Ar. 550 billion, or its equivalent of US$ 333 million[12] (See Table 9).

Table 9: Summary of Damage and Losses caused by the 2008 Cyclone Season in Madagascar

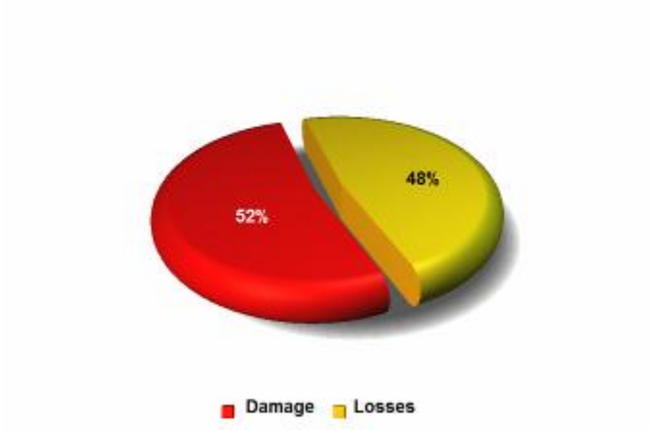
		Disaster Effects, million Ariary		
		Damage	**Losses**	**Total**
Social Sectors		**212,193.20**	**24,425.60**	**236,618.80**
	Education	5,276.60	1,059.90	6,336.50
	Health	11,230.00	5,690.50	16,920.50
	Nutrition	1,314.30	1,575.70	2,890.00
	Housing and Public Administration buildings	194,372.30	16,099.50	210,471.80
Productive Sectors		**13,974.8**	**212,216.10**	**226,190.80**
	Agriculture, livestock and fisheries	10,461.10	159,564.30	170,025.40
	Industry and Commerce	2,849.5	27,423.8	30,273.2
	Tourism	664.20	25,228.00	25,892.20
Infrastructure		**60,792.10**	**24,954.90**	**85,747.00**
	Electricity	3,502.40	2,957.60	6,460.00
	Water and Sanitation	616.80	1,729.00	2,345.80
	Transport	55,383.60	20,083.60	75,467.20
	Communications	1,289.30	184.70	1,474.00
Cross-Sectoral		**356.60**	**475.80**	**832.40**
	Environment	356.60	475.80	832.40
TOTAL		**287,316.70**	**262,072.40**	**549,839.00**

Source: Estimates by Joint Assessment Team

Of the total, the value of damages was estimated as Ar. 287.3 billion, or 52 percent of the total; and losses were estimated to be Ar. 262.1 billion, or 48 percent of the total effects (See Figure 4). The relative lower value of losses, in comparison to value of damage, can be understood by the fact that the floods caused by the cyclones covered mainly rice cultivated areas – and not most of the areas where other cash crops are grown – that are relatively resistant to water.

[12] An exchange rate of 1,650 Ariary per US Dollar was used throughout the assessment.

Figure 4: Breakdown of Total Effects into Damage and Losses



Also of significance is the fact that of the total disaster effects that have been estimated, damage and losses sustained by the public sector represent Ar. 121.5 billion (22 percent of the total), while the remainder falls within the domain of the private sector (See Figure 5). This is indicative of the relative efforts that should be undertaken by the public and private sectors for post-disaster recovery and reconstruction.

The most affected sectors of the economy were those of housing and public administration buildings (Ar. 210.5 billion and 38 percent of the total), agriculture, fishery and livestock (Ar. 170.0 billion and 31 percent), and transport (Ar. 75.5 billion and 14 percent), in order of decreasing importance. Other sectors that were affected significantly include Industry and Commerce (Ar. 30.2 billion), and Tourism (Ar. 25.9 billion).

Figure 5: Ownership of Disaster Effects between Public and Private Sectors S

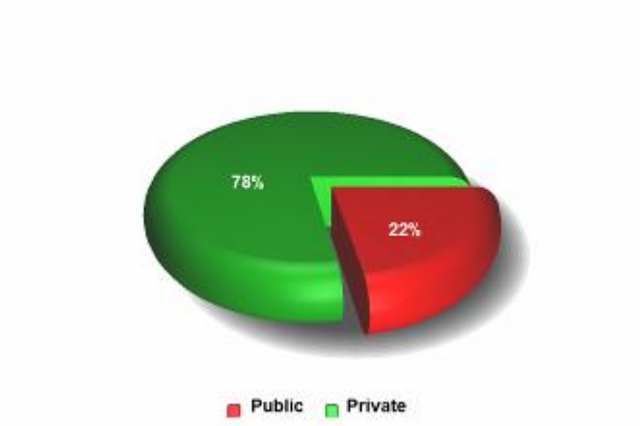
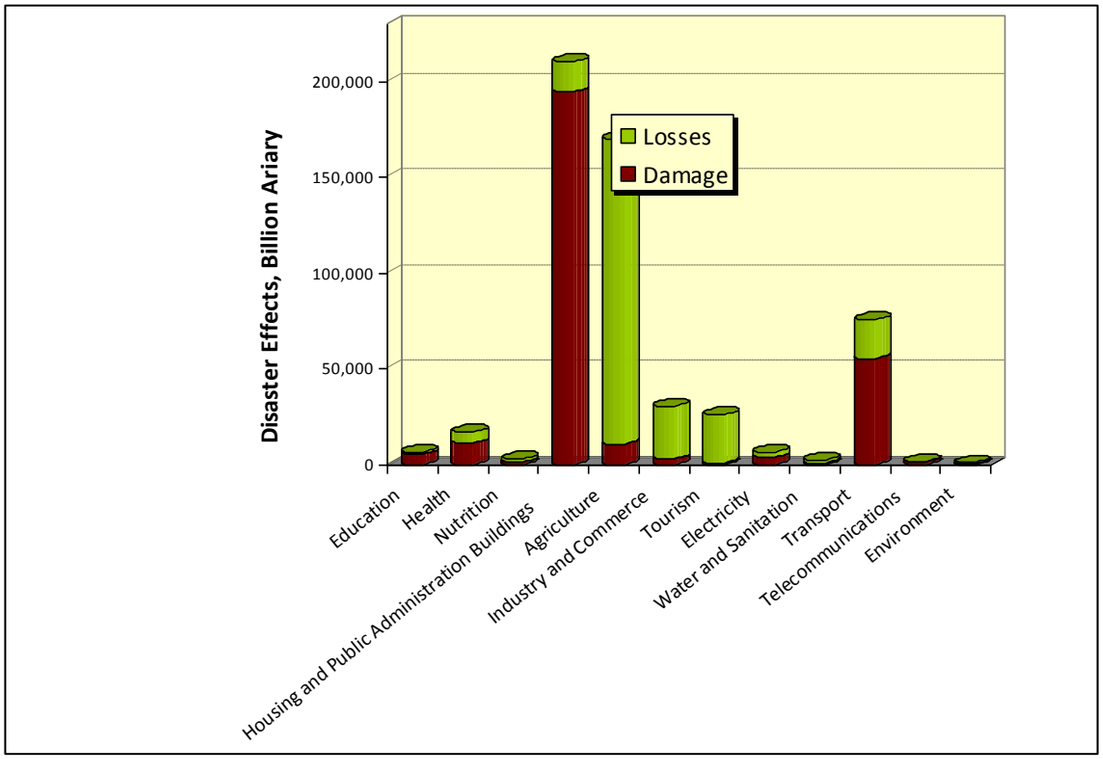


Figure 6: Most Affected Sectors in Terms of Damage and Losses

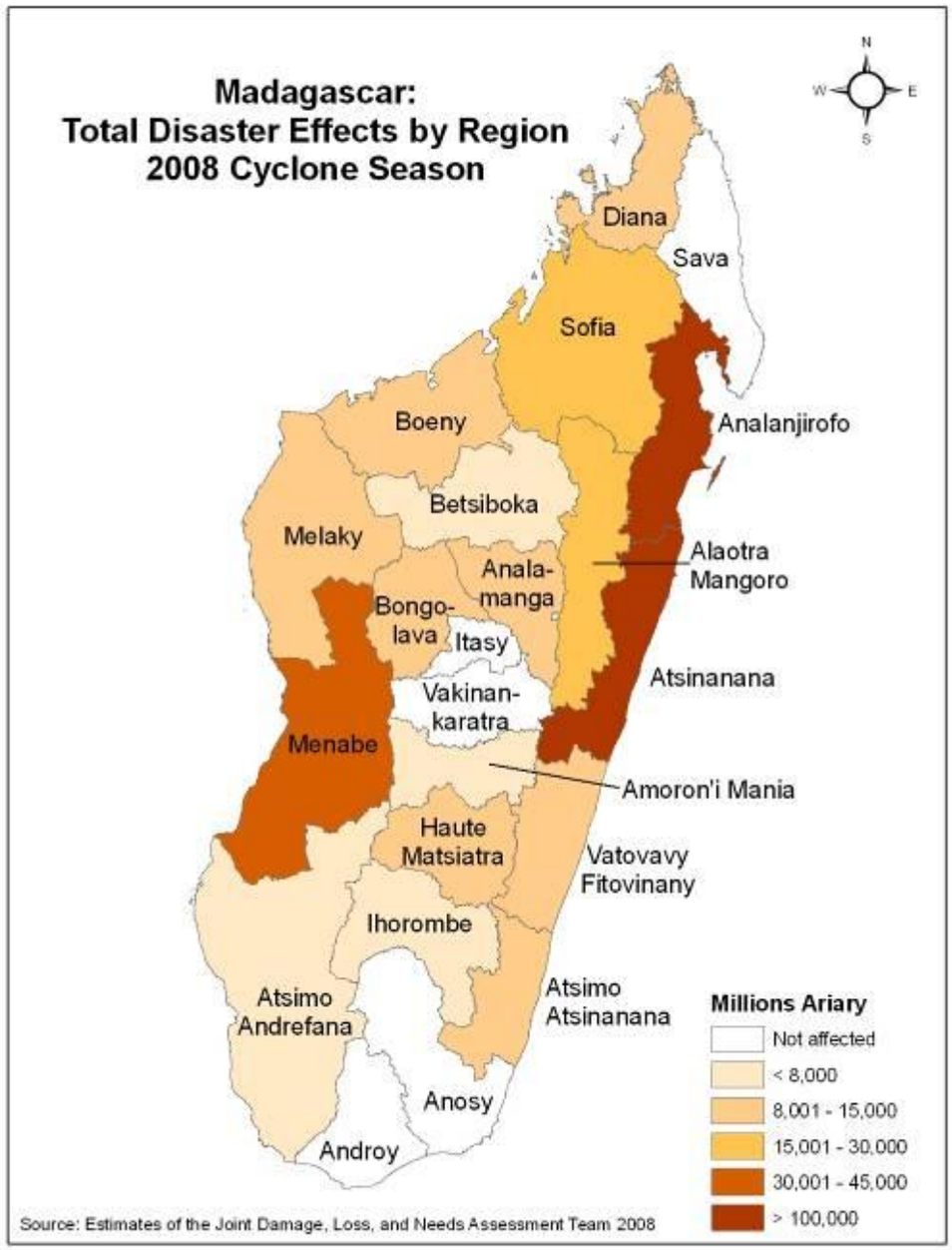


The effects of the cyclone season were not spread out evenly across the country; rather, they were concentrated in several Regions and Districts. Most affected in terms of total amounts of damage and losses were the regions of Analanjirofo and Atsinanana, where 63 percent of the effects were concentrated. Other significantly affected regions include Menabe, Alaotra Mangoro, Boeny, Atsimo Atsinanana, Sofia and Diana . This concentration of disaster effects was due to the coincidence of the paths of Fame and Ivan (see Figure 7).

Table 10: Most Affected Regions in the Country

Region	Total Effects, Million Ariary	% of Total
Analanjirofo	215,272	41.2
Atsinanana	114,220	21.9
Menabe	36,956	7.1
Sofia	26,038	5.0
Alaotra Mangoro	23,025	4.4
Atsimo Atsinanana	13,545	2.6
Boeny	13,247	2.5
Diana	13,018	2.5

Figure 7: Most Affected Regions during the 2008 Cyclone Season in Madagascar



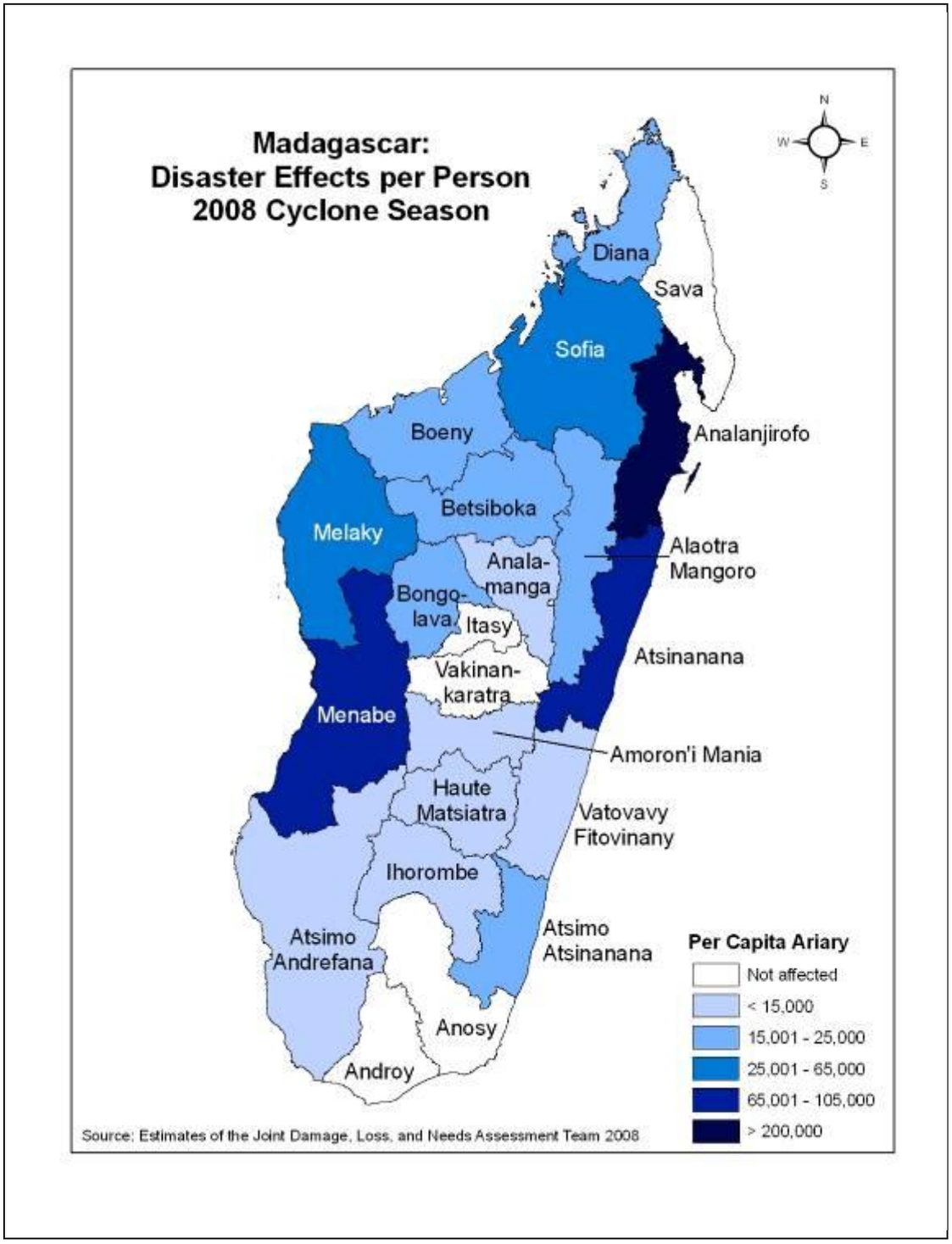
The effects of the disaster on households and individual persons were also uneven. Due to the different population densities, persons living in the regions of Analanjirofo, Atsinanana and Menabe sustained higher per capita damage and losses than others in other regions, which represent several times the value of the average per capita income (see Table 11 and Figure 7).

Table 11: Per Capita Values of Damage and Losses in Most Affected Regions

Region	Ariary per Person
Analanjirofo	226,987
Atsinanana	92,827
Menabe	86,802
Melaky	55,602
Sofia	25,279
Diana	24,700
Alaotra Mangoro	23,810
Bongolava	23,607
Boeny	22,270
Average 17 Affected Regions	36,153

The amount of damage and losses represents 4.0 percent of the Gross Domestic Product for the country in 2007, which may be considered as a moderate ratio for the economy of the country. However, two factors must be taken into consideration: first, that the country is usually affected by several cyclones every year, which leave a sequel of destruction that has been accumulating over the years and setting back efforts at development; and, second, that the impact at the personal or household level is much higher than the national figures indicate, as will be discussed on Section III.

Figure 8: Most Affected Regions in Disaster Effects per Person



Social Sectors

Education

Summary

The 2008 cyclone season damaged an estimated 657 schools nationwide (4.2 percent of the total schools in Madagascar), of which 411 were completely destroyed and 246 partially destroyed. The majority of the damage occurred in the regions of Analanjirofo and Atsianana (77 percent). In value terms, damages were estimated at Ar. 5,276.6 million (US $3.2 million) and losses at Ar. 1,059.9 million (US $0.6 million).

Clearly, the main risk management strategy should be the building and retrofitting of all schools to cyclone-proof norms, and their placement in less vulnerable areas. The estimated needs to rebuild and reconstruct the damaged schools to recognized norms amount to Ar. 26,802.1 million (US $16.2 million).

Pre-Disaster Situation

In the 17 affected regions, there were a total of 15,570 schools, of which 11,127 were public and 4,443 were private. These schools were attended by 2,889,369 pupils, of whom 2,182,736 were in public schools and 706,633 were in private schools. As for professional and technical education, there were two CFP (professional training centers) and two LTP (technical and professional lycées).

The total number of desks for pupils was 1,167,750, of which 847,553 were in public schools and 320,197 in private schools. Their total corresponding value is estimated at Ar. 836.1 million (US$0.5 million). The value of existing school buildings in the 17 regions is estimated at Ar. 890 616.8 million (US$539.8 million) Several schools do not have running water, and some do not have latrines that are up to standard.

Estimation of Damages and Losses

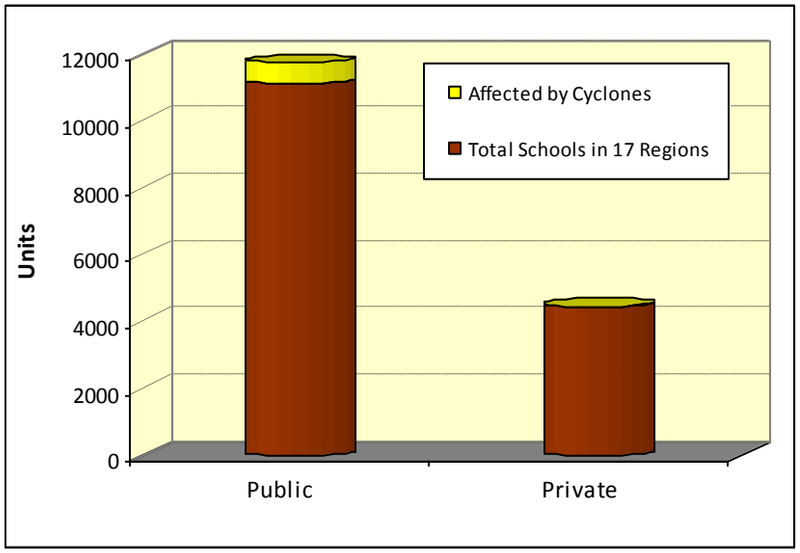
Damages

(a) School buildings affected by the cyclones Fame and Ivan

A total of 657 school buildings were affected by the cyclones, of which 411 were completely destroyed and 246 were partially destroyed. Of the schools that were completely destroyed, 393 were public and 18 were private. Of those that were partially destroyed, 234 were public and 12 were private. This corresponds to 6 percent of the public and 0.7 percent of the private schools.

In the 17 regions, the original cost of the schools totally destroyed is estimated at Ar. 3,303.3 million (US$2.0 million), while the cost of the schools that were partly destroyed is estimated at Ar. 541.5 million (US$0.3 million).

Figure 9: Comparison of numbers of school buildings destroyed in the 17 affected regions



(b) Damaged equipment

The equipment covered by this assessment is represented solely by pupil desks because no further information is available, either from the national ministry or from local governments and services, about other material damages.

The amount of damage caused by the cyclones is estimated at Ar. 1,317.1 million (US$0.8 million), of which Ar. 1229.64 million (US$ 0.7 million) correspond to the public sector and Ar. 87.6 million (US$ 53,000) to the private sector.

(c) Cost of school supplies and sports equipment

Estimates of the damages to school supplies and sports equipment (for leisure activities and games) belonging to the affected pupils amount to Ar. 114.8 million (US$69,600).

Losses

(a) Cost of repairing schools used as temporary shelters

Tents supported by metal or wood frameworks were set up as temporary schools in the following regions: Analanjirofo, Menabe, and Alaotra Mangoro and Melaky. These tents cost Ar. 208.9 million (US$127,000).

Figure 10: Heavily damaged CEG (middle school) at Besalampy and temporary schools set up in Melaky region

(b) Duration of reconstruction

Under the Education for All Program the capacity to build new classrooms is estimated at 3,000 a year. On the basis of previous experience, however, this estimate is too high, given the shortage of qualified building firms. In the framework of this study, the estimate is approximately 500 classrooms a year, in view of past experience.

Thus, the duration of the rebuilding effort is estimated at five months for hard construction (one month for invitations to bid, three months for the work itself, and one month leeway) and three months for buildings made of local materials, using a community-based approach.

(c) Cost of demolition and removal of rubble

The demolition of schools that have been entirely destroyed and the removal of rubble as part of the rebuilding effort will cost Ar. 825.8 million (US$0.5 million) of losses. This amount represents 25 percent of the total damages sustained by schools that were completely destroyed.

Figure 11: Primary school (EPP), totally destroyed, in the Amparafaravola school district (CISCO), Alaotra Mangoro region

(d) Loss of revenue in private schools

Many of the parents of private school pupils were unable to pay their children's school fees because their primary efforts were focused on re-establishing their homes. The estimated amount of these losses is Ar. 25.2 million (US$15,300).

Macroeconomic impacts

For building and rehabilitation materials, two types of acquisitions are needed:

- Local materials, such as bricks, concrete blocks, wood, and cement;
- Imports, such as sheet metal, iron rods, sheet glass, plumbing materials, and cement if insufficient quantities are available on the local market.

The cost of material and equipment to be imported represents 20 percent of the requirements corresponding to the damages, or Ar. 1055.3 million (US$ 0.6 million).

The estimated impacts of the education sector on the fiscal sector correspond to the costs of temporary schools used as shelters and the removal of debris (Ar. 2,288.9 million or US$1.4 million).

Table 12: Damages and losses in the Education Sector (in Ar. million)

	Effects of disasters (Ar. Millions)			Ownership		Effects on	
	Damages	Losses	Total	Public	Private	BOP*	Fiscal sector**
Schools totally destroyed	4,589.4	1,034.7	5,624.07	5,377.76	246.31	917.88	
Schools partially destroyed	687.2	25.20	712.47	677.72	34.75	137.44	
Total	5,276.6	1,059.9	6,336.5	6,055.48	281.06	1,055.32	2,289

*Drop in exports; rise in imports.
**Lower tax revenues; unexpected expenses.

Socioeconomic impacts

After the cyclones hit, classes were suspended for one to three weeks, depending on the scope of the damage, which occurred in two forms:

- Total or partial destruction of classrooms from the strong winds, compounded by the penetration of rainwater into the walls;
- Total or partial destruction of the school buildings as a result of flooding.

This situation primarily affected the public schools, but some private schools also felt the impact. Remedial classes were held during the Easter vacation and on weekends. Given that the cyclone season from January to March coincides with the most intensive part of the school year, the inability to hold classes in which the pupils could assimilate and digest the educational material has had a major impact on their performance.

Risk management

In the context of preparation for the cyclone season, it would be appropriate to train educators in disaster risk management. The pupils would then benefit from the training received by their teachers, who would, in turn, teach them the steps they should follow and the appropriate ways to behave in times of disaster. Manuals for pupils and guidebooks for teachers should be reproduced and distributed to all schools.

Figure 12: Non-functioning water point at a primary school (EPP) in the Amparafaravola school district

While the Education for All program now requires that all new public schools be built following cyclone-resistant standards, this principle is not yet followed by private schools (particularly those built by communities). These standards should be adopted and promoted in all high-risk areas.

Governance

Disaster risk management programs in the local school districts (CISCO) should be incorporated into community development plans to encourage greater involvement of all local officials, technical staff, and educational leaders in reducing the risks of disasters.

Recovery and reconstruction needs

The estimated amount needed for recovery and reconstruction activities is Ar. 26,802.1 million (US$ 16.2 million). This takes into consideration an average unit cost of reconstruction of Ar. 52.2 million (US$3,163 per unit) for newly rehabilitated schools, respecting cyclone-resistant standards. Rehabilitation of partially destroyed schools would cost a about a third of totally destroyed schools, or Ar. 15.7 million each (US$952).

All schools will be equipped with running water, in the form of closed wells or standpipes with pumps. These water and sanitation infrastructures will cost Ar 1,478.3 million (75 percent of the affected schools need them, at a unit cost of Ar. 3.0 million or US$182).

Table 13: Recovery and reconstruction needs for the education sector (Ar Millions)

Subsectors	Short term recovery	Medium/long term recovery	Total
Schools totally destroyed	3 278.8	18 190.1	21,468.9
Schools partially destroyed	633.8	3,221.2	3,855.0
Water and sanitation		1 478.3	1 478.3
Total	3 912.6	22,889.5	26,802.1

Priorities for short-term recovery are:

- Re-establishment of access to schools: tents, training of authorities on setting up temporary schools, distribution of didactic and pedagogical materials, awareness raising, and organization of remedial classes;
- Incorporation of disaster risk management principles into staff training programs and curricula to prevent future risks. A disaster risk management plan should be elaborated at the community level;
- Capacity building among the affected populations, to enable them to contribute actively to rehabilitation and reconstruction efforts, and campaigns to raise awareness about hygiene, water, and sanitation;
- Restoration and establishment of national and local systems to build capacities for managing the development phase, including training on disaster risk management within the regional offices of the national education department (DREN), school districts (CISCO), and pedagogical/administrative zones (ZAP).

Figure 13: Soanierana Ivongo Lycée, partially destroyed, in the Analanjirofo region

Table 14: Recovery needs in the Education Sectory by region

Region	Reconstruction	Repairs	*Water and sanitation
MENABE	522..4	0	21
Alaotra	1,619.3	0	69
Analanjirofo	8,775.6	3073.2	822
Atsinanana	5,954.9	392.0	312.75
Haute matsiatra	365.6	47.0	22.5
Sofia	1,201.4	47.0	58.5
Vatovavy fito	156.7	0	6.75
Boeny	0	62.7	9
Betsiboka	0	31.4	0
Amoron'I Mania	0	125.4	18
Melaky	574.6	31.4	29.25
Ats Atsinanana	0	0	0
Ats Andrefana	0	0	0
Ihorombe	0	0	0
Bongolava	156.7	0	6.75
Analamananga	2141.7	15.7	94.5
DIANA	0	31.4	4.5
TOTAL	21468.9	3857.2	1474.5
TOTAL NEEDS		**26,802.1**	

*Water and sanitation: 0.75 of the number of schools affected by Ivan and Fame.
*Unit cost: Ar. 3 million.

Health

Summary

Total damages and losses to the health sector are estimated at Ar. 16.9 million (US$ 10.3million),entirely located in the public sector. The 2008 cyclone season damaged an estimated 167 basic health centers and 6 hospitals in 12 regions. Most of this damage was concentrated in the regions of Analanjirofo, Atsinanana, and Haute Matsiara. In addition to the destruction of facilities, the rains created favorable conditions for increased outbreaks of diseases. This has added to the already precarious health situation of the Malagasy population.

Priorities for recovery investments include the reconstruction of the destroyed facilities to cyclone resistant standards and strengthened disease surveillance. The estimated costs amount to Ar. 31,485.1 million (US$19.1 million).

Pre-Disaster Situation

The health of the Malagasy population continues to be characterized by the burden of communicable diseases, although there has been an increase in non-communicable diseases, which are related to lifestyle changes. Malaria, pulmonary tuberculosis and schistosomiases, as well as the plague in the central plateaus, diarrheal diseases, and acute respiratory infections (ARIs), are communicable diseases that are endemic or pose an epidemic risk, and constitute major public health problems in the country.

Furthermore, given the high prevalence of common sexually transmitted infections, Madagascar continues to face the threat of an HIV and AIDS epidemic. The significance of these communicable diseases is explained or exacerbated by a precarious socioeconomic and environmental context, particularly:

- The lack of access to water and sanitation: only 38 percent and 55 percent of the population have access to safe drinking water and sanitation, respectively;
- Insufficient access to basic health services, owing to persistently low levels of health coverage (more than 40 percent of the population lives more than five kilometers from a health center), and inadequate use of health services (approximately 50 percent) caused by limited geographic and financial access to these services;
- A geoclimatic environment that is conducive to the outbreak of these endemic or epidemic diseases: favorable temperatures and/or high levels of rainfall along the coasts (malaria, arboviruses, etc.), drought in the south or the altitude in the central highlands, which are especially ideal for malaria epidemics or the plague; and
- The poverty level of the majority of the population, particularly in rural areas.

According to the 2003 National Health Accounts, total health expenditure, which accounts for 3.5 percent of GDP, was estimated at approximately 11.9 USD per capita (the average in Africa is on the order of 12.9 USD). This average is well below the 34 USD per capita rate recommended by the WHO's Commission on Macroeconomics and Health to finance basic health needs, and HIV/AIDS. Overall, 32 percent of the expenditures on the health sector are financed by the public sector, 36 percent by donors, and 32 percent by the private sector. Prevention and public health services account for 28 percent of total health services expenditures.[13]

Thus, the current health system does not offer financial protection that has been tailored for the majority of the population who are in dire need of health care. Indeed, 68.7 percent of the population lives below the poverty line, and 23 percent of those who seek health care encounter financial difficulties.[14] Prohibitive health care costs prevent them from making appropriate use of hospital services. While mutual health associations exist, they are still too few in number and fail to reach very poor families.

National and international NGOs operate in several public health areas in Madagascar. However, only a handful of NGOs manage to conduct nationwide operations, because the NGO interventions are, for the most part, concentrated in relatively accessible areas. Furthermore, added to the dearth of resources and expertise is the lack of NGO coordination at the national level, which contributes to duplication of activities.

The private sector covers only approximately 15 percent of all health facilities in the country. This low level of coverage is offset to some extent by better equipment, which serves as a resource for the ill from affluent socioeconomic backgrounds.

In this generally hostile context, basic health indicators remain worrying, despite significant strides, particularly in the area of child health. These indicators include a high maternal mortality rate of 469 per 100,000 live births, a neonatal mortality rate of 32 per 1,000, while only 47 percent of births are attended by skilled staff, and 32 percent of births take place in health facilities.

Natural or man-made disasters (annual cyclones or floods, drought in the south, and the sociopolitical crisis of 2002) only exacerbate the incidence and prevalence of these communicable diseases, and of other recurring health problems such as child malnutrition. Thus, in recent times, cyclones have determined the rate at which malaria (in the highlands or in the south), cholera (at the beginning of the 2000s), and arbovirus (dengue and chikungunya in 2006, Rift Valley fever in 2008) epidemics have developed, while the sociopolitical crisis of 2002 was undoubtedly one of the factors that strengthened the 2002 flu epidemic. The effects of the cyclones during 2006-2007 are still being felt in

Figure 14: Hospital destroyed by the cyclones

[13] National Health Accounts, 2003
[14] Household Survey, January 2006

2008, as severe malnutrition plagues the southeast regions.

Rural areas, particularly the coasts, which are very exposed and vulnerable to these hydro-meteorological hazards, are most adversely affected by the dearth and inequitable distribution of health staff. Indeed, the current ratio in Madagascar is 1.05 health workers per 1,000 inhabitants, which falls short of the standard of 2.5, considered to be the threshold for having a significant impact on the population's health. Moreover, almost 50 percent of the ministry's staff is concentrated solely in the Analamanga region (capital region) and in a number of hospitals in the major cities. Similarly, the distribution of doctors among rural and urban areas reveals an acknowledged imbalance, to the detriment of the rural populations. For example, the former Antananarivo province, which is home to 28 percent of the country's population, employs 46 percent of all doctors working in the public sector.[15]

The capacity of the health service to prepare for, and respond to, these disasters is often overwhelmed. Specifically, the disease surveillance system is still barely operational, and the capacity of health officials at the peripheral levels to counter epidemics and provide adequate treatment for serious cases remains limited.

Damage and Loss Assessment

The 2008 Cyclone Season, particularly cyclones Fame and Ivan, did not spare the health sector. In addition to the approximately 100 deaths, some 600 persons were injured during the cyclone season. Wind or water destroyed or damaged 167 basic health centers (CSBs), or approximately six percent of the total, as well as six hospitals, hitting the Analanjirofo and Haute Matsiatra regions the hardest. Overall damages were estimated at Ar. 11,230.0 million (US$6.8 million) and losses at Ar. 5,690.5 (US$3.4 million).

Table 15: Damages and Losses in the Health Sector (Million Ar.)

	Disaster Effects			Ownership		Macro-Economic Impact	
	Damage	Losses	Total	Public	Private	BOP	Fiscal Sector
Infrastructure	10,976.1		10,976.1	10,976.1		2,195.2	
Equipment and furniture	242.8		242.8	242.8		194.2	
Medicines and supplies	11.1		11.1	11.1		10.0	
Losses of revenues		3,239.8	3,239.8	3,239.8			3,239.8
Medical attention to injured		765.9	765.9	765.9			765.9
Higher cost of medical care		467.4	467.4	467.4			467.4
Prevention campaigns		622.8	622.8	622.8			622.8
Cost of demolition		594.6	594.6	594.6			594.6
Total	**11,230.0**	**5,690.5**	**16,920.5**	**16,920.5**		**2,399.4**	**5,690.5**

[15] Ministry of Economy, Finance, and Budget; the Directorate General of the National Statistical Institute [Direction Générale de l'Institut National de la Statistique]; the Department of Demography and Social Statistics [Direction de la Démographie et des Statistiques Sociales]: Population and Health Survey, EDSMD-III, Madagascar 2003-2004.

The extent of the damage to health infrastructure is related to either the intensity of the cyclone as it passed through the country, or to the age or fragile condition (constructed of local materials) of the buildings. The bulk of the damages to hospitals and basic health centers was located in the regions of Analanjirofo, Atsinanana, and Haute Matsiatra (for more details, see Annex 2)

This infrastructural damage led to the temporary and even permanent closure of a number of these health centers, thus terminating or disrupting the various basic health services, particularly the treatment of common diseases and diseases covered by control and prevention programs, especially with regard to maternal-child health.

Figure 15: Health Station

Moreover, disruptions triggered by cyclones and flooding on access roads, coupled with the financial difficulties faced by disaster-affected households, generally resulted in an even more significant reduction in the number of health facilities, which was already low before the disaster.

Free health care services had to be provided to the homeless in major cities and to disaster victims in rural areas in the weeks and months following the disaster. Thus, health care was provided to between 180,000 and 300,000 persons by medical teams working at health facilities and with mobile health services, as well as by public facilities and NGOs.

Furthermore, in addition to the high levels of rainfall during the season, the cyclones produced environmental conditions favorable to the outbreak of diseases: an increase in the number of areas of stagnant water, thereby providing countless breeding grounds for diseases such as malaria, arboviruses, and schistosomiases; the submersion of latrines and wells or other household water sources, which are thus contaminated by infectious agents, the source of diseases linked to fecal contamination; and atmospheric humidity, which is conducive to diseases of the respiratory tract.

Added to these diseases are those linked to overcrowding in temporary housing (shelters) or in host families for the homeless, which apart from acute respiratory infections include skin infections, conjunctivitis, and even sexually transmitted infections.

Figure 16: Post disaster health station

In anticipation of these epidemic diseases, urgent preventive actions such as child vaccination and Vitamin A distribution, insecticide-treated mosquito net distribution, well disinfection, and IEC campaigns, were carried out by health services at the various levels and supported by international partners and NGOs. These rapid responses to cyclones have, thus far, helped to make epidemic outbreaks a rare occurrence.

Figure 17 and Figure 18show the increased incidence of diseases in 2008 as compared to 2007 for two separate districts.

Figure 17: Comparison for 2007 and 2008 for the Mahabo Health District

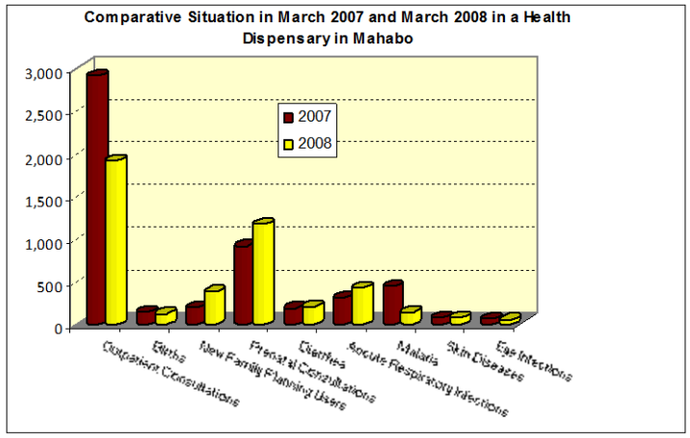
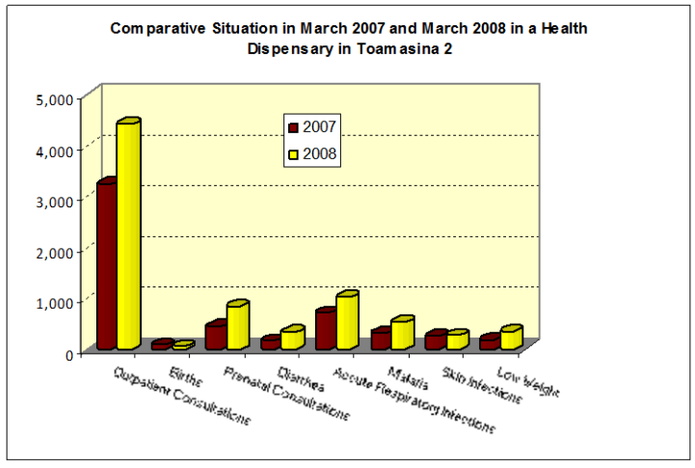


Figure 18: Comparison for 2007 and 2008 for the Toamasina 2 Health District



Macro-Economic Impacts

The estimated increase in imports due to repairs in health infrastructure, and importation of medicines and supplies is estimated at Ar. 2,399.4 (US$1.5 million). The impact on the Treasury, due primarily to losses in revenues from the damaged public facilities and unanticipated higher public health expenditures, is estimated at Ar. 5,690.5 million or US$3.4 million (Table 15).

Rehabilitation and Reconstruction Needs

Rehabilitation and reconstruction needs are estimated to be the following:

Table 16: Estimated reconstruction needs for the health sector (Ar. Millions)

Subsectors	Units	Unit Costs	Total Costs
Reconstruction and Rehabilitation of Basic Health Centers	576	144.0	24,048.0
Reconstruction and Rehabilitation of Hospitals	6	576.0	3,456.0
Equipment/Refitting of Hospitals	6	500.0	3,000.0
Public Health Interventions[1]	Lump-sum		981.2
TOTAL			**31,485.2**

[1] *Increase in acute respiratory infections , malaria, diarrhea, and preventive public health (vaccination of children under 5, insecticide spray, chloronization of wells, hygene, sanitation, and distribution of impregnated mosquito nets).*

The priorities for investment in recovery are as follows:

- Reconstruction and re-equipment of the damaged facilities to cyclone-resistant norms.
- Fresh impetus to the advanced and mobile strategies in order to reach remote and isolated populations;
- Human resource capacity building;
- Improved quality health care; and
- Strengthened disease surveillance.

Based on this, the needs for recovery and reconstruction in the health sector are estimated to be distributed as follows:

Table 17: Recovery and Reconstruction Needs for the Health Sector

	Recovery and Reconstruction (in Ar. Millions)		
	Early Recovery	Medium/Long Term Recovery	Total
Reconstruction and Rehabilitation of Basic Health Centers	9,619.2	14,428.8	24,048.0
Reconstruction and Rehabilitation of Hospitals		3,456.0	3,456.0
Equipment/Refitting of Hospitals		3,000.0	3,000.0
Public Health Interventions	392.5	588.7	981.2
Total	**10,011.7**	**21,473.5**	**31,485.2**

Nutrition and Food Security

Summary

The 2008 cyclone season resulted in damages to an estimated 1,255 community nutrition sites (CNS), primarly in the regions of Analanjirofo (where 196 were completely destroyed), Atsinanana and Atsimo Atsinana. Damages are estimated to have cost Ar. 1,314.3 million (US$0.8 million). Losses, calculated through impact on children's nutrition, were estimated at Ar. 1,575.7 million (US$1.0 million). Recovery and rehabilitation needs include the reconstruction and equipment of the community nutrition sites at cyclone resistant standards, at an estimated cost of Ar. 5,492 million (US$3.3 million). Other nutrition interventions are planned in the agriculture sector.

Pre-disaster situation

Since 2005, the fight against malnutrition has been a priority of the Malagasy Government, which is striving for sustainable human development and rapid economic growth in keeping with the Millennium Development Goal (MDG) of reducing malnutrition by 50 percent. The Nutrition Project initiated in 1990 has thus become a program, and its associated national nutrition bureau [*Office national de nutrition* (ONN)] is responsible, in close collaboration with Madagascar's partners, for multisectoral coordination of national nutrition policy [*Politique nationale de nutrition* (PNN)] in connection with the MDGs.

Within the framework of risk and disaster management, the policy has four strategic themes aimed at enhancing community disaster preparedness:

- Theme 5: outreach to severely malnourished children;
- Theme 6: improvement of household food security;
- Theme 10: disaster preparedness and response to nutritional emergencies; and
- Theme 11: national food and nutrition surveillance system.

Natural catastrophes of any kind make populations vulnerable and often threaten their quality of life (e.g., in terms of health, hygiene, safe water, food, etc.).

Since the inception of the Madagascar Action Plan, in which all segments of society, including farmers, participate in the country's development, communities have begun to organize themselves efficiently to meet their own needs and develop their villages. Three positive changes have been noted at the village level:

Figure 19 Example of smallholder garden

- Many households have made considerable investment in agriculture (including small livestock, smallholder gardens, development of new rice cultivation areas, cash crops improvement, etc.) to ensure food self-sufficiency and boost household income (through income-generating activities) for family use (Figure 19).

- The two weeks devoted annually to the Maternal and Child Health Campaign (vaccination, parasite treatments, administration of micronutrients such as vitamin A and iron, etc.) have improved health and the medical monitoring of vulnerable groups.

- The increased number of community nutrition sites, of which there are now 5,500 throughout the country (1 site per village, village, for coverage of about one-third of the country's villages), has done much to help monitor the growth of children under age five and to enhance nutritional awareness on the part of their parents. These sites, along with the basic health centers, are contributing to nutritional monitoring in each locality (Figure 20).

Thus, rates of child malnutrition and household food insecurity, which in 2004 were around 42 percent and 64 percent, respectively, have declined. The reduction of these rates was estimated at five percent in 2007.

Post-disaster situation

Figure 20 : Community Nutrition Site

Madagascar's geographic location makes it vulnerable to cyclones. Most rural villages are located near plains exposed to winds and flooding. Dwellings are built by the inhabitants themselves and do not meet cyclone protection standards. Every cyclone therefore demolishes the property of many households through the impact of wind and water with grave consequences.

The post-disaster nutritional status of children depends on the availability and accessibility of food, health care dispensed by health centers, and safe water, as well as on local hygiene conditions.

Madagascar's rural population, which is accustomed to a December-April cyclone season, always makes advance preparations, putting aside a small supply of food and money earned on cash crops to deal with post-disaster situations.

Repeated cyclones, torrential rains, and floods, however, make the situation very difficult for them, especially if crops are destroyed (the rice crop is usually harvested during the first three months of the cyclone season.)

In the case of cyclones Fame and Ivan, most community nutrition sites built of local materials were destroyed by winds and water. Many children suffered weight loss, leading to a higher proportion of underweight children in March 2008 in comparison to December 2007.

Food security is precarious in some regions due to the destruction of vegetable gardens, the siltation of rice paddies, and the loss of cash crops, which has had negative repercussions on family food supplies and household incomes.

The successive cyclones of 2008 have caused damage and losses in the nutrition and food security sector, although the scope of the damage varies from one region to another.

Damages and Losses

Damages

(a) Destruction of Community Nutrition Sites (CNS):

A community nutrition site is a small, roughly 15 m^2 house built by the community to house the activities of the Community Nutrition Program, which includes regular weighing and measuring of children to monitor their growth, nutritional education and counseling, cooking demonstrations, etc. This site is also used during the two weeks of the annual Maternal and Child Health Campaign (SSME) organized by the Ministry of Health, Family Planning and Social Protection for vaccinations, parasite treatments, and distribution of vitamins, amongst others.

Construction materials vary from one village to another and depending on the community's resources. Some use local materials, while others use hard or semi-hard construction techniques with sheet metal roofs and concrete floors. The average cost of construction, as of 2004, was about Ar. 1.5 million.

The sites are located at the *Fokontany*, or village, level (1 Site = 1 Fokontany). There are now about 5,500 sites throughout Madagascar.

Given the materials and community construction techniques used, these sites cannot stand up to cyclones and flooding. It is thus estimated that 65 percent of sites were either totally (562 centers) or partially (693 centers) destroyed.

(b) Destruction of site materials and equipment

The tools and equipment used at the sites include: (1) Salter scales for weighing; (2) devices for measuring children's height; (3) miscellaneous furniture, including tables, chairs, and shelving; (4) information and outreach posters; and (5) file binders for recording data and storing reports. The sites also have cooking equipment for cooking demonstrations.

The average cost of this equipment is estimated at Ar. 120,000.It is estimated that 52 percent of this equipment was destroyed.

Losses

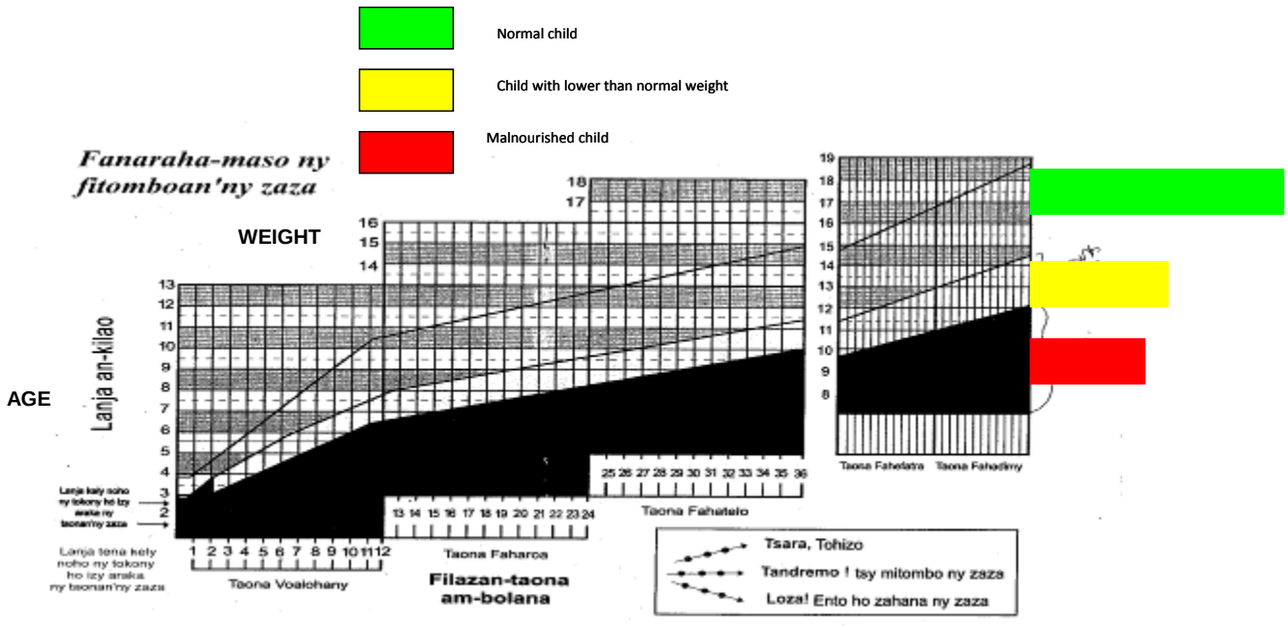
(c) Coverage of malnourished children at Nutritional Rehabilitation Care Centers

Children under the age of five years and pregnant and/or nursing women are highly vulnerable to sudden shocks. In the case of the cyclones, malnutrition sets in subtly but rapidly, and can worsen depending on the three factors of food security: availability, accessibility, and use of on-site foods.

The numbers of children to be covered by these centers is forecast by means of an analysis, by commune and by district, of the nutritional status of children at the sites. The indicator used is the **Proportion of Underweight Children.**

The malnutrition rate in a village reflects the community's vulnerability. This indicator is used at CNSs to monitor the growth of children under the age of five in the village. It is derived from an average of: weight/age of children weighed and recorded in the three (3) child nutritional status categories cited below, relative to all children weighed:

Figure 21 Scale of children malnutrition used at Community Nutrition Sites



Based on the Proportion of Underweight Children, the estimated number of moderately malnourished children requiring coverage through an Outpatient Nutritional Rehabilitation Care Center (CRENA) and those severely malnourished to be admitted in an In-Patient Nutritional Rehabilitation Care Center (CRENI) can be calculated. Malnourished children with associated pathologies are referred directly to a CRENI.

CRENAs and CRENIs are located near basic healthcare centers to ensure that the children admitted are subject to medical and nutritional monitoring in accordance with the approved protocol.

(1) CRENA:

Children admitted to CRENAs receive daily meals consisting essentially of nutrient-enriched foods, such as fortified blended flours, Plumpy'Nut energy bars, high-calorie biscuits, etc.

The average duration of care of a child in a CRENA is 12 weeks, at an average cost of MGA 22,000.

(2) **CRENI**:

Children admitted to CRENIs, on the other hand, receive a daily ration of therapeutic foods, depending on their age: F75 or F100 milk, fortified blended flours, etc.

The average duration of care of a child in a CRENI is four weeks, followed by post-recovery referral to a CRENA for eight weeks. The average cost of care for a child in a CRENI is MGA 24,000.

Table 18: Numbers of Community Nutrition Sites and facilities damaged and CRENA/CRENI children taken into care

REGION	DAMAGES		***LOSSES*** Numbers of Children Admitted into:	
	Community Nutrition Sites	Facilities	CRENA	CRENI
ANALANJIROFO	309	432	12 355	617
ALAOTRA MANGORO	223	301	11 626	581
ATSINANANA	368	321	18 563	928
MENABE	46	58	4 320	128
VATOVAVY FITOVINANY	78	92	6 680	324
ATSIMO ATSINANANA	187	192	12 614	624
BOENY	5	12	258	13
SOFIA	18	19	895	48
MELAKY	21	26	711	36
TOTAL	**1 255**	**1 453**	**68 022**	**3 299**

Danger of Nutritional Problems by Region

Nutritional and food security risks vary from one region to another. In general, however, nutritional issues can be put aside for the moment, since nutritional trends will depend on the solutions provided under food security and agricultural recovery measures.

Menabe Region

Data gathered from the assessment of damage and losses in the Melaky region seemed to indicate that the Proportion of Underweight Children was not really affected. This figure – 27 percent for late March 2008 – was unchanged in comparison to the December 2007 figure. The risk of food insecurity is lesser because of the rice availability despite damages to some rice cultivation areas, and the price is affordable for households: AR. 220 per *kapoaka* (average national price: AR. 1,000/kg). It should be noted that this region, especially with its districts of Mahabo and Morombe, is one of the country's largest rice producers.

Analanjirofo Region

The level of food insecurity in this region is alarming and may affect the nutritional status of children. This warrants special attention due to the reduction of local rice stocks in the wake of paddy damage, loss of tuber crops (e.g., cassava) and breadfruit [*soanambo*], and the nearly tota destruction of cash crops. The high price of transshipments to Ivoloina to supply the region also increases the market price of products.

Alaotra Mangoro Region

The situation in Alaotra Mangoro may improve soon, since the harvest, although affected by flooding, was scheduled for late May. The districts of Andilamena and Amparafaravola, however, require close surveillance because nearly 45 percent of rice paddies there were destroyed.

Socioeconomic Impacts

Socioeconomic impacts in most regions were generally not severe for most people, with the exception of those in the two regions cited above. Rapid intervention will foster post-cyclone economic recovery, as has been confirmed by the various assessments conducted.

However, there is an important risk of food insecurity for vulnerable groups (e.g., poor families, the elderly) and serious nutritional impacts for young children if no action is taken quickly.

The change in baseline date for the affected regions is as follows:

Table 19: Change in nutritional baseline data for affected regions

REGION	DISTRICT	COMMUNE	No of Fokontany	Children under 5, weighed	Average % of underweight children	
					Dec. 2007	March 2008
ANALANJIROFO	7	55	390	51,034	21.99	25.5
ALAOTRA MANGORO	5	54	320	38,839	28.95	30.40
ATSINANANA	6	77	695	69,877	32.09	33.88
MENABE	4	24	131	16,284	20.07	21.82
VATOVAVY FITOVINANY	6	32	102	25,500	33.48	36.1
ATSIMO ATSINANANA	5	83	244	63,070	24.44	25.7
SOFIA	1	4	23	5,299	14.29	15.98
BOENY	1	2	12	3,314	8.12	13.80
MELAKY	2	8	30	4,917	13.06	16.55

The quantitative estimates of damage and losses by region are presented in the following table.

The total cost of damage and losses by region is summarized on Table 20. Overall damages are estimated at Ar. 1,314.3 million (US$ 0.8 million). Losses amount to Ar. 1,575.7 million (US$ 0.95 million). All damages and losses are private in nature.

Table 20: Damage and Losses for the Nutrition Sector by Region (Ar. Millions)

REGION	DAMAGE	LOSSES	TOTAL
ANALANJIROFO	328.2	286.6	614.8
ALAOTRA MANGORO	236.2	269.7	505.9
ATSINANANA	378.8	430.7	809.5
MENABE	48.5	98.1	146.6
VATOVAVY FITOVINANY	81.8	154.7	236.5
ATSIMO ATSINANANA	194.3	292.5	486.8
BOENY	5.6	6.0	11.6
SOFIA	18.7	20.8	39.6
MELAKY	22.1	16.5	38.6
TOTAL	1,314.3	1,575.7	2,890.0

Macro-Economic Impact

The macro-economic impact of the cyclones on the Nutrition and Food Security sector is substantial: while only Ar. 36.3 million in imported equipment and furniture are estimated to be required for the nutrition centers (US$ 22,000), the impact on the fiscal sector of their rehabilitation is envisaged to be significant (Ar. 5.0 billion or US$3.0 million).

Table 21: Damage and Losses for the Nutrition and Food Security Sector (Ar. Million)

Disaster Effects			Ownership		Effects on :	
Damage	Losses	Total	Public	Private	BOP	Fiscal Sector
1,314.3	1,575.7	2,890.0	0.0	2,890.0	36.3	5,000.0

Recovery and Reconstruction Needs

Reconstruction of damaged or destroyed sites

The costs of reconstructing the Community Nutrition Sites to cyclone-resistant (hard) standards amount to an estimated Ar. 5 million per unit (US$3,000). The 562 fully destroyed centers will need to be rebuilt to these specifications. The 693 partially destroyed centers would have to be partially rebuilt and retrofitted to cyclone-resistant standards, at an estimated cost of Ar. 3.72 million per unit (US$ 2,254).

Replacement of site materials and equipment:

Because the equipment used at these sites (Salter scales, height-measuring devices, file binders, etc.) is very fragile and cannot resist water damage, the entire kit needs to be reconstituted[16]

The table below summarizes the total cost of recovery and reconstruction needs:

Table 22: Total cost of recovery and reconstruction needs for the Nutrition and Food Security Sector

Type	Total needs (Million Ar)	($'000)
Reconstruction of Community Nutrition Sites (SNC)	2,810.0	1,703.0
Rehabilitation of Community Nutrition Sites (SNC)	2,578.0	1,562.4
Reconstitution of equipment kit for damaged SNC (about 52% of equipment)	104.4	63.3
Total:	**5,492.4**	**3,328.7**

[16] Assuming inflation of about 22 percent on the price of supplies since 2004, the estimated cost of reconstituting an equipment kit is Ar. 160,000 (US$97).

Housing and Public Administration Buildings

Summary

The 2008 cyclone season caused damages in the Housing Sector estimated at Ar. 194.4 billion (US $ 117.8 million) and losses approximating Ar.16.1 billion (US $ 9.8 million). About 89 percent of the damages and losses were incurred by the private sector. Overall, close to 54,000 dwellings were destroyed by the cyclones and 119,000 were partially destroyed. The highest damage was inflicted on dwellings made of local (non-hard) materials: approximately 50,000 were destroyed, and 109,000 partially destroyed. Amongst public buildings, some 340 were affected, including administrative offices, lodgings, marketplaces, socio-cultural centers, barracks and prisons. The most affected districts as far as housing is concerned were Fenerive Est, followed by Toamasina II. Sainte Marie and Saonierana suffered roughly equal damages. Overall, it is estimated that the cyclones led to an increase in demand for imported building materials approaching Ar. 60 billion (US$ 36 million).

While the assessment team estimates that 80 percent of the private dwellings damaged by the cyclone have been rebuilt already, it is critical that cyclone-proof norms be promoted in high-risk areas prior to the next cyclone season. These should include standards for public buildings, and training local builders and NGOs in traditional low-cost cyclone-proof dwellings, along with better spatial planning at the commune level to avoid construction in high risk areas.

Figure 22: Dwelling in Fénérive-Est

Figure 23: Traditional hut in Vavatenina

Pre-Disaster Situation

Information on the housing sector prior to the cyclones Fame and Ivan is imprecise, since there is no government institution working in this area. The assessment team was nonetheless able to obtain some information from the Institute of Statistics (INSTAT), BNGRC, Ministry of Interior, and the Ministry of Decentralization. Based on this information, the team divided the types of housing into three different categories:

Hard Construction:

Dwellings classified as hard construction are made of materials such as cement and include a foundation or flooring, and concrete uprights. Figure 24 shows a dwelling made of hard construction materials.

Figure 24: Hard construction in Mahabo

Semi-hard construction:

Dwellings classified as semi-hard construction use cement slabs and concrete uprights, but with walls made of local materials, such as planking, woven bamboo, ravinala leaves, etc. Figure 25 shows an example of a semi-hard construction dwelling

Figure 25: Semi-hard construction in Vavatenina

Locally constructed dwelling:

Locally constructed dwellings are classified as those essentially made of local materials, such as planking, bamboo, or any other local materials. Figure 26 and Figure 27 show dwellings constructed of local materials.

Figure 26: Local materials construction in Sainte-Marie

Figure 27: Local construction in Sainte-Marie

Damage and losses

The estimated damages to private sector dwellings (including goods and equipment) is estimated at Ar. 172.0 billion (US $ 104.2 million) (for details on the methodology used see Annex 1). The damages to public administration buildings are estimated at an additional Ar. 22.4 billion (US $ 13.6 million), for a grand total of 194.4 billion Ar. (US $ 117.8 million) for the sector. Overall losses, including the cost of temporary rentals, are estimated at Ar. 16.1 billion (US $ 9.8 million) (see Table 23).

Table 23: Damages and Losses for the Housing and Public Administration Sector

	DISASTER EFFECTS (Ar. millions)			DISASTER EFFECTS (USD millions)		
	Damage	Losses	TOTAL	Damage	Losses	TOTAL
Private dwellings	171,957.30	16 099.50	188,056.80	104.22	9.76	113.98
Public administration buildings	22,415.00		22,415.00	13.58		13.58
TOTAL	**194,372.30**	**16,099.50**	**210,471.80**	**117.80**	**9.76**	**127.56**

Damages to the housing sector (including public buildings) far outweighed the losses incurred. As Figure 28 shows, nearly 92 percent of the disaster effects were damages, with only 8 percent listed as losses.

The majority of the damages and losses were concentrated in the private sector, since the bulk of the damage was to private dwellings. Of the total damages and losses in the housing sector, Ar. 188.1 billion (US $ 114.0 million) or 89 percent was incurred by private owners.

Figure 29: Damages and Losses in the Housing Sector

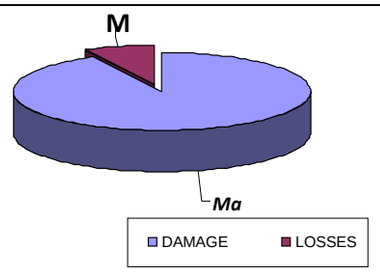


Figure 30: Damages and Losses to the Housing Sector by ownership

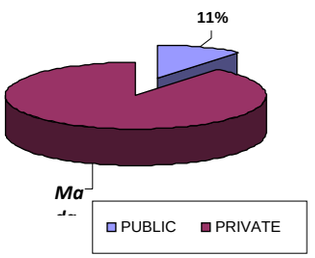
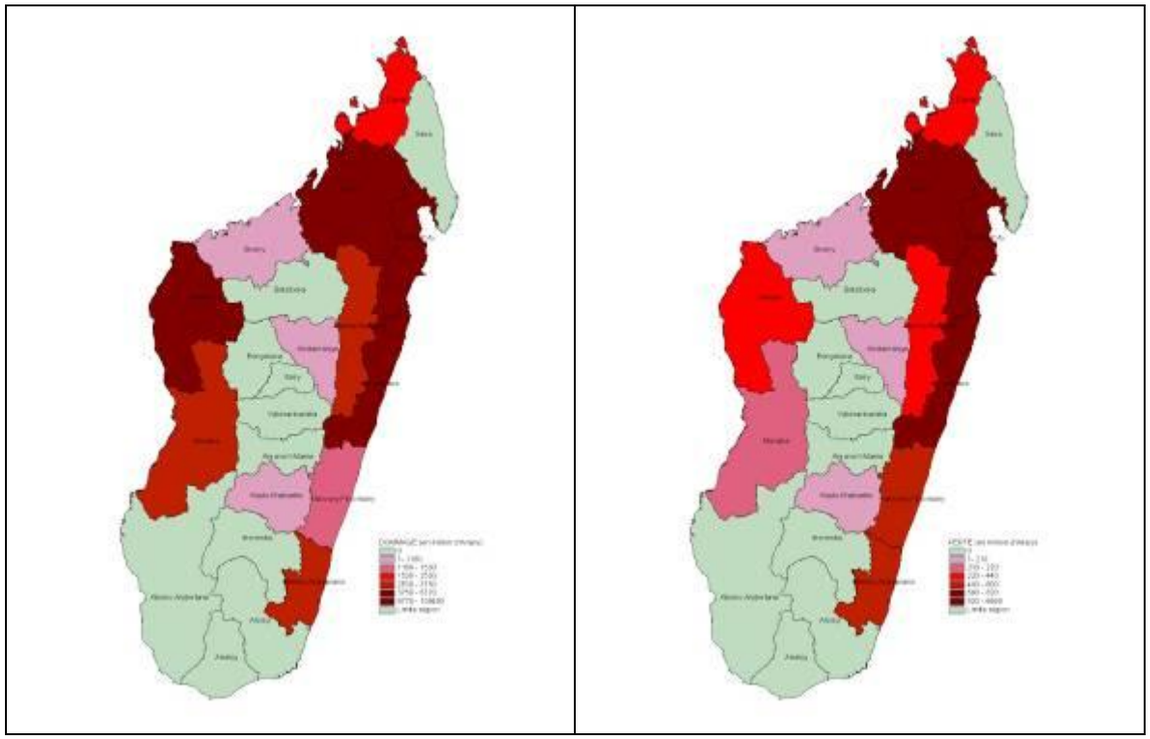


Table 24: Damages and Losses to the Housing Sector by type of ownership

Damages and Losses by ownership (Ar. Millions)		Damages and Losses by ownership (USD millions)	
Public	**Private**	**Public**	**Private**
22 415.0	188 056.7	13.58	113.98

Damages and losses were also disproportionately concentrated in a few coastal districts that bore the brunt of the storms. The most affected districts were Fenerive Est, followed by Toamasina II. Sainte Marie and Saonierana suffered about equal damages. Figure 31 and Figure 32 present a map of the damages and losses incurred by district.

Figure 31: Damages by District	Figure 32: Losses by District



Macro-Economic Impact

Reconstruction in the housing sector necessitates construction materials that will have to be imported. The total estimated value of these materials is Ar. 60.0 billion (US $36 million) (see Table 25). A breakdown of these estimated needs by region is given in Annex 1. The impact on fiscal sector of rehabilitating public administration buildings is estimated at Ar. 23.0 billion (US$13.9 million).

Table 25: Macro-Economic Impact of Housing Sector (Ar. Million)

Effects on:	BOP	Fiscal Sector
	59 653.1	22 955.4

Figure 34: Market building in Mahabo

Figure 33: Dwellings destroyed in Sainte-Marie

Socioeconomic Impacts

In the wake of the cyclones, much of the population lost five to seven days of remunerated economic activity. During this time, people tried to recover whatever household goods were salvageable and to find temporary shelter.

It should be noted that many dwellings were at the same time places of business. Therefore, merchandise may also have been lost as well, although precise figures were unavailable.

The need to rebuild a large number of dwellings over a very short period of time after the cyclone entailed a considerable increase in the cost of construction materials. This is especially true of local materials, which are obtained from the disaster area itself and thus are partially destroyed *in situ*, making it necessary to bring in local materials from other, unscathed regions. Additional costs were also incurred for transportation using damaged infrastructures.

Risk Management

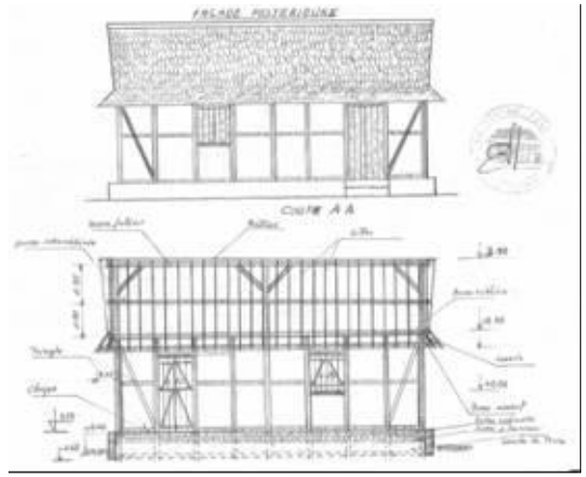
The following factors need to be taken into consideration in risk management solutions:

- Since cyclones and floods are frequent occurrences in Madagascar's coastal regions, people build their dwellings in such a way that, when disaster strikes, they do not need to spend much funds on reconstruction.
- The population's attachment to the land is often a problem, particularly when these areas are already at high risk.
- As lands are not covered by a cadastral system and official tenure arrangements, but instead by a traditional ownership system, people are afraid they will lose their lands if they leave them.
- It is difficult to find unoccupied areas for population resettlement operations.

The proposed risk management approach is therefore as follows:

- At the commune level, when communities are drawing up their land-use plans (commune land use plans), it would be advisable to delineate new areas for urban development (land preparation, utilities, etc.) in less vulnerable areas.
- Cyclone-proof norms should be systematically enforced for public buildings.
- The following shows the estimated mark-up of bringing dwellings, including those made of local materials, up to cyclone-proof norms (i.e., improving the resistance of the structures without necessarily making them invulnerable):
    - Hard and semi-hard dwellings: 30 percent mark-up
    - Locally constructed dwellings: about 100 percent mark-up (Ar. 1.6 million).
- It is also proposed to start a module of training for builders and local NGOs from areas at high risk in the principles of cyclone-proof, low-cost housing using traditional materials. It is proposed that this module be initiated at HIMO Training Center – ILO/Norway – based in Antsirabe as a precursor to the development of updated cyclone-proof construction norms in Madagascar. This Center specializes in training construction foremen and builders.

Figure 35: Model for cyclone-resistant dwellings



Governance issues

To the extent that their limited resources permit, local governments, regionalized communities, and NGOs, among others, have done their best to come to the population's aid. It should be pointed out that damage assessment was carried out by NGOs in collaboration with those government structures, and yielded fairly reliable data for calculation purposes.

Recovery and Reconstruction Needs

Based on discussions with various local interlocutors, the assessment team estimates that about 80 percent of huts made of local materials have been rebuilt already by their occupants using traditional methods (i.e., without any upgrading to standards). Thus, intervening directly in the recovery of the sector would pose a dilemma at this stage: it would be seen as rewarding those who failed to take proactive action to rebuild; in a follow-up cyclone, it could lead to perverse incentives.

Hence, while the housing sector has sustained some of the highest damages during the cyclone season, it is also the one where it is most difficult to intervene with public funds. Given the rate of reconstruction that has already taken place privately, the assessment team proposes that the reconstruction strategy focuses solely on reconstruction (to norms) of public administration buildings, and the repair of a public dike threatening a village in Mampikony (Sofia region). As part of the risk management strategy, it is also proposed that a training course be started in Antsirabe for builders and NGOs promoting the design of low-cost traditional housing according to cyclone proof standards and that this design be widely disseminated in high-risk areas during the next cyclone season (see Risk Management Chapter). This should accompany the adoption of cyclone resistant construction norms for high-risk areas.

Table 26: Recovery and Reconstruction Needs for the Housing and Public Administration Sector by Region (Ar. Millions)

REGIONS	(Ar. millions) RECOVERY AND RECONSTRUCTION		
	Early recovery	Medium/long term	TOTAL
Alaotra Mangoro		1850.0	1850.0
Amoron'i Mania			
Vatovavy Fitovinany			
Analamanga			
Analanjirofo		7,410.0	7,410.0
Atsinanana		7,485.0	7,485.0
Bongolava			
Boeny			
Diana			
Haute Matsiatra			
Atsimo Andrefana			
Ihorombe			
Menabe		1,650	1,650
Sofia		540	540
Atsimo Atsinanana			
Betsiboka			
Melaky		4,020	4,020
TOTAL		22,955.4	22,955.4

Productive Sectors

Agriculture, Livestock and Fisheries Sector

Summary

`The 2008 cyclone season did not spare the agricultural sector, affecting crops, irrigation, livestock and fisheries. Wind gusts and brief, but excessive rainfall affected 17 of the country's 22 regions to varying degrees. The 17 affected regions included Analanjirofo, Atsinanana, Vatovavy Fitovinany, Atsimo Atsinanana, Sofia, Betsiboka, Analamanga, Amoron'i Mania, Haute Matsiatra, Bongolava, Ihorombe, Alaotra Mangoro, Diana, Boeni, Melaky, Menabe, and Atsimo Andrefana.

In the agriculture sub-sector, production losses were estimated at 80,000 tons of paddy or 52,000 tons of rice. While these may seem small vis-à-vis the national production, they had a negative impact on the food balance of rural households. Overall damages to food and export crops are estimated at Ar. 145,890.4 million (US$ 88.4 million). An early recovery strategy to redistribute seeds to the most affected areas is proposed, along with a program to multiply improved and short-cycle rice seed varieties, the gradual introduction of rice adapted to inundation, and agriculture diversification in high-risk areas.

Irrigation infrastructure suffered considerable damage due to strong currents, but also due to accumulated sedimentation and a lack of maintenance. Damages in this sub-sector were estimated at Ar. 9,314.5 million (US$ 5.6 million). Rehabilitation and recovery of this infrastructure will require mobilization of Water User's Associations, at an estimated cost of Ar. 10,407.3 million (US$ 6.3 million). Internal funds through the Fund of Hydro-Agriculture Network Management (FEHRA) and the Irrigation and Watershed Management Program (BVPI) have already been mobilized; nonetheless, some Ar 3,125.8 million in emergency works will be necessary prior to the rainy season (US$ 1.9 million)..

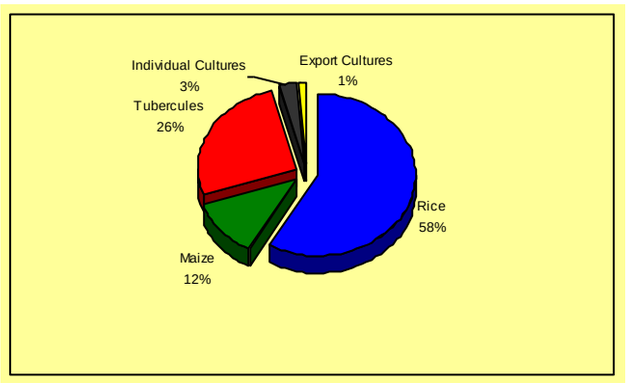
The cyclones damaged livestock resulting in the deaths of farm-yard animals (chickens, ducks, and geese), zebus, cows, and pigs, and the destruction of stables and materials estimated at Ar. 316.4 million (US$ 0.2 million). Although the revenues generated may seem modest, farm animals play an important, though indirect, role in farm income—the economic losses resulting from lost eggs, milk, draft work and potential losses of chicks were estimated at Ar. 499.7 million (US$ 0.3 million). The proposed recovery strategy for the sub-sector includes the introduction of risk management principles in associations managing livestock in high risk areas, at an estimated cost of Ar. 320 million (US$ 0.2 million).

The 2008 cyclone season resulted in damages to the fisheries sub-sector estimated at Ar 830.7 million (US$ 0.5 million) and losses of Ar 13,174.2 million or US$ 8.0 million (Annex 9). Damages included the destruction of pirogues and nets, and the inundation of lakes, fish ponds, and rice paddies. Since fisheries are a private enterprise, almost all the damages and losses were incurred by the private sector. The significant impact of Cyclone Ivan was on traditional fishers on the East coast (around Sainte-Marie and Fénérive-Est) whereas cyclone Fame and cyclone Jokwe had relatively milder impacts on traditional fishers on the central and northwestern coasts. Nonetheless, given the relatively greater importance of traditional landings in the western coast, total losses were higher on the western coast than in the east, where they were offset (in Sainte-Marie) by higher landings from the industrial fishery, which was only mildly affected. Overall, damages to capture fisheries are estimated at Ar 689.7 million (US$0.4 million), and losses at Ar 5,956.8 million (US$ 3.6 million). About Ar 589.1 million (85 percent) of the damages were incurred by traditional fisheries (US$ 0.4 million).

Aquaculture damages were estimated at Ar 141.0 million (US$ 0.1 million) and losses at Ar 7,217.4 million (US$ 4.4 million), primarily in six regions: Alaotra Mangoro, Boeny, Haute Matsiatra, Sud Est, Ihorombe, and Betsiboka, due to inundation and damage to the basins. Losses were high due to the difficulties of finding immediate replacement for lost breeders (particularly carp) and the consequent loss of a breeding season for fingerlings (or, in the case of tilapia, up to two breeding seasons).

Pre-Disaster Situation

Figure 36: Breakdown of arable land by crop



With a total surface area of 590,000 km², the country has 2,083,590 ha of arable land.[17] Land distribution by type of crop is as shown in Figure 36 .

As can be seen here, rice-growing predominates, with about 58 percent of cultivable surface area. Root crops (e.g., manioc) and tubers (e.g., potatoes and yams) are in second place with 26 percent, while corn accounts for 12 percent. Groundnuts, cotton, and tobacco occupy three percent of cultivable lands, and export crops (coffee, vanilla, and cloves) a scant one percent. Rice is the staple food: annual per capital consumption totals about 120 kg. The average farmer cultivates 0.87 ha.

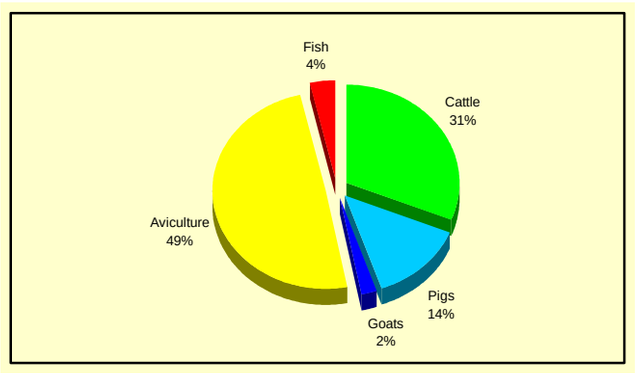
In addition, the country's geographical location in the cyclonic basin of the Indian Ocean puts it in a critical position with regard to cyclones. Three or four cyclones are anticipated in an average year. The southern part of the country is also chronically threatened by drought, while

[17] Source: National Agricultural Census - 2004-2005 Season. Agricultural Statistics Department, MAEP

devastating hailstorms, particularly before first season rice harvests, plague the Central Highlands.

The livestock sub-sector also employs a great number of rural households, and provides substantial income.

Figure 37: Distribution of Farmers by type of livestock



Livestock is essentially practiced by rural farmers: 49 percent raise poultry, 31 percent cattle, and 14 percent hogs. Goats and fish are raised by two percent and four percent, respectively, of farmers (Figure 37).

The fisheries sub-sector plays a critical role in the country's economy, especially because of shrimp exports. There are three types of fisheries: industrial, artisanal and traditional. Traditional fishing, practiced in 2008 by 72,312 fishermen throughout the country, is significant to the extent that it accounts for 66 percent (140,000 MT) of fish catches brought to market.

Traditional fisheries use small wooden pirogues (frequently with outriggers) and gill nets, seines, longlines, and traps (for crabs or lobsters). In continental or estuarine fisheries, cast nets and mosquito nets are also frequently used. Industrial fisheries account for about 20 percent of the catch, while artisanal fisheries contribute only a small share.

Madagascar exports about 35,000 MT of fisheries products a year. Shrimp exports (from both trawl fisheries and aquaculture) represent about a third of fisheries exports—12,805 MT in 2007—but a much higher proportion of its value: about Ar 250 billion (US$ 152 million). Malagasy cultured prawns [*Penaeus monodon*] are considered to be of world-class quality and are eco-certified. Prawn aquaculture is practiced on the western coast, where the climate is mild and infrastructures adequate. Their export value in 2007 was estimated at Ar 206 billion (US$ 125 million).

Despite this high potential, the country finds itself in a vulnerable position mainly due to the frequent passage of cyclones.

Damage and losses

Cyclone Ivan first made landfall in the District of Sainte-Marie before striking the District de Fenoarivo-Est with powerful wind gusts and heavy precipitation. The cloud mass brought by the cyclone dumped heavy rain on nearly the whole country.Seventeen regions were affected and were the subject of this assessment. Figure 38 shows the different regions according to their respective impact.

The two affected coastal regions, Atsinanana and Analanjirofo, received the dual impact of wind and rain. The other regions—Menabe, Analamanga, Ihorombe, Diana, Atsimo Atsinanana, Amoron'i Mania, Vatovavy Fitovinany, Betsiboka, Boeni, Soafia, Melaky, Atsimo Andrefana, Haute Matsiatra and Bongolava—incurred primarily flood damage.

The total damages and losses estimated for the Agriculture Sector are presented in Table 27.

Figure 39: Regions affected by Cyclones Fame, Ivan and Jokwe

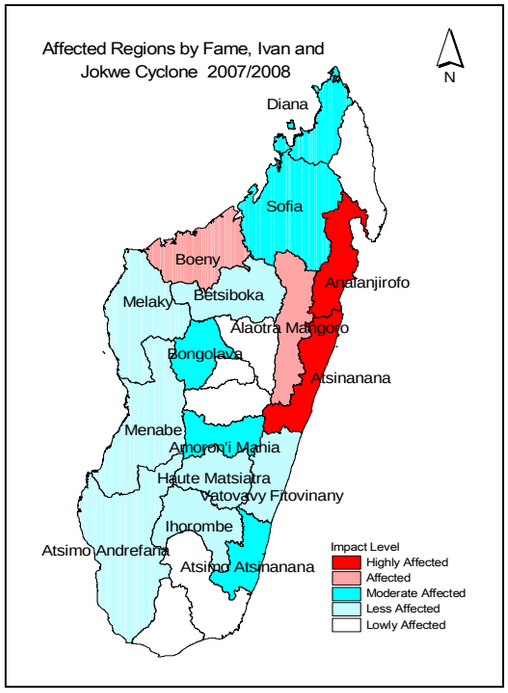


Table 28: Damages and Losses in the Agriculture Sector (in Ar. Millions)

Sub-Sector	Disaster effects		Ownership		Effect on:	
	Damages	Losses	Public	Private	BOP	Fiscal Sector
Agriculture	9,314.5	145,890.4	9,314.5	145,890.4	2,519.7	10,407.0
Livestock	316.3	499.7		816	0.0	0.0
Fisheries	830.7	13,174.2		2, 147.9	0.0	0.0
TOTAL	**10,461.5**	**159,564.3**	**9,314.5**	**148,854.3**	**2,519.7**	**10,407.0**

Sub-Sectors:

Agricultural Sub-Sector

The evaluation of food and export crop losses due to the 2008 cyclone season amounts to Ar. 145,890.4 (US$ 88.4 million).

Since Cyclone Ivan passed in mid-February, the damage to various crops (rotting, uprooting of seedlings, fruit drop, etc.) was caused either by heavy rain or by flooding that was more or less prolonged depending on the region. In short, the degree of impact ranges from 10–40 percent for annual and perennial crops.

Roughly 1,075,348 ha of rice paddies, which would normally yield 22,399,645 tons of rice, are believed to have been affected by the cyclone. Paddy losses totaling 79,162 tons have been calculated for 2008 (corresponding to 51,000 tons of rice), a significant loss for a country that imports 100,000-200,000 tons of rice annually.

Irrigation Infrastructure Sub-Sector

Several dikes and main or secondary canals have fallen victim to general decrepitude and a lack of regular maintenance. Damages to the irrigation infrastructure due to the 2008 cyclone season are estimated at Ar. 9,314.5 million (US$ 5.6 million).

Data collected thus far points to an initial rehabilitation cost of Ar. 10,407.3 million for these infrastructures, a sum corresponding to a surface area of about 44,997 ha for 12 of the country's regions. The importance of these infrastructures is obvious, especially in the rice-growing perimeters of Aloatra Mangoro (with its roughly 30,000 ha of developed area) or Menabe (10,000 ha). These two regions usually supply the large urban consumption centers of the Central Highlands.

Livestock Sub-Sector

Poultry, cattle, and hogs either died or were carried off by floodwaters. Chickens were the most vulnerable as they adapt poorly to inundation, while ducks and geese were the most resistant The livestock were either carried away by strong currents and inundations, or were left exposed to winds and rains in precarious shelters. Some 439 traditional chicken coops and 121 pig sties were also destroyed by the cyclones.

The numbers of poultry and other animals lost, and the corresponding value in the 17 affected regions, are as follows:

Table 29: Damages in the Livestock Sub-Sector (in Ar. Millions)

Poultry / animals	Number	Value of damages
Chickens	2,669	13.5
Ducks	247	1.6
Geese	208	4.2
Subtotal	3,124	19.3
Traction Zebus	354	113.2
Cows	236	51.9
Young Zebus	496	81.5
Hogs	170	48.3
Total	**1,256**	**316.3**

Table 30: Total Losses to the Livestock sector by Region (Ar. Millions)

Region	Value of Eggs Lost	Value of Chicks Lost	Value of Zebu Draft Work Lost	Value of Milk Lost	Total Losses
Menabe	0.704	19.3	11.2	3.6	34.8
Analanjirofo	0.396	12.6	14.6	6.5	34.1
Atsinanana	0.322	7.8	20.3	4.5	33.0
Alaotra Mangoro	0.438	20.0	88.7	13.6	122.8
Haute Matsiara			4.1	0.6	4.6
Sud Est			141.8	37.4	179.2
Boeny			1.9		1.9
Sofia	0.302	8.4	44.4	9.8	63.0
Diana			22.7	3.8	26.5
Total	**2.2**	**68.2**	**349.4**	**79.9**	**499.7**

Livestock losses were computed over a period of three years during which they should have generated value added. They include the lost value of eggs and chicks potentially destined for sales, the value of lost milk and the value of daily draft work (from zebus). The estimated losses from livestock amount to Ar. 499.7 million (US$ 0.3 million).

Fisheries Sub-Sector

The 2008 cyclone season resulted in damages of about 30 percent of all traditional fishing canoes in St. Marie and 12 percent in Fenoarivo-Est. Elsewhere, damages are estimated at about 5-8 percent of the traditional fleet in Boeni, Betsiboka, Diana, Sud-Est, Menabe, and Melaky, and at about 2.5 percent in Alaotra Mangoro. High storm surges (dragging canoes and nets out to sea) and winds (leading to a high number of felled trees) resulted in most of the damage to fishing assets in Fenoarivo-Est and St. Marie. Overall, the 2008 season is estimated to have

damaged a total of 2,100 traditional canoes and 12,000 fishing nets nationwide. Damages to traditional fishers are estimated at Ar. 589.1 million (US$0.4 million).

Reported damage to artisanal and industrial fisheries was not severe, except in Sainte Marie, where the *Societé de Pêche de Sainte-Marie* (SPSM) incurred repairs to one of its fishing boats. In the western coast, damages to the industrial and artisanal fisheries were largely averted due to the fact that shrimp fisheries were closed when the cyclone hit.

Losses to capture fisheries are estimated at Ar 5,956.8 million (US$3.6 million). Despite high individual losses to traditional fishers, the fishery in Sainte-Marie experienced net gains during the first quarter of 2008 compared to 2007, as the SPSM compensated for a ten day closure of its freezing plant by collecting large quantities of octopus, lobster and squid from off-island fishers. As captures of mixed fish increased as a proportion of total catch, losses became more apparent for Saint-Marie landings. Elsewhere on the eastern coast, traditional fishers incurred high losses (fishing nets and canoes) in Analanjirofo, but losses were relatively minor in other regions.

Fishers on the western coast benefited temporarily from an influx of collectors from the eastern coast after fisheries there were closed in the wake of Cyclone Ivan. This competition increased ex-vessel prices for small pelagics from Ar.1,500/kg to Ar.2,400/kg for nearly three weeks, and more than doubled the number of fisheries collectors in Morondava. Even though net losses per fisherman were lower in western regions than in Fenoarivo-Est or Sainte-Marie, losses in the western regions are estimated to be higher than in the eastern regions due to their relative importance to the national economy.

Figure 40: Traditional Canoes on the eastern coast (Fenerive Est region)

Aquaculture

Total damages to aquaculture are estimated at Ar. 141.0 million (US$0.1 million). Damages to aquaculture occurred primarily due to inundation and washing away of the basins (with consequent loss of breeders and fingerlings). For farmers in Alaotra Mangoro, for example, the rate of destruction of aquaculture basins was estimated at 33 percent in losses or an estimated at Ar 7,217.4 million (US$ 4.4 million), primarily due to the loss of a season of fingerlings (for carp) or up to two seasons of production (for tilapia) when floods washed breeders away. Aquaculture prawn stocks are not thought to have been affected.

Macroeconomic impact

The cyclone's negative impact is undeniable with respect to rice production, despite the fact that rice farmers in the Alaotra Mangoro region were pleased with the rains that occurred after Cyclone Ivan, enabling them to complete a crop cycle. Improvement of the situation in this region will not make up for the shortfall at the national level. In any case, the country has decided, as a precautionary measure, to import 50,000 tons of Indian rice.

The impact on the balance of payments is estimated at Ar. 2,519.7 million (US$ 1.5 million), primarily from seed and fertilizer imports (estimated at Ar. 441.0 million), higher sugar imports (Ar. 3,017.4 million) and lower agricultural exports (Ar. 938.7 million). On the other hand, the 2008 cyclones are expected to have a negligible impact on fisheries trade. Most exports from Saint-Marie (in value terms) are deep-water bottom fish and tuna caught by industrial fisheries, which would not have been affected by the cyclones. Aquaculture shrimp stocks, which make up a very significant proportion of Malagasy fisheries exports, are not believed to have been affected and shrimp fisheries were closed at the time of the cyclones. The impact on the fiscal sector is estimated at Ar. 10,407.0 million (US$6.3 million) primarily from higher public expenditures in irrigation rehabilitation.

Socioeconomic Impact

Inputs, including seed, fertilizers and insecticides, are available on the market, which does not seem to have experienced any local price increases. The socioeconomic impact on fisheries, although localized, was substantial for the fishing families, which lost their assets, and for the regions they supplied. This impact includes: (i) food supply; (ii) income and employment; and (iii) prices of fisheries products. For most fishing families, fish is the only source of animal protein. The impact on fish consumers is also expected to be significant. Since the road to the Tanambao Port in Belo was cut off, collectors are likely to have passed the 33% increase in transport costs to consumers in Antananarivo, since the stiff competition among them prevented them from passing this margin on to the fishers.

The impact on income and employment was also significant for fisher families. For the majority of fishers who engage in fishing as a primary occupation, this activity provided nearly all of the family revenue. Prices of fisheries products fluctuated widely during the cyclone, increasing due to scarcity and then stabilizing soon afterwards. Exceptions were noted in Sainte-Marie, where prices for octopus, squid, and lobster dropped for ten days due to the closure of the plant.

Risk management issues

Depending on the region, crop damage, especially to rice paddies, was essentially attributable to high and varied lengths of prolonged flooding. Compliance with basic rules—such as preventing cattle from grazing on dikes, or refraining from cultivating off-limit lands around dams—has yielded good results in terms of the maintenance of hydro-agricultural infrastructures. Brushfires are to be avoided, as they remove plant cover that encourages the infiltration of water that will then replenish springs. Erosion is quite severe throughout the Central Highlands, and in the region of Alaotra Mangoro in particular.

For agriculture crops, a strategy of agriculture diversification is recommended in high-risk regions, along with the progressive introduction of short-cycle and inundation resistant rice seed varieties, in collaboration with research institutes such as the International Rice Research Institute (IRRI) and the Centre National de la Recherche Appliquée au Développement Rural (FOFIFA).

In the livestock sub-sector, strategies for risk management should involve training of farmers' associations in construction of stronger (cyclone-proof) livestock shelter, and promotion of short-cycle resistant livestock (e.g. ducks, geese) in high-risk areas.

Much of the damage to traditional fisheries occurred due to three factors: (a) traditional beliefs, such as in Saint-Marie, where fishers refused to heed early warnings, thinking that a cyclone could not follow in the wake of a storm; (b) fear of collecting the nets, such as in Fenoarivo-Est, where fishers were warned, but were afraid to venture out to sea to collect them; and (c) absence early warning systems, such as in some very remote coastal villages in Menabe, which lack radio access. Three risk management measures seem therefore essential to avert future damages:

- Extending the training in cyclone risk management for BNGRC;
- Providing early warning materials to remote coastal *Fokontany* and villages (particularly in Menabe and Melaky); and
- A medium-term development program to help fishing associations better manage their resources (such as the ADB project, or PSDR, in Toliary), and gradual replacement of wooden pirogues with larger, safer non-motorized fiberglass vessels.

The first two strategies are specified further in Section IV. The third is outlined below, along with Recovery and Reconstruction Needs for the Agriculture and Livestock sub-sectors.

Recovery and Reconstruction needs

Apart from such urgent activities as the filling-in of dike breaches under the Food-for-Work (FFW) program, especially in the regions of Analanjirofo and Alaotra Mangoro with help from either national and international NGOs or the relevant ministry, other important activities—falling under early recovery and reconstruction—need to be carried out in each sub-sector.

In the **Irrigation sub-sector**, early recovery entails urgent works to prevent damage to rice paddies located downstream from ruptured canals during the next inundation period, and desiltation works. The cost of these works is estimated at Ar. 3,125.8 million and, over the entire rehabilitation period, at Ar. 10,407.3 million (US$6.3 million).

Rehabilitation needs to be carried out in close collaboration with water users' associations [*Associations des usagers d'eaux* (AUE)]. Informational visits among AUEs are an effective means of persuasion; the successful example of a technical unit working with AUEs to manage the Bas Mangoky perimeter should be further developed.

Amongst the early recovery strategies in the **Agriculture sub-sector,** is the urgent recovery of the rice, maize and other crops (according to the regional priorities) involving the distribution of rice, maize, potato and other seeds, accompanied by pesticides and farming materials to affected farmers, and food crop seeds to women's associations. This distribution will be accompanied by technical outreach by Ministry agents, promoting the System of Intensive Riziculture (SIR) on the basis of better water management and weeding. The seeds will be reimbursable at the time of harvest to establish pre-positioned seed stocks in these areas. The creation of village nurseries will also be supported to enable farmers to re-establish litchi trees, banana groves, breadfruit trees, and clove bushes that were destroyed by the cyclone. This program of early recovery is estimated to cost Ar. 978.8 million (US$0.6 million).

A second program of early recovery is the gradual multiplication and introduction of short-cycle rice seed varieties in the five regions at highest risk: Analanjirofo (including Maraontsetra), Menabe, Atsinanana, Vatovavy Fitovinany and Sud-Est. Under this scheme, the seeds would be purchased from farmers growing and multiplying the initial varieties. The costs are estimated at Ar. 575.9 million (US$ 0.3 million).

Figure 41: Damage to diversion dike, Menabe region

Amongst the programs of medium-to-long term recovery are the introduction of new varieties of rice resistant to inundation, originating from IRRI (Philippines) in partnership with FOFIFA. Field tests in five districts are envisaged following quarantine in experimental centers and directly with farmers. This introduction is estimated to cost about Ar. 40 million (US$ 24,000).

Finally, an agriculture diversi-fication and adaptation to climatic conditions program is proposed amongst farmers' organizations in the regions of Atinanana, Menabe, Alaotra Mangoro, Analanjirofo, Diana, Atsimo Atisnanana, Boeni, Sofia and Melaki. This program, for an estimated amount of Ar. 1,840 million or US$ 1.1 million (about 230 farmers' associations), envisages the improvement of fruit trees such as breadfruit, banana, and litchi, the introduction of small sized but highly productive species combined with early harvest rice to enable farmers to reap double harvests and combine them with improved livestock farming (such as poultry, goats, or pigs). This type of project could be eligible under the Agriculture Sector Program or PSDR.

Proposed medium-to-long term rehabilitation needs in the **livestock sub-sector** involve primarily the mainstreaming of risk management principles in livestock projects in high risk areas. Thus, in regions such as Menabe, Analanjirofo, Atsinanana, Alaotra Mangoro, Haute Matsiara, Amoro'I Mania, Boeni, Sofia, and Diana, a program of approximately Ar. 320 million (US$ 0.2 million) is proposed to assist livestock associations to strengthen livestock shelters against cyclone winds and inundations, favor short-cycle species, and improve risk awareness.

Recovery needs in the **fisheries sub-sector** can be divided as follows:

1. An asset replacement program for traditional fisheries on St. Marie (the most affected area) covering 37 villages), for an estimated total of Ar. 16 million (US$ 10,000).

2. Aquaculture: An asset replacement program covering roughly 50 percent of the lost carp and tilapia breeders, for an estimated total of Ar. 20 million (US$ 12,000).

3. A medium-to-long term Recovery Program of Support to Fishing Associations in high-risk regions, estimated at about Ar. 1,680 million (US$ 1.0 million). The objective would be to gradually replace wooden pirogues with more sustainable and durable fiberglass canoes, build the capacity of fishing associations to manage coastal resources, and strengthen their disaster management practices.

Table 31 below summarizes the proposed program needs.

Table 31: Summary of Recovery and Rehabilitation Needs and Costs (Agriculture Sector)

Nr.	Program	Cost (Million Ar)
1	Rehabilitation of Irrigation Infrastructure	10,407.3
2.	Distribution of Seeds Amongst Most Affected Groups	978.8
3.	Multiplication of Improved Rice Seeds	575.9
4.	Introduction of Inundation-Resistant Rice Seeds	40.0
5.	Development of Diversified Agriculture Adapted to Climatic Conditions	1840.0
6.	Fisheries Asset Replacement in St. Marie	16.0
7.	Breeders Aquaculture Replacement	20.0
8.	Support to Fishers' Associations	1,680.0
9.	Support to Livestocks' Associations	320.0
	TOTAL	**15,878.0**

Table 32 summarizes the financial needs for early recovery for each agriculture sub-sector

Table 32: Recovery and Rehabilitation Needs for the Agriculture Sector (Ar. Millions)

Subsector	Recovery and Reconstruction (Ar. millions)		
	Early recovery	Medium- to long-term recovery	Total
Agriculture	1,554.7	1,880.0	3,434.7
Irrigation Infrastructure	3,125.8	7,281.5	10,407.3
Livestock	320.0	-	320.0
Fisheries	36.0	1,680.0	1,716.0
TOTAL	**5,036.5**	**10,841.5**	**15,878.0**

Critical Need to Reconstruct Irrigation Infrastructure

The rehabilitation of irrigation networks used mainly for rice-growing is crucial, as it will support self-consumption by producers and make surpluses available for urban markets.

In this connection, relative priorities have been weighed with regard to the large perimeters (e.g., in the Menabe region) and regions suffering severe food shortages (e.g., Atsimo Atsinanana). To ensure that interventions are coordinated, the reconstruction will evolve closely with the Ministry of Agriculture's new rehabilitation objective under the Irrigation Network Maintenance Fund [*Fonds d'entretien des réseaux hydroagricoles* (FERHA)].

The Government will continue, through the Ministry, to handle maintenance of large works in the perimeters, while AUEs will be responsible for the maintenance of primary and secondary canals. This approach will entail the establishment of the FERHA arrangement, under which the Government, the beneficiaries (i.e.,AUEs), and local governments will draw up an annual performance contracts setting forth the responsibilities of each party for periodic maintenance of irrigation infrastructures.

Industrial and Commercial Sectors

Summary

Like other economic sectors of Madagascar, the industrial and commercial sectors were also affected by cyclones Fame and Ivan. The destruction caused by these two natural disasters is fairly significant, particularly in terms of the damage and losses sustained by microenterprises, small and medium enterprises and industries (SMEs/SMI), and even large enterprises. The overall damages and losses sustained by the Industry sector are estimated at Ar. 2,106.6 million (US$ 1.3 million) and Ar. 20,158.1 million (US$ 12.2 million) respectively. For commerce, the damages and losses are estimated at Ar 742.9 million (US$ 0.5 million) and Ar 7,265.7 million (US$ 4.4 million).

With their higher levels of vulnerability, microenterprises were the most hard-hit, in both the industrial (Ar. 2,082.2 million) and commercial (Ar. 737.3 million) sectors. . This finding, based on an estimate of secondary data (baseline data), obtained from a 2005 INSTAT [National Institute of Statistics] study, which offers the most recent and complete data available, is not really surprising given that the vast majority of commercial and industrial microenterprises in Madagascar are "informal" and have very few resources. Their buildings are basically made of wood and thus offer very little to no protection against the wind or flooding caused by cyclones.

Damage was significantly less in the case of SMEs/SMIs (Ar. 22.0 million in the industry sector and Ar. 5.2 million in the commercial sector), and large enterprises (Ar. 2.4 million in the industry sector and Ar. 0.4 million in the commercial sector) . In the case of large enterprises, not only was direct damage relatively insignificant, but these enterprises were covered by insurance, allowing them to restore the damaged portion of their assets, which is not always the case with SMEs/SMIs, and even less so with microenterprises.

Lastly, it should be noted that the estimate of the damage and losses sustained by the industrial and commercial sectors have led to the identification of new needs that fall into the category of early recovery programs as well as medium- and long-term ones. However, implementation of these recovery and reconstruction programs calls for more in-depth studies in order to make them as effective as possible.

Pre-Disaster Situation

An understanding of the prevailing situation in the industrial and commercial sectors in Madagascar prior to the disasters can be obtained from the information on Malagasy enterprises, as described in the "*2005 Report on Enterprises in Madagascar,*" prepared by INSTAT and sponsored by the Millenium Challenge Account (MCA).

According to this report, information on the enterprises in each region is as follows:

Table 33: Distribution of Investment by Region and Enterprise Type

Region	Investment	Distribution (%)			Rate of Investment (%)			
		Large	SMEs/SMIs	Micro	All	Large	SMEs/SMIs	Micro
Analamanga	1,511,570,505	70.07	22.62	7.30	44.12	168.22	33.42	10.79
Vakinankaratra	4,422,323	43.87	13.45	42.68	6.41	44.77	1.91	6.06
Itasy	14,403 631		7.04	92.96	101.62		10.55	139.36
Bongolava	954,506		4.84	95.16	41.87		3.25	63.92
Haute Matsiatra	16,339,950		70.96	29.04	45.19		59.46	24.33
Amoron'i Mania	441,039	32.54	15.72	51.74	5.00	4.31	2.40	7.89
Vatovavy Fitovinany	1,535,191		78.87	21.13	3.46		7.31	1.96
Ihorombe	231,205		98.63	1.37	10.97		27.34	0.38
Atsimo Atsinanana	406,127		47.25	52.75	9.48		5.91	6.60
Atsinanana	26,544,776	11.40	38.55	50.05	21.71	14.86	15.74	20.44
Analanjorofo	6,275,520	49.19	25.42	25.39	21.39	183.84	6.81	6.80
Alaotra Mangoro	1,936,579		26.10	73.90	3.67		1.56	4.41
Boeny	5,724,230	17.10	56.60	26.30	8.53	18.11	21.91	10.18
Sofia	4,327,802		13.44	86.56	41.36		8.52	54.86
Betsiboka	425,033		74.40	25.60	32.74		44.17	15.19
Melaky	453,883		22.57	77.43	17.68		5.70	19.55
Atsimo Andrefana	34,286,158		9.20	90.80	28.15		3.50	34.53
Androy	100,795		3.88	96.12	3.47		0.19	4.64
Anosy	6,927,659	47.32	39.79	12.88	37.63	269.06	123.55	40.01
Menabe	24,214,800		2.03	97.97	79.28		4.66	225.11
Diana	40,198,521	8.25	82.78	8.97	43.97	105.26	68.58	7.43
Sava	6,142 892	2.99	45.22	51.79	3.43	4.23	2.14	2.45

***Source:* 2005 INSTAT Enterprise Survey**

Although these data correspond to 2005, they are not much different for subsequent years, namely 2006 and 2007, in the case of the 17 regions affected by cyclones Ivan and Fame. In fact, there were no cyclones or floods that were major enough to impact these enterprises during the past two years.

In general, Malagasy enterprises are characterized mainly by microenterprises with roughly ten full-time, non-salaried, male workers involved in commercial activities. The business turnover and value added analysis completes the picture of local firms. The larger the enterprise, the higher the business turnover, while in the case of value added, the relationship is reversed.

According to INSTAT, in 2004, in general terms, formal companies in secondary and tertiary sectors held a total of Ar. 7,380 billion and generated Ar. 4,336 billion in value added. In addition, capital holdings were estimated at Ar. 7.173 billion. Total investment was estimated at Ar. 1,708 billion (US$ 1.0 billion), the size of which can be measured only in relation to the State budget.

From a regional standpoint, the Analamanga region where the capital is located accounts for the highest business turnover and value added figures —80 percent and 79 percent respectively, for the entire country. Analamanga also accounts for 89 percent of all investment.

The Sava region ranks second from the standpoint of value added generation, accounting for 4.1 percent of the overall total. However, the highest investment rates can be found in the Anosy and Menabe regions—269 percent for large enterprises and 123.6 percent for SMEs/SMIs in Anosy, while the rate for Menabe stands at 225.1 percent. The use of personal funds is the most common method chosen to fund investments throughout the island.

Ten of the 22 regions of Madagascar lack any major enterprises. In some regions, companies fail to make any investments over a one-year period. This is the case, for example, with the large enterprises in the Vataovavy Fitovinany, Melaky, and Atsimo Andrefana regions, as well as SMEs and SMIs in the Betsiboka and Androy regions. In other words, the economic base seems weak and very unbalanced.

The overall business environment was assessed through an opinion poll conducted to obtain the views of entrepreneurs on their current situation as well as projections for the future.

Specifically, this situation can be defined using three parameters: development prospects of enterprises, access to credit, and access to land.

In the case of the first parameter, the opinions of entrepreneurs are somewhat divergent. Entrepreneurs in the tertiary sector are more optimistic about the future than those in the secondary sector. However, neither category considers investment to be fully safe.

Among entrepreneurs, 57.5 percent consider competition to be unfair. More than half, however, have noted an improvement in administrative procedures. Without a doubt, the different programs and projects aimed at boosting activity in the Malagasy private sector and the tools introduced to streamline procedures applicable to investors are already producing results.

While the legal provisions and laws in effect are not followed by 40 percent of enterprises, only one-third see globalization as being beneficial. Though this finding is not surprising, it does not, however, mean that all entrepreneurs view globalization as a real threat.

It was noted that 53 percent of companies need credit for investment purposes and are more likely to tap into the banking network. However, in business circles, the opinion of the services provided by the banking network is negative. Furthermore, only 34 percent of credit applications from microcredit institutions are approved (compared to 74 percent for traditional financial institutions). This is attributable to insufficient collateral in 53 percent of the cases involving microfinance and to 62.6 percent of the cases involving traditional institutions. This finding is consistent with the often widespread dearth of funds in business circles in Madagascar.

In addition, it should be noted that 52 percent of enterprises own their own land (they have at least one official ownership document). Lastly, fewer than half of companies (43 percent) have no opinion on land policies and investment in Madagascar.

In light of the foregoing, industrial and commercial enterprises in Madagascar, despite administrative problems or difficulties associated with the business environment, seem to manage to get by, even though their contribution to national wealth still remains relatively minor.

Damage and losses

Although the findings of the damage assessment of cyclones Fame and Ivan were supposed to have included the "public property" and "private property" categories, the categories ultimately chosen were "microenterprises, SMEs/SMIs, and large enterprises," owing to the unavailability of relevant baseline data. However, it should be noted that this approach in no way negatively impacted the findings, given that there are very few public enterprises in Madagascar in the wake of the liberalization policy.

As Table 34 shows, total damages caused by the cyclones in the 17 regions affected amounts to an estimated Ar. 2,106.6 million in the industrial sector (US$ 1.28 million), compared to Ar. 742.9 million in the commercial sector (US$ 0,453 million). In terms of losses, the same observation appears—this figure is higher in the industrial sector (approximately Ar. 20,158.1 million or US$ 12.22 million against about Ar. 7,265.7 million or US$ 4.41 million for the commercial sector). All told, the cost associated with damage for all enterprises amounts to approximately Ar. 2.8 billion (US$ 1.73 million) and losses amount to Ar. 27.4 billion (US$ 16.62 million).

Table 34: Damage and Losses for the Industrial and Commercial Sectors

	Disaster effects (Ar. Millions)			Disaster effects (USD millions)			Effects on: (Ar. Millions)	
	Damage	Losses	Total	Damage	Losses	Total	BOP	Fiscal Sector
Subsector, component								
INDUSTRY								
Microenterprises	2082.2	162.4		1.26	0.10			
SMEs/SMIs	22.0	137.2		0.01	0.08			
Large enterprises	2.4	63.4		0.001	0.04			
Sub-Total - Industry	2,106.6	363.0	2,469.6	1.28	0.22	1.5		
Other Losses - Agroindustry		19,795.1	19,795.1		12.00	12.00		
GRAND TOTAL INDUSTRY	2,106.6	20,158.1	22,264.7	1.28	12.22	13.5		
COMMERCE								
Microenterprises	737.3	821.4		0.45	0.5			
SMEs/SMIs	5.2	361.6		0.003	0.22			
Large enterprises	0.4	27.5		0.000	0.02			
Sub-Total commerce	742.9	1,210.5	1,953.4	0.453	0.74	1.19		
Other Losses - Commerce		6,055.2	6,055.2		3.67	3.67		
GRAND TOTAL COMMERCE	742.9	7,265.7	8008.6	0.453	4.41	4.86		
TOTAL Industry and Commerce	**2,849.5**	**27,423.8**	**30,273.3**	**1.73**	**16.62**	**18.36**	**0.0**	**64.70**

Risk Management Issues

In light of the findings related to the damage caused by the two cyclones mentioned above, risk management issues are equally important for the industrial and commercial sectors. However, for both sectors, the issues pertaining to risk management at the microenterprise level are clearly more important, in view of the fact that this category is composed mainly of small wooden structures which are thus much more vulnerable to wind and flooding. Furthermore, these small structures are built without observance of codes and are not in keeping with city plans, in the instances where such plans exist. Consequently, their level of exposure to risk – in particular to cyclone wind and flooding – is in general very high.

SMEs/SMIs and large enterprises, on the other hand, are generally permanent or semi-permanent structures, hence with a lower level of risk. The biggest issues for these two categories of enterprises in the industrial and commercial sectors relate more to infrastructure and energy. Indeed, these two factors often lead to very significant damage and losses, particularly with respect to stocks and the pace of business activity in the wake of cyclones.

Lastly, unlike large enterprises, microenterprises and SMEs/SMIs often have no disaster insurance, either because of a lack of funds or simply because they are unaware of this option.

All of the above leads us to conclude that the industrial and commercial sectors are highly dependent on the other sectors, in particular the agricultural sector for which household risk and vulnerability have an almost automatic impact on the two sectors being considered here. However, the damage and losses borne by these sectors often pose a particularly serious risk to economic growth and thus to the development of the country.

Governance Issues

In the case of the commercial and industrial sectors, the main governance issues continue to be the dearth of material and human resources that prevent the State and parastatal institutions from properly assuming their responsibilities when disasters strike. This observation is applicable to both deconcentrated agencies and decentralized territorial administrations. Indeed, even though their roles are fairly clear, their disaster response is often quite slow, a factor that tends to heighten the already critical levels of vulnerability of households and many small commercial and industrial enterprises.

Recovery and Reconstruction Needs

In light of the vulnerability of the industrial and commercial sectors, and particularly of industrial and commercial microenterprises, consideration should be given to some degree of assistance to their restoration to pre-disaster conditions. However, they face the same perverse incentives as private dwellings (see Housing Section). Hence, the measures proposed below are primarily

designed to enhancing the risk management behavior, business entrepreneurship and ultimately the resilience of private commercial and industrial enterprises We also note that although early recovery needs should cover only the 17 regions that were recently affected for emergency reasons, the medium- and long-term program needs should, however, cover all 22 regions of Madagascar, given that they too could very well be impacted at some point in the future.

Lastly, we note that implementation of these programs, whether short-, medium-, or long-term, should be part of the overall policy as well as the sectoral policies of the State, with a view to enhancing their effectiveness and outcomes.

Table 35: Recovery and Reconstruction Needs for the Industrial and Commercial Sectors

	Recovery and Reconstruction (Ar. Million)			USD (millions)
	Early Recovery	Medium/Long Term Recovery	Total	Total
Subsectoral Needs				
Industry and commerce				
Microenterprises, SMIs/SMEs:				
Business management technical assistance, to be provided in the event of disasters and crises, oriented toward enhancing the level of professionalism of jobs and the productivity of these enterprises:				
Present and future entrepreneurs' sensibilisation, information and counseling activities enhancing the level of their business safety.		250.0	250.0	0.15
05 specific training modules for each of the 5 Regions (Analanjirofo, Alaotra-Mangoro, Vatovavy Fitovinany, Haute Matsiatratra, Sofia) according to the entrepreneurs'needs.		200.0	200.0	0.12
Creation of 5 Business centers (1 per Region) within the 5 most affected Regions which do not have yet (Analanjirofo, Alaotra-Mangoro, Vatovavy Fitovinany, Haute Matsiatratra, Sofia)		500.0	500.0	0.30
Total		**950.0**	**950.0**	**0.58**

Tourism

Summary

Recognized as one of the world's richest countries from an ecological standpoint, Madagascar is a very small country with vastly different habitats and a large number of native species. The island is well known for its rich fauna and flora (Figure 42).

The 2008 cyclone season damages were estimated at Ar. 664.2 million (US$ 0.4 million) mainly consisting of private sector infrastructure. The most affected region was Analanjirofo with 56.8 percent of the total damages. Losses in revenue arising from the disaster in the entire country were estimated at Ar. 25,228.0 (US$15.3 million). Recovery needs are estimated at Ar. 285.5 million (US$ 0.2 million), covering primarily promotional activities (organization of educational tours, road shows, and participation in tourist fairs). The other needs identified in the tourism sector are focused on the rehabilitation of roads which is already integrated in transport sector.

Figure 42 : The alley of the Baobab, one of the main tourism attractions of Madagascar, which was affected by the 2008 Cyclones

Pre-disaster situation

Madagascar has a variety of different landscapes that offer great tourism potential. It is a country of contrasts, with mountains that soar to 2,800 m in the highlands, vast savannahs, tropical forests with perennial vegetation, and fertile plains with terraced rice fields. The country also has 5,000 km of coastline, a large part of which is protected by coral reefs and where tropical islands with beautiful white sand beaches abound. A spectacular limestone landscape, underground rivers, and a host of caves in a number of the western regions also add to the diversity of the country's natural resources. Madagascar's ecological diversity and its unique flora and fauna are among the island's main attractions. In addition, each part of the island is associated with a different type of vegetation and contains a variety of native species (palm trees, bamboo groves, ferns, orchids, baobab species, cactus, and other succulent plants). Close to 80 percent of Madagascar's plants are native. This percentage is even higher in the case of its fauna. The big island is a paradise for ornithologists and bird lovers, with approximately 250 species of birds, 106 of which are endemic. The same applies to 98 percent of the reptiles and amphibians in the country, which include chameleons, geckos, crocodiles, tortoises, and serpents. Approximately 92 percent of fresh water fish are also endemic, while the coral reefs along the coast are home to a staggering array of marine life. The forests, deserts, and

waterways of Madagascar contain rare and exotic species, the most famous of which are lemurs—Madagascar is the only country where they all reproduce in the wild. Madagascar is home to 90 percent of the world's lemur population.

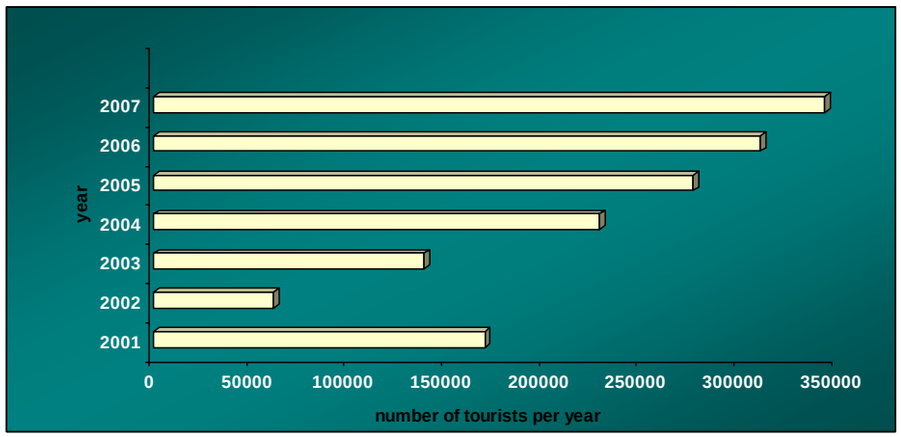
In 2007, according to the records of the tourism sector, there were approximately 344,348 arrivals of non-resident visitors (60 percent of this number being tourists), bringing about SDR 211 million in revenues (US$306 million, or Ar. 504.9 billion). The sector employed about 24,365 direct jobs, and occupied 13,340 rooms, 1,181 guest houses, 825 travel agencies and tourist-related services.

Over the past seven years (2001-2007), tourism-related activities have expanded by 102 percent Despite the 2002 crisis, the pace of increase accelerated to 98 percent during 2003-2005. In fact, while in 2004 the average number of tourist visitors to Africa increased by 7 percent, in Madagascar this rate was over 12 percent. Table 36 and Figure 46 below reflect this trend.

Table 36: Breakdown of Tourist Arrivals

	2001	2002	2003	2004	2005	2006	2007
TOTAL	170,208	61,674	139,230	228,784	277,052	311,730	344,348

Figure 46: Breakdown of Tourist Arrivals (2001-2007)



Estimation of Damages and Losses

Damages

The wind and high waves devastated the east and south-east coast of Madagascar, in particular Saint Marie, East Fénérive (Analanjirofo region), and Morondava (Menabe Region). Damage in the remaining parts of Madagascar was not significant. Direct damage to tourism infrastructure was noted in the regions visited. In some instances, this infrastructure constituted the main basis of the local economy.

Figure 47: Destruction of Girofle Beach site in East Fénérive

Figure 48: Destruction of hotels on stilts in Saint Marie

(a) Hotels along the coastline such as in East Fénérive (see Figure 47, which were exposed to wind and waves were completely destroyed—roofs blown off, walls collapsed, property (mattresses, beds, blankets, kitchen utensils, etc.) swept away by the sea, and water and power supply cut off.

(b) Hotels built on stilts (Saint Marie, see Figure 48) were totally destroyed, foundations were completely undermined, and all contents of buildings lost.

(c) Tourist equipment such as toboggans, boats, generators, chalets, and the bridge sustained damage.

(d) Some tourist facilities were also affected. For example, entrances to a number of locations such as Camp Bandro in Ambatondrazaka and "Allée des Baobabs" in Morondava sustained damage.

The total damages to the tourism sector resulting from the 2008 cyclone season are estimated at Ar. 664.2 million (US$ 0.4 million).

Losses

Losses resulting from the cyclone include the following:

(a) The temporary closing of facilities as a result of the destruction of the natural environment that supports tourist activities (in particular, beaches).

(b) The reduction of arrival of foreign tourists and hotel occupancy during the first quarters of the year and a corresponding decline in revenue. The projected recovery period is five months, which corresponds to the time needed to get things back in order for the seasonal period of July.

(c) Additional expenses related to cleaning of locations and labor to rebuild buildings and restore equipment.

The estimated losses for the 2008 cyclone season are Ar. 25,228.0 (US$ 15.3 million).

Figure 49: Trends in the number of tourists in relation to the norm and projection of the number of tourists in 2008

Table 37: Damage and Losses for the Tourism Sector (Ar. Millions)

	Disaster Effects			Ownership by Sector		Effects on:	
	Damage	Losses	Total	Public	Private	BOP	Fiscal Sector
Buildings	95.1			11.5	83.6		
Tourism boats	569.1				569.1		
Revenue losses		25,228.0	25,228.0	189.0	25,039.0	25,228.0	2,018.2
Total	**664.2**	**25,228.0**	**25 892.218**	**200.5**	**25,691.7**	**25,228.0**	**2,018.2**

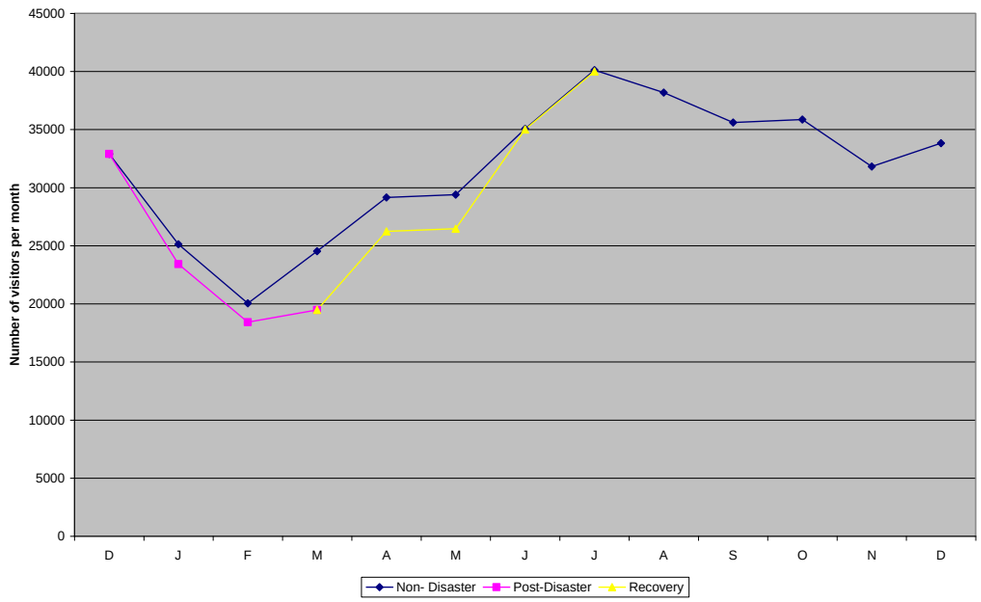


Figure 49 shows a 44 percent decline in the number of tourist arrivals over a two-month period (December and January). Beginning in March, the situation began to improve and based on projections, full recovery is expected to be achieved by July 2008.

Macro-economic impact

The impact on the balance of payments from tourism revenue losses is estimated at Ar. 25,228.0 million (US$ 15.3 million). Losses to the fiscal sector are estimated at Ar. 2,018.2 million (US$ 1.2 million).

Socioeconomic impact

Owing to the absence of visitors during the immediate post-cyclone period, female vendors who sell their products in booths at tourist sites were unable to generate any revenue.

Risk Management Issues

It should be noted that most of the bungalows that were destroyed are located in areas designated as "*pas géométriques*[19];" consequently, they are built from local or semi-permanent materials in order to comply with legislation governing construction in these areas.

In order to minimize damage to equipment, appropriate instructions must be followed and observed at each alert level from the time a cyclone warning is issued. In order to shorten the recovery period, hotel lending arrangements should be put in place (including loans at competitive rates, establishment of a central buying site, etc.).

Governance Issues

The main governance issues for the tourism sector are the maintenance of smooth and regular communication during disasters between the authorities, population, and tourist operators, particularly for those located on the coast and close to zones at risk.

Recovery and Reconstruction Needs

The total needs for recovery and reconstruction are concentrated in the early recovery period and are summarized in Table 38.

Table 38: Recovery and Reconstruction Needs for the Tourism Sector (Ar. Millions)

Subsectoral needs	Recovery and Reconstruction (Ar. millions)		
	Early Recovery (Ar. millions)	Medium-/Long-term Recovery	Total
Increase in promotion activities (organization of educational tours, road shows, and participation in tourist fairs)	285.5		285.5

[19] [Translator's note:] Land controlled by the Government and declared to be in the public domain.

Infrastructure

Transport

Summary

The 2008 cyclone season resulted in damages to the transport sector estimated at Ar. 55.4 million and losses of about Ar. 20.1 million. Most damages (Ar. 52.9 million or 95 percent) were to roads and bridges—in particular bridge toppling, destruction of metal culverts, erosion of bridge and sand embankments. Serious erosion in the watersheds is exacerbating the problem of flash floods which in turn damage the transport infrastructure. As measures of risk management, it is recommended that 1 in 100 year safety levels be adopted as a minimum if the structure is of primary importance (for example, along national roads), and 1 in 50 if it is of secondary importance. For bridges, the standards should be 1 in 100 years for the overall bridge structure and 1 in 300 for the bridge platform. The identified recovery and reconstruction needs for the sector—applying cyclone norms for bridges and reconstructing roads to cyclone standards (with measures of risk management)—are estimated at Ar. 110.9 million or US$67.2 million.

Situation Prior to disaster

The transport sector consists of four subsectors:

- Road;
- Rail;
- Maritime and river; and
- Air.

Road subsector

This is the most widely used mode of transportation, accounting for nearly 90 percent of total domestic transport, and carries tremendous economic weight in the movement of goods and persons. It relies on a large number of operators—close to 20,000—of whom 75 percent are engaged in public transportation of travelers.

The road system falls into three categories:

- The network of national roads, connecting either two Autonomous Province seats or an Autonomous Province seat and the seat of one of the regions, and covering a total distance of roughly **7,200 kilometers**;
- The network of provincial roads, connecting a *Fivondronampokontany* seat to the seat of a Municipality (rural feeder and service roads supporting agricultural activities) and

covering a total distance of **16,750 kilometers**, of which 95 percent are earth roads and the rest paved; and

- The network of municipal roads, connecting one Municipality to another, whether urban or rural.

The road system is characterized by gradual degradation due to obsolescence, overloaded vehicles, and a lack of maintenance. However, it does permit free movement of goods and persons, except for a few sections of the east coast where travel is difficult during the rainy season.

Rail subsector

The rail system includes 895 kilometers of main track, split between two systems that are not interconnected; both systems are single-track and metric-gauge. They cross very hilly terrain where the differences in altitude exceed 1,300 meters.

(a) Northern rail system

The northern rail system, by far the largest in terms of distance and economic importance, interconnects four regions: Analamanga, Vakinankaratra, Alaotra-Mangoro, and Atsinanana.

It includes three lines:

- The Tananarive-East Coast (TCE) line, measuring 377 kilometers, which connects Antananarivo to the Port of Toamasina via Moramanga (hydrocarbons, containers, construction materials, food products, fruits, etc.) and provides service to regions not served by National Road RN 2;
- The Tananarive-Antsirabe (TA) line, 153 kilometers in length, connecting Antananarivo to the Integrated Growth Pole of Antsirabe (hydrocarbons, cement, food products, fruits and vegetables, etc.); and
- The Moramanga-Lake Alaotra line, 168 kilometers in length and connected to the TCE line, linking the three regions to the rice-growing region of Ambatondrazaka (hydrocarbons, rice, chromite, etc.).

The main activities of the northern rail system are limited to cargo transport at the present time. Passenger transport will resume in March 2008 on the TCE line from Toamasina to Moramanga, with three round trips weekly.

Table 39: Cargo transport on the northern rail system (in metric tons)

	2005	2006	2007
Hydrocarbons	48,368	61,913	67,681
Ores	93,701	104,938	127,030
Containers	37,238	19,024	16,262
Cement	16,343	28,609	23,832
Grains	21,246	36,102	32,903
Construction materials	2,929	1,439	42
Other	16,630	32,408	33,087
Total	236,455	284,433	300,837

Source: Madarail

Madarail holds a concession to operate the northern system.

(b) Southern rail system

The southern rail system consists of a single line, the Fianarantsoa-East Coast (FCE) line, which is 163 kilometers in length. It connects the seat of Haute-Matsiatra Region to Manakara, a port in the Vatovavy-Fitovinany Region.

This system provides service to regions not served by National Roads RN 25 and 45 (staple goods, hydrocarbons, coffee, food products, fruits and vegetables, etc.), with a schedule of three round trips per week for lack of rolling stock.

Table 40 : Cargo transport on the southern rail system (FCE) (in metric tons)

	2005	*2006*	*2007*
Coffee	1,176	843	686
Hydrocarbons	85	88	67
Fruits and vegetables	12,728	10,341	9,554
Rice	1,630	1,110	885
Food products	918	781	533
Other	2,732	3,097	2,963
Total	19,269	16,260	14,688
Number of passengers	207,159	175,854	143,015

Source: RNCFM / FCE

The Malagasy Government operates the southern rail system through *Société d'Etat du Réseau National des Chemins de Fer Malagasy* (RNCFM).

Maritime and river subsector

Since Madagascar is an island, most of the country's trade involves maritime transport, which plays a crucial role in the Malagasy economy.

Madagascar has 17 seaports, classified as major ports (Toamasina), secondary long-haul ports (Toliary, Antsiranana, and Mahajanga), and secondary coastal shipping ports. Toamasina is the load center port, handling most imports and exports (70 percent of total traffic).

Table 41 : Cargo transport (Port of Toamasina and Madagascar total) (in metric tons)

Year / Type	2005		2006		2007*	
	DC	HYDRO	DC	HYDRO	DC	HYDRO
Toamasina	1,404,900	637,654	1,279,403	574,901	226,790	0
Total	2,235,969	801,228	1,873,547	731,292	640,151	101,215
	3,037,197		2,604,839		741,366	

DC: dry cargo; HYDRO: hydrocarbons
**Data for the first half of 2007*
Source: Port, Maritime, and River Agency (APMF) – Ministry of Transportation

Coastal shipping in the country is performed by ships that belong in all cases to private concerns but sail under the Malagasy flag.

River transport is fairly limited. Two or three rivers permit relatively safe navigation. The Pangalanes Canal serves east coast regions along a 400-kilometers stretch, from Toamasina to Mananjary (staple goods, food products, fruits, etc.).

Air subsector

Madagascar has 55 airports and airfields open to public air traffic, classified as primary and secondary airports.

Twelve primary, Category I airports are managed by ADEMA [*Aéroports de Madagascar*], a semi-private corporation: Ivato, Antsiranana, Fianarantsoa, Mahajanga, Mananjary, Morondava, Nosy-Be, Sainte-Marie, Sambava, Toamasina, Taolagnaro, and Toliary.

The bulk of the traffic consists of passenger traffic. The growth in international traffic is largely due to an increase in the number of tourists (60 percent of passengers take international flights). The preferred destinations of tourists are: Antsiranana, Nosy-Be, Saint-Marie, Morondava, Toamasina, Toliary, and Taolagnaro.

Table 42 : Number of passengers (boarding and landing)

	2005	2006	2007*
1- Long distance (international flights)			
Air Madagascar	103,234	115,186	112,165
Other	133,408	165,065	162,739
2- Regional (Indian Ocean – Africa)			
Air Madagascar	106,978	110,759	121,407
Other	86,176	92,951	101,940
3- Domestic (local flights)			
Air Madagascar	384,625	373,841	375,769
Total	814,421	857,802	874,020

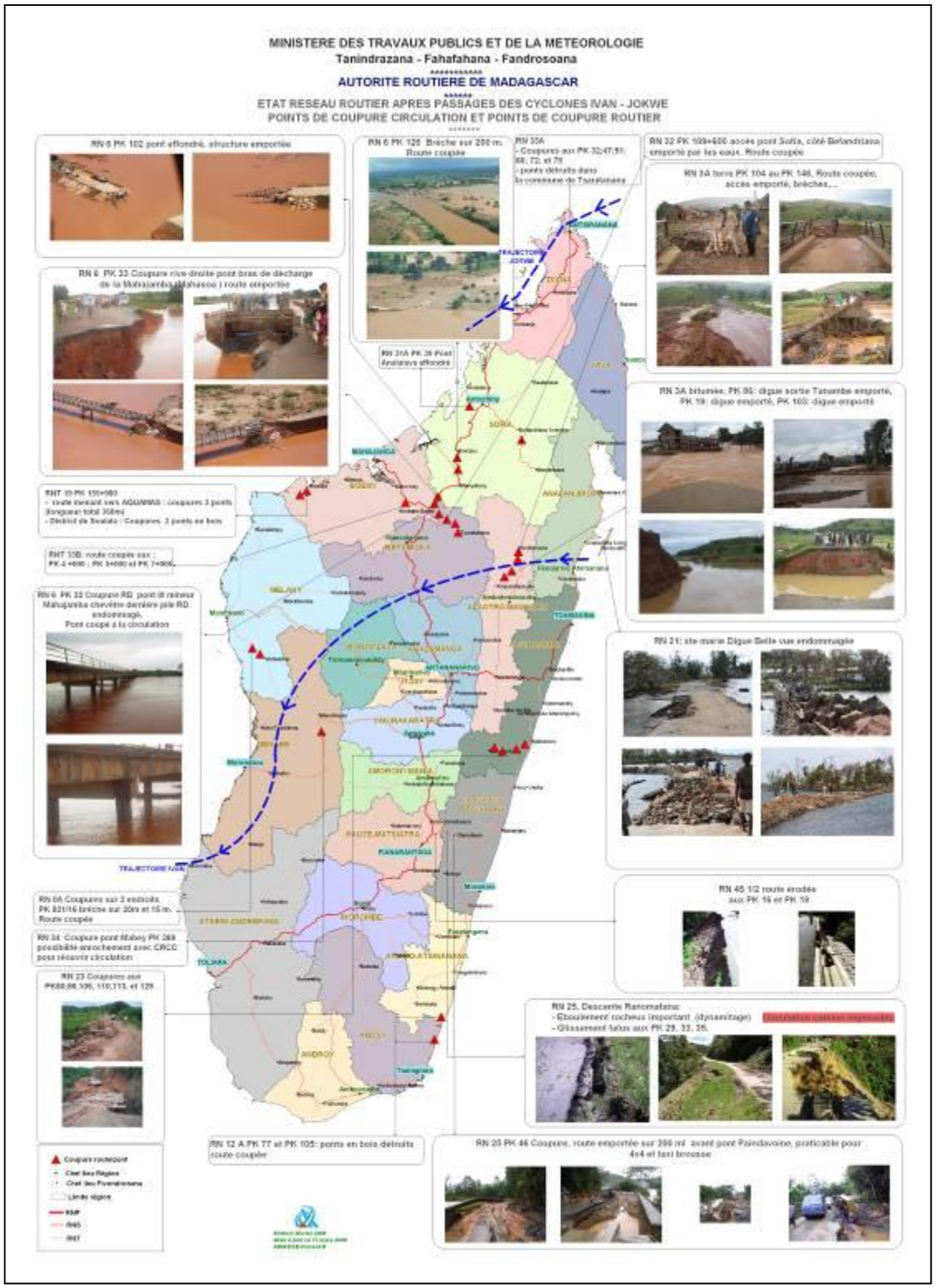
**Data from January to November 2007*
Source: ACM and Air Madagascar

Domestic transport is provided by *Société Nationale des Transports Aériens Air Madagascar*. This company operates international flights and regional flights within the Indian Ocean and Africa, alongside other foreign companies (Air France, Air Mauritius, Air Austral, South Africa Airlines, and Air Comores).

Damage and losses

The two cyclones, Fame and Ivan, battered Madagascar and had a serious impact on the transport sector. Eleven of the 22 regions suffered major damage to transport infrastructure (see Figure 50).

Figure 50 : Location of Damages to Transport Infrastructure



The most serious damage was suffered by the road sector, with roads left impassible for several days or even months in some towns.

The damage inflicted on the road sector mainly involved:

- caved-in areas, undermining of embankments, and roadway slippage
- mud and fallen trees on the roadway
- breaches
- cut-off roads
- eroded roads and alluvial deposits

The damage to road system structures can be summarized as follows:

- sand deposits around bridges
- destruction of bridges
- erosion of bridge embankments
- destruction of metal culverts
- submerged aprons
- cracked joists in BA because one of the bridge supports was toppled
- undermining of bridge abutments

For cities, the main damage involved:

- flooding of cities and roads due to bursting dikes
- coastal erosion due to waves and sea surges from the cyclones
- sunken roadways, roads covered with sand and mud

It was very difficult to estimate losses in this sector because of the lack of baseline data at the regional level and the absence of much up-to-date data at the national level. The costs of construction in the estimates do not take into account the amount of time needed to find financing, nor the procedures for obtaining same. Based on these assumptions, losses in the transport sector are estimated at Ar. 20,083.6 million (US$ 12.2 million).

Figure 51 : Damages to RN 25

In essence, the government incurred all of the damages (Ar 55 383.6 million), while the majority of the losses were incurred by the private sector (Ar. 20,083.6 million).

Table 43 : Damage and losses in the transport sector (Ar. Milions)

SUBSECTORS	DAMAGE	LOSSES	TOTAL	Ownership by sector		Effects on:	
	Amount (Ar. millions)	Amount (Ar. millions)	(Ar. millions)	Public	Private	BOP	Fiscal Sector
Roads and bridges	52,919.3	17,317.8	70,237.1	52,919.3	17,317.8	43,547.00	
Rail	1,987.3	295.8	2,283.1	1,987.3	295.8	1,529.67	
River	3.3	2,400.0	2,403.3	3.3	2,400.0	961.32	
Airport	390.0	70.0	460.0	390.0	70.0	437.00	
Port	83.7		83.7	83.7		79.52	
TOTAL	55,38.6	20,083.6	75,467.2	55,383.6	20,083.6	**46,554.51**	**63,899.7**

Macroeconomic Impact

For the transport sector, the cyclone damage had an impact on the balance of payments due to the increased volume of imports of equipment and construction materials to replace destroyed infrastructure. Furthermore, traditional exports shrunk as a result of production losses in the regions affected by the damage. This holds true, for example, in the city of Mahajamba, home to Aqualma corporation, Madagascar's leading exporter of shrimp.

In addition, sector employment and income suffered a substantial decline, especially during the time when roads were cut off. This was the case in flooded villages where rice fields and other farm fields were covered with sand.

Finally, a drop in production occurred in almost all the flooded cities, due to a temporary decline in the labor force and the destruction of arable land. The decline in the labor force is partly the result of the fact that the population focused its efforts on the reconstruction of housing and the repair of road infrastructure, as in the case of the fokonolona of the city of Marolambo. Also, eight deaths were recorded in this city when the waters rose.

In view of the preceding, there was a considerable spike in the cost of living in almost all these cities. In Marolambo, for example, the price of rice nearly tripled. Since rice is the staple food in Madagascar, the increase in its price resulted in a general increase in the cost of living.

The estimated impact on fiscal sector was Ar. 63,899.7 million (US$38.7 million).

Figure 52 : National Road RN 45: Flooded road and bridge and Breach

Socioeconomic impact

In general, the socioeconomic impact of the cyclone damage was felt mostly during the time when roads were cut off, except in the case of villages that remained isolated for several weeks after the cyclones.

In the city of Mahajamba, for example, access has been cut off since mid-February. From a socioeconomic perspective, the main problem for this area and other flooded cities such as Mampikony and Marolambo is the sand deposited in the rice fields and other farm fields. It is estimated that more than half of total output has been lost since the cyclones.

Since the disaster, overland access to these cities is nearly impossible. In the village of Mahajamba, a combination of carts and canoes is being used to transport agricultural and fish products to the large city of Mahajanga. In the city of Marolambo, one 4x4 vehicle per week is used to transport travelers in the area, and the movement of staple goods toward the village and local products away from the village is nearly impossible.

During the flooding, residents fled their village. As a result, students could not return to their classroom until several months after the floods. Even today, access to drinking water is difficult.

Figure 53 : Overturned bridge on RN 6

In the case of roads that were cut off, the flow of products was slowed while they remained cut off – and even afterward, since the corrective measures undertaken to date are only temporary. In the case of the city of Marolambo, for example, the basic health center was relocated in an unsuitable building.

From a health perspective, the spread of diseases such as malaria, diarrhea, and malnutrition-related illnesses has disproportionately affected vulnerable persons (women, children, and the elderly).

Risk management

Every year, Madagascar is prone to cyclones. The negative impact of such calamities, intensified by the climate change which the planet now faces, is growing greater and greater. As a result, actions must be undertaken to minimize the harmful effects of such a disaster. In the case of the transport sector, the infrastructure needs to be strengthened. To that end, the measures described below are recommended.

Road infrastructure

In general, the recommended safety level for all infrastructure except bridges is:

- 1 flood in 100 years if the structure is of primary importance (for example, along national roads)
- 1 flood in 50 years if the structure is of secondary importance

For bridges along national roads:

- 1 flood in 100 years safety level for the overall bridge structure
- 1 flood in 300 years safety level for the bridge platform

In some mountainous areas, serious erosion has developed. Erosion depends on local slopes, soil composition, rainfall patterns, land use, humidity, and vegetation. Overall erosion of the mountains will continue or even increase over time. Accordingly, the recommendation is to protect watersheds and thereby protect infrastructure, farm fields, and surrounding villages.

Figure 54 : Flooding along roadways

A large portion of eroded material is transported by rivers. The sediment carried by rivers results in sand deposits and/or flooding along the watercourse. The recommendation in this case is to implement a program of intensified tracking of the sedimentation process in order to measure the form of the riverbed and regularly check its level after each flood, analyze the size of the deposit and its composition based on samples, monitor surface runoff deposits, and measure deposit concentrations at certain monitoring stations during floods. The data will be used for morphological studies which have the ultimate objective of forecasting future development of the sedimentation process. These forecasts could then be used to estimate any adjustments that need to be made.

To stop riverbank erosion or restore an eroded section, permanent bank protection would be an appropriate action. The type of protection will depend on the local situation.

A study of the local river morphology is recommended to ensure optimal design of the actions described.

Governance issues

The National Risk Management Bureau (CPGU) in the Office of the Prime Minister, established by Decree 2005-866, lays out the implementation arrangements for Law 2003-010 of September 5, 2003 pertaining to national risk and disaster management policy.

Through the assistance of the Global Facility for Disaster Reduction and Recovery (GFDRR a TRACK II steering committee has been working since December 2007 with the goal of setting up a structure and a mechanism in the country for dealing with disasters.

This assistance, scheduled for three years, is very useful because there is a need for improvement in four areas, corresponding to four components of TRACK II, as follows:

- risk assessment
- risk mitigation
- risk management financing
- emergency management

In reality, the government needs a contingency fund in order to work in partnership with international institutions; but such a fund has yet to be set up in the country, and it is the third component listed above that will study the procedure to be envisioned for establishing an appropriate mechanism.

In addition, the second component will focus on the necessary cyclone norms and standards for different types of infrastructure.

Recovery and reconstruction needs

(a) Needs identified on the basis of damage and losses

Damage

It is evident that repairing the damage requires appropriate organization (given the urgency of the interventions) and the availability of special funds. This further requires mobilization of all donors, including local resources.

Figure 55 : Erosion of dikes

To successfully perform the interventions, it will be necessary to identify and mobilize the organizations that will serve as executing agencies. It will also be necessary to mobilize contractors through a media campaign. And in all cases, there is a need to make sure of the availability of local and imported materials to carry out the projects.

Losses

Needs identified on the basis of losses should focus on resumption of the population's normal activities. This means emergency interventions to quickly restore traffic flow (treatment of problem areas that obstruct traffic on road systems, removal of earth and rock from railroad tracks, clearing of airfields for air traffic, etc.). In particular, restoring the traffic of heavy trucks would diminish these losses.

Thus, a reduction in the burdensome travel times caused by losses will be achieved through gradual improvements in the stricken areas.

Finally, an adequate supply of fuel will be important to sustain the mobility of the rolling stock.

(b) Needs in relation to risk reduction

These needs will be based on all the preventive measures to be taken in order to forestall disasters, of which information and awareness plays an important part.

Other measures to be taken are listed below:

- establish an emergency budget
- implement a rapid and effective communication system
- enforce cyclone resistant standards in construction activities
- follow up, if necessary, on earlier studies (particularly hydrological and geotechnical studies) so as to have sustainable technical options
- draw lessons from earlier technical solutions (both effective and ineffective solutions)
- step up construction oversight
- establish a simplified procedure for initiating interventions

(c) Needs in relation to capacity constraints

Inasmuch as disaster management will largely depend on the availability of appropriated funds, it is important to prioritize actions on the basis of damage and losses in order to optimize the available resources.

To carry out the projects, capacity building could be targeted toward:

- existing enterprises, depending on their performance and experience
- oversight agencies
- local skilled labor

Table 44 : Losses estimates for national routes affected by the cyclones (Fame, Ivan)

National Road	Itinerary	In Millions Ar
32	Antsohihy-Mandritsara	653,4
31	Antsohihy-Bealananana	68,6
	Mahajanga-Mahajamba	19,6
23	Mahanoro-Marolambo	51,0
3A	Ambatondrazaka-Vohitraivo	2.147,4
44	Ambatondrazaka-Andilamena	187,8
6	Antsohihy-Ambondromamy	4.527,4
33B	Andranofasika-Ambato Boeny	97,5
25 & 45	Ambohimahasoa-Irondro Alakamisin' Ambohimaha-Vohiparara	3.354,5

Table 45 : Recovery and Reconstruction Needs for the Transport Sector

	Early Recovery	Medium to Long-Term Recovery	Total	Total
Sub-Sector	**Amount (Ar Million)**			**(in US$ '000)**
1. Roads and works rehabilitation (MTPM)	577.5	107,859	108,436.5	65,719.1
2. Railroads Works Rehabilitation (MTPM)	0.0	1,987.3	1,987.3	1,204.4
3. River Traffic Works Rehabilitation (MTPM)	0.0	3.3	3.3	2.0
4. Air Traffic Works Rehabilitation (MTPM)	0.0	390.0	390.0	236.4
5. Maritime Traffic Works Rehabilitation (MTPM)	0.0	83.7	83.7	50.7
TOTAL	577.5	110,323.3	110,900.8	67,212.6

For the Transport sector, the medium and long-term needs for recovery and reconstruction amount to an estimated Ar. 110,900.8 Million (equivalent to 67.2 Million US$) which concern the 7 most affected Regions (Sofia, Atsinanana, Analanjirofo, Alaotra Mangoro, Boeny and Menabe). Roads and bridges account for 98% of the needs (Ar. 108,436.5 million or US$ 65.7 million). Remaining needs include railroad rehabilitation (Ar. 1,987.3 Million or US$1.2 Million), river traffic rehabilitation (Ar. 3.3 Million or US$ 2,000), Air Traffic rehabilitation (Ar. 390 Million or US$ 236,400) as well as Maritime Traffic Rehabilitation (Ar. 83.7 Million or US$ 50,700).

Electricity

Summary

The 2008 cyclone season caused damages in the electricity sector estimated at Ar. 3,502 million (US $ 2.12 million) and losses of Ar. 2,958 million (US $ 1.79 million). About 48.8 percent of the damages and losses were in power production, 7.6 percent in high-voltage lines, and 43.6 percent in distribution lines. Most of the damages occurred in Atsinanana and Analanjirofo the regions due to violent wind gusts. Losses were highest in Analamanga region. Recovery and reconstruction needs include not only the cost of repairing the damages, but also the gradual annual burial of 110 km of aerial electric lines to underground cables and the replacement of wooden poles with concrete pylons for over 50 km of medium-tension electricity lines in high-risk cyclone areas.

Pre-Disaster Situation

JIRAMA (Jiro sy Rano Malagasy) is Madagascar's national water and Power Company. It produces, transports, and distributes electricity and drinking water throughout the country, and provides nearly all public water and power services. The company owns 114 plants, 100 of which are powered by diesel thermal generators and the rest by hydroelectric dams.

Figure 56: Madagascar – Electricity sales, 2001-2007 and 2008

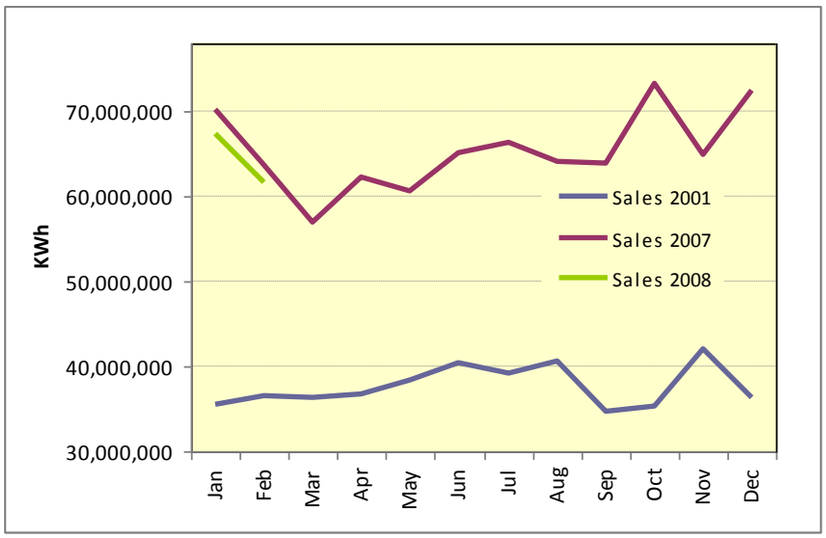


Figure 56 shows the total electricity sales in kilowatts per hour (KWH) for the years 2001, 2007 and 2008. In 2001, Madagascar was not affected by any cyclones, providing a reasonable baseline for what electricity sales could be without any disasters. In March 2007, the country was hit by cyclone Indlala and in February 2008 by cyclone Ivan. There was little change in sales figures between January and April 2001. However, sales for those months when a cyclone hit

dropped in both 2007 (13,157,178 kWh), as they did between January and February 2008 (5,756,678 kWh).

Damage and Losses

Cyclone Ivan struck Madagascar at full force on February 17, 2008 at about 6 p.m., first on the island of Sainte-Marie and then in the districts of the Analanjirofo and Atsinanana regions. High winds ravaged this part of Madagascar, causing significant damage to distribution networks and lines as well as high-voltage lines. Economic losses were also significant; calculated on the basis of the power not distributed to users, duration of the outage, the amount of the network damaged, and the cost of the diesel thermal generators used to operate back-up or reserve power plants in place of the hydroelectric plants shut down as a result of cyclone damage.

Figure 57: Damage to high-voltage and distribution lines

Overall damage and losses in the power sector are estimated at Ar. 6,460.0 million (US$3.9 million), of which Ar. 3,156 million (US$1.9 million) or 49 percent for power production; Ar. 489 million (US$0.3 million) or 7.6 percent for high-voltage lines; and finally, Ar. 2,816 million (US$1.4 million) or 44 percent for distribution lines. Total damages are estimated at Ar. 3,502 million (54 percent) and losses at Ar. 2,958 million (46 percent).

The greatest damage occurred in the distribution network, since this part of the infrastructure is almost entirely above ground and was thus vulnerable to falling trees and the powerful wind gusts accompanying cyclones Ivan and Fame. Damage is estimated at Ar. 2,591.7 million (US$ 1.6 million) and losses at Ar. 224.1 million (US$ 0.14 million).

The greatest losses occurred with respect to power production capability. Following the shutdown of hydroelectric plants in the wake of cyclone passage, diesel thermal plants were required to make up the shortfall, entailing significant fuel costs. Damages in this sub-sector are estimated at Ar. 422 million (US$0.26 million) and losses at Ar. 2,733 million (US$ US$1.7 million).

While high-voltage trunk lines did not sustain any losses, damages are estimated at Ar. 488 million (US$ 0.30 million). Table 46and Table 47 show the total estimated damages and losses to the electricity sector as well as the estimated effect on the Balance of Payments and Fiscal Sector.

Table 46: Damage and losses to the electricity sector (Ar. Millions)

	Disaster effects			Effects on:	
Subsector	Damage	Losses	Total	BOP	Fiscal Sector
Electricity production	422.3	2,733.4	3,155.7		2,733.4
High-voltage lines	488.5		488.5		
Distribution lines	2,591.7	224,1	2,815.8		224.1
TOTAL	3,502.5	2,957.6	6,460.0	5,808.2	2,957.6

NOTE: Assessment based on 2005 JIRAMA price scale

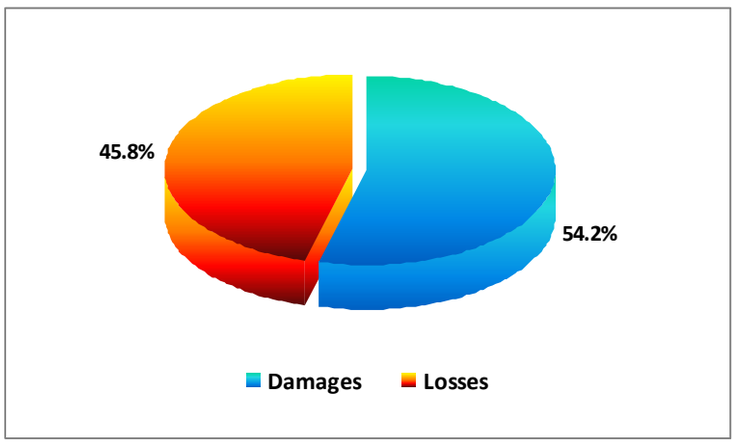
Table 47: Damage and losses to the electricity sector (US$ '000s)

	Disaster effects			Effects on:	
Subsector	Damage	Losses	Total	BOP	Fiscal Sector
Electricity production	255.9	1,656.6	1,912.5		1,656.6
High-voltage lines	296.1		296.1		
Distribution lines	1,570.7	135.8	1,706.5		135.8
TOTAL	2,122.7	1,792.5	3,915.2	3,520.1	1,792.4

NB: US$1 = Ar. 1,650

Damages and losses in the electricity sector are entirely within the public sector, since JIRAMA is a government-run company.

Figure 58: Damage and losses caused by cyclone Ivan



Immediately following cyclone passage, JIRAMA response teams were deployed to the storm-hit areas to restore power to subscribers using spare parts and equipment stored in company warehouses.

In most of the affected areas, service was restored to important and strategic customers (e.g., administrative centers, telecommunications hubs, radio and television stations, etc.) roughly within a week. In the city of Fénérive-Est, most of the power network (production, high-voltage, and distribution) was repaired within two weeks. In Sainte-Marie, power production was operating four days after the passage of cyclone Ivan (i.e., by February 22, 2008). At the time of

the April 28th assessment, repairs to distribution lines were still ongoing to restore electricity to the Hotel Masoandro in the northern part of the city and to two nearby neighborhoods.

The Atsinanana and Analanjirofo regions were most severely affected, due to the violent wind gusts they experienced during cyclone passage. Analamanga received the most losses, however.

Table 48: Damage and losses by region, in Ar.'000

REGIONS	DAMAGE	LOSSES
ANALANJIROFO	926,174.73	123,851.63
ATSINANANA	1,736,689.47	526,508.83
ALAOTRA MANGORO	123,484.56	11,426.28
ANALAMANGA	186,047.24	2,257,635.80
MENABE et VAKINANKARATRA	40,811.77	5,092.92
AMORON'I MANIA	1,025.63	
HAUTE MATSIATRA	79,648.02	
VATOVAVY FITOVINANY	123,319.38	
ATSIMO ATSINANANA	26,272.08	
IHOROMBE	17,535.75	
DIANA	148,692.71	33,045.6
PURCHASE OF POLES	52,276.30	
TRANSPORTATION OF POLES	40,474.61	

Impact on Balance of Payments

The foreign exchange costs of materials to be imported for early recovery is US$1.9 million, or 90 percent of the total amount of damages.

In the category of recovery and medium-term reconstruction, the value of electrical equipment to be imported totals US$1.6 million, consultant fees included. Labor costs account for only 10 percent of the total amount of damages. Nearly all electrical equipment and replacement parts will need to be imported from outside Madagascar.

Socioeconomic impacts and governance issues

Power outages have economic impacts due to the closure of factories and service providers in areas such as telecommunications, computer processing, banks, etc. The back-up generators maintained by companies can ensure only minimal service. The impact also has a social dimension, since the staff of the affected companies are unable to work during the closure period.

There are also issues of risk management and governance, since power outages affecting administrative centers (e.g., at the regional, district, and gendarmerie level), hospitals and water distribution stations can disrupt risk management and disaster-preparedness plans.

Recovery and Reconstruction Needs

Recovery and Reconstruction:

Recovery and reconstruction needs will involve the repair of all damaged power distribution networks. These are estimated at 100 percent of the total damage amount of Ar. 3,502 million (US$2.1 million). Most of the affected plants are just beginning their restoration work and the upgrading to norms.

Risk Management Measures

A pilot project is proposed to develop cyclone resistant norms for the calculation of mechanical stresses borne by medium- and low-tension overhead lines, and identify and assess other preventive measures.

In the interest of improved reconstruction, annual goals include the conversion of 110 km of overhead electric lines to underground lines and the replacement of wooden poles with concrete pylons for over 50 km of medium-tension lines.

Table 49 : Risk reduction measures

	Total (Ar. Million)	Total in US$'000
Pilot project	495.0	300.0
Conversion from overhead to underground	1,440.1	872.8
Replacement of wooden poles with concrete pylons	720.9	436.9
TOTAL	2,656.0	1,609.7

Source: Consultant to JIRAMA General Directorate

Table 50: Medium/Long Term Recovery and Reconstruction Needs for the Electricity Sector

Type of Need	Ar Million	US$ 000
Repair of damaged power distribution networks	3,502.0	2,122.4
Risk reduction measures	2,656.0	1,609.7
TOTAL	**6,157.8**	**3,732.1**

Telecommunications

Summary

Damage and losses in the telecommunications sector throughout Madagascar due to the 2008 cyclones total Ar. 1,474 million (US$ 0.9 million). Damages account for 87 percent of that amount, and losses for 13 percent. The bulk of the damages were among cell phone operators, followed by radio and television. Table 51 shows a summary of damages and losses accrued to the telecommunications sector:

Table 51: Damage and losses to the telecommunications sector (Ar. Millions)

	Disaster effects			Ownership by sector		Effects on:	
	Damage	Losses	Total	Public	Private	BOP	Fiscal sector
TOTAL	1,289.30	184.7	1,474.00	683.2	790.80	1270.5	113.8

Recovery and rehabilitation needs involve primarily the reconstructon of the post offices of Besalampy and St. Marie, at an estimated cost of Ar. 17.0 million (US$ 10,000).

Pre-disaster situation

The telecommunications sector in Madagascar is considered key to economic growth, and a tool needed for the expansion of other spheres of economic and social life. In Madagascar, this sector is growing steadily, characterized by the development of cutting-edge technologies. The use of New Technologies of Information and Communication (NTICs) is keeping pace with globalization, and the national backbone is expected to be completed this year. The sector is no longer under exclusive government control; liberalization has occurred over the past few years and competition is the order of the day.

The telecommunications sector includes postal services, radio and television broadcasting, and telephony operators.

The “Big Island” counts nearly 582 post offices, most of which were built in the 1960s. Thus, post office buildings are fairly old and suffer each year from rain and poor weather conditions.

Radio and television service in Madagascar is dominated to a great extent by public channels. Over the past few years, the Government has invested in improving the material resources and broadcast quality of public audiovisual offerings, but much remains to be done, especially in the most remote areas.

Fixed, mobile or internet telephony, on the other hand, is characterized by open competition and is overwhelmingly dominated by the private sector. The various operators deploy technical and financial resources unstintingly, investing in ever more sophisticated equipment.

Damage and Loss Assessment

Sixteen regions were hit by the cyclones of the 2007-2008 season. The Melaky region was the most severely affected by the first, i.e., tropical cyclone Fame, on Sunday, January 27, 2008. Tropical cyclone Ivan, on the other hand, which ploughed through nearly all of Madagascar, caused considerable damage in the Analanjirofo region.

The telecommunications sector was not spared. Public and private postal facilities, radio and television stations, telephony operators—all suffered damage to buildings and equipment. In some districts, all communication was lost for several days, a situation that rendered repair and salvage extremely difficult.

Damage to other sectors, such as transportation or power, also had a significant impact on the telecommunications sector. Road blockages and interruption of the usual means of conveyance disrupted telecommunications at post offices in the Analanjirofo region and in many other locations. Damage to power facilities wrought havoc with equipment used by telephony operators and radio and television broadcasters.

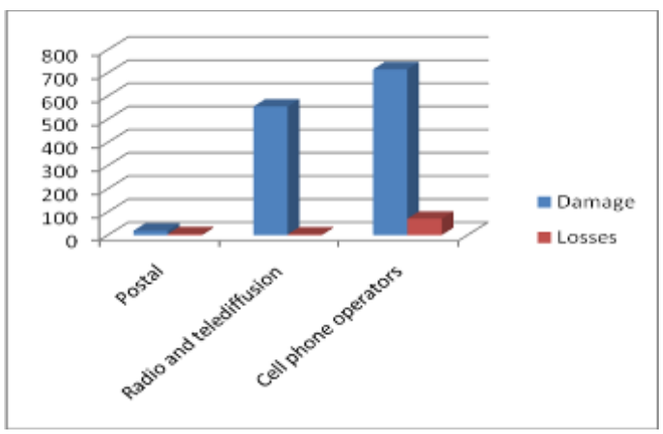
Table 52: Damage and losses to the telecommunications sector

	Disaster Effects (Ar. Millions)			Disaster Effects (USD '000)		
Subsector Component	**Damage**	**Losses**	**Total**	**Damage**	**Losses**	**Total**
Post offices	18.8	111.4	130.2	11.4	67.5	78.9
Radio and television	554.6	2.6	557.2	336.1	1.6	337.6
Cell phone operators	715.90	70.7	786.6	433.9	42.8	476.7
TOTAL	**1,289.30**	**184.7**	**1,474.00**	**781.4**	**111.9**	**893.3**

Damage and losses in the telecommunications sector throughout Madagascar due to the 2008 cyclones total Ar. 1.474 billion (US$ 0.9 million). Damages account for 87 percent of that amount, and losses for 13 percent.

The telephony sector suffered the most damage and losses, with 53 percent, followed by radio and television with 38 percent and postal services with 9 percent.

Figure 59: Breakdown of damage and losses by subsector

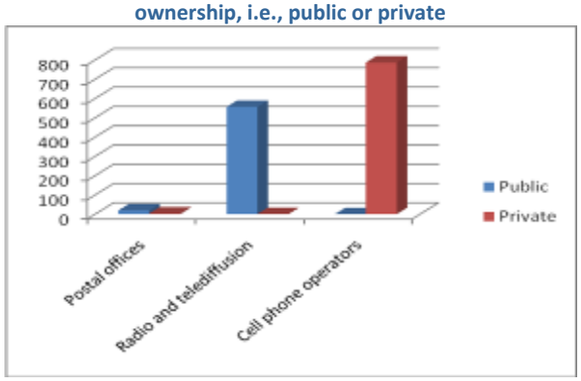


Since there are no public cell phone operators, the public telecommunications sector received the bulk of the damages and losses in radio and television, followed by damages and losses to post offices (see Table 53). Some 46 of the estimated damages and losses were incurred by the pubic sector; 54 percent were absorbed by the private sector.

Table 53: Disaster effects by ownership

	Disaster effects by ownership (Ar. Millions)		Disaster effects by ownership (USD '000)	
Subsector Component	Public	Private	Public	Private
Post offices	103.5	3.5	62.7	2.1
Radio and television	556.5	0.7	337.3	0.4
Cell phone operators	0	786.6	0	476.7
TOTAL	660	790.80	400	479.3

Figure 60: Breakdown of damage and losses by property ownership, i.e., public or private



The following section provides a detailed analysis of the relevant telecommunications subsectors affected by the cyclones.

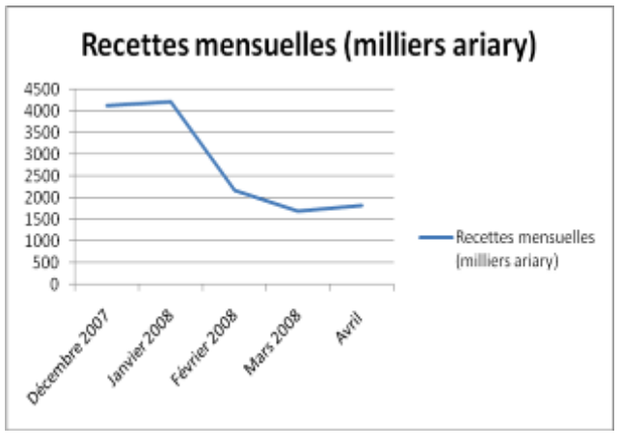
Damage and losses at post office facilities

In general, post offices in districts most hard-hit by cyclones Fame and Ivan suffered the heaviest physical and material damage, which also caused service to be interrupted for a week. This was the case for the post offices at Besalampy and Sainte-Marie. The cost of repairs to the Sainte-Marie post office, which have yet to be carried out, amounts to Ar. 9 million according to the Ministry of Telecommunications, Post and Communication (MTPC). Repair costs for the Besalampy post office total Ar. 8 million.

Figure 61 Damages to Post Office Facilities

The Sainte-Marie post office normally takes in Ar. 4.2 million per month. After the passage of cyclone Ivan and the destruction of the postal building, revenue dropped by half in February, March and April. Because the facility has not been rebuilt and mail continues to be transported, the losses experienced by the Sainte-Marie post office continue to mount and are expected to continue through June—the traditional arrival date of tourists who buy a great deal of post office products. The impact of cyclone Ivan on the post office at Sainte-Marie, which is a popular tourist destination, can e seen in the sharp drop in revenue over the February–March period.

Figure 62: Trend in monthly revenue of the Sainte-Marie post office, December 2007 – March 2008



Although postal buildings in some locations were spared physical harm, significant damage and losses are still resulting from traffic difficulties caused by road blockages and the interruption of other means of conveyance, as was the case with the post office at Fénérive-Est. Due to the two-month-old stoppage of traffic at the floating bridge at Tanambao Nosibe, public and private postal services (e.g., express packages) have noted a steep drop in monthly revenue. In addition, the obligatory transshipment boosts the post offices' operating costs, as they must pay more for transportation and take more time to deliver the mail. Since these access problems began, the monthly revenue of the Fénérive-Est post office (or at least the public one) has declined considerably (Figure 64).

Figure 63: Ste. Marie Post Office Facility

In some locations, such as Morondava, Mahabo or Ambatondrazaka, monthly post office revenue also experienced a drop during and after the cyclones' passage (see Figure 65) . While buildings were unharmed, considerable flooding inside the structures caused service to be interrupted for an average of three days, pending the withdrawal of the floodwaters.

Figure 64: Trend in monthly revenue of the public post office at Fénérive-Est, January – April 2008

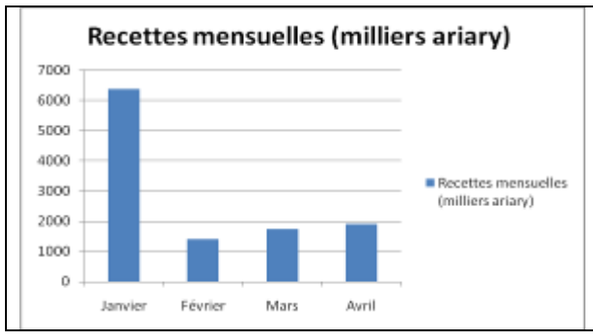
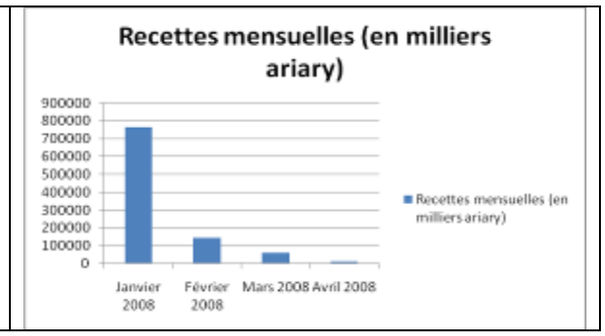


Figure 65: Trend in monthly revenue of the Ambatondrazaka post office, January – April 2008

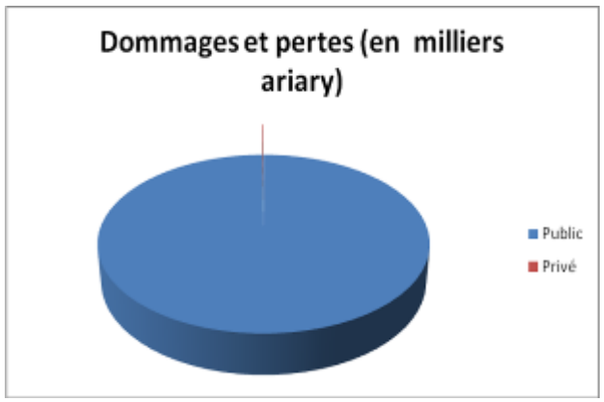


Damage and losses for radio and television broadcasting

Most of the damage suffered by radio and television stations due to the cyclones is being paid for by the Government, since public channels are still the only ones being broadcast in many regions. Most of the material damage noted is also due to power outages, which damaged several television and FM radio transmitters.

Losses are also fairly insignificant in this segment of the telecommunications sector. Advertising revenue in the cyclone-hit regions is minimal. Repairing the damage is the responsibility of the Government. Most of the equipment damaged by the cyclones has now been refurbished and repaired.

Figure 66: Breakdown of damage and losses by property ownership, i.e., public or private



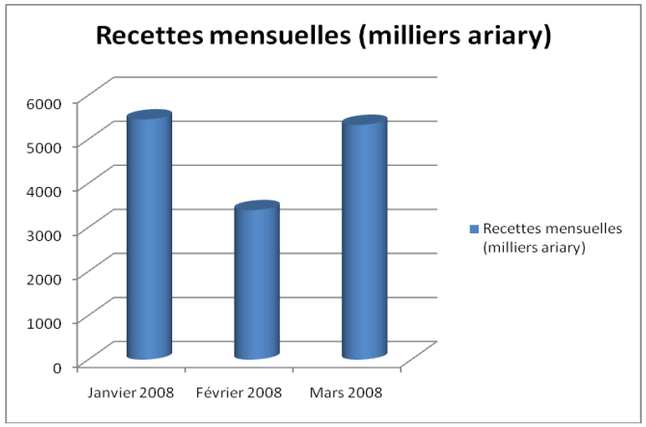
The radio and television subsector requires some serious thought in terms of its medium- to long-term reconstruction, since damage re-occurs with each year's cyclone season. The use of more wind- and water-resistant materials will help avoid large annual allocations for the repair of damaged equipment.

Damage and losses for telephony operators

Madagascar's telephony sector is freely competitive. Three main operators—Telma, Celtel and Orange—share the market. Telma is still the only one permitted to operate in the **fixed** telephony sector apart from mobile and internet service. It therefore covers most regions of Madagascar.

Cyclones are a constant threat to telephony operators. This sector has suffered significant damage, especially since the equipment used is very costly. One linear meter of pylon, for example, costs the equivalent of Ar. 2.08 million (US$1,260/m).

Figure 67: Monthly trend in Telma's commercial sales in the Fénérive-Est district, January – March 2008



Disruption of the network is a shock for telephony sales, and a hiatus of just a few days is difficult to make up. After cyclone Ivan, which damaged the aforementioned equipment, Telma's commercial sales also took a hit.

Telephony operators in Madagascar have recently been investing more in wind- and water-resistant equipment. Some sites, like those belonging to Celtel in the Sainte-Marie and Morondava districts, are in higher-lying and more protected areas and thus less vulnerable to flooding and high winds. This would explain in part why Celtel was the least affected of the three operators.

Figure 68: Daily trend in Telma's commercial sales in the Morondava district, February 11 – March 10

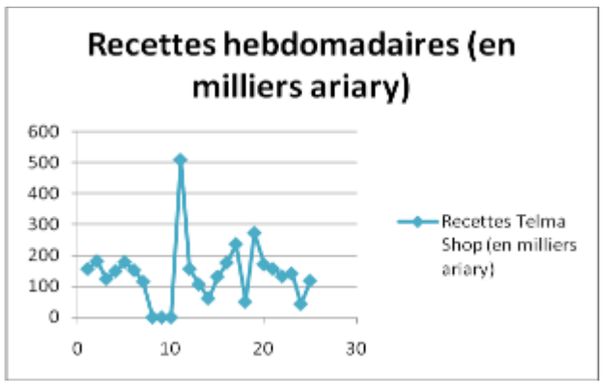
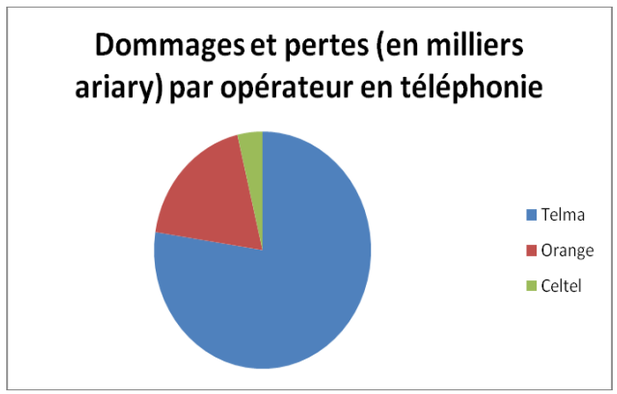


Figure 69: Breakdown of damage and losses by telephony operator



Impact on the Balance of Payments

The impact of the balance of payments is estimated at Ar. 1,270.5 million (US$ 0.8 million), and effects on the fiscal sector are estimated at Ar. 1190 million (US$ 0.06 million). Table 54 shows these effects by subsector.

Table 54: Disaster effects on Balance of Payments and Fiscal Sector

	Disaster effects (Ar. Millions)		Disaster effects (USD '000)	
Subsector Component	**BOP**	**Fiscal sector**	**BOP**	**Fiscal sector**
Post offices		88.2		
Radio and television	554.6	2.6		
Cell phone operators	715.9			
TOTAL	1271	90.8	1,270.5	114.0

Recovery and Reconstruction Needs

Two months after the cyclones' passage, nearly all telecommunications equipment, especially in the private sector, has been restored and replaced with higher performance material able to resist high winds. There remains, however, the reconstruction of public buildings like the Post Office of St. Marie and Besalampy, at an estimated cost of Ar. 17 million (US$ 10,300).

Table 55 Recovery and Reconstruction Needs for the Telecommunications Sector (Ar. Million)

	Recovery and Reconstruction Needs (Ar. Million)		
Sub-Sector needs	Early Recovery	Medium/Long-Term Recovery	Total
Rehabilitation of St. Marie Post Office (Analanjirofo Region)	0	9.0	9.0
Rehabilitation of Besalampy Poste office (Melaky Region)	0	8.0	8.0
Total	**0**	**17.0**	**17.0**

Water Supply and Sanitation Sector

Summary

Water supply and sanitation facilities were highly affected by the 2008 cyclones. The assessment reported damage to 767 public wells, 166 gravity systems, and six public latrines. Some 140 solid waste containers were destroyed and 93.5 km of rain and waste water networks were cut off (primarily in Alaotra Mangoro, Menabe, Atsinanana, and Analanjirofo).

Damages were estimated at Ar. 616.8 million (US$ 0.4 million), whereas losses were estimated at Ar. 1,729.0 million (US$ 1.0 million). Sanitation accounted for 61.3% of total damages and losses (Ar 1,437.5 million or US$ 0.9 million) and water supply accounted for 38.7% (Ar 908.3 million or US$ 0.6 million). Losses were higher (73.7%) than direct damages (26.3%) due to the relatively poor development of the infrastructure. The majority of losses related to pumping and cleaning costs, unsold water, cleaning of flooded areas and the disinfection of polluted hand dug wells.

To mitigate recurrent damages to the sanitation network and to avoid the potential spread of waterborne contamination, a strategy of rehabilitating wells, restoring the water supply, sanitation and waste sewage facilities, introducing waste containers in urban areas, and rehabilitating public latrines is proposed. The estimated costs are Ar. 15,075.8 million (US $9.1 million).

Pre-Disaster Situation

Drinking Water Supply

Larger urban areas in the affected regions have an established drinking water supply network, usually managed by water and energy supply authorities (Jirama) or, in the case of bigger villages, by a locally established water supply committee, composed primarily by beneficiaries of the infrastructure.

The systems are either supply systems taking raw water from natural springs or rivers or those pumped from boreholes. Raw water is usually treated when necessary (with sand filters) and chlorinated. Water is generally stored in concrete water tanks and distributed through the network (predominantly GI-pipes) to households and public fountains. Beneficiaries pay for the delivered water and each household has a working water counter.

These infrastructures organized by Jirama are typically in an acceptable condition; the quality of the supplied water is periodically analyzed (physically, biologically and chemically) in Antananarivo, the infrastructure maintained, the production and the sale well recorded. Workers of Jirama are well trained technicians and know how to react in case of crisis and problems and can rely on support by the central office in Antananarivo.

Figure 70 Water Carriers in Rural Melaky

The system managed by local water supply committees are not that well monitored. Lack of maintenance is the main problematic factor. Water fees do not cover the minimal maintenance requirement costs and lack of capital prevents any type of rehabilitation. Therefore most of those systems only are partially working, treatment is not assured, water is seldom chlorinated, and no guarantee of portability of delivered water is given.

In rural areas water is mainly supplied by hand dug wells (advantageously accessing the shallow aquifer). Part of these wells are protected and equipped with hand pumps (India Mark III or locally made pumps). However, these wells are seldom treated or cleaned. No coherent and constant chlorine supply is guaranteed by the authorities.

Some villages also simply rely on untreated surface water sourced directly from nearby rivers.

Sanitation

(a) Excretal disposal and Sanitation Awareness

Only a very low percentage of the rural population is using latrines or established excretal facilities. In urban areas this percentage is higher, but still under the tolerable limits. Private latrines commonly consist of simple pit latrines which are abandoned once filled.

In high frequented urban areas (markets, stadiums, etc.) as well as schools and health centers, public latrines are used. In certain cases, such as marketplaces, public latrines collect a fee for each use. This fee allows for the minimal maintenance of the infrastructure. Public latrines at schools and health centers are usually in a deplorable condition and need maintenance or rehabilitation.

(b) Waste water and sewage

Larger urban areas and cities have an old and non-maintained sewage and drainage system. The maintenance of the system is primarily the responsibility of the municipality and little support has been given to this important sector. The budget allocated for the maintenance of the sewage and rainwater drains does not allow for proper upkeep. Renovating existing canalization is rarely done. Between 50%-70% of the existing canalization need urgent maintenance (chiefly

cleaning) and 40%-30% need rehabilitation. The municipalities are well aware of the deplorable situation of the canalization systems and have been struggling with daily problems. During the rainy season, flooding is common due to the limited or nonexistent drainage capacity of the present canalization system. Furthermore, open canalization systems are used by the population as solid waste disposal.

Rural areas are usually not reliant on canalization and sewage systems.

(c) Solid waste management

Urban areas, as opposed to rural areas, rely on organized solid waste management. The organization and management is the responsibility of the municipality which typically does not confer much importance to this sector.

F71 : Solid waste deposit in Diego Suarez (Diana region)

Generally, there are established collecting points (trailers or drums) at marketplaces. In other parts of the city deposit spots are fixed, though without any type of protection. Rats and dogs as well as other types of vermin are constantly present at these locations. During the rainy season, stored garbage frequently becomes waterlogged and floods the surrounding area.

In rural areas the solid waste management is not organized.

Damage and Loss Assessment

Drinking Water Supply

Except for the case of St. Marie, where very strong winds destroyed the whole area, water supply systems (networks) suffered only minor damage by the cyclones. There are few reported cases of soil erosion where infrastructures were built. The cut in energy supply and the flooding of some infrastructures caused a temporary break in water production (reportedly 18 days maximum) as well as a loss of income. Floated infrastructures (pumping stations, sand filters) had to be cleaned and, in a few cases, electrical motors had to be repaired.

Many hand dug wells, however, especially those situated in lower areas were flooded and contaminated. Generally, the water quality of all hand dug wells suffered due to the cyclones. The infrastructures themselves were not damaged, but an urgent need to clean and, in some cases, of restoration (large amount of debris/sand deposited in the wells) has been reported. Some hand dug wells were cleaned and disinfected already during the emergency response. Nevertheless, a high number of wells still need attention.

Sanitation

(a) Excretal disposal

There were no reports of damaged household latrines. Some public latrines, especially at the marketplaces that were already in dire conditions before the cyclones, have been flooded and are now in need of urgent rehabilitation (cleaning of septic tanks, structural rehabilitation, etc.).

(b) Waste water and sewage

The substandard situation of the urban waste water system deteriorated greatly due to the cyclones. Due to the high quantity of water with waste flooding during the event the few working parts of the systems were affected.

The emergency reaction of the responsible municipalities and humanitarian actors was to build wherever possible emergency dewatering channels and to pump waste water out of the inundated areas. Further, the channels dug during the emergency are now considered dangerous and need to be covered with concrete.

(c) Solid waste management

No damages of the existing solid waste management infrastructure are reported. Nevertheless, an impressive cleaning campaign was organized in all the urban areas after the events. The campaign was organized by the responsible municipalities with the support of humanitarian actors and private industry. The available information of the involved manpower and technical support has been evaluated and quantified.

There is no report of organized cleaning campaigns in rural areas. However, it is assumed that the onus for cleaning waste disposal areas was dependent on rural villagers taking the initiative.

Table 56: Damages and losses to the Water and Sanitation Sector (Million Ar).

SUB SECTOR	Disaster Effects			Ownership by sector		Effects on:	
	Damage	Losses	Total	Public	Private	BOP	Fiscal Sector
Water supply	606.7	301.6	908.3	889.4	18.9		
Sanitation	10.1	1427.4	1437.5	265.6	1172		
TOTAL	**616.8**	**1729.0**	**2345.8**	**1155.0**	**1190.8**	**0.0**	**3000.0**

Socio-economic Impact

During the event and during the two weeks following, the population of the affected areas was committed to the removal of waste, cleaning up, and reorganizing their households. Significantly, daily salaried work was not completed, thereby affecting most of the sectors.

Governance Issues

The maintenance and sustainability of water and sanitation facilities are the key issues for proper functioning. Unfortunately, these remain weak points as highlighted during the assessment. Weak organization and commitment of the municipalities and committees are the key causes for the deterioration of the facilities. Therefore, it is important to include a very strong sensitization and appropriations measures for each intervention. Furthermore, all campaigns must take into account proven cultural practices in order to seek wider acceptance.

Annex 11 shows the breakdown of damages and losses by region and type.

Recovery and Reconstruction Needs

With the affected regions (Menabe, Atsinanana, Analanjirofo, Alaotra Mangoro) as an initial focus area, a needs assessment has been outlined taking into account the following aspects:

- Restoring the drinking water supply to pre-cyclone condition;
- Cleaning and repairing all public wells (as inventoried by the Ministry of Mine and Energy);
- Restoring / rehabilitating the sanitation facilities (publics latrines in urban areas) to a working condition or to pre-cyclone condition;
- Restoring (cleaning) the waste water and sewage system in urban areas, including essentials rehabilitation works;
- Introducing a solid waste management system in urban areas, including installation of protected collection points (waste containers) and basic transport facilities.

These recommendations take into account:

- Medium-term and long term solutions, with appropriate institutional and implementing partners.
- In areas where wells are periodically flooded, consideration should be given to moving the facility and equipping boreholes with hand pumps.
- Building the capacity of the community and local government institutions in terms of water supply and sanitation to cope with the crisis and emergency response during national disaster as well as normal periods.
- All the proposed interventions concern public facilities.

Prioritizing the interventions

(a) Public wells in rural area:

- 40% of public wells should be rehabilitated, protected and equipped with hand pumps. The selections of the *fokontany* should be done according to the probability

of flooding of the area. Local authorities and inhabitants know where the most floods occur. These villages should be targeted for the first early recovery phase.

(b) Water supply networks in rural area:

- 30% of the existing water supply network should be rehabilitated. The selection of the facilities should be determined by number of beneficiaries of network, vulnerability to flooding, existence of a maintenance committee, and existence and quality of alternative water sources.

(c) Rain and waste water network:

- 30%-40% of the rain and waste water network should be rehabilitated. The selection of the network should be determined by vulnerability to flooding in the area. Focus should be given to those frequently flooded with an understanding of the whole system.

The estimated recovery and reconstruction needs for the water and sanitation sector amounts to Ar. 15,075.8 million or US$ 9.14 million (Table 57). For details, see Water and Sanitation Annex).

Table 57: Recovery and Reconstruction Needs for the Water and Sanitation Sector (Ar. millions)

SUB SECTOR	Early Recovery	Medium/Long term Recovery	Total
WATER SUPPLY	**2097.2**	**3160.6**	**5257.8**
Region Atsinanana	259.3	379.8	639.1
Region Alaotra Mangoro	691.1	1206.0	1897.1
Region Menabe	916.4	1365.4	2281.9
Region Analanjirofo	230.4	209.4	439.8
SANITATION	**4139.0**	**5679.0**	**9818.0**
Region Atsinanana	1265.0	1700.0	2965.0
Region Alaotra Mangoro	1363.0	2180.0	3543.0
Region Menabe	804.0	1079.0	1883.0
Region Analanjirofo	707.0	720.0	1427.0
TOTAL	**6,236.2**	**8,839.6**	**15,075.8**

Crosscutting Issues

Environment

Summary

The environment sector team assessed the material damage to forests and the economic losses resulting from the two cyclones, Fame and Ivan. In all, five of the total of 17 regions affected (Menabe, Analanjirofo, Atsinanana and Alaotra Mangoro and Melaky) suffered substantial impacts on the environment sector. The first four regions were surveyed and assessed in the field.

In all, the two cyclones affected a total surface of forests of 2,992,170 ha and damaged an estimated 258.8 ha. Environmental damages are estimated at Ar. 356.6 million (US$0.2 million), and losses at 475.8 million (US$ 0.3 million). Given the potential for abuse (exploitation of precious wood), affected forests need to be subject to strengthened surveillance (estimated at Ar. 819 million), and to systems of management which may include natural regeneration (Ar. 15.2 million), competitive adjudication of timber that has been damaged by the cyclone (Ar. 23.3 million), or forest restoration (Ar. 340.2 million or US$ 0.2 milion).

Pre-Disaster Situation

In the regions most affected by Cyclones Fame and Ivan, there was a total of 6,850,811 ha of forest cover, including 5,030,510 ha of forest, 1,119,918 ha of protected area and 700,383 ha of potential protected area (see Table 58). For more details on the individual regions, see Annex 12.

Table 58: Forest area in most affected regions (in hectares)

Region	Forest	Protected Area	Potential Protected Area	Total Forest Cover
Menabe	1,105,121	265,690		1,370,811
Analanjirofo	1,739,835	430,483	275,179	2,445,497
Alaotra Mangoro	905,724	157,782		1,063,506
Atsinanana	442,181	64,028	425,204	931,413
Melaky	837,649	201,935		1,039,584
Total	5,030,510	1,119,918	700,383	6,850,811

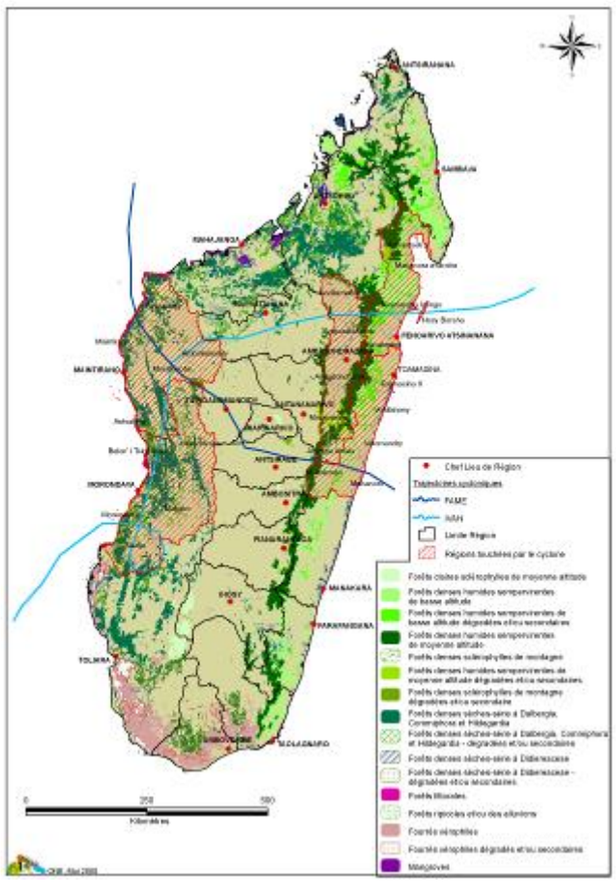
Damages and Losses

The overall damages and losses due to the cyclone season of 2008 are summarized on Table 61 below. They amount to an estimated Ar. 832.4 million (US$504,450). Damages are estimated at Ar. 356.6 million (US$216,000) whereas losses are estimated at Ar. 475.8 million (US$288,400). Most of the damages and losses occurred in natural forests, and primarily in Analanjirofo. Figure 72 shows the trajectory of the cyclones and the areas of forest affected.

Table 59: Damages and Losses to the Environmental Sector

Subsectors	Effects of the disaster (Ar. Million)			Effects of the disaster (USD Millions)
	Damages	Losses	Total	
Natural forests	340.2	471.8	812.0	0.49
Nurseries	5.3	0	5.3	0.0032
Other (Zetra)	11.1	4.0	15.1	0.01
TOTAL	**356.6**	**475.8**	**832.4**	**0.50**

Figure 72: Forest cover and regions struck by cyclones Ivan and Fame



LEGEND:
Principal town of region
Paths of cyclones
FAME
IVAN
Regional border
Regions struck by cyclones
Clear sclerophyllous forest, medium altitude
Dense wet evergreen forest, low altitude
Dense wet evergreen forest, low altitude, degraded and/or secondary
Dense wet evergreen forest, medium altitude
Dense mountain sclerophyllous forest
Dense wet evergreen forest, medium altitude, degraded and/or secondary
Dense mountain sclerophyllous forest, degraded and/or secondary
Dense dry Dalbergia, Commiphora, and Hildegardia forest
Dense dry Dalbergia, Commiphora, and Hildegardia forest, degraded and/or secondary
Dense dry Didiereaceae forest
Dense dry Didiereaceae forest, degraded and/or secondary
Littoral forests
Riparian and/or alluvial forest
Xerophilous thickets
Xerophilous thickets, degraded and/or secondary
Mangroves
Kilometers

Damages and losses were assessed based on impact on (a) natural forests; (b) impact on nurseries; and (c) impact on natural habitats such as Zetra (*Cyperus madagascariensis*) in the region of Alaotra, as well as on a species of lemur (Bando). These estimates are outlined below.

(a) Damages to Forests

Damages to forests are estimated at Ar. 340.2 million and losses at Ar. 471.8 million (see Table 57).

Table 60: Assessment of damages and losses of forests

REGION	AREA DAMAGED (Ha)	DAMAGES (Ar, Million)	LOSSES[20] (Ar. Million)
MENABE	19.7	25.9	36.2
ANALANJIROFO	158.8	208.7	287.8
ALAOTRA MANGORO	24.6	32.3	45.2
ATSINANANA	39.0	51.3	71.8
MELAKY	16.8	22.0	30.8
TOTAL	258.9	340.2	471.8

(b) Damages to Nurseries

The estimated damage to nurseries is Ar. 5.3 million (US$3,200) in the regions of Atsinanana and Alaotra Mangoro (Table 61).

Table 61: Assessment of damages and losses of tree nurseries in Atsinanana and Alatra Mangoro (Nursery Antsevabe/CR Didy) regions

Region	Beds	Number of plants per bed	Number of beds destroyed	Number of plants destroyed	Unit cost Ar/plant	Total Cost (Ar. Million)
Atsinanana		2,000	14	28,000	120	3.4
Alaotra Mangoro	50		2	4,420	120	0.51
Damage to Greenhouses (Antsevabe Didy)	480	5 ha		2,400 ha	3,000	1..44
Total						5.3

(c) Damages to Other Resources

Damages to the Zetra habitat (Genus *Cyperus madagascariensis*) in the Lac Alaotra area are estimated at 11 million Ar. (US$6,700) and losses estimated at 4.5 million Ar. or US$ 2,700 (Table 62).

[20] The discount rates used to calculate losses range from 3 to 10 percent yields. For more details see Annex 12

Table 62:Assessment of damages and losses of zetra, Alaotra Mangoro region

Total surface area (hectares)	Damaged area (hectares)	Restoration (man-days/hectare)	Unit cost in man-days (Ar)	Damage (Ar Million)	Loss (Ar. million)
24000	11	200	5000	11	4.5

For details on the assumptions used in calculating losses see Annex 12.

Socioeconomic impacts

The destruction of forests or natural habitats often affects the socioeconomic situation of a region. It triggers community effort to clear the roads, forestry stations, access routes to protected areas, and other infrastructures. This work is typically remunerated by the granting of felled timber to families that participate in the clean-up work. In addition, households that sustained partial or total physical damages to their homes are authorized to take the felled timber and use it to repair the damages.

Risk management

Forests play a particularly important role in the maintenance of the factors of production in a given area. It is therefore essential to keep the forests as compact as possible, in order to avoid gaps that might later make them more vulnerable to strong winds and mudslides. The damaged forests should be carefully monitored to ensure that they regenerate naturally. It is even recommended that fallen trees should be left in place, in order to avoid additional gaps and allow for the natural habitat regeneration.

Governance issues

Damage caused by cyclones to forests is often used to justify unlawful exploitation, in particular of wood categorized as precious. Such exploitation has been going on for several years in the Sava region, and the solution to the problem is near at hand. It is therefore important to take appropriate legal, procedural, and technical steps, such as the implementation of tools for the prevention of damage to forested areas and natural habitats and for the better management of these areas and habitats. To that end, the trees that have been damaged should not be removed until an inventory has been taken by the forestry administration. Moreover, in order to avoid additional administrative costs, the felled timber should be evaluated on site and allocated by auction.

Recovery and rehabilitation needs

Recovery and rehabilitation needs can be divided into five major interventions:

- Re-Introduction of Bando (already carried out under early recovery);
- Restoration of Zetra in Lac Alaotra;
- Restoration of affected areas with indigenous species;
- Systematic inventory of the damaged forest areas (258 ha) with a view to facilitate competitive adjudication for the felled timber; and
- Strengthened enforcement on the remaining natural forest areas affected by the cyclones (2,992,170 ha)

Based on this strategy, the estimated needs for recovery and restoration to the environmental sector are as follows (for assumptions, see Annex 12):

Table 63: Recovery and restoration needs to the Environment Sector (Ar. Millions)

	Early recovery	Medium-Long Term Recovery	Total
Subsector			
Forest Surveillance, Inventory and Restoration	842.5	340.2	1,182.7
Nurseries (cost of greenhouses, seeds, containers, etc.)[1]	5.3		
Restoration of Zetra and Introduction of Bando	0.1	9.8	15.2
TOTAL	847.9	350.0	1,197.9

Note: Introduction of Bando already carried out by Durrell at an estimated cost of Ar. 5.3 million. Hence, it is not counted on the recovery estimates.

Section III: Economic and Social Impacts

Introduction

Whilst the previous section looked at the impact of the cyclones at the sector level, this section looks at the disasters' macro and micro-economic (livelihood) impacts. The first sub-section (Macro-Economic Impacts) examines the impact of the 2008 cyclones against Madagascar's overall economy, balance of payments and fiscal sector. The second sub-section (Impact on Livelihoods and Income) examines their impact at the personal or household level, where declines in income and livelihood are estimated.

Macroeconomic Impact

Pre-Disaster Economic Situation

Following the 2002 crisis, GDP has grown by an average of 5 percent a year between 2004 and 2006, growing by 6.2 percent in 2007. Growth has been driven by strong secondary sector performance (up from 3.5 to 9.8 percent between 2006 and 2007), and by the tertiary sector (7.7 percent), primarily public works, tourism transport, banking and telecommunications. Inflation declined in 2007 relative to 2006 (8.2 vs. 10.8) but has recently started to increase again due to the food and oil crises. Growth projections for 2008-11 are about 7.9 percent a year, dependent primarily on extractive industries, tourism, construction, and strengthened prospects in agriculture. This will require a steady investment averaging about 26.8 percent of GDP21.

In 2006, the Government has launched the Madagascar Action Plan (MAP) its new development plan for 2007-2012 which includes eight strategic commitments: (a) responsible governance; (b) connected infrastructure; (c) educational transformation; (d) rural development and a green revolution; (e) health, family planning, and the fight against HIV/AIDS; (f) high growth economy; (g) cherishing the environment; and (h) national solidarity. However, without taking into consideration disaster risk management and the rehabilitation of recurrent cyclone damage, major MAP goals could be strategically compromised.

Assessment of the Impacts of the 2008 Cyclones on GDP Growth in Madagascar

In the aftermath of the 2008 cyclones, damages and losses were recorded for 17 affected regions. These damages and losses have affected the social, production sectors as well as the social sectors. The damages and losses assessed by the ministerial teams are summarized in Table

[21] IDA 2008. Program Document for a Proposed Credit in the Amount of SDR 30.7 Million (US$50 million equivalent) for a Fifth Poverty Reduction Support Credit to the Republic of Madagascar, May 29, 2008. Human Development 3, Poverty Reduction and Economic Management 1, Country Department 1, Africa Region. The World Bank. Washington DC.

Table 64 : Damage and Losses of 2008 Cyclone Season (Used in Macro-Economic Impact)

		Losses and Damages		
		Damages	**Losses**	**Total**
Social Sector		212,193.20	24,425.60	236,618.80
	Education	5 276.60	1,059.90	6, 336.50
	Health	11,230.00	5,690.50	16,920.50
	Nutrition	1, 314.30	1 ,575.70	2, 890.00
	Habitat	171,957.30	16,099.50	188,056.80
	Public Administration Buildings	22,415.00		22,415.00
Productive Sector		13,974.80	212,216.10	226,190.90
	Agriculture, Livestock & Fisheries	10,461.10	159,564.30	170,025.40
	Industries	2,106.60	2,0158.10	22,264.70
	Commerce	742.90	7,265.70	8,008.60
	Tourism	664.2	25,228.0	25,892.20
Infrastructures Sector		60,792.10	24,954.90	85,747.00
	Electricity	3,502.40	2,957.60	6,460.00
	Water & Sanitation	616.80	1, 729.00	2,345.80
	Transport	55,383.60	20,083.6	75,467.20
	Telecommunications	1, 289.3	184.7	1, 474.0
Intersectorial		356.60	475.80	832.40
	Environment	356.60	475.80	832.40
TOTAL		**287,316.70**	**262,072.40**	**549,389.10**

Damages are calculated to be 287.3 billion Ariary (US$174.1 million), and total losses are calculated to be 262.1 billion Ariary (US$158.8 million).

Loss of point on the annual Gross Domestic Product (GDP) real growth

The assessment of the GDP mainly takes into account the production of a country. It is essential to note that only losses were accounted for when assessing the modification to real GDP growth.

The forecast for real GDP growth for 2008 was 7.3 percent prior to the natural disasters. The constant GDP for 2007 was estimated to be 585.0 billion Ariary (1984 base), thus the GDP expected for 2008 was 627.7 billion Ariary.

Total losses are estimated to be 212.2 billion Ariary for the production sector. Most of these losses were registered in the “Agriculture, Livestock and Fisheries” sub-sector, with an estimated 159.6 billion Ariary. This figure represents 75.2 percent of total losses in the sector. However, it is essential to note that, in conformity with the structure of the Madagascar economy and national accounting, weighted losses were used for each sub-sector. When weighted, the losses translate as an alteration of the total GDP of 41.1 billion Ariary in terms of nominal added value, i.e., 1.6 billion Ariary in real terms (1984 base). The real value of the 2008 GDP would be revised to 626.1 billion Ariary, a drop of 0.3 percent.

In conclusion, the cyclones Ivan and Fame, caused a drop of 0.3 points on the real GDP growth rate in Madagascar.

Impacts on the Balance of Payments

In 2008 the cyclones Fame, Ivan and Jokwe battered 17 regions of Madagascar, causing damage to many sectors of activity. This damage results in a negative impact on the balance of payments of the country.

In comparison to 2007, the estimate for the current balance in 2008 will increase by some 7 percent. Following the harmful effects of the cyclones, the balance is calculated to be 71.3 million SDR, instead of an estimated 114.3 million SDR for this year, i.e., a loss of 43.0 million SDR due to the passage of these two cyclones (Fame and Ivan).

Table 65: Impacts of the cyclones Fame and Ivan on the balance of payments in 2008 (million SDR)

	2008 BP	Estimated losses	Revised BP
Current account balance	(1 338,2)		(1 381.2)
Exports	827,0	0.3	826.7
Imports	(1 994,4)	34.2	(2,028.6)
Services receipt	625.3	7.0	618.3
of which travel (tourism)	184.8	7.0	177.8
Services payment	(873.3)	0,9	(874.2)
of which government (electricity)	(125.3)	0,9	(126.2)
Capital and Financial Account	1 452.5		1 452.5
Overall balance	114.3		71.3

Source : our own calculations

In comparison to 2007 the exports estimates should increase in volume by 8 percent, and 12.7% in value. But analysis of the damages caused by the cyclones reveals a loss of 0.036 percent in comparison to the initial estimated value.

The exports value forecast for 2008 was 827 million SDR. This figure will decrease to 826.7 million SDR due to the impacts of the cyclones. Generally, losses are estimated to be 0.3 million SDR this year.

The reduced value of exports concerns sectors such as agriculture and tourism. The value of agricultural exports would lose 938.7 million Ariary, i.e., 0.26 million SDR. This drop is a consequence of damages caused by the cyclones to route and port infrastructures. The loss in value of exports of services linked to the tourism sector is estimated to be around 25 billion Ariary. The decrease of this value is due to cancellations in the tourism sector. All these issues have a negative impact on the balance of payments (BOP).

For importations, the total volume forecast in 2008, compared to 2007, should have decreased by about 31 percent. However, following the passage of these two cyclones, the value of importations increased by 26.3 percent, compared to a forecast of 19.4 percent for 2008.

In terms of absolute value, total importations for 2008 are estimated to be 2,028.6 million SDR, compared to 1,994.4 million SDR originally estimated, i.e., an increase of 34.2 million SDR, which represents the losses caused by these two cyclones. This situation is mainly due to the needs and requirements of some economic sectors. The increased importations of goods involves sectors such as agriculture, livestock, fisheries, electricity, telecommunications, education, and health.

The education and health sectors concern more than 40 percent of total importations following the passage of the cyclones Fame and Ivan. Importations in the agriculture, livestock and fisheries sectors mainly concern food products and agricultural input, and represent more than 27 billion Ariary. Importations for other sectors were mostly destined for repairs and reconstruction of damaged facilities.

To summarize, importations mainly concern the importations of goods required during the cyclone season valued at 34.2 million SDR. The decreases exportations in comparison to increased importations further increased the trade balance deficit, and in turn will obviously have a negative impact on the balance of payments.

Impact of the Cyclones on the Public Finances

The passage of the cyclones resulted in damages and losses both in productive as well as in social sectors. In this context, they had repercussions on Public Finances through a decline in the receipts accruing to the treasury.

Overall losses to the Treasury are estimated at Ar. 118.4 billion (US$71.7 million). The infrastructure sectors (and especially transport) registered the bulk of these losses, at Ar. 70.0 billion. Production costs of electricity increased by Ar. 3.0 billion.

Social sectors registered losses of Ar. 35.9 billion (US$21.8 million). This is explained by an important decline in the health sector which affected treasury revenues in the order of Ar. 5.7 billion. The removal of debris also accounted for impacts on public finances on the education sector (Ar. 2.3 billion). Significant public expenditures were also needed for reconstruction of public administration housing (estimated at Ar. 23.0 billion) and nutrition (Ar. 5.0 billion).

The deficit in the productive sectors were relatively less important, at Ar. 12.5 billion (US$7.6 million) primarily due to losses from tourism (Ar. 2.0 billion) and expenditures in irrigation rehabilitation (Ar. 10.4 billion).

The budget deficit is estimated to have increased from -4.9 to -5.6 percent of GDP.

Table 66: Ownership of Disaster Effects and Impact on Fiscal Sector , in Millions of Ariary

		Disaster Effects			Ownership by Sector		Effects on:
		Damage	Losses	Total	Public	Private	Fiscal Sector
Social Sectors		**212,193.20**	**24,425.60**	**236,618.80**	**48,280.98**	**188,337.76**	**35,934.80**
	Education	5,276.60	1,059.90	6,336.50	6,055.48	281.06	2,288.90
	Health	11,230.00	5,690.50	16,920.50	16,920.50	0.00	5,690.50
	Nutrition	1,314.30	1,575.70	2,890.00	2,890.0	0.00	5,000.00
	Housing and Public Administration Buildings	194,372.30	16,099.50	210,471.80	22,415.00	188,056.70	22,955.40
Productive Sectors		**13,974.8**	**212,216.10**	**226,190.80**	**9,515.00**	**216,676.2**	**12,489.90**
	Agriculture, livestock and fisheries	10,461.10	159,564.30	170,025.40	9,314.50	160,711.3	10,407.00
	Industry and Commerce	2,849.5	27,423.8	30,273.2	0.00	30,273.2	64.70
	Tourism	664.20	25,228.00	25,892.20	200.50	25,691.70	2,018.20
Infrastructure		**60,792.10**	**24,954.90**	**85,747.00**	**63,681.80**	**22,065.20**	**69,970.40**
	Electricity	3,502.40	2,957.60	6,460.00	6,460.00		2,957.60
	Water and Sanitation	616.80	1,729.00	2,345.80	1,155.00	1,190.80	3,000.00
	Transport	55,383.60	20,083.60	75,467.20	55,383.60	20,083.60	63,899.00
	Telecommunications	1,289.30	184.70	1,474.00	683.20	790.80	113.80
Cross-Sectoral		**356.60**	**475.80**	**832.40**	**0.00**	**832.40**	**0.00**
	Environment	356.60	475.80	832.40		832.40	
TOTAL		**287,316.70**	**262,072.40**	**549,389.00**	**121,477.78**	**427,911.56**	**118,395.10**

Impact on Livelihoods and Income

Summary

1. PRE-DISASTER SITUATION

The affected population. Almost 2.9 million households live in the 17 regions affected by the 2008 cyclones. It is estimated that about 125,000 households (4.3 % of the total) have been directly or indirectly impacted by the natural hazards. The affected districts fall predominantly in rural areas, the majority being among the poorest within Madagascar. There is a rapid population growth rate in these areas: higher fertility rates tend to offset rural to urban migration. The vast majority of the population (approximately three quarters of the population of Madagascar lives in rural areas) live off small, mainly subsistence farms. Only 2.7 percent of the labor force is engaged in non-agricultural, wage-earning jobs. Life expectancy has increased dramatically from 41 years in 1960 to 56 years today, but one-third of children under the age of 5 years are malnourished. Rates of infant and maternal mortality are high and access to basic water and sanitation services is limited. Education outcomes have improved significantly in recent years and there is gender parity at the level of primary education.

Farm and non-farm employment. Agriculture employs 80 percent of the population, but represents less than 20 percent of the GDP of Madagascar (2005). Agriculture has been stagnant for years, trapping the rural population in a vicious cycle of poverty. Over the last twenty years the distribution of arable land has become more unequal, partly due to the most vulnerable households at times being forced to sell their land to cope with shocks. The poorest and most vulnerable families own little land, particularly marginal bottomlands, or work under share-cropping contracts on land owned by others. Women have less access to land ownership than men do.

Given the agricultural orientation of the economy along with the importance of family-level production units, most workers are “self-employed”. Over a third of rural households have at least one member engaged in work outside the farm, as a form of reducing risk-exposure through diversification of income. Shrimp farming, and more recently, tourism have grown impressively in some of the areas, and now represent two of the most dynamic sectors, together with mining. Although they generate opportunities for employment, these are not likely to produce enough non farming jobs for the growing labour force.

The non-farm economy of the 17 affected regions is composed of an estimated number of 18,000 establishments in the Industry sector and 174,500 in the Service/Commerce sector. More than 90 percent of these are micro-enterprises operating on the margins of the formal sector, between 3 and 6 percent are PME/PMI and the rest are large enterprises.

It is estimated that 55 percent of the workforce who are earning wages and have salaried jobs are employed in unskilled positions, while 34 percent are skilled labourers. But in rural areas

unskilled labour accounts for more than 65 percent of wage labour. More than half of the workforce has no formal education. According to a recent survey, over 60% of the formal sector firms consider this to be an impediment to their growth. Women account for half of the total workforce, but their wages are well below those of their male counterparts and men, in general, have greater access to higher paying jobs.

Table 67: Basic Labour Market Indicators for Madagascar, 2005

Indicator	**2005**
Employment and unemployment (%)	
Labour Force	88.1
Employment-to-population ratio*	85.8
Unemployment rate	2.6
Child Labour rate	18.8
Women's Employment rate	83.2
Poverty rate among unemployed	42
Wage and Salaried Workers (000Ar)	
Median Monthly Earnings	71.5
Low Earnings Rate	18.6
Poverty Rate **	47
Non-wage Workers (000Ar)	
Median Monthly Earnings	32.2
Low Earnings Rate	36.6
Poverty Rate**	69
All workers (000Ar)	
Median Monthly Earnings	35.3
Low Earnings Rate	33.8
Poverty Rate**	65

* The individual is employed if he has a permanent job or he has worked at least one hour in the week prior to the survey. Prime working age (15-64 years old)

** Low earnings line: Official national poverty line Ar. 305,300 per year for 2005

Source:D. Stifel, F.H. Rakotomanana, E. Celade - Assessing Labour Market Conditions in Madagascar - The World Bank, June 2007

Table 68 Decomposition of the Labour Market in Madagascar, 2005

Tier	Level (millions)	%
A. Total Working Population (6+)	14.44	100
B. Child Population (65+)	4.78	33.1
B.1 Child Labourers	0.90	18.8
C. Elderly Population (65+)	0.49	3.4
C.1 Employed	0.31	63.7
D. Working Age Population (15-64)	9.17	63.5
D.1 Inactive	1.09	11.9
a) Discouraged	0.07	6.1
D.2 Active	8.08	88.1
b) Unemployed	0.21	2.6
c) Employed	7.87	97.4
c.1 Wage and Salaried	1.17	14.9
- With low earnings	0.22	18.6
- Management	0.12	10.1
- Skilled workers	0.41	34.8
- Unskilled workers	0.65	55.1
c.2 Non Wage Employed	6.69	85.1
- With low earnings	2.33	34.4
c.1) Primary	6.30	80.1
c.2) Industry	0.20	2.5
c.3) Services	1.37	17.4

Source:D. Stifel, F.H. Rakotomanana, E. Celade - Assessing Labour Market Conditions in Madagascar - The World Bank, June 2007

***Child Labor*.** Though child employment rates have decreased between 1993 and 2005 throughout Madagascar, 18.8 percent of all children between the ages of 6 and 14 are still involved in income-earning activities (2005). Child labour is prevalent predominantly in the rural areas (87 percent). Boys are more exposed to child labour than girls (51 percent). Child labour plays an important role in coping strategies among poor households. Children are employed in the sectors with the lowest earnings. They are employed as non-wage workers and in agricultural activities. Families rely on children for multiple tasks in agriculture (e.g. planting, re-planting, harvesting). They are often exposed to dangerous and/or demeaning work environments and their schooling is affected and compromised by excessive work: fewer than half of all employed children are enrolled in school, compared to the 80% of non-working children.

The Informal Economy. The formal labour market is very limited in minor centres and rural areas throughout Madagascar: less than 15 percent of workers involved in income generating activities are compensated in the form of wages or salaries. Conservative estimates place between 64 and 74 percent of the total worker population in the informal sector, this figure rises up to almost 98 percent in rural areas[22].

Income. At the household level, income distribution is highly unequal. According to the 2004 Household Survey the richest 20% of the population account for 49 percent of total consumption while the poorest 20% account for only 6 percent. The earnings in the agriculture sector are the lowest. The average monthly earnings of workers in the agriculture sector is Ar. 31,500, in non-farm enterprises is Ar.51,900 and those of the wage workers is Ar. 87,100 (2005 estimation). Job earnings for wage workers in urban areas are almost double those in rural areas. Median earnings for wage workers in large urban areas are Ar. 100,000 per month, compared to Ar. 78,300 in secondary urban, and Ar. 55,600 in rural areas.

In Madagascar nearly seven out of ten individuals live below the poverty line (INSTAT, 2006). Poverty is much more pronounced in the rural areas than in the cities, despite an improvement observed since 2005. Poor people derive most of their income from their own largely unskilled labour. Almost 58 percent of agricultural wage workers are employed seasonally and therefore have annual earnings which are lower than those of permanent workers. A complicating factor is population growth, currently at 2.7% a year. The rapid population growth makes it more difficult for poor household to escape poverty.

***Asset ownership*.** Almost all households (97%) have physical assets, including land, housing, livestock and durable goods. Primary forms of assets are land and livestock. Access to land is a major constraint in agricultural production and land scarcity continues to worsen due to the pressures from population increase. Agricultural plots are small, and the 2004 estimates show that 60 percent of the agricultural population exploits less that 1.5 hectares. Livestock ownership is high, constituting 41 percent of all asset holdings, and is often used as a risk mitigation measure.

Savings. Formal commercial banks have little market penetration, particularly outside urban areas. With only seven banks, the banking system in Madagascar is highly concentrated. Basic deposit, payments and credit services are beyond the reach of the majority of the population. Microfinance and other non-formal financing systems have grown rapidly in the recent years, but overall penetration remains limited. MFIs are located in relatively better-off areas. The majority of credit is most likely carried out through informal arrangements. A large segment of the population uses traditional informal insurance and saving mechanisms to mitigate the impact of external shocks. These include local savings associations, reciprocal labour arrangements, and investment in human resources or in assets. Investments in cattle is a widespread means of mitigating shocks and allows households to self-insure a certain level of risk, as modern kinds of insurance and social security practices are not widespread.

***Basic infrastructure and social services*.** Lack of access to essential infrastructure, drinking water, electricity, roads – as observed in the affected regions visited - renders households more

[22] Based on the formality status of the job (if the employee has social security, social protection and paid leave), not on the formality status of the firm

vulnerable to poverty. Access to safe drinking water is limited to 32 percent of the population. One-quarter of the population gets their water directly from rivers and lakes. Only 14% of the population in Madagascar (including 30 percent in Antananarivo) uses electricity for lighting and only 4% in rural areas. Wood remains the primary cooking fuel in rural households and among the poorest quintile (96 percent). The country's road infrastructure has deteriorated over the last two decades and high transport cost reduces agricultural productivity and increases poverty.

The poor health status of the population is a consequence in part of a lack of access to basic health services, despite recent improvements. In terms of the educational outcomes, in recent years the primary school enrolment ratio has increased from 70 to 90 percent. Although these are impressive result, a quarter of adults in their prime working age have never attended school. Less than half of the students in primary schools complete five years of primary education.

In Madagascar traditional social protection programs such as social security or social insurance programs apply to only very limited, formalized segments of the workforce, such as public and formal private sector employees.

2. Damage and Losses

While the rest of the damage and loss assessment captures the quantity of damage and losses in terms of lost assets and outputs, the assessment of livelihood losses focuses on estimating the impact on employment and income. The cyclones of 2008 affected livelihoods in different forms and magnitude. The assessment estimates show the total loss in employment to be about 6 million working days for a loss in earnings of 11.2 billion Ariary (equivalent to 6.8 million US$). The largest job losses are in agriculture and fisheries. No employment loss is assumed in the industrial and commercial formal establishments.

A total of 4.5 million working days were lost in the agriculture sector for a total loss of earnings of 8,100 million Ariary. Most of the working days were lost due to damage to agricultural land: Rice (2.4 million days), Girofle (almost 1.0 million days), followed by Vanilla (0.3 million days) and Manioc (0.25 million days). The regions most affected by losses in terms of agricultural earnings were Analanjirofo, which lost 2.0 million working days, followed by Atsinanana, with 0.8 million working days lost. The regions of Sofia and Alaotra Mangoro lost around 0.2 million working days each, and the others suffered losses averaging between 150,000 and 50,000 working days each.

In the fisheries sector, the loss in employment has been estimated at 1.5 million working days for a total loss of 3.1 million Ariary in earnings. Fisher folk were affected by the loss of boats (pirogues), fishing gear and other fishing equipment causing them to suspend their activities for up to a year. Those who did not loose their boats had to stop for periods varying from one to two weeks due to the conditions of the sea.

Damage to public assets included destruction of common infrastructure such as roads, bridges, electric networks, irrigation canals, the silting of river beds, and destruction of public buildings. Damage to individual assets in the agriculture sector included the destruction of crop land (mostly rice, corn, manioc, sugarcane), as well as export-oriented cash crops (such as highly

valued Vanilla, Girofle, Coffee) and fruit trees (banana, litchis), farm infrastructure, and livestock (a traditional form of savings for poor families). Fishermen lost small fishing boats and gear and/or had to stop their activity for a period.

Concerning the non-agricultural activities, in the Industry sector it is estimated that approximately 350 enterprises (approximately 2 percent of the more than 18,000 establishments) suffered partial destruction to business premises, equipment and inventories and many had to suspend their production due to power and water cuts for periods ranging from 2 to 4 weeks. It is estimated that micro enterprises and PMEs representing 92 % and 6.5 % of the total industrial enterprises, respectively, have been damaged the most. The damage to large industrial enterprises (around 1 % of the total) had no major relevance. Small industries were affected in different sectors: metallic works, boat making, wood processing, furniture making, brick making, paper and cardboard making, candles, electrical material, goldsmith/jewelleries, and chemicals. Agro-industries, categorized under Industry - such as rice mills, fish, sugar, milk processing, leather industries, tobacco processing, rice mills, alcohol making, etc., mostly small and medium – were also affected.

In the Commerce sector, it is estimated that some 3,550 enterprises (2.0 percent of the almost 175,000 commercial establishments) have been affected, partially or completely due to the cyclones. The micro enterprises (representing 96 % of the total commercial establishments) have been most affected. Trades such as repair shops, mechanics, barber shops, photocopying shops, handicraft makers, etc. and small and micro retail shops in the informal market places (such as grain shops, clothes/dresses shops, food shops, small restaurants/ “gargottes”, handicraft shops) had their business premises damaged or destroyed (in many cases the activities were located within the house), and lost tools and inventories. Wholesale multipurpose shops (such as hardware shops, agricultural inputs and materials shops, etc.) representing 3.5% of the commercial establishments, have suffered less: some of them had their inventories partially damaged.

Private businesses were forced to interrupt or reduce their activities for varying lengths of time during and after the cyclonic events up to four weeks, due to power and water cuts(ice factories). More than 80% of the entrepreneurs declared having re-established operations within two months of the last cyclone, the remaining businesspersons envisaged attaining full functionality of their activities within three months.

3. Socio-Economic Impact

***Impact on the vulnerable*.** The main victims of the 2008 cyclones are population groups that were already vulnerable, living in marginal areas exposed to risk of inundation, with lower levels of income and service provision as compared to the national average. Such groups (i) have a higher poverty rate than the remainder of the population; (ii) are incapable of taking advantage of opportunities; (iii) lack assistance or have less than limited resources in the event of shocks. These are groups that without substantial support may be in severe and chronic poverty, unable to take advantage of profitable opportunities if they emerge, and possess limited defences in case of serious events or shocks occurring. The most vulnerable groups amongst the poor are marginal farmer households with little land and no other sustainable source of income, landless households living off seasonal non-skilled job opportunities in agriculture or some form of

commerce in the informal economy, female-headed households who have to raise several children, disabled, elders without relatives, and parentless children.

The poor are the most exposed segment to a broad range of risks and have the fewest instruments to deal with these risks, due to the limited assets, less recourse to savings and borrowing in times of crises, reduced human capital and less income to pay for essential services. Disabled, elderly and other vulnerable groups are disadvantaged in accessing relief not only during the occurrence of natural hazards but also in their aftermath. Correcting this will require the development of mechanisms to provide long term care where needed, as well as support for skills development for people with disabilities. The involvement of the community at the Fokontani level will be essential to preserve existing solidarity networks that form the basis of support among affected households.

Coping mechanisms

The households affected have adopted diverse mechanisms to cope with the disaster. In the regions visited, almost all the houses (mostly made of local materials) were quickly rebuilt; savings (in cash or in the form of livestock) were used to meet basic needs; some families had to borrow funds from relatives. The poorest had to reduce food intake or quality of food in order to cope with the disaster. Some groups of particularly vulnerable communities are still relying on relief distribution (2 months after latest cyclone). Another form of dealing with shocks is to send children to work on other farms or in non-agricultural jobs. It is estimated that at approximately 15 percent of children under the age of 15 years are engaged in work. Special protection is therefore required for this group.

4. Recovery and Reconstruction Needs

Following the assessment of damage and losses during the field visits, and the resultant analysis of the impact on the livelihoods of the affected population, the following needs were identified:

Immediate income recovery opportunities need to be created. To compensate for the working days lost, labour-intensive schemes need to be created for immediate community infrastructure recovery and public works. This injection of cash through wages will help stimulate local demand and contribute to kick-starting the local economy. Cash for work schemes need to be complemented by short-cycle skills training for community members, local contractors, and local labourers. In order to help the local population to quickly recover from the losses of jobs in the agriculture sector, an estimated 6 million working days should be created. In addition it would be useful to *establish an effective local labour supply and demand matching mechanism.*

Poor and vulnerable households *who depend on relief schemes and do not have any other income source need immediate livelihood support through micro-credit for livelihood activities.* Microfinance programmes are confronted by both the demand by members for the withdrawal of their savings and the fact that members with outstanding loans are unable to repay them because their asset base has been destroyed or damaged. The micro-credit schemes, thus, require immediate funds for asset replenishment to enable them to re-start credit operations lost as a consequence of the cyclones.

Fragile micro enterprises need to be enabled to invest *in the recovery of their productive assets.* A number of affected micro and small entrepreneurs do not have the financial capacity to foot the investment needed to restore their production capacity. Formal credit is scarce and most of these entrepreneurs already have outstanding loans to repay. Their inability to operate is obviously affecting the workers who used to have jobs with those entrepreneurs. Support schemes aimed at supporting the urgent investments would be needed. Furthermore, micro enterprises routinely face difficulties from the scarcity and cost of working space, and from lack of any adapted business advice on economies of scale, quality improvement and market linkages. There is a need to progressively support such micro enterprises through expanding the provision of business services and credit.

Local youth do not have access to public or private vocational training. Vocational training opportunities in the area are limited or non existent. Young people who want to acquire specific skills would normally have to migrate to towns incurring costs that are not affordable for the poor. Availability of skilled labour can be achieved by providing accessible vocational training, addressing female and male youth. The training should respond to the following needs: (i) increased demand for skilled labour generated by recovery works; (ii) the demand of the entrepreneurs willing to (re-)start a micro-business; and (iii) the demand of the unemployed in search of employment or self-employment.

Local primary and secondary markets have suffered considerable infrastructure damage and need to be recovered and upgraded, *thus creating additional jobs while facilitating the reestablishment and consolidation of the local market flows.* Prior to the cyclone these markets were generally spontaneous markets, with structures made of traditional materials, poorly organized, with difficult access, though they were the major hubs for the provision of essential goods and the flow of local produce to township and urban markets and to markets external to the region. Restoring these markets, facilitating ease of access, providing the minimum basic facilities, expanding the market area where the demand exists, will not only create additional jobs, but will also contribute to an increase in costumers and producers.

Local youth should have better access to public or private vocational training. Vocational training opportunities in the area are limited or non existent. Young people who want to acquire specific skills would normally have to migrate to towns incurring costs that are not affordable for the poor. Economic recovery is dependant on the availability of skilled labour making the provision of accessible training an important part of any recovery strategy. Training should be available to respond to:

(i) the increased demand for skilled labour generated by major reconstruction works
(ii) the need to have available the necessary skills for the full effective utilization of tools and cash-grants provided in the context of livelihood recovery
(iii) the demand of entrepreneurs willing to restart or start a micro-business
(iv) the demands of the job seekers, especially women and youth, in search of a means of living or willing to create their self-employment

To be effective training activities must be accompanied by ongoing support mechanisms. This would include grants, provision of tools, start-up assistance, access to credit, technical support and targeted coaching.

Local trade and industry organizations can have a critical role in stimulating and supporting the recovery process but currently lack capacity. Existing trade or industry associations of entrepreneurs or operators in the main sectors tend to be embryonic and weak. This affects their capacity of providing services to members and to have advisory and advocacy capacity with the authorities for the development of their sector. There is a need to accompany the recovery of the local economy with the support to these organizations, in a way for them to help their associate to access the available services, create new business services, help members to achieve economies of scale, strengthen contractual relations with buyers and markets and facilitate social dialogue. These associations also provide networking opportunities and can act as a vehicle for human resource development including conditions of work. Recognition and adherence to core labour standards and good employment practices today are a condition for many enterprises to operate in the international supply chains.

Clear identification of non-agricultural livelihoods vulnerabilities and planning for the mitigation of risk to them from future shocks are critical for the ongoing stability of the local economy and associated communities. Well designed livelihood recovery and risk reduction interventions must target specific disaster prone-areas and at-risk populations. For this reason, the first step in the implementation of recovery programs will be an analysis of the vulnerability, ranking the target communes by priority. The different levels of vulnerability analysis - geographic, household, individual, by risk-shock – enable programs to develop appropriate targeting mechanisms, some of which may be community-level investments, some may target a type of household and others may focus on specific groups, like marginal farmers in extreme situations. The definition of the priority areas has to be based on an analysis of two main aspects: (a) the nature of household and commune characteristics that put at risk future livelihoods, and (b) the type and severity of the shocks the household faces. Specifically, the following criteria of prioritization will be taken into consideration: (i) Share of population that is at increased risk of becoming or remaining poor; (ii) Sources and dynamic of the vulnerabilities; (iii) Characteristics of the vulnerable groups and communities; (iv) Mapping of the spatial distribution of the productive livelihood vulnerabilities; and (v) Analysis of the risks that provoke the vulnerability.

4.1 The recovery strategy

The Government is already engaged, under the Poverty Eradication Strategy Paper and the Madagascar Action Plan: 2007-2012 (MAP), in putting into place a social protection agenda, improving the assistance to the poorest and most vulnerable. This identifies risks and vulnerabilities (economic, environmental and natural hazards) as central challenges to the development of Madagascar. Several advances have been made to extend alphabetization programs, to improve housing, to protect unemployed through cash-for-work interventions, to accommodate vulnerable and excluded groups, to provide for the elderly, to address malnutrition. The existing social protection spending has been developed in response to diverse crisis. For instance, safety nets were implemented in the immediate aftermath of the cyclones which struck the country in 2004. It is crucial therefore, in response to the 2008 cyclones, to clearly define priorities with regard to risks and target populations.

The main objective of the present strategy for productive livelihoods to recover from the 2008 cyclones is to better orient investments aimed at recovering from the damage and losses caused by cyclones, while contributing to reducing poverty as a means to reducing the risks of future natural hazards and increasing the resilience of the populations at-risk. The strategy addresses the individual and community risks and weaknesses in structural productive livelihoods in a way to produce a positive interrelation and make public and individual market-based interventions more effective in order to reduce risks and vulnerabilities.

4.2 Short term recovery measures to support recovery of loss to productive livelihoods

The proposed strategy for productive livelihood recovery and livelihood risk management is based on a set of short-term measures (coping) in order to limit the impact of the 2008 cyclones, and medium-long term measures aiming at reducing the probability of a livelihood risk materialising (prevention) and decreasing the potential impact of a future risk to livelihoods (mitigation). These measures focus on the poor since they are the most vulnerable to the given risk and lack appropriate risk management instruments. The productive livelihood recovery-cum-risk management strategy not only focuses at building more equitable social safety nets, but is also is an opportunity to improve local economic efficiency and growth. The economic growth implications of this are increasingly acknowledged by the international community.

The proposed measures, may be considered essential but are not sufficient to allow a sustainable recovery of the livelihoods in the affected areas, will be implemented by redirecting present efforts of existing programs that are not operating in the affected areas. The suggested priority interventions, components, to be considered mutually complementing each other in the short-term recovery phase, include:

A - Expand the coverage of the labour-intensive, cash-for-work schemes, the HIMO (Haute Intensité de Main d'Oeuvre).

This approach will be used for the rehabilitation/reconstruction of minor community infrastructure, such as rural access roads, irrigation schemes, public buildings (schools, health centres, etc.). This will contribute to injecting cash (wages) into the local economy, facilitating autonomous household coping strategies (improvement of food intake, housing reconstruction, micro-investments in income generating activities, use of local material), increasing the capacity of local and national authorities to plan and manage recovery interventions, increasing the capacity of the local private sector to handle anti-cyclone norms and public bidding processes, multiplying public works in a number of rural communities, give a boost to the local economy. This should be done by:

- Capitalise on the expertise, experience and lessons learned from the existing HIMO programs (BIT, FID, AGETIPA, etc.)
- Strengthening the capacity of the local administrations in planning, managing and supervising HIMO programs, with an evident beneficial effect on local governance and decentralization

- Increasing the capacity of the local private sector (the local contractors) in implementing anti-cyclone norms and in dealing with transparent public sector bidding, procurement and labor intensive programs
- Creating – including temporary – skilled and unskilled jobs, conducive to improving the access of local workforce, especially young people, to the labour market.

The total estimated number of work-day losses is 6 million working days. At the prevailing HIMO average rate of Ar. 2,000/day, and assuming full compensation for days of labor lost during the cyclone, this would put the HIMO requirements at an estimated Ar. 12.4 billion (US$7.5 million).

It is assumed that most of the sanitation works, commune road rehabilitation and some of the small irrigation rehabilitation needs identified in this assessment (see respective Annexes) can be done through HIMO procedures. Hence, HIMO needs are already sub-assumed under the Water and Sanitation, Transport, and Agriculture sector reports.

B -Establish decentralized employment information services (EIS).

The first action for supporting recovery of livelihoods of people who suffered the devastating effects of cyclones should be to facilitate their search for alternative jobs. The core tasks of the EIS will be to function as a mechanism to:

- Facilitate the matching of job seekers and job opportunities by gathering information from local employers concerning demand for unskilled and skilled workers and information from the job seekers on their skills and preferences
- Facilitate exchange and dissemination of information on employment opportunities;
- Gather information on the characteristics and skills of job seekers including micro-entrepreneurs who have lost their tools and capital due to the disaster and need to find an alternative source of income. This will be extremely useful for designing and planning tailored training programmes, and will also provide support for micro and small business recovery.

The cost of these services is estimated at Ar. 82.5 million per region (US$50,000) or a total of Ar. 1.3 billion (US$0.8 million).

Box 2: The HIMO (Haute Intensité de Main d'ouvre) programs

High Labour Intensive (HLI) cash-for-work schemes (HIMO) have a long tradition in Madagascar. Donors have been very active in supporting HIMO programs since the beginning of 2000. Various HIMO programs are active in various regions. Among them:
Community Development Project (FID IV), funded by IDA
Project in Support to Rural Development (PSDR), funded by IDA
Water Basin Management – Mandrare II, funded by FIDA
Road Projects, funded by FED (EU)
School Construction Project, implemented by AGETIPA
The HIMO/Routes (construction and maintenance), HIMO/Batiments (construction of schools), and HIMO/Communal (communal infrastructure) programs, implemented by ILO (BIT), funded by Norway.

These HIMO schemes aim to fight against poverty by creating direct and indirect employment. The HIMO/BIT programs have adopted a comprehensive approach, which implements the investments while improving the capacity of local authorities and stakeholders to plan, manage and supervise HIMO projects; facilitates access of local contractors to training on HIMO techniques, anti-cyclone norms and public bidding procedures; ensures the integration of decent work conditions into all the projects. The HIMO/BIT program executes projects for a variety of organizations, UNDP, FENU and UNICEF. The strategy is based on the following steps:
Identification with central and local authorities of the infrastructure to be built (school, road, etc.) on the basis of pre-defined criteria
Support and training to local authorities to improve their capacity of planning local infrastructure, implementing and supervising public works, ensure quality of works and timely delivery.
Establishment of a local maintenance contract (e.g. in the case of schools with CISCO/MENRS-Commune-Parents' Association)
Implementation of the investment with anti-cyclone norms, in a decentralized way, working with local authorities, local architects, hiring through bidding processes local contractors for the construction work and supervision. Supervision is permanent and supported by the mobilization of the Parents' Association
The works realized through the HIMO approach create jobs and income (wages) for local population in a direct waythrough the participation to the works and in an indirect way through the provision of local materials, thus contributing to poverty reduction
The project unit ensures the follow up of the operations and the analysis of the socio-economic impact of the works on the base of established indicators

The training of all the operators (private contractors and local authorities) is ensured by the HIMO training centre created by the project and based in Antirabe, that has now become autonomous and self-sustaining, working for a variety of programs (World Bank, EU, AFD, NORAD). The training improves the technical capacity of the local contractors in following the anti-cyclone norms and in adhering to transparent norms of the public building procedures. This, in turn, allows the local private sector to acquire additional technical experience, increase own resources and have access to the public works market.

The construction of a three room school creates about 1,300 direct working days. The use of local material allows the creation of additional indirect employment for about 1,200 working days. The salary per working day is equivalent to the SMIG (Established Minimum Wage). The construction of a 3 room school has a cost of 203 US$ per sqm. Between 2003 and 2007 the HIMO/BIT, with an investment of about 1 m. US$ has produced 176 schools (453 classrooms), mobilizing and training 113 local contractor companies. It has created 380,000 working days (50% direct and 50% indirect) at a cost of 2.3 US$ per person/workday.

An Association (the MRL/HIMO) was created since 1999 to manage HIMO investments throiugh four antennas and two mobile units. These antennas intervene in all regions depending on the demand. Specialized trainers are deployed to support local programs. Two of these antennas cover two of the region affected by the 2008 cyclones (Vatovavy Fitovinani from the base in Vohipeno and Antsinanana from the one in Vatomandry). The HIMO approach can be combined and harmonized in order to achieve delivery levels compatible with the needs to recover from disastrous events, on the basis of public funding and/or external funding available.

C - Rehabilitating and upgrading of "Rural Market Areas",

to make them easily accessible by vehicles and equipped with basic facilities. This will allow an increase in consumers and producers, the establishment/improvement of associations and market linkages, leading towards a boost to the consolidation of the local economic recovery. It is proposed that a total of 30 small markets be constructed in high-risk regions, targeting particularly district centres and communes where such facilities are still lacking. The standards of the Social Development Fund (FID) would be used, at a unit cost averaging US$50,000 each, for a total investment of Ar. 2.5 billion (US$1.5 million).

4.3 Medium and long term recovery

An effective recovery and risk reduction (to future shocks) strategy will have to be complemented in the medium-long run with an additional comprehensive set of interrelated measures, livelihood prevention and mitigation strategies. The combination of the short term and medium to long term measures will create a critical mass of investments which will contribute towards the recovery of the livelihoods of the affected people, eliminating the worst forms of extreme poverty and spark a process of re-vitalization of the affected local economies.

The medium-long term strategy will include interventions to assist individuals, households, and communities to better manage the risks of income or capital loss. This, combined with equity enhancement measures (safety nets, better access to basic services, community interventions through social funds, social insurance including pensions), presented in other sections of this report, will contribute to (i) reducing the vulnerabilities of low-income families, (ii) attenuate major fluctuations in family incomes, and (iii) protect the meagre assets of at-risk groups to help them withstand shocks.

The following components will be implemented in the medium to long term:

D. Promotion and support to the creation/consolidation of micro and small enterprises in order to create more jobs in the local economy, by:

- Facilitating the formalization of micro and small informal enterprises by implementing awareness campaigns and establishing one-stop-shops (guichet unique) at the decentralized levels (region/district), following similar schemes already implemented for major industries in Antananarivo.
- Supporting the improvement or the emergency of a quality handicraft sector, linked to internal and external market demand.
- Facilitating the operation of Micro Finance Institutions (MFI) in a way to increase access to credit for micro-small enterprises, by easing administrative procedures, while providing specialized training to MFIs, establishing modalities for strict control of their performance.
- And, eventually, exploring the possibility to establish forms of fiscal subsidy for micro and small enterprises in areas affected by disasters.

This initiative would be implemented through the Business Centers proposed under the Commerce and Industry Sector (see respective Annex).

E – Access of local youth to public and private vocational training programs, in order to improve the employability of job seekers and diversification of employment and sources of income. The training component should have the following objectives:

- to further improve the skills and entrepreneurial capacity of those who have benefited from immediate support in terms of equipment, tools and cash support to restart livelihood activities lost in the disaster;

- to respond to the demands of the job seekers, especially women and youth, in search of a means of living
- to respond to the demands of micro-entrepreneurs who are willing to restart or start a micro-business; and
- to prepare the local labour force to the increased additional demand in skilled labour that will come from the labour market due to major public and private reconstruction works.

Existing tools, designed specifically by the ILO for this type of training interventions, could be used such as the "*Start and Improve Your Business*" tool-kit. A flexible approach should therefore be adopted, taking full advantage of the local and international organizations currently delivering training. Efforts should be made to potentially expand the capacity and delivery of skills through the **training of trainers** and alternative means like on-the-job training and internships with the existing businesses and enterprises.

All training activities should be accompanied by measures for supporting the restart of the activities of graduates through grants and assistance to the start-up process, micro credit schemes, technical support and coaching to the micro-entrepreneurs for a limited period.

The estimated costs of this activity (about 5 training courses per region in 12 regions) are Ar. 600 million or US$0.4 million.

F - Revitalize/strengthen the rural professional organizations and strengthen the capacity of the local administration in high-risk areas, in order to support the implementation of effective livelihood and disaster risk management programs, and empowerment of producersas a means to achieve economies of scale, strengthening contractual relations with buyers and markets, facilitate social dialogue. This strengthening, linked to existing programs such as the Rural Development Support Program (PSDR) or FID, should be tied to the expansion of markets (Activity C). The estimated needs are 5 training sessions per market rehabilitated, at a total cost of Ar. 247.5 million or US$150,000. The estimated needs to strengthen the capacity of the local administration for a three year program of support to the regions most at risk, are Ar. 2.5 billion, or US$1.5 million.

Table 69: Livelihoods: Recovery and Reconstruction Needs (US$ Million)

Subsector Needs EARLY RECOVERY	Early Recovery (US$ Million)	Medium/Long Term Recovery (US$ Million)	Note
Strategy: quick income recovery, revitalization of local markets, matching demand and supply of labour			
A- HIMO (Haute Intensité de Main d'Oeuvre) programs	(12.4)		Already accounted for under Agriculture, Transport and Water and Sanitation Sectors
B- Rehabilitation and expansion of market places	1.50		
C- Establish Employment Information Centres/Units	0.80		
TOTAL	2.30		
MEDIUM-LONG TERM RECOVERY			
Strategy: livelihoods risk reduction, increasing livelihood resilience, avoiding poverty trap			
C- Promotion of micro and small enterprises		(0.15)	Already accounted for under Industry and Commerce
D- Access of local youth to vocational training		0.36	
E- Strengthening of rural professional organizations		0.15	
F- Development of diversified agricultural production		(1.38)	Already accounted for under Agriculture Sector
G- Strengthening the capacity of decentralized public services		1.50	
TOTAL		2.01	
Total Needs Livelihoods (Net of Other Sectors)	4.3		

PART B: Facing the Future: Recovery and Reconstruction Requirements

Section IV: Reducing Risk

Disaster Risk Reduction Investments for Recovery

Summary

Given the recurrent occurrence of cyclones in Madagascar, disaster risk reduction (i.e. prevention efforts) becomes of primordial importance. Neither the Government, nor the people of Madagascar, nor yet the donors can afford expenditures approaching US$330 million per disaster when the events occur with near annual frequency.

Five priorities have therefore been identified to reduce disaster risk:

1. A ***National Plan for Disaster Risk Management***
2. Strengthened ***Risk Assessment***
3. Strengthened ***Early Warning Systems*** and ***Disaster Preparedness***
4. Development of ***Cyclone Norms and Standards*** and integration of ***Risk Management into Sectoral Programs***
5. ***Catastrophe Risk Financing and Transfer***

1. National Plan for Disaster Risk Management

In 2002, the Government produced a *National Strategy for Disaster and Risk Management* which is currently being updated. It now needs to develop and implement a National Plan for Disaster Risk Management, involving the relevant sectors and building upon the Strategy's vision. The Plan would need to specifically address the challenge of decentralization and provide for capacity building for the various administrative levels in all aspects of disaster risk reduction (prevention, preparedness, response and recovery). It should also address community-level needs, and public-private partnerships. A national training institution or University curriculum would likely be required to support the capacity building needs.

2. Strengthened Risk Assessment

National and regional decision-makers need to identify risks based on better maps and hazard and vulnerability patterns. This is important so they can define development priorities and land use plans, allocate resources, and orient relief and recovery efforts. It is critical to start developing a common approach to assess disaster and climate change risks and produce assessment maps that are comparable from event to event.

3. Strengthened Early Warning Systems

All district authorities commended the efforts undertaken by BNGRC prior to the 2008 season to strengthen disaster preparedness. It is clear that these preventive efforts helped save lives. To maximize their effectiveness, however, training in disaster preparedness should now descend to the level of communes and Fokontany at risk. Systems are also needed to provide more targeted warnings to remote villages using when necessary local dialects, with clear information on measures to be taken upon receipt of an alert. Simple warning materials (e.g. megaphones, sirens and wind-up radios) should be distributed to Fokontany at high risk that may be out of radio contact.

4. Development of Cyclone Norms and Standards and Integration of Disaster Risk Reduction into Sectoral Programs

It is recommended that the Government review existing norms in the housing and construction sector to ensure they are appropriate for the levels of wind, inundation and fire risk to which different high-risk regions are exposed. This should be followed by training of builders and NGOs, and guidelines dissemination for safe construction. A comprehensive set of norms and standards are also needed for the transport and agriculture infrastructure sector, including baseline data for monitoring hazard risk (especially inundation). In general, it is recommended that the Government adopt a minimum safety level of 1 in 100 year flood level for all infrastructure (including bridge basic structures) and 1 in 300 years for bridge decks. Given that transport norms require site-specific hydraulic modelling, it is recommended that the Government adopt preliminary norms while investing in further post-graduate training for young professionals in hydraulic engineering and inundation modelling at a selected world-class institution.

In other sectors, disaster risk reduction parallels adaptation to climate change: for example, in agriculture, communities expressed the need for seed varieties adapted to cyclones and inundations and for better information on the available seed stocks prior to the cyclone season. In the Power sector, there is a need to test the cost-effectiveness of burying electrical cables to protect them from exposure to cyclone winds.

5. Catastrophe Risk Financing and Transfer

The assessment identified the need for a Disaster Fund capable of financing recurrent disaster and disaster risk management efforts, including recovery and reconstruction efforts that promote better building codes. A separate need was catastrophe risk transfer for rare events such as insurance. The Ministry of Finance has started responding to this need by establishing a new Contingency Fund in the 2008 Budget and a visit by Caribbean regional experts is envisaged in September 2008 to discuss catastrophe insurance.

Priorities 1, 2 and 5 are for the most cases being dealt with under a Track II Technical Assistance Grant from the Global Facility for Disaster Reduction and Recovery. The estimated total needs for Priorities 3 and 4 which are not already taken into account into the various sectors' needs

are estimated at Ar. 11,130 million or US$6.7 million. These include the incremental costs of development of cyclone-proof norms and standards (Ar. 584.4 million or US$354,200), and the costs of training and early warning materials at the commune and Fokontany levels (Ar. 10.1 billion or US$6.1 million). The remaining Ar. 0.5 billion Ar. (US$0.3 million) involve coordination of the early recovery program at the national, regional and local levels.

Situation during the Disaster

The three tropical cyclones - Fame, Ivan and Jokwe - and the recovery operations already being carried out provide an important opportunity to learn key lessons about the risks affecting Madagascar and identify specific measures to address them. This is particularly relevant given the cyclic occurrence of cyclones in Madagascar and the fact that most regions of the country are at risk of cyclones and floods, and several at risk of drought, locust invasion, and tsunami.

Reconstruction and recovery needs related to this year's cyclones need also to be seen in the broader context of development. For example, while cyclone damage is estimated to be responsible for 20-75 of the damage to dykes and 50-80 percent of the damage to bridges, excessive sedimentation in rivers and poor maintenance of canals (combined with the intense rains caused by cyclones) are the main causes of damage to dams and weirs.

It became apparent throughout the assessment that many existing practices and mechanisms contributed to reduce the impacts of the three cyclones in 2008. Commitments and policies established in recent years by the Government, BNGRC's effective dissemination of early warnings and disaster preparedness training and simulations, new anti-cyclonic building norms for schools and hospitals disseminated by the Fund of Investment for Development (FID), and the development of specific school curricula on disaster risk reduction are some of the examples of such good practice.

Figure 73: Vihimbia, a traditional famine food in St. Marie Island. During cyclone Ivan, this seed was one of the only sources of food available to affected fishing villages.

Figure 74: Sharecroppers in Alaotra Mangoro region. As with many poor, these farmers built their houses in a flood-prone area and suffered a high degree of damage during the cyclones.

In addition, communities have developed traditional mechanisms to cope with the impact of cyclones. These practices are essential for the communities in rural areas to ensure economic development and avoid the trap of poverty. Examples of such mechanisms include the type of building material used for houses - wooden frames with bamboo or *ravenala* leaf covers, which are easily replaced after the cyclones. Another example is the type of rice produced, which may produce lower yield but is more resistant to cyclone impacts. Yet another is the use of *vihimbia,* a traditional famine seed consumed during cyclones in areas such as St. Marie (Figure 73).

Poverty is changing habits and customs and increasing communities' vulnerability to disasters, forcing poor sharecropping families, for example, to settle in low-lying inundation-prone areas (Figure 74). Climate change is also projected to increase communities' vulnerability to extreme climate events. Hence, current projections need to be factored in disaster risk management plans. Building on existing practices, the present assessment defines a number of strategic measures that should be taken as part of recovery to reduce future disaster risk.

Box 3: Methodology Used for Integration Disaster Risk Reduction and Climate Change Adaptation Needs in the JDLNA

At the global level, the Hyogo Framework for Action 2005-2015 identifies as one of its three main strategic goals the inclusion of risk reduction into emergency preparedness, response and recovery programmes in the reconstruction of affected communities.

At the national level, the Government of Madagascar committed to the integration of disaster risk reduction into its recovery and reconstruction efforts. It was decided to give a strong priority to the concept of "building back better" in the Joint Damage, Loss and Needs Assessment.

The following steps were taken to integrate disaster risk reduction into the JDLNA:

Strategies identification for disaster risk reduction and climate change adaptation (including when available sectoral plans).
Analysis of vulnerability factors behind the impact of cyclone Ivan and Fame (sector-by-sector).
Consultations with partners and with each sector team on measures to reduce risk through recovery with evaluation of related costs.
Validate the analysis through field visits to four affected regions (Menabe, Antsinana, Analanajirofo, Alaotra Mangoro).

The analysis also builds on the following principles developed so as to contribute to a more systematic integration of disaster risk reduction into Track III operations, namely:

The needs to 'build back better' are considered based on the damages and losses of the evaluated by each sector of the JDLNA.
Measures and recommendations related to disaster risk should address all relevant hazards and that take into consideration the broad range of vulnerability factors (economic, social and environmental).
Recommendations should contribute to existing national and sectoral strategies, plans and projects for disaster risk reduction.
Recommended risk reduction needs are defined by the relevant Government counterparts in consultation with partners, including the UN country team, international organizations, bilateral partners and civil society organizations.

The term disaster risk reduction is used to define a way to minimize vulnerability and disaster risk, in order to avoid (prevention) or to limit (mitigation and preparedness) the adverse impacts of hazards.

The definition of strategic measures builds on the accepted international framework for disaster risk reduction and the Malagasy national strategy. This included indicators of progress developed in the Guidance on Measuring the Reduction of Disaster Risks and the Implementation of the Hyogo Framework for Action (ISDR, 2008). This section of the JDLNA was developed with support and advice from staff of the BNGRC, CPGU, UNDP, World Bank. The section's main authors were an expert from UNISDR and a cyclone norms expert from DELTARE/ Delft University of Technology.

Madagascar Strategy for Disaster Risk Reduction

Since the mid-1990's, the Malagasy Government has taken disaster risk reduction into account in its national planning. The highest body overseeing disaster risk reduction is the Conseil National de Gestions des Risques et Catastrophes (CNGRC) chaired by the Prime Minister. The Bureau National de Gestion des Risques et des Catastrophes (BNGRC) is the operational body of the CNGRC. The Cellule de Prevention et de Gestions de Urgences (CPGU) was established in 2006 to oversee policy coordination issues on behalf of the CNGRC.

The Comité de réflexion des intervenants en catastrophes (CRIC) was established in 1999. The CRIC was designated as the National Platform for Disaster Risk Reduction in 2003. In 2002, Madagascar developed a "National Strategy for Disaster and Risk Management" and at the same time, the Strategy was incorporated into the country's Poverty Reduction Strategy Paper (PRSP). Disaster risk reduction was further strengthened in the 2007-2012 "Madagascar Action Plan" (MAP), thus mainstreaming it into the broader sustainable development agenda.

The national strategy is structured around the following strategic pillars:

1. Establish and implement institutional mechanisms for disaster risk management;
2. Strengthen long term capacity at national, regional, district and communal levels;

3. Strengthen comprehensive information systems;
4. Develop long-term financial mechanism;
5. Global reduction of vulnerability and risk; and
6. Regional and international cooperation.

Madagascar also developed in 2006 a National Adaptation Plan of Action for Climate Change which highlighted the particular vulnerability of the island to cyclones, floods and droughts and the fact that these events were becoming more frequent and intense. It also identified a number of priority projects to address the main climatic risks. In March 2008, in collaboration with the University of Cape Town, the Meteorological Directorate published a comprehensive review of climate change trends (past and future) based on a review of all available meteorological stations and global circulation patterns validated for Madagascar.

In 2007, under the leadership of the BNGRC and in close cooperation with UN-OCHA and UNICEF, the existing sector groups of the CRIC were recognized following the UN humanitarian cluster approach to henceforth have a dual leadership consisting of one national focal point institution as President and an international support agency as support secretariat. These task teams focus on seven thematic areas: Health; Water, hygiene and sanitation; Agriculture; Nutrition and food security; Education; Logistics; and Shelter and non-food issues. Each group considered risk and vulnerability, albeit with a strong focus on humanitarian needs.

A number of related initiatives are ongoing or in the pipeline in Madagascar. For example, UNDP supports a programme for the implementation of the Malgasy national strategy for disaster risk reduction. In December 2007, GFDRR initiated a project on disaster risk reduction to Madagascar under its Track II. This is a three year project totalling approximately 1.2 million USD. A further multi-sectoral committee was established to support the implementation of Track II, named “Comité de pilotage du TRACK II”. Both GTZ and ECHO also support on-going disaster risk reduction initiatives in Madagascar, such as inundation modelling in Greater Antananarivo and review of regulations (GTZ) and support to various NGO adaptation programs (ECHO).

Box 4: Outline of GFDRR Track II project in Madagascar

Track II was initiated in Madagascar in 2008 as a three year Technical Assistance managed under the Prime Minister’s Office, for a total of US$1.26 million. It comprises four components:

Risk Assessment, including studies and training to strengthen the monitoring of hazards (cyclones, drought and floods) and vulnerability, and the production of a national risk atlas condensing this information. A further study is proposed to revise the location of the national hydro-meteorological stations.
Risk Reduction: consisting in a review of existing national cyclone-proof norms and standards for building, agriculture infrastructures and public works, and related information, sensitisation and training.
Risk Financing: consisting in incorporating disaster risk parameters into the national budget, as well as the potential establishment of a disaster contingency fund for Madagascar.
Preparedness and Response: consisting in streamlining the early warning information available to BNGRC and CPGU, the development of a National Plan for Disaster Risk Management and training of trainers on disaster preparedness.

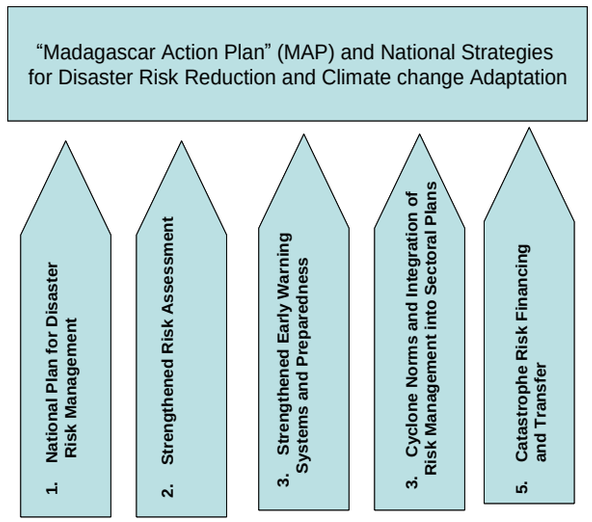
Strategic Measures to Reduce Risk through Recovery and Reconstruction

The five proposed measures to reduce risk through recovery, reconstruction and development processes are based on the existing national strategy, and are aligned with the priorities set up in the Hyogo Framework for Action 2005-2015.

To reduce risk through the recovery, reconstruction and development processes were identified in five priority areas. These five areas were based on existing institutional structures and national strategies and are aligned with the priorities set out in the Hyogo Framework for Action 2005-2015.

1. A National Plan for Disaster Risk Management

Figure 75: Five strategic pillars to reduce risk through recovery aligned with Hyogo Framework for Action



A major challenge with regard to building institutional capacity and integrating disaster risk into recovery and development processes relates to decentralization. If this challenge is adequately addressed it can provide an opportunity to bring disaster risk reduction closer to community level concerns.

In 2004, the process of decentralization into 22 regions was accompanied by a greater spreading of technical services. This process reinforced the communes and Fokontanys as the basic units to provide administrative services to communities.

Disaster risk reduction committees are being proposed at the regional (22), district (119), communal (1,548) and local (17,433) levels. Raising the awareness, establishing and sustaining such a large structure is a considerable challenge.

Currently, the implementation of regional and district *gestion de risques et catastrophes (GRC*) committees appear to vary, due to lack of capacity and the fact that the decentralization in this area was not accompanied by additional resources. It appears that the rural areas were less well covered than urban settings despite the fact that the majority of the population and the most vulnerable groups live in rural zones.

The identified needs therefore include:

a) Strengthening the **National Plan for Disaster Risk Management**, engaging relevant sectors and building on the vision of the National Strategy. The Plan should build on the existing efforts carried out by BNGRC, such as the national contingency plan, the 22 regional plans for disaster risk reduction and ongoing efforts to integrate disaster risk reduction into Communal Development Plans. It should address the challenge of decentralization and provide recommendations for building capacities at different administrative levels for all aspects of disaster risk reduction - from prevention, preparedness, response and recovery.

b) The **private sector** – which has incurred most of the damages and losses from the 2008 cyclone season - needs to be more systematically involved in disaster risk reduction, through such initiatives as training in disaster risk reduction, incentives to limit business discontinuity, and promote corporate responsibility.

c) Several training requirements were identified through sectoral evaluations and at different administrative levels. A national training institution and/or partnership with a University or higher education programme is needed to strengthen and coordinate such capacities. A master course in disaster risk reduction is currently being put in place at the University of Antananarivo. Another example includes the Antsirabe ILO Center, which could be used to provide specialized training in cyclone-proof construction norms.

The costs of developing the National Plan for Disaster Risk Management are already included in the Track II Technical Assistance, and are therefore not costed separately here.

2. Strengthened Risk Assessment

Past information on hazard risks has been very variable. Each sector tends to rely on its own assessment methodology, rendering it difficult to compare both at the national level, as well as across events. This is a major constraint both for risk mapping and planning, as well as for integrating risk into recovery and reconstruction processes.

Considerable efforts have been undertaken to increase coherence in communicating risk patterns between BNGRC, CRIC members and other partners. This was apparent during the evaluation and the field visits. The focus remains however on efforts to communicate information related to the preparedness and response and collecting impact data through the Fiches d'Enquetes Initiales Multi-Aléas (EIMA), such as concerned casualties, loss of infrastructure, prevision of destruction of crops, and impact on food security, including market analysis. It will also be important to review the EIMAs to ensure they include critical sectoral information for a follow-up damage and loss assessment. These efforts are currently on-going with the incorporation of the DALA results and matrices into BNGRC's database, in preparation for the next season.

The identified needs include:

a) The need for geo-referenced risk maps based on continuous review of hazard patterns and vulnerability. Track II is envisaged to produce a National Risk Atlas, but it is critical that this be downscaled to regions and districts. A harmonized approach to assess risks to disasters

and climate change should be developed, building upon the work initiated under GFDRR Track II and III.

b) Risk maps need to be mainstreamed into regional development plans, in order to be effective development tools and help regional decision makers set up no-occupation zones or high-risk areas that will be off-limits to development (or, alternatively, where intensive risk mitigation measures would need to be adopted).

The costs of developing a Risk Atlas are already included in Track II Technical Assistance and are therefore not costed separately here.

3. Strengthened Early Warning Systems and Disaster Preparedness

The early warning systems and contingency plans developed over the past 1-2 years likely saved a considerable number of lives and reduced the material losses due to cyclones Fame, Ivan, and Jokwe. The contingency plans were particularly effective in setting up decentralized disaster preparedness and response systems and harnessing the full potential of sector groups and actors at different levels. There were certain limitations, however: many of the affected villagers had received warnings but did not take any measures to protect themselves: in St. Marie, for example, there was a local belief that a cyclone would not follow after a major storm; in Analanjirofo, people were seen making fun of those who took preventive measures. These local superstitions and beliefs can be overcome with education and awareness, provided that it reaches down to the lowest level (*Fokontany*).

BNGRC and its key partners (e.g. Red Cross) need therefore to be provided sufficient resources to devolve disaster preparedness training and materials to the commune and *Fokontany* levels. This would require also developing incentives for constituting local committees that meet regularly and address prevention as well as disaster preparedness and response. Community leaders play a key role in developing resilience measures in the rural areas as well as for the preparedness to warning including the issuance of warning. These initiatives should also factor in the specific needs of women and men.

The interventions should provide more targeted warnings to at risk communities, formalizing the alert chain, and use local dialects and traditional warning methods when necessary (e.g. conch sound alerts between remote villages), with clearer information on measures to be taken upon receipt of an alert. This also requires the identification of vulnerable communities based on hazard maps and regular simulation exercises.

The identified needs include:

a) A medium to long-term disaster risk management training program for at-risk Fokontany.

In 2007-08, district-level training involved about 30 people, including district-, commune- and *Fokontany*-level participants (training of trainers). The costs involved transport and *per diem* for participants and trainers, trainers' fees, training materials and field expenses. Training costs at the *Fokontany* level are estimated at Ar. 6-9 million.

For the 35 districts already trained in 2007-08, 364 *Fokontany* are estimated to require training, at a cost of Ar 2,448 millions (Ar. 6-9 million per Fokontany).

Table 70. Proposed Training Program, by Administrative Structure

Structure	Already Trained		To Be Trained	
	Beneficiaries of risk/disaster mgmt. training	Persons trained	No. of persons to be trained, by level	No. of persons to be trained (2 per Fokontany)
District	35		35	
Commune	182	1,050	408	6,474
Fokontany	364		3,237	

Note: About 70 percent of the *Fokontany* in 408 communes of these 35 districts are considered to be at-risk and thus entitled to priority in the provision of training.

The estimated total cost of training to be dispensed to 3,237 *Fokontany* in 408 communes is as follows:

Table 71. Training costs by commune and Fokontany

Structure	Number	Unit cost (Ar. millions)	Estimated training cost (Ar. millions)
Commune	408	6	2,448.0
Fokontany	3,237		

Forty-two (42) additional districts have yet to be covered by the risk management training, including 3,264 *Fokontany* in the regions of Sofia, Diana, Sava, Vatovavy Fitovinany, Atsimo Atsinanana, Alaotra Mangoro, Analanjirofo, Atsinanana, Menabe, Boeny, Analamanga, Bongolava, Vakinankaratra, Melaky, Betsiboka, Amoron'Imania, Haute Matsiatra, Anosy, and Atsimo Andrefana.

In regions that have already benefited from previous training, only the *Fokontany* of communes and districts that have not been beneficiaries will be targeted for the new training. Of these districts, 7 are remote and accessible only by airplane. The estimated cost of providing the training is outlined below.

Table 72. Estimated Costs in Districts Not Yet Covered by Disaster Risk Management Training

No. of districts, by means of travel		Number	Estimated cost of training (Ar. million)	Total (Ar. millions)
Airplane (7 districts)	Commune	36	212, 634	2,546.0
Automobile (35 districts)	Commune	389	2,334	
Total	Fokontany	3,264		

b) Extension of Early Warning System.

Very few communes and *Fokontany* have communication equipment such as mobile phones or short wave radios. Some traditional methods of communication such as whistles, trumpets (*anjombona*) and flags continue to be used. For the 6,501 *Fokontany* at risk, it is proposed that they be provided with simple megaphones, sirens and wind-up radios to supplement these traditional means of communication. Training in the use of the early warning system would then incorporate simple warning signs, such as a single siren alert when a cyclone is 72 hours away, two sirens when it is 48 hours away, etc. The estimated cost of the early warning materials is outlined below. The program could be implemented as an add-on to the UNDP Technical Assistance to BNGRC or to the World Bank Track II assistance to BNGRC or CPGU, in collaboration with partners such as the Red Cross.

Table 73. Estimated Cost of Extending the Early Warning System

Type	Fokontany	Unit Price (Ar. millions)	Total (Ar. millions)
Megaphone	6,501	0.2	1,300.2
Siren	6,501	0.5	3,250.5
Wind-up Radio	6,501	0.078	507.0
Total Equipment	**6,501**		**5,057.7**

4. Development of Cyclone Norms and Standards and integration of Risk Management into Sectoral Programs

For most sectors, risk reduction needs were integrated and costed directly into their respective recovery and rehabilitation plans (see Sectoral Annexes). Below is a summary for each sector. The costs of developing cyclone norms and standards are aggregated at the end of this section.

Social Sectors

Education

Schools were particularly affected by the cyclones with over 657 buildings totally or partially destroyed. In the 10 affected regions about 90 percent of the damaged school buildings had been built by local villagers using traditional building materials (either wood-frame or *falef* and/or mud/brick walls). The rest were build out of solid material with corrugated iron roofs. The percentage at national level is 60 percent traditional materials and 40 percent solid materials.

The Fund of Intervention for Development (FID) has, since 1998, adopted cyclone standards on new school construction which add a mark-up of 10 percent to their total cost. The Ministry of Education has also endorsed a strategy, since 2007, of requiring all new schools to be built according to cyclone-resistant standards. The Ministry has acquired experience in building such schools through HIMO (*Haute Intensité de Main d'Oeuvre*) programs, through partners such as FID. According to FID only one building built to cyclone-resistant norms (and 8 to non-cyclone norms) was partially damaged in the affected areas – out of approximately 1000.

This points to the need for a clear national strategy:

(a) **Progressive replacement of traditionally built schools by schools built to norms in high-risk areas.** Schools are often referred to by communities as gathering places to protect themselves when cyclones hit. Unfortunately these traditional buildings were also suffered heavy destruction. This requires a strategy of progressively replacing and retrofitting traditionally-built schools by more secure buildings to avoid potential loss of lives. The safety aspects should not only concern cyclone winds, but also fire hazards and flooding (amongst others).

(b) **Upscaling programs to mainstream disaster risk reduction into school curricula.** A teacher's guide and a school children manual on disaster risk reduction have been developed by BNGRC and UNICEF with support from UNDP, the Ministry of Education, Meteorology Direction, and IOGA. This initiative needs to be expanded nationally.

Health

The Government of Madagascar has adopted a decree that makes anti-cyclonic standards compulsory for new hospital buildings. These norms have been adopted through FID also for basic health centers (*Centres de Santé de Base*). Thus, the identified needs for the health sector include:

(a) **Strengthening the construction standards of hospitals and health centres** (to cyclone-proof and other norms) – including, in rare cases, relocating hospitals and health centres away from high risk zones.

(b) To prevent the systematic development of epidemics following cyclones and related floods, further **stockpiling of medication, preventive vaccination campaigns, measures of vector controls and training of medical staff** are needed in high risk areas on reducing and managing health risks related to cyclones and floods.

Habitat and Administrative Buildings

Three types of housing structures are used in Madagascar:

- Houses build with locally available material.
- Semi-hard construction with cement base and
- Solid engineered buildings.

The traditional housing structure build of wooden frames and *falef* or bamboo walls are particularly adapted to cyclone and flood risk, as they are easily rebuilt at a relatively low cost using locally available material. The estimated unit cost for such a building is about 890'000 Ariary, although this cost will increase following a cyclone due to the high demand for local materials. Nonetheless, reconstructing these houses at every season is a heavy cost for poor households.

The identified risk reduction needs in the habitat sector are therefore the following:

(a) Systematic **enforcement of cyclone-proof norms for public buildings** in high-risk areas.

(b) For **private houses**, a review of existing norms, supported by related training of builders and development of guidelines for safe constructions. Urban plans and building authorizations should require more systematic review of risk levels based on hazard maps. At the commune level, for example, when communes are drawing their land-use plans, it would be advisable to earmark areas for urban development based on vulnerability criteria. Typical mark-up costs for cyclone-proof traditional houses amount to 100 percent (ca. Ar. 1.6 million); for solid and semi-solid structures, the mark-up is typically 30 percent of normal construction costs.

(c) A module of **training should be started for builders and local NGOs in cyclone-proof construction standards**, at the HIMO Training Center in Antsirabe.

(d) One of the challenges identified is land tenure. Communities seldom hold property rights and while most are aware of the hazard risk, they are recalcitrant to move away from their houses, even in high risk zones, for fear of losing their land. It will be important to **incorporate vulnerability mapping into the Local Land Occupancy Plans** (PLOF) designed by the on-going Land Tenure Program.

Most of the above initiatives do not require resources incremental to those already identified in the concerned sectors (see Annexes). Development of habitat norms and related training costs are summarized on Table 74 below.

Table 75. Incremental Costs of Cyclone-Resistant Training for Habitat Infrastructure

Type	Total (Ar. millions)
Development of national norms and training materials (1 expert @ 1 month)	25.0
Training for builders/NGOs in cyclone and fire proof norms (HIMO Antsirabe)	40.0
Adaptation and dissemination of norms in high-risk areas	50.0
	115.0

Productive Sectors

Agriculture

Approximately 80% of the Malagasy population depends on agriculture and it remains the economic sector most vulnerable to climatic shocks. This sector also comprises some of the poorer communities which have lower capacities to deal with the impacts and recover after disaster events. This also limits capacities to deal with climate change impacts.

The identified needs include:

(a) Introduction of **seeds adapted to cyclones**, such as multiplication of short-cycle rice seeds and rice varieties resistant to inundation.

(b) **Agriculture diversification** (to spread the risk) such as mixed systems consisting of fruit trees and small sized but highly productive species, combined with early harvest rice and small ruminant livestock.

(c) More **systematic information** at the commune and district level on the available stock of seeds and working tools prior to the cyclone season.

(d) **Introduction of risk management principles amongst livestock and fisheries associations** – e.g. promotion of cyclone-resistant species (ducks over chickens); construction of cyclone-resistant holding pens; replacement of wooden canoes by fiberglass; principles of safety at sea, etc.

Industry and Commerce

Only major industrial establishments are insured against the damage and business discontinuity due to cyclone impacts. For small and medium enterprises, the strategies for risk reduction include:

(a) **Training, awareness and information in disaster risk reduction and management principles** (provided potentially through local Chambers of Commerce).

(b) **Expansion of Business Centers** to assist SME development and strengthen resilience against poverty (and against shocks). This strategy is akin to that promoted in livelihoods (Section III.B).

Tourism

Tourism is a major source of income for Madagascar, earning US$306 million, bringing 345,000 visitors, and employing 24,000 people in 2007. Yet the sector is particularly vulnerable to cyclones due to the location of most tourism infrastructure on coastal areas. Although the cyclone occurred during the low season and no tourists were directly injured, the impact on the sector was considerable in particular areas such as St. Marie.

The identified risk reduction needs for the tourism sector include:

(a) Promotion of **cyclone-proof norms in hotels and other tourism infrastructure**, accompanied with targeted training and guidelines for builders, tourism authorities and hotel owners.

(b) Promotion of risk transfer mechanisms, such as **insurance**.
(c) **Information materials**, covering as many foreign languages as possible, to warn tourists about the threat of hazards and measures to take upon the issuance of a warning.

Environment

Forests play an important role in maintaining production levels, mainly agricultural production through limitation of siltation and wind damage. Forest cover needs to remain compact to avoid further damage and limit vulnerability to high winds and landslides.

The main risk reduction need for the environment sector includes:

(a) Follow-up and evaluation of the damaged forest area, to ensure **natural regeneration** and maintain the protection level in vulnerable areas. If judged necessary, replant or regenerate with indigenous species.

Infrastructure Sectors

Electricity

Electric production and distribution networks were particularly hit with parts of the affected areas without power over one month after the disaster, highlighting the need for more resilient

infrastructure. Another priority is better preparedness for quick restoration of electric distribution.

The identified needs for disaster risk reduction include:

(a) A **pilot project to develop anti-cyclonic norms and standards for electricity distribution networks**, including exchange of experience with neighbouring islands in the Indian Ocean, and logistic support.

(b) **Staged replacement of aerial electricity distribution network with underground networks** for medium and low voltage.

(c) **Staged replacement of wood posts with cement posts** in high risk areas.

Water and Sanitation

Larger urban areas usually have established and working drinking water supply network, usually managed by the central leaded water and energy supply authorities or in case of bigger villages by a local established water supply committee. Lack of maintenance is the main problematic factor. Water fees do not cover the minimal maintenance requirement costs and lack of capital prevents any type of rehabilitation.

On rural areas water is mainly supplied be hand dug wells accessing mainly shallow aquifer. Part of those wells are protected and equipped with hand pumps. There is very low infrastructure in both urban and rural settings for excretal disposal, waste water and sewage, and solid waste management. Hence, there is a high risk of contamination due to floods, especially in lower areas.

The identified needs for disaster risk reduction include:

(a) **Strengthened design** of rehabilitated public wells and other water infrastructure to avoid contamination in future floods.

(b) **Strengthen preparedness** and capacity for disinfecting water systems in case of floods.

Transport and Irrigation Infrastructure

Box 5: The Bridge over Sofia RN 32, PK 32

This bridge was built in 1960 to withstand a 1 in 50 year flood. The last extreme flood was in 1959. Little has been spent on maintenance, but the bridge is relatively good condition for its age (48 years). So why did the right abutment fail completely during the 2008 cyclone? The abutment consists of a few layers of gabions that support a cement stone pitching, which is a very rigid top layer on a steep slope. The high water flow eroded the soil near the base of the gabions, which slid into the scour hole and the rigid stone pitching lost support. The sand under the stone pitching could now erode quickly. Next the concrete structure became exposed to the flow attack. The vertical sides of the concrete abutment structure induced very strong turbulent eddies which increased the scour hole. This hole in turn reached below the base of the abutment structure and the sand inside the structure started to erode and to slide into the hole, because the structure had no concrete bottom. After some time, the concrete abutment structure was standing alone in the water.

In fact, deforestation has changed the shape of the river and the flood wave: the volume has remained more or less the same, but the maximum peak discharge has increased markedly and the duration of the peak discharge has reduced to a few hours. This period is sufficient to cause serious damage to an infrastructure. If the bed of the river rises, then the safety level is at present much reduced, maybe to a 1 in 25 years flood. So how can the safety level of the bridge be increased to a standard level? For this type of vital infrastructure, it is recommended that a safety level of 1 in 100 year flood for the bridge as a whole, and 1 in 300 years for the bridge deck be adopted. The reconstructed bridge deck should be raised by about 3 meters with proper approach roads (also to be raised). The bridge opening should be increased by an additional bridge to the right side or the bridge span should be increased by the construction of a new abutment. The sediment upstream of the bridge may need to be dug after a flood of every few years.

A. Infrastructure Safety Levels

The current practice in Madagascar has been to design infrastructure on the basis of an expected life time of 50 years, to withstand a 1 in 50 years flood. However, in case the design conditions change over time, for example due to sedimentation of the river bed, the actual strength might gradually reduce to much less than a 1 in 50 years flood.

In certain mountain areas serious **sedimentation and erosion** has developed. This erosion phenomenon depends on local slopes, composition of the soil (high content of mica), rainfall characteristics, land use, humidity and vegetation. At some locations the erosion has stopped and vegetation has covered the eroded area, but in others new erosion has started. Therefore it is to be expected that the overall erosion of watersheds will continue in the future and it may even increase as a consequence of climate change and higher rainfall intensities. Cyclones accelerate this erosion process.

A large part of the eroded material will be transported by rivers. Most rivers, in eroded mountain areas are not in equilibrium at present. Rivers that flow over a rock bed do not show large problems with erosion and sedimentation. However, rivers that flow in their own sediment, so-called alluvial rivers, react when the sediment transport deviates from their equilibrium sediment state. In Madagascar many rivers carry more sediment than in their natural equilibrium state. Therefore the behaviour of such rivers changes over time.

As a river flows toward the sea or lake a lot of sediment is deposited as overland flow in the plains during floods. The delta at the river mouth near the sea or a lake grows fast in height and size. In many fluvial rivers the river bed has been raised considerably by sediment deposition. This reduces the sediment transport capacity, so more sediment will be deposited. This results in more flooding, more overland flow and more breaches. The rivers increase their width as a response to the sedimentation of the bed.

At present this can be observed at some locations. In the smaller rivers these developments may be faster still than in larger rivers. It might be expected that small alluvial river stretches will show a problematic behaviour after 10 to 20 years, and the main alluvial river stretches after a period 20 to 40 years. This means that frequent breaches will occur. Finally, if breaches are not repaired quickly, a river will tend to develop new branches and it will find a new route to the sea or lake. This can result in an extra supply of sand and clay to nearby rivers, a natural process of river delta formation. But for all bridges and the whole water management system this constitutes a threat and it might result in new construction projects related to infrastructures such as bridges, barrages, weirs and dykes. Cyclones have contributed to this sedimentation process, but it is difficult to determine their precise role.

Infrastructure maintenance in Madagascar is often limited to the most necessary repairs, and can be a cause of future damage. The maintenance of bridges should be linked to the maintenance strategy for rivers, which is still not fully adopted at the national level. A flexible maintenance strategy should include shifting a river if it is silted up completely, construction of dykes or to construct diversion routes. In general is recommended that the design and maintenance of bridges be tuned to the maintenance strategy for a river.

Design is mentioned as a cause of damage only if the original design included an obvious poor aspect. The insufficient design conditions and safety levels of the time are not seen as a cause for damage.

The main perceived causes for infrastructure failure are summarized on Table 79.

Table 76. Common Reasons for Infrastructure Failure

Infrastructure	Poor Design %	Lack of Maintenance %	Sedimentation %	Cyclone %
Bridges	0 to 10	20 to 40		80 to 50
Dykes	0	0 to 20	25 to 60	75 to 20
Barrages and weirs	0	20 to 80	80 to 20	0
Radier	0	100	0	0

Given the degree of infrastructure failure due to inundations and cyclones, and the seriousness of the river sedimentation patterns, it is recommended that the Government adopt the following **revised safety levels**:

Recommended Revised Safety Levels for Infrastructure in Madagascar

All infrastructures, but no bridges: 1 in 100 years and

Bridges in national routes:
1 in 100 years safety level for the bridge as a whole structure
1 in 300 years safety level for bridge decks (as it can often be obtained at low extra cost)

These safety levels are tuned to the life time of a well designed bridge that needs a minimum amount of maintenance (commonly, the elements of a bridge take into account a safety factor between 1.5 and 2).

Table 77 provides the safety standards adopted by a sample of countries and regions around the world.

Table 77. Examples of Infrastructure Safety Levels Around the World

Country	Structure	Safety Level
Bangladesh	Bank Protection Works (Primary Importance) Other river bank protection works	1 in 100 years 1 in 50 years
India	Spillway for major/medium dams Permanent barrage and minor dams Pickup weirs, flood embankments Aqueducts foundations	Minimum 1 in 1000 years Minimum 1 in 100 years Between 50 and 1000 years 1 in 100 years
Netherlands	Central dykes Northern dykes Major rivers	1 in 10000 years 1 in 2000 to 4000 years 1 in 1250 years
Pakistan	Dykes protecting agricultural land	1 in 50 years
New Orleans (prior to Katrina)	Dykes protecting the city	1 in 30 years

B. Permanent repairs

The design of repair measures should starts with an inventory of all possible measures. Besides technical aspects, political, economic, environmental and sociological considerations can also play a role also, but often engineers are no experts in those fields. Finally, after input from environmentalists and sociologists a few alternative measures remain which are technically feasible and acceptable for all involved. A good training in theory and experience in practice in the field of infrastructures are required to apply this approach effectively.

Construction measures

During the evaluation, the Transport Team proposed a number of measures to increase the strength of infrastructures to resists extreme flow attack. These are summarized below per type of infrastructure.

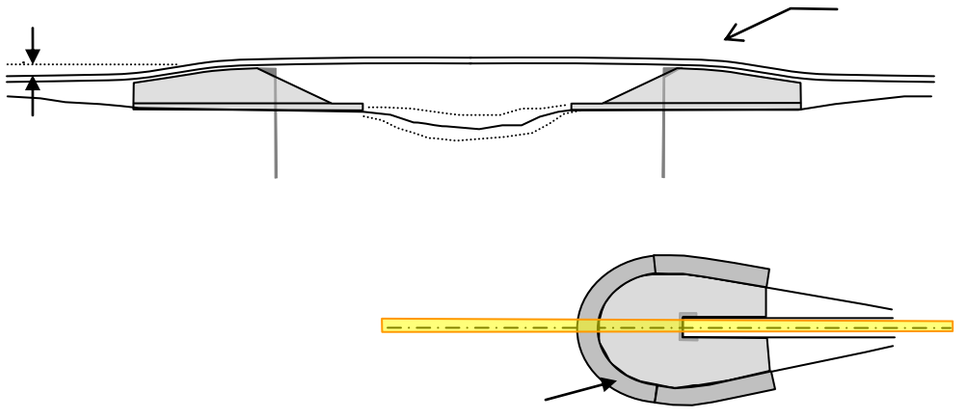
Bridges

A standard design of an abutment has the following elements:

Slope protection

The elements with vertical sides are replaced by a slope protection at a minimum slope of 1 in 2.5 and a preferred slope 1 in 3 (see sketch in Figure 4).

Figure 76. A bridge with a sloped abutment.



Filter

A filter construction is required under the slope protection, either as a granular filter (often too many layers of gravel and sand of different sizes are required, or a geotextile (often most appropriate). The connection of the geotextile to the concrete structure of an abutment needs special attention: some slack is required; it should be folded in two. The seam between geotextiles is made of an overlap of minimum 0.3 m (see CIRIA,CUR Building and infrastructure, CETMEF, 2007, the Rock Manual; and Pilarczyk, 2000).

Falling apron

The toe of the slope protection is supported by a falling apron. The width and the thickness of an apron depends on the expected local scour depth. Methods to calculate the maximum expected local scour depth are explained in Hoffmans and Verheij (1997) and Melville and Coleman (2000). A minimum width of an apron is 5 m. The transition between the rigid structure and a flexible falling apron should be designed with an overlap of several meters (see design rules in for example Rock Manual).

Wing walls

Depending on the design of an abutment, wing walls prevent seepage of flow behind the concrete structure.

Bridge deck

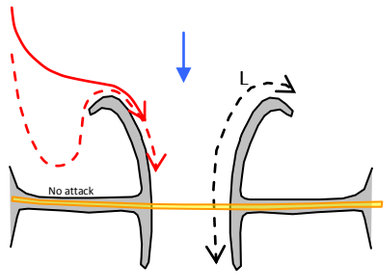
The underside of a bridge deck should be a minimum 1.5 m and in practice 2 m above the level of the road (see sketch in figure 5). This to guarantee that during the design flood the bridge deck remains above the water level.

Bridge opening
If the bridge opening is too small, for example because of floating debris that can pile-up against the bridge, an additional bridge in the approach is suggested, if in the approach roads sufficient space is available.

Inclined pillar
For the inclined pillar a construction engineer can suggest an optimal construction to stabilize and to support the inclined pillar.

Guide bunds
Upstream of some bridges the river has a tendency to widen and to split in several branches (probably because of river bed sedimentation). In that case guide bunds guide flow to the bridge opening and that it not will attack the abutments with the approach roads. The idea of a guide bund is that a flow along the red dashed line in Figure 77 will experience more resistance than a flow along the full red line. Therefore the flow will follow the full red line and it will not attack the approach roads. The length of a guide bund, L in figure, is 2.5 to 3 times the bridge span. For the curvature design rules developed, see Indian Power Board Commission manual.

Figure 77. Plan of a bridge with guide bunds



It is mentioned that guide bunds often are applied in braiding rivers with several parallel branches. Guide bunds are relative expensive measures, but in general they function very well.

Dykes
Many people propose heightening dykes as a solution for inundation of inhabited areas (villages, towns). It might be expected that the life time of this solution is rather limited in case of a fluvial river, because it concentrates the sedimentation in a river bed. This holds only for rivers with excessive sedimentation. As a consequence the dykes have to be heightened repeatedly. If a breach develops in very high dykes the damage is often considerable. Therefore it is recommended to be careful with dyke heightening.

In rivers with excessive sedimentation it is often difficult to determine the design water level with a fixed safety level (for bridges minimum 1 in 100 years). A study is recommended on river hydraulics and morphology in a considered stretch of a river for an optimal design of new crest level of a dyke.

The side slope of a dyke should have a minimum slope of 1 in 2.5 and preferably 1:3. The material of the dyke body should be well compacted and preferably be rather homogenous.

Vegetation (brushes, trees) can be an effective measure to reduce the flow attack in front of a dyke and therefore can increase its life span.

Culverts

Culverts are relatively small hydraulic structures and after a cyclone it is often unclear where damage is located. They need well designed wing walls, and it is recommended to construct a screen in the middle of the culvert to prevent groundwater to flow along their surface (so-called piping phenomena). In this respect attention is recommended for a careful compaction of earth around a culvert during construction.

Culverts with multi channels can be further blocked up by piling of floating debris than culverts with a single channel or tube.

River Bank Erosion Treatments

To stop bank erosion or to reclaim an eroded area a hard protection of a (reconstructed) bank is a suitable measure. The type of protection depends on the local situation, but in general a revetment with a falling apron is a suitable measure and a series of groynes is effective because between groynes sedimentation will fill an eroded area.

In general theses measures are applied in urban areas of near infrastructure with high economic value. Experience shows that often these measures have a risk of additional costs, as the protection often needs to be extended in a downstream direction after a few years. Also adverse effects on the opposite bank (extra erosion) may occur as response to a bank protection.

In agricultural areas it is often more economic to apply a strategy of retreat and to construct a diversion road, because the economic value of agricultural fields is relatively low. The costs of the construction of a diversion road are in general lower than the costs of a bank protection with its associated risks.

A study of the local river morphology is recommended for an optimal design of the described measures.

C. Monitoring Program

Strengthened hydraulic and morphological monitoring will be important to improve the knowledge about the behaviour of key rivers (e.g. Sofia) on major infrastructure at risk.

(a) **Hydraulic monitoring** consists of measuring water levels in given monitoring stations (generally on a daily basis) and special campaigns to measure flow velocities and bathymetry in cross sections either manually or with semi-electronic devices.

(b) **Morphological monitoring** consists of measuring the sediment transport especially during medium and high discharges. Preferably the whole river bed is measured. From monitoring of such parameters as river plan form, bed levels after each flood, sediment concentration during floods, sediment size and composition, one can make predictions and estimate whether adjustments to the infrastructure will become necessary, as well as the scope of measures to prevent adverse developments in the river plan form (so that the river remains flowing under the existing bridges).

To determine safety levels related to maximum water levels the hydraulic monitoring data from monitoring stations have to be analyzed using statistical concepts. The quality of the monitoring data has to be checked and if possible improved. A mathematical model is then derived to determine safety levels not only in the monitoring stations, but also in any arbitrary locations along a river (including the location of the infrastructure). After sufficient monitoring data has become available and has been analyzed, infrastructure norms can be derived from real data. Several one-dimensional mathematic models such as SOBEK (Netherlands), Hydratec (France), and Mike 11 (Denmark) can be used to model hydraulic and morphological levels along the river. Other models (free of charge) include RMA 2 and RMA 4 (USACE), Floodworks and InfoWorks (Wallingford Software).

D. National Capacity Building and Development of Infrastructure Norms

Given the vital importance of hydraulic and morphological modelling to the development of infrastructure norms in Madagascar, the assessment mission recommends investing in the capacity building of a minimum of 3 professionals from the Ministries of Public Works and Meteorology, and Ministry of Agriculture, Livestock and Fisheries. Thus, a three-prongued strategy is proposed:

(a) Engaging an international norms expert to assist Madagascar to develop **preliminary infrastructure norms.**

(b) **Investing in building national capacity in hydraulic and morphological monitoring** (and through it, the development of infrastructure norms). The recommended course would be a 10-months training in UNESCO-IHE[23] (Institute for Water Education) for three young national professionals, followed by a 1-months training in risk management at Delft University of Technology. UNESCO-IHE is owned by all UNESCO member states and is the largest water education facility in the world. It serves as an international standard-setting body for post-graduate water education programs and continuing professional training. The most suitable course is in the field of rivers, river training, hydraulic structures and erosion and sedimentation processes.

(c) Once the national professionals returned, they would be involved in carrying out the **final modeling and development of the national infrastructure norms**.

The estimated costs are presented on Table 78 below.

Table 78: Incremental Costs of Capacity Building for Cyclone-Proof Norms for Transport and Irrigation Infrastructure

Type	Total (Ar. millions)
Development of preliminary cyclone-proof norms (1 expert @ 1 month)	41.3
Training in hydraulic and morphological monitoring (UNESCO-IHE) 10 months x 3 people	383.6
Adjustment and finalization of national norms	44.5
Total	**469.4**

[23] http://www.unesco-ihe.org

5. Catastrophe Risk Financing and Transfer

During the assessment mission, many stakeholders mentioned the need for a disaster fund that would be sustainable, transparent, take into account decentralization policies, and cover all aspects of disaster management. It could build on existing mechanisms such as the *Fond Spécial de Prévoyance*. The Government has made the first step in this direction by establishing in 2008 a Contingency Fund for major shocks under the Ministry of Finance. However, the rules for the utilization of this fund, as well as its opening to contributions from donors are still in its early stages. A second major priority is the need for catastrophe risk financing for rare events (such as catastrophe insurance). The possibility of Madagascar joining a pooled insurance (such as the Caribbean) should be explored, given the frequency of cyclones and the high premium that a solo policy might entail.

The most pressing identified need includes:

(a) **A study followed-by a national consultation process to develop the modalities of such a disaster financing mechanism** (e.g. reserve fund, insurance, etc.). This should be integrated into the consultations planned to review the current national strategy for Madagascar, and the activities supported by Track II and ProVention.

Conclusion

The JDLNA assessment process allowed for the gradual mainstreaming of risk reduction solutions into sectoral recovery and rehabilitation strategies, and a good coherence between Track II, Track III and early recovery programs. The estimated total needs for risk reduction which are not already included in other program priorities are summarized on Table 79 below. They include the costs of development of cyclone-proof norms and standards (Ar. 584.4 million or US$354,200), and the costs of training and early warning materials at the commune and Fokontany levels (Ar. 10.1 billion or US$6.1 million). The remaining Ar. 0.5 billion Ar. (US$0.3 million) involve coordination of the early recovery program at the national, regional and local levels.

Table 79. Summary Incremental Costs Disaster Risk Reduction Needs

Item	Ar. Million	US$'000
1. Development of National Cyclone Proof Norms for Transport and Irrigation Infrastructure	469.4	284.5
2. Development of National Cyclone Proof Norms for Habitat Infrastructure	115.0	69.7
3. Training and Materials for Early Warning System	10,051.2	6,091.6
4. Coordination of Early Recovery	495.0	300.0
TOTAL	**11,130.6**	**6,745.8**

Section V: Recovery and Reconstruction Requirements

Early Recovery

Early Recovery Strategy

Background

During 2007, the Government of Madagascar, with assistance from the UN Office for the Coordination of Humanitarian Affairs (OCHA), put in place a sectoral approach based on the model recommended as a result of the humanitarian reform. This then made it possible, in October 2007, to draw up a contingency plan. At the same time, the Civil Protection Corps (CPC) succeeded, along with all of the humanitarian partners, in setting up a cyclone response simulation exercise based on a scenario from the contingency plan. These two factors appear to have been extremely beneficial in terms of the response to the two cyclones that struck Madagascar during the first quarter of 2008.

The initial humanitarian response coordinated by the national risk management bureau (BNGRC) was successful in limiting the impact of these cyclones on the affected communities. Necessity and timeliness now dictate, however, that this coordination be expanded and formalized to include administrative levels such as the regions, districts and villages, which will remain in the post-crisis phase longer, and also to optimize the impacts of the response.

The coordination of the initial humanitarian response must take into account community requirements beyond the immediate urgency and integrate such cross-cutting dimensions as gender, governance, the environment, and risk/disaster management. A decision was therefore made in March to initiate an Early Recovery coordination or network to take care of these issues.

The Flash Appeal initially included therefore some Early Recovery projects to take these needs into consideration. To the demand of the donors they were finally withdrawn to be funded separately later on. However, as the results of the JDLNA[24] show, the withdrawal of these projects from the Flash Appeal combined with a low response to it from the donor community[25] results in having large needs for Early Recovery that have not yet been fulfilled and that this document tries to address.

[24] The JDLNA carried out in May 2008 is based on the 17 regions affected by the cyclone (out of a total of 22). A specific report is to be released in July 2008.

[25] As of June 23, 2008, 46% of the requested funds have been financed while another US$ 1,262,208 are pledged.

Strategic and programmatic objectives

Early Recovery for Madagascar is a multidimensional process that begins at the same time as humanitarian interventions. Guided by development principles, but with its own objectives, expertise, and mechanisms, the process also seeks assistance from emergency programs in order to take advantage of and initiate opportunities for sustainable development.

The strategic objective of Early Recovery for Madagascar is to restore and strengthen the capacities of communities and authorities to preside over a transition period conducive to long-term development.

This main Early Recovery objective is qualified and refined by three sub-objectives:

√ **Madagascar Strategic Sub-Objective 1:** Restore activities associated with the means of subsistence of the affected populations.

√ **Madagascar Strategic Sub-Objective 2:** Restore and/or strengthen basic services in the most severely affected districts.

√ **Madagascar Strategic Sub-Objective 3:** Develop the country's capacity to coordinate and manage a networked Early Response by integrating it into the National Strategy for Risk and Disaster Management.

These bases of the Strategic Framework for Early Recovery in Madagascar are the foundation of the cluster program[26] for this specific Early Recovery phase:

1. **Agriculture:** Reconstitute household capital and the common means of production;
2. **Water and sanitation**: Restore basic water service and waste water management in the affected communities and ensure their sustainability;
3. **Education:** Re-establish school attendance and access to high-quality education in the affected zones;
4. **Habitat:** Provide outreach and support to local initatives so the principle of "Building back better" is integrated and strengthen the capacities of local authorities;
5. **Logistics:** Restore access to the means of production, marketing, and communication, and support other sectors ;
6. **Health:** Enhance health care coverage in the affected zones and encourage the population to use these services;
7. **Food and nutritional security**: Restore the three pillars of food security in households and communities in order to avoid any deterioration in nutritional status in the zones affected by cyclones and flooding; and

[26] The sectoral approach, which is one of the four pillars of humanitarian reform, was introduced to Madagascar in 2007 and involves seven sectors as of this writing: agriculture, water and sanitation, education, housing, logistics, health, and food/nutritional security.

Figure 78 : Strategic Framework for Early Recovery in Madagascar

Box 6: How an Early Recovery Strategy can complement national risk/disaster management, early recovery, and development plans

By augmenting ongoing emergency assistance operation by building on humanitarian programs, to ensure that their inputs become assets for long-term development and thereby foster the self-reliance of affected populations and help rebuild livelihoods.
By supporting spontaneous recovery initiatives by affected communities and change the risk and conflict dynamics
By establishing the foundations of longer-term recovery

Excerpt from "Guidance Note on Early Recovery" CWGER in collaboration with UNDG-ECHA Working Group on Transition April 2008, page 10, 11

8. **Early Recovery**[27]: Establish a network of Early Recovery for Madagascar coordination as a part of the transition phase[28] following a crisis.

To the extent that they adopt an integrated approach focusing on the restoration of the capacities of national and community institutions in a post-crisis situation, while at the same time ensuring that spontaneous Early Recovery initiatives of the affected populations are sustainable and likely to reduce future risks, the Early Recovery Strategy and its projects and programs contribute to the "Madagascar Action Plan", to the National Risk and Disaster Management Strategy of which they are intended to be a part, and to development programs under implementation in the country.

This strategy is also an outgrowth of the National Risk and Disaster Management Strategy and its broad themes and strategic priorities, which include:

1. Implementation of institutional mechanisms for risk/disaster management;
2. Long-term capacity building at the national, provincial, local, and community levels;
3. Strengthening of exhaustive information systems;
4. Development of long-term funding mechanisms;
5. Overall reduction of vulnerability and risks; and
6. Regional and international cooperation.

[27] As indicated in the "Background" portion of this section, the Early Recovery Cross-Cutting Group did not emerge until April 2008 as a sideline to this assessment process. It is also not considered to be a sector, because of the networked nature of its operations.
[28] In the Malagasy context, the term "transition" refers, in times of crisis, to the period in which external aid is most crucial in terms of supporting efforts to stabilize the situation during natural disasters, by contributing to political stability, security, social equity, and equality before the law.

Box 7: Main reasons for incorporating cross-cutting issues into Early Recovery

Early recovery situations are often multidimensional, complex, and involve a range of specialized actors. Effectively addressing cross-cutting issues helps to forge links with other programs and with and the work of other agencies.
Early Recovery should focus on promoting and strengthening equity and equality for all, and should avoid (further) marginalization of certain groups or the creation of new sources of risks. Identifying and incorporating cross-cutting issues right from the start helps to ensure that they are given the required consideration during the planning and execution of recovery activities.
Early Recovery provides a unique opportunity to shape the agenda of the subsequent development phase. Effectively addressing cross-cutting issues from the start, such as integrating gender equality concerns in all early recovery programs and activities, will result in beneficial interventions.
Early Recovery provides the opportunity to redress inequalities in opportunities and health that may have existed before the crisis. Excerpt from "Guidance Note on Early Recovery", CWGER in collaboration with UNDG-ECHA Working Group on Transition, April 2008, page 28.

Cross-cutting issues in Early Recovery

Gender and Diversity

Early Recovery interventions must pay particular attention to the fact that women, girls, men, and boys have different experiences and needs during and after a crisis. If this diversity is not sufficiently recognized, Early Recovery interventions may cause some groups or individuals to be marginalized or treated in a discriminatory manner.

In order to meet the needs of groups identified as vulnerable, Early Recovery projects should incorporate participatory and community-oriented approaches specifically geared to them.

Governance, Coordination and Risk Mitigation

National and local institutions can be affected just as much as the population when a natural disaster such as a cyclone occurs. Restoring and strengthening the functions of local institutions are key during the post-crisis transition phase. It is therefore critical that the Early Recovery Strategy for Madagascar foster the development of interventions during this phase that would enable these institutions to resume their roles as quickly as possible.

In Madagascar, establishment of CRGRCs for better response coordination and strengthening of the capacity of districts and communities to manage information up to the time of the Early Recovery phase should therefore be a priority.

Box 8: Guiding principles for Early Recovery

1. Achieving national ownership of the Early Recovery process
2. Promote local and national capacities, by ensuring that external technical assistance complements rather than replaces existing capacities
3. Use and promotion of participatory approaches and practices
4. Build constructive working relationships between civil society organizations and nascent government institutions
5. Influence how humanitarian and early recovery assistance is provided to ensure that interventions Primum non nocere – first do no harm as well as take into account longer term development considerations
6. Maximizes synergies between different actors through efficient coordination of stakeholders in the early recovery process.
7. Includes risk reduction and conflict prevention measures.
8. Ground early recovery interventions on a thorough Understanding of the context
9. Ensure integration of gender and other cross-cutting issues
10. Promote gender equality
11. Conduct effective assessment of needs and capacities
12. Monitor, evaluate and learn through appropriate participatory techniques and mechanisms; and
13. Build and/or reorient ongoing development initiatives

Excerpt from "Guidance Note on Early Recovery", CWGER in collaboration with UNDG-ECHA Working Group on Transition, April 2008, pages 11 and 12.

Other cross-cutting issues

Other cross-cutting issues, such as the environment, grassroots communication, or HIV/AIDS prevention, should be considered and integrated into the interventions planned for each sector. The importance of these issues will vary, however, depending on the nature of the disaster that touched off the crisis and the transition phase. It may be decided, in the case of a specific disaster, to treat them as separate, free-standing sectors.

Within the framework of the Joint Assessment of Damage, Losses, and Needs for 2008, following the passage of the three cyclones, the environment and risk mitigation are treated as sectors unto themselves.

Implementation of this strategy

The experience of recent years indicates that the most appropriate mechanism for managing Early Recovery is an integrated, multi-sectoral, and multidimensional approach based on the observed needs in the affected zones. This approach therefore relies upon knowledge of constraints, needs, capacities, and development potential and is conducive to local ownership of the process on the part of communities and authorities.

It should be noted that there are three essential levels involved in the coordination of Early Recovery:

***Support for local coordination mechanisms*:** These mechanisms may be defined in collaboration with local institutions or leaders (e.g., CRGRC, district committee) to identify Early Recovery priorities in relation to a specific disaster.

- ⇨ Local administrations develop their capacity to plan and coordinate recovery;
- ⇨ They reassert their legitimacy more quickly.

National coordination: Government structures lead the coordination of Early Recovery. In Madagascar, two agencies (i.e., the BNGRC and the CPGU), may currently be playing this role.

- ⇨ Linkage between the Early Recovery and development processes;
- ⇨ Linkage between the Government and the populace;
- ⇨ More rational resource use.

International support for Early Recovery coordination: The UNDP is responsible, in collaboration with national actors, for coordinating the Early Recovery efforts of international organizations.

- ⇒ The UNDP establishes a Cross-Cutting Group on Early Recovery and provides expertise in networked management of this group.
- ⇒ Early Recovery focal points are identified in each sector. (These focal points have existed in Madagascar since April 21, 2008.)

This coordination is in its infancy, although progress (e.g., the design of this Strategy) since April 21, in Early Recovery management has already been impressive. The fact that, within this Strategy, a strategic sub-objective specific to Early Recovery management has been identified is also indicative of the priority accorded to Early Recovery by the Government of Madagascar.

Cross-cutting issues in the evaluation process

Background

Several cross cutting-issues are not clearly assessed in the Damage and Loss Assessment Methodology (DaLa); only the environment and risk reduction are being addressed seriously, as they are being treated, respectively, as a separate sector and a full section. Other cross-cutting dimensions particularly relevant to Madagascar, such as gender and diversity and governance, need to be considered, however, if this exercise is to accurately reflect the human dimension of the disasters and Early Recovery requirements.

Therefore, despite the time constraint involved in integrating this aspect into the general DaLa process, and in order to give more specific attention to these two cross-cutting issues, which the team felt to be of critical importance, a Cross-Cutting Issue Committee was formed. A decision was also made to add the Disaster Risk Management theme to those two issues. The Committee agreed on two main axes for data collection:

- ✓ Determine short and general questions for the three above-mentioned cross-cutting issues, for discussion outside the sectors with representatives of regional and local authorities, civil society and the affected populations; and
- ✓ Ask the sectors to integrate these questions pertaining to the three cross-cutting themes when collecting quantitative data during their various field encounters.

Apart from the overall goal of garnering information on these issues across and beyond the sectors, the objective was also to collect more qualitative data that could be used in the analysis to confirm or invalidate data of a more quantitative nature collected by the sectors.

Early Recovery Findings

The findings in this section were collected by the Committee in meetings with representatives of various social and political circles, as indicated in Table 80 below.
The findings here will not address the cross-cutting issues from a sectoral perspective, as this report deals with specific issues on these three themes in the sector sheets provided in the annexes.

Governance (focused on coordination of the transition phase)

For the purposes of this exercise, the governance theme focused on the coordination, at the time of the regional-level response, between the authorities, international organizations, civil society, and the victims. Coordination linkages at these sub-levels in the Early Recovery phase are indeed essential, although extremely challenging, as indicated in the Guidance Note on Early Recovery:

> Support for early recovery from governments, international agencies, NGOs and others is often a combination of isolated and uncoordinated interventions, leading to a duplication of effort in some areas, a waste of resources in others, a failure to consider risk reduction and conflict prevention, and a failure to put in place the conditions for sustainable longer-term recovery. The challenge is to bring together a broad range of organizations to support national actors in a coordinated and cohesive way.[29]

29 Guidance Note on Early Recovery, CWGER in cooperation with the UNDG-ECHA Working Group on Transition, April 2008, page 14

Table 80: List of meetings held and institutions met by the Cross-Cutting Issues Committee

Date	Location	Type of institutions
26-04-08	Morondava	Extensive field visit with the rest of the evaluation team and regional authorities
27-04-08	Morondava	Representatives of civil society (all from national institutions)
27-04-08	Morondava	Local Representative of a UN agency
28-04-08	Sainte-Marie	Representatives of civil society and international NGOs
28-04-08	Sainte-Marie	Representative of a village and field visit to this village
29-04-08	Fénérive-Est	Representative of regional authorities (DDR)
29-04-08	Fénérive-Est	Representatives of civil society and international NGOs
01-05-08	Ambatondrazaka	Extensive 3-hours field visits to various villages and infrastructures around the lake
01-05-08	Ambatondrazaka	Representative of regional authorities
02-05-08	Ambatondrazaka	Representatives of civil society (all from national institutions) and affected villages

Support for national coordination and international support

The link between the BNGRC, the national institution responsible for coordinating the national response, and the international humanitarian institutions has already been described in positive terms in the section entitled “The Immediate Response” (see page 6) and this aspect of the coordination was not the focus of the Cross-Cutting Issues Committee. It will therefore not be addressed here again.

Support for local coordination mechanisms

The institutional and conceptual response model to be developed at the regional level as a relay to the BNGRC and Regional Committee for Disaster and Risk Management (CRGRC) is clearly set forth in the National Strategy for Disaster and Risk Management (SNGRC). Some tools, such as the Multi-Disaster Initial Survey Sheet (Fiches EIMA), already exist. The intent of the Cross-Cutting Issues Committee was then to determine which aspects of coordination at these sub-levels had worked and which had not, what could be done better when the next disaster strikes, and what support would be needed to achieve this higher level of coordination in the Early Recovery phase.

The first finding worthy of mention here is that none of the areas visited had yet formally established the CRGRC. Similarly, the Fiches EIMA, another formal element of a coordinated response, in which data is collected at the village/commune level within 48 hours to be encoded for quick analysis at the national and regional levels, seems to have been used only in the main affected areas. In other regions, the authorities, the United Nations Agencies, and civil society were all unaware of the existence of this tool.

The second finding is that ad hoc coordination did nonetheless take place in several regions, indeed linking regional authorities to local authorities and NGOs. Good use of the Fiches EIMA was also observed. As an example of effective multi-level coordination we can cite the example of the collection and data encoding by CARE International of all Fiches EIMA, which were filled in by the various villages/communes along the eastern coast before they were sent to authorities at various levels for analysis and action within a matter of days at the various levels (district, regional, national). This example should be more thoroughly documented for use as a case study for analysis of strengths/weaknesses and future replication.
In one region, the regional representative's theoretical knowledge of the CRGRC was excellent, but practical application was not confirmed by representatives of civil society, who lamented the lack of collaboration and mutual support in the weeks following the cyclone Ivan.

Through meetings with the various groups, the Committee found people committed to coordination and became aware of a strong desire on their part for faster decentralization, perceived as a factor that would enhance coordination. However, it was also felt that the same people were limited in their capacity and means to do so. They were therefore often receptive to being helped to set up a CRGRC and in establishing mechanisms for communications and data collection. Such help would include:

- Training on CRGRC;
- Long-term human support based at the regional level to set up the CRGRC and establish coordination at the lowest level; and
- Development of communication systems for the most remote areas (systematize the use of the Fiches EIMA, adequate means of communication, etc.).

In conclusion, at the time of the field visit of this mission, the committee was not able to clearly identify needs for Early Recovery projects aimed at improving immediate coordination. The current situation and the end of the cyclone season meant that a high level of coordination was no longer required. What was needed was instead a focus on specific interventions, e.g., in the agricultural sector, where sector coordination often exists already between the various stakeholders. From an Early Recovery perspective, however, strengthening and building a capacity for post-crisis governance and, more specifically, post-disaster response coordination, would need support and funding. Support to the regions and districts in the coming months and until the next cyclone season will be needed to put these functions in place. Discussions are already pending for potential support from the United Nations System to the regions and the BNGRC in setting up this capacity, so that it can be funded outside the scope of this report.

Disaster and Risk Management

As mentioned above, this theme is discussed in section IV of this report and is therefore not developed further here.

Section IV shows clearly what information was gathered through the interviews conducted by the Cross-Cutting Issues Committee:

- ✓ Reconstruction and recovery needs related to this year's cyclone cannot be dissociated from ongoing development requirements.
- ✓ Many existing practices and mechanisms helped reduce the impacts of the three cyclones. Commitments and policies established in recent years by the Government, effective dissemination of warnings, new anti-cyclonic building norms for schools and hospitals, and the development of specific school curricula on disaster risk reduction are some examples of good practices.
- ✓ Communities have adequate traditional coping mechanisms and practices and a high degree of resilience in the face of cyclones, and this limits the storms' impact on their socioeconomic development.

Section IV also identifies needs and estimates the costs of programs for integrating disaster risk reduction. As indicated in the preceding section on governance, Early Recovery programming of the type suggested above would be a great help in strengthening institutions, building capacities, assessing and communicating risk, and in developing a coordinated approach to Early Recovery.

Gender and Diversity

The Guidance note on Early Recovery indicates that

> Early Recovery should focus on promoting and strengthening equity and equality for all, and should avoid (further) marginalization of certain groups or creation of new sources of risk. Identifying and incorporating cross-cutting issues right from the start helps to ensure they are given the required consideration during the planning and execution of recovery activities.[30]

In looking at gender and diversity, the Cross-Cutting Issues Committee therefore intended to determine whether the aid recipients were indeed those who had been made vulnerable by the disasters. It is important here to note that, due to time limitations on the field visits, the mission was not in a position to assess the distribution of aid between remote areas and easily accessible ones. However, it emerged from some interviews that, in terms of a lack of resources (e.g., water pumps, prepositioned supplies, means of communication), the severity of the cyclone's impact was not necessarily the most important factor favoring accessible and influential zones to the detriment of more remote places. The latter's needs became known somewhat later due to problems in communications between the central and outlying areas.

It seems that, due to the nature of the destruction, the victims were readily identified for relief activity. In Sainte-Marie, however, there was a consensus that excessive emphasis on vulnerability criteria not specifically linked to the disaster itself but to more generic lists led to an unbalanced distribution of aid (and even multiple distributions of the same goods to the same families by different agencies) to those with a certain number of children, or to elderly and disabled people rather than to the most severely disaster-hit individuals and families.

[30] Guidance Note on Early Recovery, CWGER in cooperation with the UNDG-ECHA Working Group on Transition, April 2008, page 28

To reduce these aforementioned problems of victim identification encountered during the immediate emergency, the systematic use of Fiches EIMA would appear to be a more objective way to allocate aid within regions and districts.

The types of vulnerability proved diverse and often different depending on how the region was affected. They also broke down very clearly along the lines of the main economic activities of households. Children, as an age group, have also been consistently identified as major victims of the cyclone. Women as a group were mentioned as having suffered more than men, but in specific cases, the coming months may have variable impacts on them depending on activities to be developed in some sectors to relieve the burden of the lean season.

Children

Children were affected directly by the cyclones in that all areas reported school closures of varying durations immediately after the cyclones. Infrastructures were often affected (see Education Sector) or occupied by displaced people. Of interest for Early Recovery programming, however, is the fact that in several areas children did not immediately return to schools when they reopened, but were instead kept home, either to help the family to rebuild, resettle or rehabilitate the means of economic support or, more alarmingly, to go out and earn income. In one area, prostitution was mentioned as one way for young girls to do so. At the time of the visit, however, most of the meetings confirmed that school attendance levels had returned to levels comparable to previous years for the same season. A drop in attendance occurs every year during the lean season because parents cannot afford to send the necessary food along with children leaving for the week and therefore decide to keep them home.

Women

Women as a group were not identified as being more vulnerable to cyclones. From female-headed households, it seems that the traditional “Fihavanana” system of mutual aid and self-help, as well as the easy construction methods used for houses prevented them from being further marginalized.

In some areas, however, the destruction of non-irrigated rice and of most crops providing food and/or income during the lean season (e.g.: breadfruit, manioc, vanilla, clove, litchis) will only now begin to affect households, and possibly the women in particular. There will now be a need to replace these losses by other quick crops (kitchen and market garden vegetables) that could increase the women’s workload at time when outreach sessions are occurring and the gardens need maintenance. Other Early Recovery programs now in place, such as the Food-for-Work programs often involving construction and reserved for men, should ensure that women and households headed by single women are included.

Fishermen

Pre-cyclone warning systems averted the huge losses of assets (boats, fishing nets) for fishermen that had initially been expected. They also have often been the first to be able to

restart their economic activities. However, they have been variously affected depending on the geographical area. In the regions around Morondova and Ambatondrazaka, the fish is either consumed locally or sent to markets (Antananarivo) where demand was not affected by the cyclones. In these regions, the fishermen's' livelihoods were thus scarcely affected. On Sainte-Marie, however, where fishing activity is either geared to on-site tourists or, more importantly, to the eastern coast of the mainland, the impact was far greater and is still being felt, since demand from both consumer groups dropped after cyclone Ivan. Without going into the detailed analysis that the sections on agriculture and trade will provide, it emerged from interviews that Early Recovery programming should therefore focus, where the Cross-Cutting Issues Committee is concerned, more on improving market conditions than on the replacement of assets.

Cattle farmers

This socioeconomic category of people was encountered only in the region of Morondava. Participants agreed that this category was generally among the most vulnerable, with low school attendance and frequent victimization by bandits. However, they were not considered among the most vulnerable to cyclones (since they do not live in low-lying irrigated areas affected by floods). Their problem is instead drought, which pushes them to migrate around the region. No specific Early Recovery need is highlighted for this category.

Landless and those who do not own cattle

This category of people was mentioned several times. Those offering their labor were believed to have benefited from increased work opportunities immediately after the cyclone or in the Early Recovery phase, as they were either employed by landowners to rehabilitate fields or enlisted in Food-for-Work programs. Similarly, those tilling the fields or renting land for rice cultivation, having initially believed that they had lost the future harvest, have actually turned out to be little affected, since irrigated rice did not actually suffer from the post-cyclone floods. Apart from Food-for-Work, no immediate specific Early Recovery programming seems to be needed for this category.

Farmers

Immediately after the cyclone, and even now, farmers are considered in every area visited to be the category most affected by and vulnerable to the cyclones of 2008, even though the impact on irrigated rice has now been discovered to be slight. This seems to be based on the fact that this category has a livelihood strategy based on multiple crops that enter the household economy at various time in the year. The loss of the main alternate crop will only begin to affect most of these households in the coming months, and Early Recovery programming needs are potentially substantial. Outreach and training concerning alternate crops, supplementary feeding in schools, and malnutrition surveillance are only a few examples of projects that could/should be developed in the coming months.

Lessons learned for future practical exercises

This experience probably represents the case in which cross-cutting issues were most systematically considered within a DaLa. Committee participants agreed that this should be further institutionalized as one way to integrate the qualitative and human dimensions of the disaster.

The Cross-Cutting Issues Committee noticed that addressing the various themes in informal discussions with the various stakeholders in separate meetings in the same geographical zone (rather than in one meeting all together) allowed for more effective triangulation of the information collected.

However, the lack of time available for this approach made it difficult to obtain consistent and comprehensive results. Indeed, the lack of training and supervision offered by the Cross-Cutting Issues Committee to the sectoral groups in advance of and during the field visit, combined with the DaLa's enormous quantitative data requirements, somehow made the cross-cutting issues and questions secondary or superficial in the sectors. However, it was observed that groups that had received more support during data collection were subsequently more aware of the need to get data information on cross-cutting issues. In the future, time should be allocated to train people on this specific aspect of the methodology prior to the field visit.

It was also observed that the general questions, although appropriate for the Committee's encounters with various audiences, were not suited to the sector-specific issues related to the three cross-cutting questions. In the future, more sector-specific questions should be developed for each of the cross-cutting issues.

Early Recovery Needs

Agricultural Sector: Support for off-season crops

Situation

Cyclones Fame, Ivan, and Jokwe caused considerable damage to Madagascar's agricultural sector. The hardest hit regions were Analanjirofo, Alaotra Mangoro, Sofia, Atsinanana, Atsimo Atsinanana, Menabe, Haute Matsiatra, Vatovavy Fitovinany, and Diana.

After cyclone passage, various assessments concluded that 58,868 ha of rice paddies had been flooded nationwide and that 137,788 ha of cultivated fields had been destroyed. Agricultural inputs were lost, traditional and modern hydro-agricultural infrastructures were damaged, and there were significant losses of livestock and fishing equipment. The waters receded from rice paddies at varying rates depending on the region. This is now known to have occurred rapidly, however, and the paddy losses initially feared were less than predicted.

Traditional cash crops (e.g., clove, vanilla, litchis) also suffered considerable damage, especially in the region of Analanjirofo, where cyclone Ivan made landfall and these crops are the main source of household income.

The rapid assessments conducted by the humanitarian partners or the Ministry of Agriculture, Livestock and Fisheries (MAEP) made it possible to identify the urgent needs of agricultural households and essentially resulted in the distribution, by MAEP and the NGOs, of donor-funded improved short-cycle seed to salvage the cropping season that was underway. Not all needs were covered, however, and these interventions have not yet been developed for some very remote districts, such as Midongy Atsimo and Befotaka. A recent nutritional survey of those districts indicates that there is a danger of food insecurity in the coming months.

Production resulting from this seed distribution may ensure food availability to offset this possible food insecurity situation.

The off-season cropping campaign begins in May. These crops may provide partial subsistence for households until the next harvest, but their level of intensification varies greatly from one region to another.

Within the context of Early Recovery, it therefore seems essential to establish or support ongoing outreach campaigns on the importance of these crops and on the type of crop to be developed this year in the affected zones. If households are to resume their agricultural activities, it is crucial that they be provided with material and technical support to help reduce the vulnerability of the production system to various shocks.

Sectoral objective

The Early Recovery objective for the agricultural sector feeds into Madagascar Early Recovery Strategic Objective 1, which is to restore activities associated with the affected population's means of subsistence. This objective is defined as follows:

Reconstitute household capital and shared means of production

Priorities

- ✓Resumption of agricultural activities:
  - Distribution of seeds, tools and agricultural inputs;
  - Outreach and support for improved techniques;
  - Establishment of an agro-meteorological information system;
  - Vaccination of livestock (in connection with diseases/epidemics arising from the disaster rather than under routine national vaccination campaigns);
  - Distribution of fishing equipment; and
  - Improvement of markets.
- ✓Agricultural infrastructure rehabilitation project:
  - Rehabilitation of perimeters and irrigation/drainage canals.
- ✓Environmental improvements:
  - Adjustment of cropping calendars;
  - Restoration of watersheds through tree nurseries and village-level reforestation;
  - Restoration of plant cover; and
  - Outreach and support on environmentally friendly techniques.

Implementation partners

Partners already active in this sector are the following: MAEP through its DRDRs, CARITAS, CRS, CARE, German Agro Action, SAF FJKM, FAO, and ONN.

Water, Sanitation, and Hygiene

Improving access to safe water and sanitation for the populations of Analanjirofo, Atsinanana, Alaotra Mangoro, and Menabe.

Situation

Access to safe water and sanitation is an ongoing development challenge in Madagascar. Even in non-emergency situations, access to safe drinking water and adequate sanitation facilities in both urban and rural areas is extremely limited. Following the destruction caused by recent cyclones, it was estimated that over 220,000 people were directly affected by poor water quality, lack of adequate sanitation facilities and flooding, and were thus at greatly increased risk of disease.

The initial humanitarian response in the WASH sector focused on the immediate improvement of access to safe water and basic sanitation. Along with an intensive hygiene information campaign in the affected areas, the implementing partners distributed WASH kits to households, schools, and health centers. Flooded and contaminated wells and water points throughout the regions of Alaotra Mangoro, Analanjirofo, Menabe, Haute Matsiatra, Sofia, and Melaky were cleaned and disinfected to improve the quality of drinking water for the affected populations. Following an in-depth evaluation of schools, sanitary structures and other main infrastructures in affected areas, emphasis was also placed on rehabilitating obsolete sanitation facilities and on improving safe water access through the rehabilitation and protection of existing water points. Rainwater catchments systems were also installed in selected schools and health centers.

Following a damage and loss assessment in the affected areas, a main issue of concern in the larger urban areas was the lack of maintenance of existing wastewater and sewage systems. Proper cleaning and maintenance of these systems could have minimized much of the damage caused by severe flooding. Sustainable maintenance and the rehabilitation of damaged and destroyed water and sanitation facilities in key communities is now a priority, as are solid waste management support and maintenance, hygiene promotion and communication aimed at behavioral change in the area of safe water and sanitation.

In order to better prepare for the next cyclone season, emergency preparedness training will be given and first response WASH supplies will be pre-positioned in key locations.

Sectoral Objectives

The Early Recovery objective in the water, sanitation, and hygiene sector fall under Strategic Objective 2 in Madagascar, which is to renovate or strengthen basic services in the most affected districts. This objective can be defined as follows:

Sustainable rehabilitation and protection of basic water supply and wastewater management systems in cyclone-affected communities.

Figure 79: Access to safe drinking water and adequate sanitation facilities in urban and rural areas is extremely limited.

Humanitarian Actions / Priorities

- ✓ Restore and improve access to basic safe water supply systems and sanitation facilities.
- ✓ Support or strengthen the creation/establishment of maintenance systems to ensure the sustainability of these services.
- ✓ Improve hygiene conditions of affected populations through appropriate hygiene awareness campaigns.
- ✓ Integrate the Early Recovery process into the National Strategy for water, sanitation, and hygiene.

Implementing Partners

UNICEF is the lead agency for the water, sanitation, and hygiene cluster and will work alongside the following partners: CARE, CRS/USCCB, Fandrosoana, German Agro Action, GREEN, Jirama, local water management committees, the Malagasy Red Cross, Medair, the Ministry of Health, Oddit, Odipe, PRINAS, PSI, SAHI, St. Gabriel, Taratre, WaterAid and InterAid.

Education

Rehabilitation and capacity building for national and local partners in standards of emergency education response.

Situation

As access to the most affected areas improved following the passage of cyclone Ivan, the number of classrooms known to have been damaged or destroyed more than tripled from the original estimates (of 700 in the Flash Appeal) to 2,282 (the latest figure from a damage and loss evaluation carried out by the Ministry of Education, the United Nations System and the World Bank). The number of primary and secondary school children whose educations were disrupted thus rose to 295,200. During the initial emergency response phase, humanitarian actors in the education cluster provided a tailored package of Emergency Education assistance to affected schools in 17 regions throughout Madagascar. This assistance was aimed at ensuring that children would return to school as quickly as possible, and included temporary classrooms, pedagogical supplies, and recreational equipment.

There are still too few classrooms in cyclone-affected areas, however. School schedules have been reorganized (e.g., morning/afternoon rotations and multi-level classes) to accommodate as many students as possible during the school week.

In the poorest rural areas and those hardest hit by the cyclone, communities are finding it extremely difficult to devote resources to school reconstruction when they are facing hardships with their household livelihoods.

To ensure educational continuity and access for all children throughout the school year, partnerships with the Ministry of Education need to be developed, and additional support is needed for school rehabilitation and to ensure a sustainable and safe learning environment. The rehabilitation of schools will strategically target those that have maximum impact on children. All rehabilitation work will use anti-cyclone construction methods to guard against future damage and disruption. An integrated package of programmatic interventions will include access to clean water and sanitation, and will incorporate protection measures.

Educational objectives will also focus on capacity building for national and local education authorities in the area of disaster management and on integrating emergency education standards into the various phases of the emergency response.

Sectoral Objective

The Early Recovery objective of the education sector fall under Strategic Objective 1 in Madagascar, which is to **revive activities associated with the livelihood of the affected population.** This objective can be defined as follows:

Restore education and ensure access to quality education for all children and adolescents in cyclone-affected areas.

Figure 80: Reinforced school structures will prevent future disruptions to children's education.

Humanitarian Actions / Priorities

- ✓ Support the return of students and teachers to schools.
- ✓ Provide temporary classrooms, school supplies, and pedagogical materials to facilitate reintegration of students and completion of the school year.
- ✓ Ensure safe water access and promote hygiene in schools in all affected areas.
- ✓ Enhance the capacity of the affected population to actively contribute to the renovation and reconstruction process.
- ✓ Integrate awareness of disaster risk management, and build on local structures and strategies by ensuring links between local education authorities and local-level Disaster Risk Management Committees.
- ✓ Restore / strengthen the capacity of national and local education authorities to manage future disasters and their resultant development / recovery phases. Provide disaster and risk management training to education authorities at all levels.

Figure 81: Humanitarian actors in the education sector must ensure a sustainable and safe learning environment for children.

Implementing Partners

UNICEF will work in close collaboration with the Ministry of Education to devote appropriate resources to the restoration of an educational system that will ensure the basic right to education for all children in Madagascar.

Habitat Sector

Outreach and capacity building above all

Situation

Madagascar is highly vulnerable to natural disasters. According to the UNDP's 2004 World Report on Disaster Risk Reduction, Madagascar is ranked 13th among countries exposed to tropical cyclones and 1st among African countries in this situation.

During the 2007-2008 cyclone season, cyclones Fame, Ivan, and Jokwe totally or partially destroyed 136,564 dwellings and displaced 344,304 people, of which 192,368 became homeless. Houses constructed of local materials accounted for 80 percent of the damage. This year, ample numbers of tents were distributed under grants from various donor countries.

In the affected regions, housing sector interventions were conducted jointly by local authorities and humanitarian partners. For example, NGOs such as CARE International are currently engaged in rebuilding damaged houses made of local materials in the hardest hit regions, such as Analanjirofo, giving priority to the most vulnerable groups (e.g., female-headed households, the elderly, etc.). The Malagasy Red Cross is doing the same in Sainte-Marie. However, this reconstruction is essentially limited to the use of materials that can be salvaged on site to create makeshift shelters.

Two months after the cyclone, there are no longer any people sheltering in common relocation sites, with the exception of a few very localized cases, such as the district of Mahabo (region of Menabe), where the original built terrain itself was carried off by floods when the track of the riverbed was altered. In other locations, people have either returned home or have remained with neighbors or relatives, but with no change in their previous living conditions (i.e., they are still subject to the dangers of flooding, wind damage, etc.). Most homes appear to have been rebuilt in two or three days, in the local style and using locally available materials, given:

- The financial capacities of the households (since this type of housing is inexpensive and is affordable for households in these regions); and
- The climatic conditions (since traditional building materials are well suited to the climate of Madagascar's coastal regions).

On this latter point: Past experience in the district of Vatomandry indicates that people do not live in houses built according to cyclone-resistant standards because the interiors are not comfortable in the local climate. Instead, they build cyclone-resistant dwellings next to their year-round homes, and live in them only during the cyclone season.

The situation with basic public buildings is different. It is crucial that they be (re)built to cyclone-resistant standards within the framework of Early Recovery, since they often serve as gathering

places during cyclones. In connection with Early Recovery and "Rebuild, but better" campaigns, efforts should not focus on individual dwellings, but rather on outreach and capacity building.

Sectoral objective

The Early Recovery objective for the habitat sector contributes to Early Recovery Strategic Objective 2, which is to **restore and/or strengthen basic services in the hardest hit districts.** This objective is defined as follows:

Provide outreach and support to local initiatives so that the principle of "Building back better" is integrated, and strengthen the capacity of local authorities

Priorities

- ✓Capacity building:
  - Updating of cyclone-resistance standards and training of the various actors;
  - Training of local authorities on measures required at each alert/warning phase;
  - Training in land tenure security (in the event of displacement);
  - Integration of Early Recovery issues into development plans; and
  - Site planning.
- ✓Information, Education, Communication (IEC):
  - Outreach/awareness concerning cyclone-resistance standards and land tenure/site management laws and regulations.
- ✓Security:
  - Support for community initiatives (reconstruction, risk reduction);
  - Establishment of Steering Committees and Rescue Committees;
  - Mobilization of donor funds; and
  - Establishment of pilot municipalities.

Implementation partners

The following government agencies and humanitarian/development organizations have either undertaken or are planning Early Recovery activities in the housing sector: Ministry of Land Tenure Reform, Public Lands and Regional Planning, UN-HABITAT, UNICEF, CRM, CPC, CARE, and SEIMAD.

Logistical Sector

Restore access to means of production, marketing, and communication

Situation

The passage of cyclones Fame, Ivan, and Jokwes during the first quarter of 2008 caused significant damage to several infrastructures, particularly in the northwestern and eastern parts of Madagascar. These events cut off access to several zones that are either vulnerable or vital to the Malagasy economy and made it difficult for the population to move about freely. The following types of damage are the most frequently encountered in the logistical sector, particularly with regard to road, rail, and port infrastructures.

- Bridge access destroyed;
- Bridge pilings undermined and overturned;
- Temporary Bailey bridge overturned;
- Dikes destroyed;
- Foundation rafts carried away;
- Landslides onto roads and railways;
- Emergence of gaps;
- Degradation of submerged roadbeds;
- Damage to wharfs;
- Some interruption/disruption of telecommunications as a result of damage to relay antennas.

Figure 82: Damage to roads because of cyclones

Passage risqué pendant l'innondation au PK 100 de la RN6

The initial multisectoral assessments carried out required the mobilization of airborne resources, which were coordinated by the logistics sector group in the hardest hit regions. In some regions, this continued until humanitarian interventions arrived; in the interim, the logistics sector was obliged to bring major resources to bear in support of humanitarian interventions in other sectors. The WFP, for example, chartered a helicopter for nearly a month to bring food to inaccessible municipalities in the regions of Analanjirofo and Atsinanana. UNICEF did the same to implement a vaccination campaign in those regions.

The current situation is the following:

- Some damage was quickly and permanently repaired (e.g., repairs to the RN 6 highway between Port Bergé and Ambanja, which were carried out under an already existing contract. Most telecommunications are also completely restored.)
- Some roads were provisionally repaired using locally available resources to temporarily restore traffic circulation (e.g., installation of Bailey bridges, roadbed repairs, removal of landslides from some railways and roads, repairs to foundation rafts, construction of temporary wooden bridges, development of detours, etc.).
- Several damage sites have still not been addressed in any way (e.g., landslides, breaches, bridge access, various water-crossing and sanitation works, wharfs, etc.).Some zones are therefore still inaccessible (e.g., road to Mahajamba in the northwest, RNT 23 to Marolambo on the east coast, RNT 18 to Midongy and Befotaka in the southeast, and truck route RNT 32 to Mandritsara). Some food insecurity could occur in the coming months in Midongy, Befotaka, and Mahajamba.

Sectoral objective

Beyond the sectoral situation, the Early Recovery objective in the logistical sector contribute to Early Recovery Strategic Objectives 1 and 2, which are, respectively, to **restore activities associated with the means of subsistence of the affected populations** and to **restore and/or strengthen basic services in the hardest hit districts.** This objective is defined as follows:

Restore access to means of production, marketing, and communication, and support other sectors

Priorities

- ✓ Conduct a preliminary study to identify temporary remedies, pending the definition of definitive and sustainable solutions:
  - Identify damage and trouble spots (in collaboration with other sectors);
  - Study the causes and origins of each problem and trouble spot; and
  - Find appropriate technical solutions that address these causes and comply with standards (Food-for-Work program, extended funding for a helicopter to transport materials once transport needs for immediate emergency activities have been covered).
- ✓ Convert these appropriate solutions into definitive solutions in cases of small- and medium-scale rehabilitations aimed primarily at communities:
  - Rehabilitation of access to health centers, schools, and public buildings damaged by the disaster;
  - Small temporary repairs to main roads pending more definitive reconstruction.

- Restoration of warehousing capacities damaged by the disaster.

Implementation partners

The World Food Program is already implementing Food-for-Work projects in partnership with NGOs on site. The Ministry of Public Works and Meteorology, the Ministry of Transportation, and the Malagasy Highway Authority are also potential operational partners.

Health

”Build back better” and surveillance

Situation

Tropical cyclones Fame, Ivan, and Jokwe destroyed or damaged 167 basic health centers and six hospitals, distributed among 59 health districts in 16 regions of Madagascar. This caused either temporary or permanent disruption of primary health care services in the zones served by these facilities.

The destruction or deterioration of hydraulic and sanitation works, as well as of means of production (e.g., cultivated fields), only added to the precariousness of the living conditions of an already vulnerable population.

Although the situation improved soon after cyclone passage (e.g., standing water receded and most houses were rebuilt quickly), risks associated with vector- or waterborne diseases, or with diseases aggravated by crowding, were increased due to fecal pollution of many of the population’s sources of water used for drinking and other household tasks.

In addition, these populations are repeatedly affected by natural disasters. It is therefore critical to make services available in a sustainable manner, but also to encourage their actual use by the population, by means of intensive Information, Education, and Communication (IEC) activities, accompanied by efforts to strengthen the disease surveillance and epidemic response system.

Figure 83: Basic Health Center 1 at Ambodiforaha (Island of Sainte-Marie) damaged by cyclone Ivan, February 2008

The Government, in collaboration with its partners, provided a rapid first-phase response by treating patients free of charge, intensifying preventive activities such as vaccination, distribution of vitamin A, disinfection of wells, anti-vector measures, and intensive IEC campaigns. These Early Recovery activities will still require support in the coming months, however, not only to restore the pre-cyclone situation but also to improve knowledge and practices and mitigate the impact of future cyclones.

Sectoral objective

The Early Recovery objective for the health sector contributes to Early Recovery Strategic Objectives 1 and 2, which are, respectively, to **restore activities associated with the means of subsistence of the affected populations** and to **restore and/or strengthen basic services in the hardest hit districts.** This objective is defined as follows:

Strengthen health care coverage in the affected zones and promote the use of these services by the population

Priorities

- ✓ In order to make preventive and curative care available:
  - Rehabilitate damaged health care infrastructures;
  - Re-equip health care facilities (supplies and drugs);
  - Strengthen human resources; and
  - Strengthen disease surveillance systems.
- ✓ In order to promote the use of services by the population:
  - Carry out IEC activities to promote use of health care services; and
  - Provide technical and financial support for local/community initiatives.

Implementation partners

Agencies involved in health care include the Ministry of Health, the WHO, UNICEF, UNFPA, CRM, MDM, ASOS, and other NGOs.

Food and Nutritional Security Sector

Situation

Cyclone Ivan struck Madagascar as the country was entering the lean season, which lasts from February to May. Seasonal food insecurity is mainly caused by the depletion of household food stocks and seasonal price increases of staple commodities. As the lean season coincides with the cyclone season, the effects of natural disasters further aggravate seasonal food insecurity. Malnutrition is multisectoral, however, and is caused by a combination of factors including food shortages, lack of safe water, inadequate health care and poor hygiene and sanitation.

Humanitarian actors in the food security and nutrition cluster worked alongside the Government's National Nutrition Organization (ONN) to put in place a nutritional surveillance system. Health staff and community workers received specific training to enable them to identify cases of acute malnutrition specifically in cyclone-affected areas where therapeutic feeding centers already exist.

South East: A nutrition survey was conducted in April 2008 in the flood-affected districts of Midongy and Befotaka. Results indicated that the level of acute malnutrition—11 percent global acute malnutrition—was typical for this time of year. The food security situation was a concern, however, due to a poor rice harvest in December 2007 caused by a dry spell in the second half of the year followed by flood damage to subsidiary crops and cash crops in the wake of cyclone Ivan. Thus, the hunger gap started earlier this year and will last longer than usual, i.e., until the next harvests in October and December.

Figure 84: Malnutrition rates will be closely monitored to detect any deterioration in status and allow a timely response.

Analajirofo: A survey was conducted by CARE International aiming at evaluating the food security situation in the region (more precisely in the districts of Vavatenina, Fenerive Est, Soanara Ivongo and Sainte-Marie). About 75 percent of the rice crops (second season) maize, coffee and other cash crops have been damaged, as have been 50 to 75 percent of the cassava crops. Some 40 percent of the households did not have any remaining food stock at the moment of the survey (April 2008) and 40 percent will not have remaining food stocks within the three months following the survey. The production level of the current crop will be under the last year's productivity and will be delayed by two months and a half.[31]

Alaotra Mangoro: Overall the food security situation in this region is rated as adequate and partners working in the area have evaluated that there is no food insecurity concerns and that the immediate response provided after the cyclone was sufficient.

[31] As the population has cultivated for a second time their land, a delay of 2.5 months on the agricultural calendar is expected.

Further nutrition surveys will be conducted in selected districts of Analanjirofo and Alaotra Mangoro, and a nutritional response will be mounted if required. The immediate priority is to restore household food security through a range of livelihood activities aimed at preventing the emergence of a nutrition crisis.

Sectoral Objectives

The Early Recovery objective in the food security and nutrition sector fall under both Strategic Objective 1 and 2 in Madagascar which are, respectively, to **revive activities linked to the livelihood of the affected population** and to **renovate or strengthen basic services in the most affected districts.** These objectives can be defined as follows:

To restore the three pillars of food security: food availability, access, and utilization at the household and community levels in order to avoid any deterioration in the nutritional status of the cyclone-and flood-affected population

Humanitarian Actions / Priorities

- ✓ Evaluation of Early Recovery needs.
- ✓ Accessibility: Cash for Work; support for livelihood activities; provision of fishing nets/pirogues; and income-generating activities.

Implementing Partners

UNICEF is the lead agency for nutrition and WFP the lead agency for food security. Both agencies will work in close collaboration with the National Nutrition Organization (ONN), Ministry of Health, Regional and District Health Authorities, CARE International, Help Madagascar.

Early Recovery Cross-Cutting Group: Coordinate and Institutionalize Early Recovery

Situation

The humanitarian platform, under the leadership of the national risk management bureau (BNGRC) and with the support of OCHA on behalf of the Office of the UN Resident Coordinator for Madagascar, has been implementing the UN system's sectoral approach since the 2007 humanitarian reform. The response to the 2008 cyclones in Madagascar was developed at the national and regional levels through these structures.

The concept of Early Recovery is new to Madagascar, however, and it was not until this year's humanitarian response that the BNGRC, with support from the UNDP's Crisis Prevention and Recovery Unit (BCPR), developed the initial components of a National Early Recovery Strategy. At an Early Recovery training workshop held on April 21, the following results were achieved:

- ✓ Early Recovery training for CRIC partners;
- ✓ Development of the general strategic objective and of specific Early Recovery strategic objectives;
- ✓ Development of Early Recovery definitions and objectives for each sector; and
- ✓ Preparation of an initial list of activities/priorities for Early Recovery after the 2008 cyclones.

The Joint Assessment of Damage, Losses, and Needs following the 2008 cyclones, as well as the sector-specific assessments prepared by various agencies, confirmed the Early Recovery requirements within the various sectors. These assessments also confirmed, however, the need to support the Government's efforts to coordinate and institutionalize Early Recovery in Madagascar. The following section further details the objective and the priorities in this area.

Objective of the Early Recovery Cross-Cutting Group

Beyond the sectoral situation, the Early Recovery objective of the Early Recovery Cross-Cutting Group contributes directly to Early Recovery Strategic Sub-Objective 3, which is to develop **the country's capacity to coordinate and manage the Early Recovery network by integrating it into the National Strategy for Risk/Disaster Management.** Due to its nature, it also contributes indirectly to Strategic Sub-Objectives 1 and 2 of Early Recovery in Madagascar, which are, respectively, to **restore activities associated with the means of subsistence of the affected populations** and to **restore and/or strengthen basic services in the hardest hit districts.**

This objective is defined as follows:

Establish an Early Recovery coordination network as part of the transition phase[32] following a crisis

Priorities

Two intervention themes are important for this Coordinating Committee:

- ✓ Establishment of focal points for each sectoral group, to permit networked coordination of Early Recovery activities led by the supervising government agency [to be determined]:
  - The sectoral groups select their Early Recovery focal points;
  - An informal ER network is meeting regularly with support of UNDP/BCPR
- ✓ An ER cluster is put in place at a time of pre-crisis for the duration of it with a task description approved by BNGRC and CRIC. The updated SNGRC include strategic ER plan to ensure establishment of ER program for each disaster.
  - Components of ER are integrated during the revision of the SNGRC.

Implementation partners

The operational partners of this Early Recovery Coordinating Committee are the agencies represented by focal points in the Early Recovery network, the UNDP, in its capacity of institutional support to the Government and lead agency within this Early Recovery Committee, and the supervising government agency serving as the Chair of this Committee. However, and to the extent that focal points each represent their respective sectoral groups, it is fair to say that all the partners of the Disaster Discussion Committee (CRIC) will be actively involved in implementing Early Recovery in Madagascar.

[32] In the Malagasy context, the term 'transition' refers, in times of crisis, to the period in which external assistance is most crucial in terms of supporting efforts to stabilize the situation during natural disasters by contributing to political stability, security, social equity, and equality before the law.

Medium and Long Term Recovery and Reconstruction Needs and Strategy

Summary

Major Strategy. The Madagascar Government and the donors have recognized the need for a shift in the present strategy of responding annually to cyclone events towards an approach that would manage these recurring disasters better and more efficiently. Such a shift in strategy would require a refocus of the recovery and rehabilitation assistance along three major axes:

- First, the Government needs to adopt and disseminate cyclone-resistant norms for major infrastructures (agricultural infrastructures and public works). This would be relatively simple for housing, schools and healthcare centers, as plans based on such norms already exist (e.g., those of FID), or can be adapted. The main challenge will be to train constructors and NGOs, and to disseminate and enforce the norms. Specific flood-resistant designs will be necessary for roads, bridges and irrigation infrastructures. A one-year training course for national experts from specialized institutions is recommended before final national norms are adopted.

- Second, all major public infrastructures in high risk areas should be rebuilt in accordance with cyclone-resistant norms. Since improved re-building typically costs 30-100 percent more than ordinary standards, this shift in strategy may require greater selectivity in reconstruction – e.g., first targeting high priority infrastructures in the high risk regions, but with the certainty that they will then better resist subsequent cyclone seasons (instead of funding a larger number of poorly-built infrastructures). In time, this progressive plan would in turn cover the reconstruction of all critical infrastructures in all high risk areas – but without wasting funds on rebuilding the original poorly-designed structures.

- Third, the strategy would fund cost-efficient disaster risk management (adaptation) activities - such as agricultural diversification, introduction of flood-resistant seed varieties, early warning systems, and laying underground electricity cables in high risk areas.

These three major axes were taken into account in the outlined strategy for recovery and reconstruction in the Call for Funds for the Global Facility for Disaster Reduction and Recovery (below).

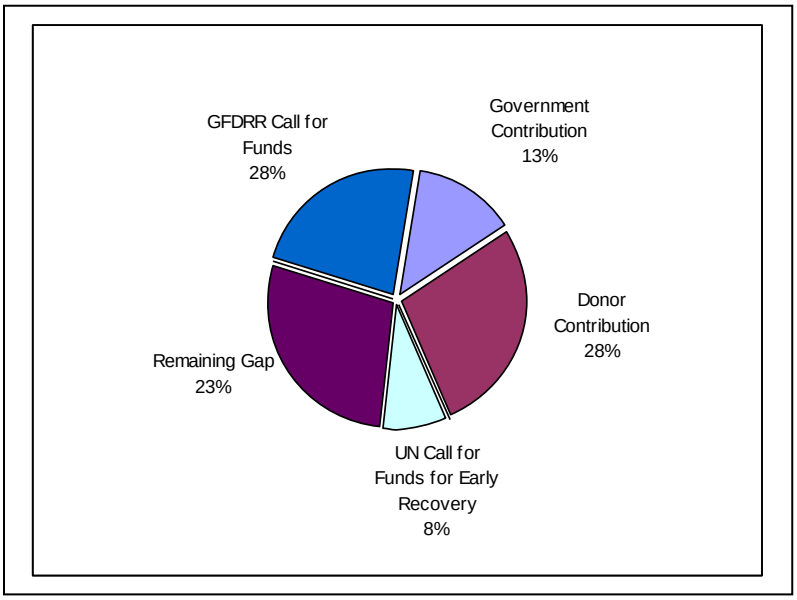
Total Needs. The estimated total funds required for recovery and reconstruction amount to Ar. 255.4 billion (US$154.8 million). These include the damage and loss assessment for all economic sectors, but prioritize public sector needs – in most cases private sector recovery and reconstruction needs are not included in the estimate. However, risk management measures and the costs of improved re-building are included in this estimate in order to target mitigation of the effects of future cyclones.

Of the total funds required, Ar. 86.6 billion (US$52.5 million or 34 percent) involve social sectors such as education, health, nutrition and habitat. About Ar. 17.1 billion (US$10.4 million, or 7 percent) are for productive sectors such as agriculture, industry and commerce, and tourism;

some Ar. 132.2 billion (US$80.1 million, or 52 percent) involve infrastructures such as electricity, water and sanitation, transportation and telecommunications; and Ar. 19.4 billion (US$11.8 million, or 8 percent) are inter-sectorial in nature, involving environment, risk management and livelihoods.

***Government and Donor Contributions*.** The Government is expected to meet about 13 percent of the total needs (Ar. 33.6 billion, or US$20.3 million); donor contributions are expected to fund about Ar. 70.3 billion (US$42.6 million, or 28 percent) through on-going sectoral programs or projects. About Ar. 21.1 billion (US$12.8 million or 8 percent) would be classified as Early Recovery and included in a separate funding request from the United Nations system.

Figure 85: Allocation of Identified Needs



Proposed GFDRR Call for Funds. The proposed Call for Funds under the Global Facility for Disaster Recovery and Reconstruction would focus on specific medium to long-term needs estimated at Ar. 71.3 billion (US$43.1 million) and covering 28 percent of the estimated total assessment. This amount only covers the needs, and does not include any overhead or implementation supervision costs. The Track III funds would focus on the following clear packages of activities, implemented through programs where the World Bank and the Government of Madagascar already have on-going projects (to minimize overhead costs):

Recovery and Rehabilitation:

- Rehabilitation of 132 schools to cyclone-resistant norms,
- Rehabilitation of 45 basic healthcare centers (to norms),
- Rehabilitation of 1,255 nutrition centers (to norms),
- Rehabilitation of 12 market places, construction of 10 new markets and 35 socio-cultural centers (to norms),
- Rehabilitation of 3 priority large irrigation schemes, irrigation micro-perimeters, and elevation of a village,
- Restoration of 212 ha of damaged forest by planting indigenous species,
- Rehabilitation of 15 km of rain and wastewater drains; 460 wells and 100 gravity systems,
- The incremental costs of rehabilitation of 3 bridges (to norms), several national roads, and 2 small airports.

Measures of risk management:

- Pilot introduction of aerial electricity cables, but laying underground cables in high-risk areas,
- Introduction of flood-resistant rice seed varieties,
- Training for Small and Medium Enterprises in disaster risk management principles,
- Early warning materials for 6,501 high risk villages,
- Development of cyclone-resistant norms for public infrastructures and habitat construction,
- Vocational training for youths and strengthening of professional rural organizations in high risk areas.

The Government has requested that given the pending food crisis, maximum priority be accorded to the rehabilitation of irrigation infrastructures.

Figure 86 Strategy for Reconstruction and Recovery

Although housing was the sector most affected by the disaster, nearly 80 per cent of the private homes damaged by the cyclones have been reconstructed. An assistance program to the remaining 20 per cent would risk introducing perverse incentives for the next cyclone season (as households that would otherwise take proactive action may choose to wait for assistance). Hence, the strategy for recovery in the housing sector is limited to rehabilitation of public administration buildings and training and dissemination of cyclone-resistant codes. A strong focus is placed on reconstruction of schools, public health centers, market places, and nutrition centers to cyclone-proof norms. The strategy also prioritizes the rehabilitation of irrigation networks, essential to address the pending food crisis; rehabilitation of critical transport infrastructure; improved water and sanitation infrastructure (one of the persistent causes of post-cyclone mortality); and risk management measures mainstreamed across all key sectors.

Table 81: Estimated Needs of Madagascar's 2008 Cyclone Season

	Total Needs	Government Contribution	Donor Contribution	Early Recovery UN Call for Funds [2,3]	Medium-to-Long-Term Recovery GFDRR Call for Funds[3]	Activities Covered by GFDRR Call for Funds	Remaining Gap
		US$'000					
Social Sectors	52,566.6	3,899.4	8,000.0	7,662.8 #	12,662.8		20,341.6
Education	16,243.7	1,333.3	8,000.0	1,609.0	4,418.9	Rehabilitation 132 schools to cyclone-proof norms	882.5
Health	19,081.9	2,438.8	0.0	6,053.8	3,928.5	Rehabilitation 45 basic health centers to cyclone-proof norms	6,660.8
Nutrition	3,328.7	0.0	0.0	0.0	3,328.7	Rehabilitation 1255 nutrition centers to cyclone-proof norms	0.0
Habitat	13,912.3	127.3	0.0	0.0	986.7	Rehabilitation 12 market places, 35 socio-cultural centers	12,798.3
Productive Sectors	10,371.8	1,142.7	2,882.6	942.2 #	2,402.6		3,001.7
Agriculture, Livestock, Fisheries	9,623.0	969.7	2,882.6	942.2	2,129.9	Rehabilitation 3 priority large irrigation; several micro-perimeters, elevation of one village; introduction innudation resistant rice seeds	2,698.6
Industry and Commerce	575.8	0.0	0.0	0.0	272.7	Training for SME in disaster risk management	303.1
Tourism	173.0	173.0	0.0	0.0	0.0		0.0
Infrastructure	80,091.5	14,058.9	28,485.5	3,950.0 #	21,646.5		11,950.6
Electricity	3,732.1	2,122.4	0.0	0.0	1,609.7	Replacement of aerial cables into underground cables in high-risk areas	0.0
Water and Sanitation	9,136.8	1,370.5	0.0	3,600.0	4,166.3	Rehabilitation of 15 km rain/wastewater drains; 460 wells; 100 gravity systems	0.0
Transport	67,212.6	10,563.0	28,485.5	350.0	15,870.5	Incremental costs of rehabilitating 3 bridges (to norms) and several national roads; 2 aeroguards	11,943.6
Telecommunications	10.0	3.0	0.0	0.0	0.0		7.0
Cross-Sectorial	11,785.4	1,243.5	3,224.2	250.0 #	6,482.6		585.1
Environment	726.0	0.0	126.7		170.0	Restoration of 212 ha of damaged forest with indigenous species	429.3
Risk Management[1]	6,745.8	1,243.5	97.5	250.0	5,300.0	Early warning materials for 6,501 Fokontany at risk; development of cyclone-proof norms (public infrastructure; training for habitat norms); training in DRM in 60% of Fokonta	-145.2
Livelihoods	4,313.6	0.0	3,000.0	0.0	1,012.6	Vocational training for youths; strengthening professional rural organizations; construction of 10 market places in high risk areas (to increase livelihood resilience)	301.0
TOTAL	154,815.3	20,344.5	42,592.3	12,805.0	43,194.5		35,879.0

[1] In 2008, the Government of Madagascar established a new Contingency Fund to handle catastrophes and shocks. The amount estimated to be allocated to cyclones (Ar. 1 billion) is included in the Government contribution to risk management.

[2] The UN Early Recovery Appeal led by the UN System shows a difference of US$16,138,608 with the estimates presented on this table for Agriculture and Habitat. The majority (98.2%) of this difference is explained by the fact that this appeal considers both public and private needs while the table above shows primarily public needs.

The remaining 1.8% comes from the need for Early Recovery to add some improvements to the pre-crisis situation for the agricultural sector.

[3] Does not include program overheads.

Education Sector

The total reconstruction and recovery needs for the education sector are estimated to be Ar. 26.8 billion (US$16.2 million). This is for 411 totally destroyed schools, 246 partially destroyed schools and their water and sanitation facilities (see Education Annex).

The Ministry of National Education and Scientific Research is the main institution responsible for reconstruction and recovery under the project Education for All. This project has been funded since 2003 by a multi-donor Catalytic Fund managed by the World Bank, involving partners such as AFD, African Development Bank, ILO, USAID, UNICEF, and PAM. The Catalytic Fund received US$60 million in 2005-2008 and an additional US$85.1 million in 2009-2011, to assist Madagascar in achieving its Millennium Development Goals of universal primary education by 2015. The project is helping to implement programs of reform from primary to high school levels, and to expand the construction of schools in areas that are not included. All new schools are to be built in conformity with cyclone-resistant standards. However, many traditional schools built by villagers were not built to such standards, and their heavy rate of destruction during the 2008 cyclones (and previous ones), risks undermining the project's targets.

The Education for All Project has made a commitment to allocate about US$1.3 in Government funding and US$8.0 million in donor funding (about US$1.5 million expected from the African Development Bank and US$6.5 million from the Catalytic Fund) for the reconstruction of 279 destroyed schools (68 percent of the total). The remaining 246 partially destroyed schools are expected to be rehabilitated using local community resources – e.g., roof repairs – and/or by a separate UN funding request for early recovery (US$1.6 million).

The GFDRR Call for Funds focuses on the construction of the remaining 132 destroyed schools and their water and sanitation facilities, at an estimated cost of US$4.42 million. To facilitate procurement, it is proposed that these schools be selected from the four most affected regions – Analanjirofo, Antsinanana, Alaotra Mangoro and Analamanga. The reconstruction would use the cyclone-resistant norms that have been established by the Ministry for construction of new schools, and which are based on experience acquired in school building by the Fund of Investment for Development (FID).

To minimize overheads and to expedite works, Track III funds could be processed as a Supplement to the Education for All project supervised by the World Bank and executed by the Ministry of Education and Scientific Research, using its established procurement and financial management procedures (which are acceptable to the Bank). Should it prove too lengthy to amend this multi-donor trust fund, the schools would be built by FID.

FID, now into its fourth phase, is a successful Social Fund that finances social infrastructures at the community level upon request – including schools, healthcare centers, markets, wells, rural roads, etc. Since mid-2004, it has also funded cyclone-resistant schools and healthcare centers that are resistant to winds of up to 250 km/h. It has a network of well-trained professionals who sub-contract the community works to qualified contractors or manage them as high intensity labor projects (HIMOs). FID also has a unit that is specialized in post-cyclone rehabilitation works.

Health Sector

The total reconstruction and recovery needs for the health sector are estimated at Ar. 31.5 billion (US$19.1 million), centering on the rehabilitation of 167 basic healthcare centers; 6 hospitals and their respective equipment; and incremental public heath expenses related to incidence increases in acute respiratory infections, malaria and diarrhea in the affected areas (see Health Annex).

The Ministry of Health and Family Planning is the main institution responsible for the health sector, which is supported through a transitional Health Sustainable System Development Project (PDSSP) in preparation for a system-wide approach expected to be set up in 2009. Partners include the World Bank, the African Development Bank, the Global Fund, AFD, and the Presidential Malaria Initiative, amongst others. The project is managed by a Project Management Unit within the Ministry of Health. UNICEF and WHO are also active partners of the Ministry.

The Government has committed about Ar. 1.9 billion (US$1.1 million) to the reconstruction of basic healthcare centers, involving 13 basic healthcare centers. UNICEF and WHO are expected to help with the reconstruction of an additional 69 basic healthcare centers through a separate US$6.1 million flash appeal. The plan calls for communities to help with the reconstruction of about 25 percent of the centers (42 units). This would leave a funding gap for 45 basic healthcare centers.

The rehabilitation of the 6 hospitals and their equipment (estimated to cost Ar. 5.4 billion or US$3.3 million) is considered to be of secondary priority. The Government has made an allocation of Ar. 1.1 billion (US$0.7 million) which covers about 18 percent of the total needs. This leaves an unfulfilled gap that would need to be funded by program donors.

Similarly, it is assumed that funding for public health needs would come from program donors as they would be primarily associated with early recovery.

It is proposed that the GFDRR Call for Funds cover the costs of rehabilitating the remaining 45 Basic Healthcare Centers, at an estimated total cost of Ar. 6.5 billion or US$3.9 million (Table 6).

Like the educational centers, the Basic Healthcare Centers would be built to cyclone-resistant norms, in conformity with the plans already approved by FID. To be consistent with the program funded by UNICEF and WHO, the funds would be overseen by the Ministry of Health's Project Management Unit, but sub-contracted either through FID, or through qualified contractors, using procedures acceptable to the World Bank.

Nutrition Sector

The reconstruction and recovery needs for the nutrition sector are estimated to be Ar. 5.5 billion (US$3.3 million), including reconstruction of 562 community nutrition centers, rehabilitation of 693 centers, and reconstitution of kits for all 1,255 centers (see Nutrition Annex).

The National Office of Nutrition (ONN) is responsible for the nutrition program under the program Surveillance et Education des Ecoles et des Communautés en Matière d'Alimentation et de Nutrition Elargie (SEECALINE) overseen by the Prime Minister's Office. The World Bank presently contributes to funding the program through budgetary support.

Due to the heavy commitments of ONN to the nutrition emergency needs in the immediate aftermath of the cyclone, there are no funds in the Government budget for rehabilitation of the community nutrition centers. And given that much of the nutrition program is funded through budgetary support, it would not be possible for donors to earmark funds specifically for the rehabilitation of the centers.

Given these constraints, and the importance of the small centers for the nutritional needs of the communities which they support, it is proposed that the GFDRR Call for Funds cover the full costs of their rehabilitation to cyclone-resistant norms for an estimated total cost of US$3.3 million, covering 1,255 centers in 9 regions – Analanjirofo, Alaotra Mangoro, Atsinanana, Menabe, Vatovavy Fitovinany, Atsimo Atsinanana, Boeny, Sofia, and Melaky.

FID would build the centers since it has the best technical, procurement and financial management capacities to manage this type of small infrastructure work in accordance with procedures that are acceptable to the World Bank-, under the supervision of ONN.

Habitat Sector

The reconstruction and recovery needs for the habitat sector are estimated to be Ar. 23.0 billion (US$13.9 million). This includes the rehabilitation of 153 damaged administrative buildings, 36 administrative lodgings, 12 market places, 6 cultural houses, 118 socio-cultural centers, 8 military and police hangars, and 5 prisons (see Habitat Annex). It also includes the protective elevation works of a village (in Mampikony).

Several Ministries are responsible for these buildings and the works: they include the Ministry of Interior and Decentralization and the corresponding decentralized Government; Ministry of Agriculture, Livestock and Fisheries; Ministry of Education and Scientific Research; Ministry of Justice; Ministry of Sports, Culture, and Leisure; and Ministry of National Defense. While a Government allocation of only US$0.127 has been confirmed to date in the 2008 revised budget, it is clear that repairs to these administrative buildings primarily remain a Government responsibility for which sectoral funding needs to be obtained.

Socio-cultural centers and market places come under a distinct category. These are important structures where local villagers may take shelter during cyclones (socio-cultural centers) or where they carry out their economic trade (markets). Furthermore, cash-strapped local communes - already heavily affected by the cyclones – are often responsible for their rehabilitation.

For this reason it is proposed that the GFDRR Call for Funds include the rehabilitation of 12 market places in Analanajirofo, Atsinanana, Menabe, and Melaky and 35 socio-cultural centers (5 in Analanjirofo, and 30 in Atsinanana) at a cost of US$1.0 million.

The market places and socio-cultural centers would be built under the supervision of FID, which has extensive experience with this type of social infrastructure at the community level, and under the supervision of the Ministry of Decentralization.

Agriculture, Livestock and Fisheries Sector

The reconstruction and recovery needs for the Agriculture, Livestock and Fisheries sector are estimated to be Ar. 15.9 billion (US$9.6 million). Two thirds of these needs concern rehabilitation of irrigation schemes; 22 percent involve agriculture rehabilitation; 11 involve fisheries and the remaining concern livestock needs (See Agriculture Annex).

The Ministry of Agriculture, Livestock and Fisheries is responsible for the sector, under two major programs: the Irrigation and Watershed Management Program (BVPI), involving AFD, Japan, the African Development Bank, and the World Bank; and the new multi-donor Agriculture Sector Program which the Ministry has set up in collaboration with the European Union, IFAD, the World Bank and SAHA. To date, the World Bank has contributed a US$30 million IDA credit to BVPI, and to the precursor of the Agriculture Sector Program through the Rural Development Support Project (PSDR). The latter is an SDR $69.2 million IDA credit which is active in 70 percent of the rural communes in Madagascar and (in parallel with FID) provides small grants to farmers' associations for productive investments in agricultural and non-agricultural activities. It also funds agricultural infrastructures, such as small irrigation schemes, up to US$100,000 each. Like FID, PSDR has been active in the past in funding cyclone recovery initiatives. The World Bank is expected to process a US$20 million supplement to PSDR around September 2008 for a period of 3 years (2009-2011).

In the irrigation sub-sector, of an estimated total need for Ar. 10.4 billion (US$6.3 million), the Government commitment amounts to about Ar. 1.6 billion (US$1.0 million), principally through the Irrigation Rehabilitation Management Fund (FEHRA). The donor commitment is estimated to be Ar. 0.9 billion (US$0.5 million), leaving an unfunded gap of Ar. 7.9 billion (US$4.8 million).
'

Three priorities are proposed for the GFDRR Call for Funds, for an estimated amount of Ar. 3.5 billion (US$2.1 million):

- Rehabilitation of three large irrigation schemes involving areas with great agricultural potential (Mahabo, Anony, and Marovoay);

- Emergency repair works to protect a village from potential flooding (in Mahajamba);
- Rehabilitation of several damaged irrigation micro-perimeters (in Analanjirofo, Atsinanana, Atsimo Atsinanana, Amoron'I Mania, Vitovavi Fitovinany, and Betsiboka) covering a total irrigated surface of 8,900 ha.

These works would be carried out through two major channels:

- Funds for the large irrigation schemes and the Mahajamba works would be implemented through the BVPI project fiduciary arrangements at the Ministry of Agriculture, Livestock and Fisheries, which are acceptable to the Bank. Anony and Marovoay are already included in the BVPI project sites. Mahabo and Mahajamba are not and may require extra supervisory capacity.

- Funds for rehabilitation of the micro-perimeters would be implemented through the PSDR project through its normal procedures (which include a minimum contribution by Water Users' Associations of 15 percent). PSDR already has extensive experience with small micro-perimeter rehabilitation in remote areas. It would also have the added advantage of combining the rehabilitation with training in improved agriculture technology for Water Users' Associations.

In the agricultural sub-sector, of an estimated total need for Ar. 3.4 billion (US$2.1 million), donor commitments are estimated to cover US$1.1 million. An additional US$0.94 million falls under early recovery.

The main priority proposed for GFDRR Track III is the funding of the introduction and field testing of new rice seed germ plasmas adapted to flooding, by the International Rice Research Institute (IRRI). This field testing, calculated to last three years, would be carried out in 4-5 FOFIFA stations. The funding gap is about Ar. 30 million (US$18,200).

In the fisheries and livestock sub-sector, medium to long-term needs are expected to be covered by a supplement to PSDR. Remaining needs in the fisheries sub-sector – a program of asset replacement in St. Marie, and a program to compensate the losses of aquaculture breeders – fall under early recovery needs and are therefore not proposed under the GFDRR Call for Funds.

The overall Call for Funds under the Agriculture, Livestock and Fisheries sector amounts to Ar. 3.5 billion (US$2.2 million), primarily in the irrigation sub-sector (See Agriculture-Irrigation Annex).

Commerce and Industry Sector

The total reconstruction and recovery needs for the Commerce and Industry sector are estimated to be Ar. 0.95 billion (US$0.6 million). This includes training modules for entrepreneurs, business centers and chambers of commerce in disaster risk management in the five regions most at risk (Analanjirofo, Alaotra Mangoro, Sofia, Vatovavy Fitovinany, and Haute Matsiatra). They also include the establishment of business centers in these regions to promote small and medium enterprises, the growth of the private sector, and local wealth creation as a means of ultimately strengthening the self-reliance and resilience of local households (See Industry and Commerce Annex).

The Ministry of Economy, Commerce and Industry is responsible for the sector. Several donors – notably the Millennium Challenge Account, the International Finance Corporation, the World Bank, the World Conservation Society and most recently IFAD – support the development of SMEs. The Millennium Challenge Account, in particular, has helped to establish business centers in several regions.

The role of the Ministry is primarily that of policy development and facilitation. It lacks a budgetary allocation earmarked for the development of new business centers, or for risk management training.

Funds to develop future business centers could be obtained from in-country partners. Therefore it is proposed that the GFDRR Call for Funds focus on organizing Training in Disaster Risk Management for industry and commercial representatives in the five regions most at risk. The costs are estimated to be Ar. 450 million or US$273,000.

The training would be provided by organizing Disaster Risk Management modules upon request through Chambers of Commerce and similar professional organizations in each of the five regions. The funds would be managed by CPGU.

Tourism Sector

Recovery needs in the tourism sector (apart from the initial reconstruction efforts undertaken by private operators) primarily concerned the re-promotion of the affected areas and strengthening communication between the National Tourism Office and the populations in the affected areas. These efforts cost an estimated Ar. 286 million (US$173,000) and were covered by Government funds. No further public recovery needs exist in the tourism sector.

Electricity Sector

The total reconstruction and recovery needs in the electricity sector are estimated to be Ar. 6.2 billion (US$3.7 million). This includes (see Electricity Annex):

(a) Ar. 3.5 billion (US$2.1 million) for the replacement and reconstruction of equipment and damaged power plants;

(b) Ar. 495 million (US$0.3 million) for technical assistance and cross-experiences with other Indian Ocean countries to lay an underground network of electrical cables in high risk areas;

(c) Ar. 1.4 billion (US$0.9 million) to transform approximately 110 km of aerial cables (50 km of low tension and 60 km of medium tension) into an underground network in a high risk area, following a feasibility analysis; and,

(d) Ar. 0.7 billion (US$0.4 million) for the replacement of 950 wooden poles with concrete pylons in high risk areas.

(a) is purely a reconstruction activity, whereas (b)-(d) are risk management initiatives.

The electricity sector (distributed by the public company JIRAMA) is supported by donors such as the World Bank (through the Power/Water Sector Recovery and Restructuring Project), the Asian Development Bank, and Korean investment.

JIRAMA has committed to taking on the reconstruction costs of its damaged power plants and equipment replacement, for a total of Ar. 3.5 billion (US$2.1 million). Owing to the pilot nature of the proposed disaster risk management initiative no donor commitment is as yet available.

It is therefore proposed that the Call for Funds under GFDRR cover the pilot disaster risk management activities proposed under (b)-(d), for a total estimated cost of Ar. 2.7 billion (US$1.6 million). The details are outlined in the Electricity Annex.

The pilot activities would be managed by JIRAMA, either as a supplement to the existing World Bank project, or in parallel with the Track III project, with JIRAMA as the implementing agency for the component.

Water and Sanitation Sector

The total reconstruction and recovery needs for the Water and Sanitation sector are estimated to be Ar. 15.1 billion (US$9.1 million) in the four regions most affected – Atsinanana, Alaotra Mangoro, Menabe, and Alananjirofo. This includes the rehabilitation of 767 wells; rehabilitation of 166 gravity water systems; installation of 140 solid waste collectors; repair of 23 km of rain and wastewater drains; and rehabilitation of 6 public latrines (see Water and Sanitation Annex).

The Ministry of Energy and Mining is responsible for Water and Sanitation under the Water and Sanitation Program (WATSAN). This program receives general budget support from donors such as the World Bank. Other donors and NGOs (such as CARE and UNICEF) are active in the water and sanitation sector, particularly during the humanitarian phase. FID has extensive post-cyclone reconstruction experience in the sector, managing small, high intensity labor reconstruction works.

The Government has made a commitment of Ar. 2.3 million (US$1.4 million) to fund water and sanitation reconstruction needs. An additional Ar. 5.9 billion (US$3.6 million) is expected to be included in a separate UN early recovery appeal.

It is proposed that the Call for Funds under GFDRR include an allocation of Ar. 6.9 million (US$4.2 million) to cover funding the reconstruction of 460 wells, 100 gravity water systems, and the rehabilitation of about 15 km of rain and wastewater drains.

The reconstruction works would be managed by FID, under its established high intensity labor post-cyclone procedures, which are acceptable to the Bank.

Transportation Sector

The total reconstruction and recovery needs for the Transportation and Public Works sector are estimated to be Ar. 110.9 billion (US$67.2 million, see Transportation Annex). This includes the reconstruction of major bridges and rehabilitation of roads damaged by the cyclones (Ar. 108.4 billion, or US$65.7 million); rehabilitation of rail transport over both the southern and northern railway lines (Ar. 2.0 billion, US$1.2 million); dredging a transportation canal (Ar. 3.3 million, US$2,000); rehabilitation of two small airports (in Analanjirofo and Atsinanana) at a cost of Ar. 0.4 billion (US$0.2 million); and rehabilitation of maritime transport installations in Atsinanana (Ar. 83 million or US$51,000).

The Ministry of Public Works is responsible for the design and rehabilitation of all roads and bridges. The Ministry of Transportation is responsible for all rail, river, air and maritime transportation. The Madagascar Road Authority (ARM) oversees most road and bridge construction works and supervises current construction of roads and bridges.

The Transportation Program is supported by the European Commission, the World Bank, the African Development Bank and the Arab Bank for Economic Development in Africa (BADEA). The donors follow an agreed work schedule with the Ministries concerned which no longer depend on Project Implementation Units (through recent institutional reforms they have built their own institutional capacity for project execution).

The Ministry of Public Works has committed Ar. 17.4 billion (US$10.5 million) to the rehabilitation of the transportation infrastructure damaged by the cyclones. The Ministry of Transportation has made a commitment of Ar. 70.3 million (US$42,600) to the repair of rail transport. Donor commitments are estimated to be Ar. 47.0 billion (US$28.4 million), mainly

from the European Commission. About US$350,000 is expected to be included in a UN early recovery Flash Appeal. This leaves an unfunded gap of Ar. 19.6 billion (US$11.9 million).

It is proposed that the GFDRR Call for Funds provide an allocation of US$15.9 million (Ar. 26.2 billion) for rehabilitation of the highest strategic transport priorities for which there is insufficient funding, namely (Transportation Annex):

- The National Road 6 (Sofia): Ar. 7.1 billion (US$4.3 million) to fund the costs of reconstruction of three bridges at PK101, PK31 and the Mahajambo bridge (136 meters). The latter will have to be rebuilt to meet upgraded construction standards, and the design should be for a higher and longer bridge.. The normal reconstruction costs of these three bridges will be funded by the European Commission. The GFDRR allocation would fund the cost of rebuilding them to cyclone-resistant norms. It would also fund the cost of repairing a 70m breach at PK 126 and protective rock filling for a 260m section;

- In St. Marie: Ar. 1.3 billion (US$0.8 million) to fund the repair of the coastal seawall (RNT 23) which was extensively damaged by Cyclone Ivan;

- In Analanjirofo: Ar. 1.0 billion (US$0.6 million) to fund costs of repairs to RN 5 (linking Vahibe to Mananara Nord);

- In Alaotra Mangoro: Ar. 0.5 billion (US$0.3 million) to fund the costs to rehabilitate RN 3A, a highly strategic road that links the main cities with the rice belt of Madagascar;

- In Boeny: Ar. 0.35 billion (US$0.2 million) to fund repairs on RN33B, linking Andranofasika to Ambato;

- In Menabe: Ar. 0.35 billion (US$0.24 million) to fund repairs to the essential access road that links Morondava with Mahabo (PK 116; PK399+500);

- In Menabe: Ar. 5.0 billion (US$3.0 million) to fund repairs to the infrastructure of the village on the banks of the Mahabo, which was destroyed by the cyclone;

- In Analanjirofo: Ar. 9.9 billion (US$6.0 million) to fund communal roads and the fight against erosion on RN 22, damaged by the cyclone;

- In Analanjirofo and Atsinanana: Ar. 0.4 billion (US$0.2 million) to fund the rehabilitation of two small airports;

- In Atsinanana: Ar. 0.08 billion (US$50,000) to fund the rehabilitation of port facilities.

If detailed examination revealed that damage was other than as indicated by the assessment, a reallocation within priority transport sites could be requested of GFDRR.

It is proposed that the funds be managed by the Ministry of Public Works under the same procedures as those of the Second Transport Project (APL II) which are acceptable to the Bank. It would be essential to ensure that the works on the bridges on RN. 6 be carried out at the

same time as those funded by the European Commission. Emergency procurement procedures would be requested to ensure that the works be procured and completed on time, prior to the next cyclone season, while maintaining the necessary quality control and financial supervision.

Telecommunications Sector

The total reconstruction and recovery needs for the Telecommunications Sector are estimated to be Ar. 17 million (US$10,300). This includes rehabilitation of the Post Offices in St. Marie and Besalampy.

The sector is overseen by the Ministry of Telecommunications, Post Office, and Communications. The Ministry has committed Ar. 5 million (US$ 3,000) to rehabilitate the buildings. Although this still leaves a funding gap, no request is included in the GFDRR Call for Funds for this sector since it concerns administrative buildings for which local materials and/or funds would be found,.

Environment Sector

The total reconstruction and recovery needs of the Environment Sector are estimated to be Ar.1.2 billion (US$0.7 million, see Environment Annex). This includes reinforced surveillance over an area of 3 million ha; systematic inventory of 259 ha of damaged forest area (targeting competitive adjudication); restoration of this damaged area by planting indigenous forest species; restoration of indigenous habitat (zetra) and reintroduction of a species of lemur in the Lac Alaotra region (Alaotra Mangoro region).

The sector is managed by the Ministry of Environment, Water, Forestry and Tourism, in partnership with about 16 financial and technical partners (including UNDP, GTZ, KfW, USAID, Conservation International, WCS, France, WWF, World Bank, GEF, Durrell, the Zurich Zoo, amongst others). The National Association for the Management of Protected Areas (ANGAP) manages a large proportion of core protected areas. Environmental Impact Assessment and environmental oversight falls under the responsibility of the National Environmental Organization (ONE). The Foundation for Biodiversity and Protected Areas was established recently to help fund the System of Protected Areas of Madagascar, which expects to reach 6 million ha (10% of the national territory) by 2012. So far, it is expected that a little more than 6 million ha of protected areas will be established under temporary status by 2008. The Environmental Program is now in its third phase, and is expected to become a Sector-Wide Approach (SWAP) in a few years.

Of the total identified needs, donor commitment (primarily from IDA/GEF) is estimated to be Ar. 0.2 billion (US$0.1 million), leaving an unfunded gap of US$0.7 million.

While surveillance needs over a 3 million ha area are important, experience has shown that it is almost impossible to thoroughly monitor given the limited number of forestry staff. Rather, it

may be preferable to concentrate surveillance efforts on critical roads and points of exit (such as ports and customs), and accelerate the process of adjudication and certification of legal wood.

It is proposed that the GFDRR Call for Funds focus on restoration of 212 ha of forest area to be planted with indigenous species, at an estimated cost of Ar. 280 million (US$170,000). The funds would be contracted out by the project implementation unit of the Ministry of Environment to qualified NGOs or local partners, under the normal procedures of the Third Environmental Program (which are acceptable to the Bank).

Disaster Risk Management Sector

The total reconstruction and recovery needs for the Disaster Risk Management Sector are estimated to be Ar. 10.0 billion (US$6.1 million). This includes five key activities (see Risk Management Annex):

(a) Development of national norms for transportation and agriculture infrastructures (US$0.3 million);
(b) Development of national norms for habitat and construction infrastructures (US$69,700);
(c) Awareness and training in disaster risk management at the Fokontany level in high risk areas (US$3.0 million);
(d) Distribution of early warning equipment to Fokontany in high risk areas (US$3.1 million); and,
(e) Coordination of early recovery activities at national, regional and local levels (US$0.3 million).

These activities – particularly (a) and (b), will be closely linked to on-going Track II Technical Assistance for Madagascar.

BNGRC (under the Ministry of Interior) and CPGU (under the Prime Minister's Office) are the main agencies responsible for disaster risk management in Madagascar.

CPGU is responsible for policy and technical coordination of disaster risk management, on behalf of the Inter-Ministerial National Council for the Management of Risks and Disasters which was established in 2005 and is chaired personally by the Prime Minister. This office manages the Track II Technical Assistance fund (US$1.14 million) which was launched in mid-April 2008 to cover four major activities:

(a) Risk assessment strengthening;
(b) Development of anti-cyclone norms;
(c) Risk transfer (adoption of a contingency fund); and,
(d) Development of a rapid information system and training of trainers in emergency management.

BNGRC is responsible for emergency response and preparedness, and in 2007 organized effective training in early warning and community emergency preparedness at the district level. It is this training that local authorities have requested be extended to the Fokontany level to ensure maximum outreach to remote villages. Many such villages (e.g., in Menabe, Melaky Analanjirofo and Boeny) are beyond normal radio broadcasting, and therefore fail to receive BNGRC's early cyclone warnings. This contributes to high levels of annual damages and continued loss of lives from cyclones, particularly amongst coastal villages. The distribution of simple standard warning materials to those Fokontany at risk – megaphones, sirens, and wind-up radios – could therefore help save lives and prevent significant damage to assets.

The Government is highly committed to disaster risk management and has allocated a substantial counterpart budget to the priority needs identified by the assessment: in addition to an estimated Ar. 1.1 billion (US$0.64 million) allocated to BNGRC and CPGU for these needs (in addition to their regular budget for other activities), the Ministry of Finance has earmarked a new Contingency Fund of Ar. 1.0 billion (US$0.6 million) for disaster management in 2008. The UN Flash Appeal is expected to cover the early recovery needs (US$300,000).

Track II funds will cover a large part of the development of the cyclone-resistant norms (as originally planned). There are, however, two critical gaps:

- First, national capacity in flooding and silting modeling remains extremely limited. Without accurate on-site modeling or river flows, it will not be possible to design better bridge and irrigation structures and/or retrofit them to cyclone-resistant norms. While international standards can be adapted to meet preliminary norms, it is necessary to develop in-country capacity to model silting loads and flooding rates in order to design and/or retrofit critical infrastructures. It is therefore recommended that a minimum of three national experts (from the Ministry of Public Works and Meteorology and the Ministry of Agriculture, Livestock and Fisheries) receive specialized training at UNESCO-IHE (10 months), followed by specialized 1 month training in risk management at Delft University of Technology, or other similar international institution. The estimated costs would amount to Ar. 0.4 million (US$0.23 million);

- Second, an estimated Ar. 0.1 million (US$24,000) is required to complement Track II funding in support of training builders and NGOs for the development of habitat and building norms.

The remaining two major gaps involve:

- Distribution of megaphones, sirens, and wind-up radios in 6,501 high risk Fokontany (US$3.1 million);

- Extension of the district-level training in disaster risk management to 75 percent of the high risk Fokontany (US$1.9 million).

It is proposed that the Call for Funds for GFDRR include these four major priorities, at an estimated total cost of US$5.3 million (Ar. 8.7 million) – see Disaster Risk Management Annex.

Training in disaster risk management and distribution of early warning materials would be carried out by BNGRC and its partner NGOs that have a strong presence on the ground (such as the Red Cross).

Development of norms and training concerning them would be managed by CPGU, along with Track II activities.

Livelihoods Sector

The total reconstruction and recovery needs for Livelihoods are estimated to be Ar. 7.2 billion (US$4.3 million). This does not include an estimated US$13.5 million for high intensity labor works which have already been accounted for under the various infrastructure and social sectors (see Livelihoods Annex).

Since two-thirds of the damages and losses were incurred by the private sector, livelihood needs target the revitalization of local markets, seek to match supply and demand for labor, and increase livelihood resilience. This would reduce the vulnerability of households to future disasters. Livelihood needs include five distinct activities (see Livelihood Annex):

- Revitalization (and construction) of small markets in high risk districts – a total of 30 markets are proposed in 9 regions, at a cost of Ar. 2.5 billion (US$1.5 million);

- Establishment of employment information units in high risk regions, to facilitate job searching by affected people after cyclones (1 center in each of the 16 high risk regions, at a cost of Ar. 1.3 billion, or US$0.8 million;

- Vocational training for local youth in 12 high risk regions, at a cost of Ar. 600 million (US$363,000);

- Training for rural professional organizations associated with market creation, in 9 high risk regions, at a cost of Ar. 0.25 billion (US$0.15 million);

- Strengthening the capacities of decentralized public services in the regions at high risk (for a period of 3 years) at an estimated cost of Ar. 2.5 billion (US$1.5 million).

Given that there is no Livelihoods Program in Madagascar, it has not been possible to confirm a Government or donor commitment for this cross-sectoral need.

The mandate for implementation of livelihood-type activities falls under the Ministry of the Interior and Decentralization and through it, projects such as FID, which has experience with the construction of markets and training of rural organizations (PSDR also has extensive experience with training of farmers' associations).

It is expected that many of the markets and Livelihood high intensity labor needs identified by the assessment can be funded through the FID supplement which will be processed in the second-half of 2008.

It is proposed that the GFDRR Call for Funds focus on the construction of 10 market places, vocational training for local youths and training for rural professional associations, at a total estimated cost of US$1.0 million (Ar. 1.7 billion). The program would be implemented through FID.

Overall Implementation and Coordination

To ensure coordination with the disaster risk management activities supported under Track II, under the Prime Minister's Office CPGU would ensure overall coordination of Track III activities. Project management assistance would be provided in the form of extra staff to the PIU.

CPGU would use FID (which also comes under the Prime Minister's Office and has the most experience) to manage the rehabilitation of schools, basic healthcare centers, nutrition centers, market places, socio-cultural centers, water and sanitation infrastructures, communal roads, and livelihood activities, under the supervision of the respective sectoral ministries.

CPGU would use PSDR to manage the rehabilitation of small irrigation schemes. Larger irrigation schemes would be managed by the Watershed and Irrigation Project under procedures acceptable to the Bank.

Large transportation infrastructures would be executed by the Ministry of Public Works, which would entrust it to the Road Authority of Madagascar. This could be carried out either through a supplement to the existing Second Transport Project (APL 2) or, should this prove too difficult, through a sub-contract signed between CPGU and ARM overseen by the Ministry of Public Works.

BNGRC and the Red Cross would take responsibility for implementation of the early warning materials and the organization of training.

CPGU would contract out training in habitat and construction norms, overseas training in flood modeling, and training for small and medium scale enterprises to specialized individuals, agencies or NGOs. The environmental restoration component would be contracted out to specialized NGOs, in collaboration with the Environmental Program.

Sectoral Needs Annexes

EDUCATION

For questions contact: andriamialina@yahoo.fr, jrandimbiarison@unicef.org, dissoa@gmail.com et sbettencourt@worldbank.org

Rehabilitation of Schools to an Anti-Cyclone Standard (Education Sector) - Program Education for All

Priorité	Damage	Number	Region	Type	Type of Damage	Average Unit Cost (Million Ar)	Total Needs (Million Ar)	Total Needs ($'000)	Government Commitment (Millions Ar)	Commitments of Donors and Budgetary Support (Millions Ar)	Commitments of Donors and Budgetary Support ($'000)	Net Needs (Millions Ar)	Net Needs ($'000)
1	Totally Destroyed Schools (reconstructed to anti-cyclone standard)	168	Analanjirofo	EPPs	151 (Publ); 5 (Priv)								
				CEGs	10 (Publ); 2 (Priv)								
		114	Antsinanana	EPPs	99 (Publ); 7 (Priv)								
				CEGs	4 (Publ); 1 (Priv)								
				Lycee	3 (Publ)								
		31	Alaotra M.	EPPs	30 (Publ); 1 (Priv)								
		23	Sofia	EPPs	23 (Publ)								
		10	Menabe	EPPs	9 (Publ); 1 (Priv)								
		7	Haute M.	EPPs	7 (Publ)								
		3	Vatovay F.	EPPs	3 (Publ)								
		11	Melaky	EPPs	9 (Publ);								
				CEGs	2 (Publ)								
		3	Bongolava	EPPs	3 (Publ)								
		41	Analamanga	EPPs	41 (Publ)								
		411				**52.2**	21,468.9	13,011.4	2,200.0	13,200.0	8,000.0	6,068.9	3,678.1
2	Partially destroyed schools	196	Analanjirofo	EPPs	176 (Publ); 4 (Priv)								
				CEG	14 (Publ); 1 (Priv)								
				Lycee	1 (Publ)								
		25	Atsinanana	EPPs	19 (Publ); 5 (Priv)								
				CEG	1 (Prive)								
		3	Sofia	EPPs	3 (Publ)								
		3	Haute M.	EPPs	2(Prive)								
				CEG	1 (Publ)								
		2	Melaky	EPPs	1 (Publ)								
				CEG	1 (Publ)								
		1	Analamanga	EPPs	1 (Publ)								
		2	Diana	EPPs	2 (Publ)								
		4	Boeny	EPPs	4 (Publ)								
		2	Betsiboka	EPPs	2 (Publ)								
		8	Amoron'I	EPPs	8 (Publ)								
		246				15.7	3,855.0	2,336.4	0.00	0.0	0.0	3,855.0	2,336.4
1 et 2	Water and sanitation	**657**	All rehabilitated schools			3.0	1,478.3	895.9	0.0			1,478.3	895.9
	Total						**26,802.1**	**16,243.7**	**2,200.0**	**13,200.0**	**8,000.0**	**11,402.1**	**6,910.4**

EPP = Primary School
CEG = Secondary School
Lycee = High School

		US$ 000		
Total Needs		16,243.7	100%	
Contributions	Government	1,333.3	8%	
	National Programs	8,000.0	49%	1.5 Million ADB; 6.5 Million from Catalytic Fund
	Gap	6,910.4	43%	
	Minus Early Recovery	1,609.0		Early recovery aimed primarily at rehabilitation of partially destroyed schools
	Total Gap	5,301.4		
	Minus Gap on Partially destroyed Schools	727.0		Note: Partially destroyed schools not presented as priority for call for funds, as might be repaired through locally available funds
	Unit Cost of Totally Destroyed Schools with Sanitation	55.3 million Ar		
	No. schools covered by Government and Donors	279		
	Remaining Schools Gap	132		
	Cost of Remaining Totally Destroyed Schools	4,418.9		
	Total Call for Funds GFDRR	**$ 4,418.9**		**Covering rehabilitation of 132 totally damaged schools**

Summary of Needs for Madagascar Cyclones 2008

HEALTH

For information contact sulcadultmt@yahoo.fr, dissoa@gmail.com et sbettencourt@worldbank.org

Rehabilitation of Health Centers to Cyclone Standards (Health Sector) Ministry of Health - Programme PDSS

Priority	Type	Nombre	Region	Unit Cost (Million Ar)	Total Needs (Million Ar)	Total Needs ($'000)	Government Commitment (Millions Ar)	Government Commitment ($'000)	Donor Potential Commitments (Millions Ar)	Donor Potential Commitments ($'000)	Net Needs (Millions Ar)	Net Needs ($'000)
1	Rehabilitation of Basic Health Centers	38	Analanjirofo				144	87.3				
		35	Atsinanana					0.0				
		49	Haute Matsiara				144	87.3				
		7	Bongolava					0.0				
		8	Vatovavy Fitovinany				144	87.3				
		7	Alaotra Mangoro				144	87.3				
		5	Atsimo Atsinanana				144	87.3				
		5	Sofia				144	87.3				
		2	Menabe				288	174.5				
		2	Diana				288	174.5				
		3	Boeny				144	87.3				
		6	Melaky				288	174.5				
		167		144	24,048.0	14,574.5	1872	1,134.5	0.0	0.0	22,176.0	13,440.0
2	Rehabilitation of Hospitals	2	Analanjirofo									
		1	Atsinanana									
		1	Melaky				576	349.1				
		1	Haute Matsiara									
		1	Vatovavy Fitovinany									
		6		576	3,456.0	2,094.5	576	349.1	0	0	2,880.0	1,745.5
2	Re-Equipment of Hospitals	2	Analanjirofo									
		1	Atsinanana									
		1	Melaky				500	303.0				
		1	Haute Matsiara									
		1	Vatovavy Fitovinany									
		6		500	3,000.0	1,818.2	500	303.0	0	0	2,500.0	1,515.2
2	Incremental public health costs from increase in diseases (accute respiratory infections, malaria, diarrhea), and preventive public health (vaccination of children less than 5 years old, insecticide spray, chlorinization of wells, awareness on hygene and sanitation, distribution of impregnated mosquito nets)		Analanjirofo Alaotra Mangoro Menabe Atsinanana Melaky Diana Amoron'Imania Sud Est Haute Matsiatra Betsiboka Sofia Bongolava Analamanga Boeny Vatovavy Fitovinany Sud Ouest Ihorombe		981.2	594.7					981.2	594.7
	Total				**31,485.2**	**19,081.9**	**4,024.0**	**2,438.8**	**0.0**	**0.0**	**28,537.2**	**17,295.3**

		US$ '000		
Total Needs		19,081.9		
Minus Hospitals and Equipment		3,912.7	Second Order Priority	
Minus Public Health Needs		594.7	GFDRR funds may come too late for these public health needs (part of early recovery)	
Total Needs Basic Health Centers		14,574.5		
			# Health Centers	
Total Needs Basic Health Centers		14,574.5	167	
Contributions	Government	1,134.5	13	
	Donors	0.0	0	
	Early Recovery	6,053.8	69	
	Gap	3,928.5	45	This covers 75% of all destroyed basic health centers

Total Call for Funds		
GFDRR	**3,928.5**	**Covering rehabilitation of 45 Basic Health Centers to cyclone-proof norms**

Remaining Gap 6,660.9

Summary of Needs for Madagascar Cyclones 2008

For further information, contact onn@blueline.mg, dissoa@gmail.com et sbettencourt@worldbank.org

NUTRITION

Rehabilitation of Nutrition Community Centers to Cyclone Norms (Nutrition Sector)

Priority	Type	Number	Region	Unit Cost	Total Needs		Government Commitment	Donor Commitments		Total Needs	
				Million Ar	(Million Ar)	($'000)	(Millions Ar)	(Millions Ar)	($'000)	(Millions Ar)	($'000)
1	Reconstruction of the Centers	196	Analanjirofo								
		95	Alaotra Mangoro								
		152	Atsinanana								
		4	Menabe								
		11	Vatovavy Fitovinany								
		96	Atsimo Atsinanana								
		0	Boeny								
		4	Sofia								
		4	Melaky								
		562		5	2,810.0	1,703.0	0	0	0	2,810.0	1,703.0
2	Rehabilitation of the Centers	113	Analanjirofo								
		128	Alaotra Mangoro								
		216	Atsinanana								
		42	Menabe								
		67	Vatovavy Fitovinany								
		91	Atsimo Atsinanana								
		5	Boeny								
		14	Sofia								
		17	Melaky								
		693		3.72	2,578.0	1,562.4	0	0	0	2,578.0	1,562.4
1 bis	Reconstitution of the kits for the Centers (at 52% of the equipment)	309	Analanjirofo								
		223	Alaotra Mangoro								
		368	Atsinanana								
		46	Menabe								
		78	Vatovavy Fitovinany								
		187	Atsimo Atsinanana								
		5	Boeny								
		18	Sofia								
		21	Melaky								
		1255		0.16	104.4	63.3	0	0	0	104.4	63.3
	Total				**5,492.4**	**3,328.7**	**0**	**0**	**0**	**5,492.4**	**3,328.7**

Total Needs	3,328.7	
Government Contribution	0	
Donor Contribution	0	
Gap	3,328.7	
Total Call for Funds GFDRR	**3,328.7**	**Reconstruction of 562 centers, rehabilitation of 693 centers and kits for 1255 centers**
Remaining Gap	0	

Summary of Needs for Madagascar Cyclones 2008

HABITAT AND ADMINISTRATIVE BUILDINGS

For further information, please contact rso@fid.mg.dt@fid.mg, nomad@simicro.mg, dissoa@gmail.com et sbettencourt@worldbank.org

1. Habitat and Administrative Buildings

Rehabilitation of Administrative Buildings

Concerned Ministries	Type	Number	Region	Unit Cost (Million Ar)	Total Needs (Million Ar)	Total Needs ($'000)	Potential Commitments (Million Ar)	Potential Commitments Donors (Millions Ar.)	Net Needs (Millions Ar.)	Net Needs ($' 000)
MDAT,	Administrative Buildings	11	Alaotra Mangoro		1,100.0	666.7			1,100.0	666.7
MAEP		58	Analanjirofo		5,800.0	3,515.2			5,800.0	3,515.2
MENRES		42	Atsinanana		4,215.0	2,554.5			4,215.0	2,554.5
MSCL		11	Menabe		1,100.0	666.7			1,100.0	666.7
		31	Melaky		3,100.0	1,878.8			3,100.0	1,878.8
		153		**100**	**15,315.0**	**9,281.8**			15,315.0	9,281.8
MDAT	Administrative Lodgings	4	Alaotra Mangoro		250.0	151.5			250.0	151.5
MAEP		6	Analanjirofo		300.0	181.8			300.0	181.8
MENRES		7	Atsinanana		360.0	218.2			360.0	218.2
MSCL		2	Menabe		100.0	60.6			100.0	60.6
		17	Melaky		850.0	515.2			850.0	515.2
		36		**50**	**1,860.0**	**1,127.3**			1,860.0	1,127.3
MDAT	Market Places	1	Analanjirofo		70.0	42.4			70.0	42.4
		7	Atsinanana		490.0	297.0			490.0	297.0
		4	Menabe		290.0	175.8			290.0	175.8
		1	Melaky		70.0	42.4			70.0	42.4
		12		**70**	**920.0**	**557.6**			920.0	557.6
MDAT	Cultural Houses	2	Alaotra M.		200.0	121.2			200.0	121.2
		3	Analanjirofo		300.0	181.8			300.0	181.8
		1.4	Menabe		140.0	84.8			140.0	84.8
		6.4		**100**	**640.0**	**387.9**			640.0	387.9
MSCL	Socio-Cultural Centers	12	Analanjirofo		240.0	145.5	40.0		200.0	145.5
		105	Atsinanana		2,100.0	1,272.7	100.0		2,000.0	1,272.7
		1	Menabe		20.0	12.1	20.0		0.0	12.1
		118		**20**	**2,360.0**	**1,430.3**			2,360.0	1,430.3
MDN	Military and Police Hangars	2	Alaotra M		200.0	121.2			200.0	121.2
		4	Analanjirofo		400.0	242.4			400.0	242.4
		2.2	Atsinanana		220.0	133.3			220.0	133.3
		8.2		**100**	**820.0**	**497.0**			820.0	497.0
MJ	Prisons	1	Alaotra M.		100.0	60.6			100.0	60.6
		3	Analanjirofo		300.0	181.8	50.0		250.0	181.8
		1	Atsinanana		100.0	60.6			100.0	60.6
		5		**100**	**500.0**	**303.0**			500.0	303.0
	Total				**22,415.0**	**13,584.8**	210.0	0	**22,205.0**	**13,584.8**

Protection of Towns

Ministries Involved	Type	Region	Locality	Mesures	Total Needs (Million Ar)	Total Needs ($'000)	Government Potential Commitment (Million Ar)		Donor Potential Commitment (Millions Ar.)		Net Needs (Millions Ar.)	Net Needs ($' 000)
MDAT	Rupture on the Dyke Protecting the Village	Sofia	Mampikony	Elevate the Village	540.4	327.5					540.4	327.5
	Total				**540.4**	**327.5**	0	0	0	0	540.4	327.5

Total Needs	13,912.3
Government commitment	127.3
Donor commitment	0
Net gap	13,785.1
Total Proposed Gap	986.7
Total Call for Funds GFDRR	**986.7**
Remaining Gap	12,798.4

Rehabilitation of 12 market places, and 35 socio-cultural centers

AGRICULTURE

Total Needs Agriculture Sector

	Million Ar	US $'000
Irrigation	10,407.3	6,307.5
Agriculture	3,434.7	2,081.6
Fisheries	1,716.0	1,040.0
Livestock	320.0	193.9
Total	**15,878.0**	**9,623.0**

	US$'000
Total Needs Agriculture Sector	9,623.0
Total Government Contribution	969.7
Total Donor Contribution	2,882.6
Gap	5,770.7
Minus Early Recovery	942.2
Total Proposed Gap	2,129.9
Total Call for Funds for GDFRR	**2,129.9**
Remaining Gap	2,698.6

Summary of Needs for Madagascar Cyclones 2008

AGRICULTURE - Irrigation

For further information, please contact vrandriana@gmail.com, dissoa@gmail.com et sbettencourt@worldbank.org

1. Rehabilitation of Infrastructure of Irrigation and Drainage (Ministry of Agriculture, Livestock and Fisheries, MAEP)

Priorité	Type	Region	Locality	Benefits	Damage	Total Benefits (Million Ar)	Total Benefits ($'000)	Government Commitment (Million Ar)	Donor Commitments (Million Ar)	Ne (Million Ar
1	Rehabilitation of Large Irrigation Infrastructure which threaten to Innundate Population Centers, and with high Agricultural Potential	Menabe	Mahabo	10,000 ha	Enrochement, remblai d'emprunt	739.1	447.9	300.0		4
	Rupture of the Dyke and Innundation of the Village	Boeny	Ville de Mahajamba	17,000 pop	Elevation du terrain dans la ville ou reparation de la digue	767.9	465.4	300		4
2	Rehabilitation of Large Irrigation Infrastructure with Great Agriculture Potential	Alaotra M.	Anony			1,381.3	837.2	200.0	251.8	9
		Boeny	Morovoay		Reseaux hydroagri.	829.9	503.0	65.0	552.6	2
3	Rehabilitation of Micro-Perimeters Manageable by Water Users Associations	Analanjirofo;		2391 ha	12 barrages; 777 m canaux; 2 digues; 2,500 m drains; 31 siphons; 31 m bâches; rehabilitation de 3 secteurs	822.2	498.3			8
		Atisnanana	Ambalahasina, Sahamatevina, Sahave, Masomeloka, Sahavaro	2750 ha	MPIs	203.2	123.2			2
		Atsimo Atsinanana	Itamia; Befotaka, Ambalafamafa	550 ha		40.7	24.7			
		Amoron'i Mania		1306 ha	9 MPIs	459.9	278.7	200.0	102.0	1
		Vitovavy Fitovinany	Vohilava, Vohitrindry, Sahave	580 ha	MPIs	42.9	26.0			
		Betsiboka	Bekapaika, Madirotelo	1300 ha		96.1	58.2			
4	Rehabilitation of Large Irrigation Works in Isolated Areas or without On-Going Programs	Boeny	Ambalabe			515.4	312.4	65.0		4
			Ambato			225	136.4			2
		Ihorombe		3970 ha	Ouvrages, curage, regabaritage	1,339.3	811.7	100.0		1,2
		Diana	Bas Sambirano	13500 ha		997.8	604.7			9
			Mahavavy	8000 ha		591.3	358.4	220.0		3
		Atsimo Andrefana			Curages, reconstruction mur	840.5	509.4	150.0		6
5	Management and Deviation of River North of Ambatondrazaka	Ambatondrazaka			Deviation de riviere (projet pilote)	514.8	312.0			5
					Total	10,407.3	6,307.5	1,600.0	906.4	7,9

Total Needs	**6,307.5**	
Government Commitment	969.7	
Donors Commitment	**549.3**	
Gap	**4,788.4**	
Total Proposed Gap	**2,111.7**	**Priorities 1-3**
Total Call for Funds for GDFRR	**2,111.7**	**Rehabilitation of Perimeters in High Potential Areas a Water User Associations**
Total Remaining Gap	2,676.7	

AGRICULTURE - Crops

For further information, please contact sulcadultmt@yahoo.fr, dissoa@gmail.com et sbettencourt@worldbank.org

1.1 Distribution of seeds to relance production amongst amongst the most affected groups in 15,000 ha (20% of losses)

Type	Quantity	Unit Cost (Ar)	Total Needs (Million Ar)	Total Needs ($'000)	Government Commitment (Millions Ar)	Potential Commitment Donors (Millions Ar)	Potential Commitment Donors ($'000)	Net Needs (Millions Ar)	Net Needs ($'000)
Semences									
Riz	300 tons	1,400	420.0	254.5				420.0	254.5
Mais	90 tons	1,400	126.0	76.4				126.0	76.4
Pomme de terre	100 tons	1,000	100.0	60.6				100.0	60.6
Haricots	30 tons	1,400	42.0	25.5				42.0	25.5
Cultures potagères	17000 (bags 200 g)	600	10.2	6.2				10.2	6.2
Insecticide	3750 l	20,000	75.0	45.5				75.0	45.5
Sprayer	1500 units	100,000	150.0	90.9				150.0	90.9
Sarcleuses	1875 units	19,000	35.6	21.6				35.6	21.6
Pepiniere	20 villages	1,000,000	20.0	12.1				20.0	12.1
Total			**978.8**	**593.2**	**0.0**	0	0	**978.8**	**593.2**

Geographical Distribution: Proportional to losses

1.2. Multiplication of improved rice seeds (short-cycle) in the five most affected regions (program of risk management)

Type	Quantity	Unit Costs (Ar)	Total Needs (Million Ar)	Total Needs ($'000)	Government Commitment (Millions Ar)	Potential Commitments Donors (Millions Ar)	Potential Commitments Donors ($'000)	Net Needs (Millions Ar)	Net Needs ($'000)
Semences de base	3000 kg								
Semences pour multiplication	160 tonnes								
NPK									
Pesticides									
Assistance Technique									
Formation			575.9	349.0				575.9	349.0
Regions ciblés	Analanjirofo								
	Menabe								
	Antsiranana								
	Vatovavy Fitovinany								
	Sud Est								
Total			**575.9**	**349.0**	**0.0**	**0.0**	**0.0**	**575.9**	**349.0**

Distribution Geographique: Proportionnel aux pertes

1.3 Gradual Introduction of rice seeds adapted to climatic regions (through IRRI) - Collaboration between IRRI, MAEP and FOFIFA (in 4-5 regions where FOFIFA has field stations)

Type	Quantity	Total Needs (Million Ar)	Total Needs ($'000)	Government Commitment (Millions Ar)	Potential Commitments Donors (Millions Ar)	Potential Commitments Donors ($'000)	Net Needs (Millions Ar)	Net Needs ($'000)
Introduction and field-testing of new germoplasms of rice adapted to innundations	100 g	40	24.2		10	6.1	30.0	18.2
Total		**40.0**	**24.2**		**10.0**	**6.1**	**30.0**	**18.2**

1.4 Development of diversified agriculture adapted to climatic conditions by farmers associations in the regions at high risk

Region	Farmers Associations	Unit Cost	Total Needs (Million Ar)	Total Needs ($'000)	Government Commitment (Millions Ar)	Potential Commitments Donors (Millions Ar)	Potential Commitments Donors ($'000)	Net Needs (Millions Ar)	Net Needs ($'000)
Atsinanana	13							0.0	0.0
Menabe	5								
Alaotra Mangoro	34								
Analanjirofo	50								
Diana	22								
Atsima Atsinanana	33								
Boeny	15								
Sofia	45								
Melaky	13								
Total	**230**	**8.0**	**1,840.0**	**1,115.2**		**1840.0**	**1115.2**	**0.0**	**0.0**

Total Needs	2,081.6
Government Commitment	0
Donors Commitment	1,121.2
Gap	960.4
Minus Early Recovery	942.2
Total Proposed Gap	18.2

AGRICULTURE - Fisheries

1.1 Program of Relancement of Traditional Fisheries in St. Marie (Amongst Most Affected Fishers) aiming at 15% of replacement of 15% of lost assets

Type	Quantity	Unit Costs (Ar)	Total Needs (Million Ar)	Total Needs ($'000)	Government Commitments (Millions Ar)	Potential Donors (Millions Ar)	Potential Donors ($'000)	Net Needs (Millions Ar)	Net Needs ($'000)
Pirogues	31	160,000	5.0	3.0				5.0	3.0
Filets de pêche	90	58,270	5.2	3.2				5.2	3.2
Artificial bait	15	14,000	0.2	0.1				0.2	0.1
Lignes de pêche	81	3,935	0.3	0.2				0.3	0.2
Petromax	15	60,000	0.9	0.5				0.9	0.5
Materiels de plongé	13	120,000	1.6	0.9				1.6	0.9
Plombs	8	4,000	0.0	0.0				0.0	0.0
Hooks	72	20,000	1.4	0.9				1.4	0.9
Miscellaneous			1.3	0.8				1.3	0.8
Total			**16.0**	**9.7**	**0.0**	0	0	**16.0**	**9.7**

1.2 Program of Relancing of Carp and Tilapia Breeders Amongst Most Vulnerable Farmers (aiming at replacing 50% of lost breeders)

Region	Estimated Lost Breeders	Unit Cost (Ar)	Total Needs (Million Ar)	Total Needs ($'000)	Government Commitment (Millions Ar)	Potential Donor (Millions Ar)	Potential Donor ($'000)	Net Needs (Millions Ar)	Net Needs ($'000)
Amoron'I Mania	2,400.0	5,000	12.0	7.3				12.0	7.3
Alaotra Mangoro	480.0	5,000	2.4	1.5				2.4	1.5
Sud Est	483.0	5,000	2.4	1.5				2.4	1.5
Boeny	533.0	5,000	2.7	1.6				2.7	1.6
Ihorombe	13.0	5,000	0.1	0.0				0.1	0.0
Betsiboka	80.0	5,000	0.4	0.2				0.4	0.2
								0.0	0.0
Total	3,990.0							0.0	0.0
Total			**20.0**	**12.1**	**0.0**	0	0	**20.0**	**12.1**

1.3 Program of Support to Fishers Associations in High Risk Regions (Gradual Replacement of Wooden Vessels by Fiber-glass Vessels, Principles of Disaster Risk Management; Association Formation; Safety at Sea; Resource Management)

Region	Number of Associations	Unit Costs (Ar)	Total Needs (Million Ar)	Total Needs ($'000)	Government Commitment (Millions Ar)	Potential Donor (Millions Ar)	Potential Donor ($'000)	Net Needs (Millions Ar)	Net Needs ($'000)
Analanjirofo									
Menabe									
Diana									
Sofia									
Boeny									
Melaky									
Atsinanana									
Sud-Est									
Total	210.0	8	1,680.0	**1,018.2**				1,680.0	1,018.2
Total	**210**	**8.0**	**1,680.0**	**1,018.2**	**0.0**	1680	**1,018.2**	**0.0**	**0.0**

Note: Number of Associations per region will depend on demand

Total Needs	1,040.0
Government Contribution	0.0
Donors Contribution	1,018.2
Gap	21.8
Total remaining gap	21.8

AGRICULTURE - Livestock

1. Program of support to livestock associations in regions at high risk (Reconstitution of small ruminants, vaccination, principles of DRM, resistant stables)

Target Regions	Number of Associations	Unit Costs (Million Ar)	Total Needs (Million Ar)	Total Needs ($'000)	Government Commitments (Millions Ar)	Potential Commitments Donors (Millions Ar)	Potential Commitments Donors ($'000)	Net Needs (Millions Ar)	Net Needs ($'000)
Menabe									
Analanjirofo									
Atsinanana									
Alaotra Mangoro									
Haute Matisatra									
Amoron'I mania									
Boeny									
Sofia									
Diana									
Total	40	**8.0**	**320.0**	**193.9**	**0.0**	320	0	**0.0**	**0.0**

Total Needs	193.9
Total Government Contribution	0
Total Donors Contribution	193.9
Gap	0
Total remaining gap	0

Summary of Needs for Madagascar Cyclones 2008

INDUSTRY AND COMMERCE

For further information, please contact tsaramodyalfredo@yahoo.fr, trandrianalijaon@worldbank.org, dissoa@gmail.com et sbettencourt@worldbank.org

Technical Assistance to Small and Medium Enterprises in Areas at High Risk (Commerce and Industry Sectors) - Ministry of Economy and Commerce and Industry

Type		Unit Costs (Millions Ar)	Total Needs (Million Ar)	Total Needs ($'000)	Government Commitments (Millions Ar)	Donor Commitments (Millions Ar)	Donor Commitments ($'000)	Net Needs (Millions Ar)	Net Needs ($'000)
Modules of training, awareness and information for enterpreneurs in disaster risk management	5 per region	10	250.0	151.5				250.0	151.5
Training Modules for Business Centers/Chambers of Commerce in Disaster Risk Management (according to demand)	5 per region	8	200.0	121.2				200.0	121.2
Creation of Business Centers in High Risk Regions (where they do not yet exist)	1 per region	100.0	500.0	303.0				500.0	303.0
	Regions: Analanjirofo								
	Alaotra Mangoro								
	Sofia								
	Vatovavy Fitovinany								
	Haute Matsiatra								
Total			**950.0**	**575.8**				**950.0**	**575.8**

Total Needs	575.8
Government Commitment	0
Donor Commiment	0
Gap	0
Total Proposed Gap	272.7

Total Call for Funds for GDFRR	**272.7**	**Training Courses for SME in DRM in five regions at highest risk**

Remaining Gap	303.0

Summary of Rehabilitation and Recovery Needs for Madagascar Cyclones 2008

ELECTRICITY

For further details, please contact consultant.dg@jirama.mg,dissoa@gmail.com et sbettencourt@worldbank.org

Rehabilitation of JIRAMA (Power Sector)

Priority	Type	Intervention	Region	Unit Cost	Total Needs (Million Ar)	Total Needs ($'000)	Government Commitment (Millions Ar)	Donor Commitment (Millions Ar)	Donor Commitment ($'000)	Net Needs (Millions Ar)	Net Needs ($'000)
1	Rreplacement and Reconstruction of materials and damaged centrals	Rehabilitation	70% of the Damages in DIR Tomasina	N/A	3,502.0	2,122.4	3,502.0	0	0.0	0.0	0.0
2	Pilot project on cyclone-proof norms to transform aerial cables into underground cables	Technical Assistance; Cross Visit to IOC; Site Equipment	Centers at Highest Risk	495.0	495.0	300.0				495.0	300.0
3	Step-wise replacement of aerial network of electricity for low and medium tension into underground network (for centers at high risk)										
		50 of low tension;	Centers at Highest Risk	13835.6	691.8	419.3				691.8	419.3
		60 medium tension		12471	748.3	453.5				748.3	453.5
4	Step-wise replacement of wooden poles by concrete pylons in the areas at highest risk	900 Concrete (400)	Centers at Highest Risk	751.2	676	409.7				676.0	409.7
		30 Concrete (600)		853.9	25.6	15.5				25.6	15.5
		20 Concrete (800)		964.7	19.3	11.7				19.3	11.7
			Total		**6,158.0**	**3,732.1**	**3,502.0**	**0.0**	**0.0**	**2,656.0**	**1,609.7**

	US$'000	
Total Needs	3,732.1	100%
Government Contribution	2,122.4	57%
Gap	1,609.7	43%
Minus early recovery	1,609.7	43%
Total Proposed Gap	1,609.7	43%
Total Call for Funds GFDRR	1,609.7	**Covering piloting of risk management measures on electricity sector**
Remaining Gap	0	

Summary of Needs for Madagascar Cyclones 2008

WATER AND SANITATION

For further information, please contact acippa@unicef.org, prakotoniaina@worldbank.org , dissoa@gmail.com et sbettencourt@worldbank.org

Rehabilitation of Water and Sanitation (Program WATSAN) Ministry of Energy and Mining

Priority	Type	Number	Region	Unit Cost	Total Needs		Government Commitment	Potential Commitment Donors		Besoins Nets	
				(Million Ar)	(Million Ar)	($'000)	(Millions Ar)	(Millions Ar)	($'000)	(Millions Ar)	($'000)
1	Rehabilitation of Simple Wells (No.)	61	Atsinanana								
		82	Alaotra Mangoro								
		591	Menabe								
		33	Analanjirofo								
		767		3.0	2,304.8	1,396.8	345.72			1,959.1	1,187.3
2	Rehabilitation of Gravity Water Systems (No. Systems)	28	Atsinanana								
		93	Alaotra Mangoro								
		29	Menabe								
		16	Analanjirofo								
		166		17.8	2,953.0	1,789.7	442.95			2,510.1	1,521.2
3	Installation of Solid Waste Collectors (No. Collectors)	30	Atsinanana								
		26	Alaotra Mangoro								
		54	Menabe								
		30	Analanjirofo								
		140		18.1	2,535.0	1,536.4	380.25			2,154.8	1,305.9
4	Rain and wastewater drains (Km)	4	Atsinanana								
		3	Alaotra Mangoro								
		12	Menabe								
		4	Analanjirofo								
		23		321.6	7,235	4,384.8	1085.25			6,149.8	3,727.1
5	Rehabilitation of public latrines (No. latrines)	2	Atsinanana								
		1	Alaotra Mangoro								
		2	Menabe								
		1	Analanjirofo								
		6		8.0	48	29.1	7.2			40.8	24.7
			Total		**15,075.8**	**9,136.8**	**2,261.4**			**12,814.4**	**7,766.3**

	US$'000	
Total Needs	9,136.8	100%
Government Commitment	1,370.5	15%
Gap	7,766.3	85%
Early Recovery Needs	3,600.0	
Total Proposed Gap	4,166.3	
Total Call for Funds GFDRR	**4,166.3**	**Rehabilitation of 15 km of affected rain and wastewater drains** **Rehabilitation of 460 wells** **Rehabilitation of 100 gravity water systems**
Remaining Gap	0	

TRANSPORT AND PUBLIC WORKS

tact harisoa.rateloson@gmail.com, tramankirakina@worldbank.org, dissoa@gmail.com et sbettencourt@worldbank.org

istry of Public Works and Meteorology)

Proof Norms

Type of Damage	Total Needs		Government Commitment	Donor Commitment		Net Needs	
	(Millions Ar)	($'000)	(Millions Ar)	(Millions Ar)	(Millions Euros)	(Millions Ar)	($'000)
- Accès emporté par les crues - Renforcement de l'accès	2,619.6	1,587.6					
- Radier submergé - construction d'un nouveau pont	3,307.2	2,004.4		3,000.0	1.2 (UE)		
- Brèche au PK 126, buse démolie, brèche sur 70m - Construction de 3 épis de 50m, enrochement sur 260m	3,764.4	2,281.5		662.5	0.265 (UE)		
- Basculement dans l'eau du pont - construction d'un pont en BA de 30m	1,069.2	648.0					
- Accès de pont emporté par les crues - Enrochement	221.0	133.9					
- Pont de 136m: Une de ses piles a basculé et a entraîné la fissuration du chevêtre en BA - Construction d'un nouveau pont	7,143.6	4,329.4 0.0		6,750.0	2.7 (UE)		4,320.8
Pont fottant PK 35+500 (Tamatave - Fénérive Est) Pont cassé	7,200.0	4,363.6					
Routes dégradées après le cyclone . Coupure aux PK 86,105,113 et 129	2,637.0	1,598.2		1,250.0	0.5(UE)		800
Mananara Avaratra PK 283+150 à Maroantsetra PK 406+000 Plusieurs ponts en bois endommagés (coupés)	19,440.0	11,781.8					
Vahibe PK 239+500 à Mananara Nord PK 283+150 tronçon très dégradé	15,321.2	9,285.6		21,500.0	8.6 (UE)		600
- éboulement, affouillement de talus, glissement de chaussée - Reconstruction de la chaussée - protection en gabion ou en maçonnerie	1,653.6	1,002.2		1,600.0	0.64 (UE)		9.105
Lokintsy PK 26+500 à Ambodiatafa PK 54+000 : routes dégradées	Reconstruit dans le cadre du financement arabe						
Erosion du talus, route atteinte et emprunt de l'aérodrome pour les voitures	50.0	30.3					
- Ensablement, route coupée, remblai d'accès de pont, buses métalliques détruites, brèche - remblai de la chaussée protégée par enrochement et géotextile, revêtir l'accotement par une enduit superficielle	2,383.9	1,444.8		2,162.5	0.865 (UE)		300
- Accès de 3 Ponts - construction de 3 radiers (80m, 30m, 100m)	357.1	216.5					216.5
Digue rompue pendant le cyclone au PK 435	400.0	242.4					242.4
Innondation de la ville durant 2 j/ Chaussée affaissée, rues ensablées et apparition des bourbiers sur les rues Affouillement au niveau de la culée d'un pont de 31m à l'accès vers l'hopital	11,209.3	6,793.5					
Innondation de la ville / Dégradation rapide des infrastructures routières de la ville	7,742.6	4,692.5					
Coupure de la route à Ambalakida PK 265 : accès au pont bailey affaissé et pont ruiné	1,555.2	942.5			BAD		
Beroboka PK 52 à Sakay PK70 : tous les remblais d'accès aux Ouvrages sont affaissés	132.0	80.0					80.0
Berge de Mahabo	4,955.0	3,003.0					3,003.0
Routes dégradées après le cyclone	12,635.4	7,657.8					6,000.0
Talus au PK 48+500 et PK 51+500 Talus érodé par les crues	34.1	20.6					20.6
- pont détruit, éboulement, bourbier, arbres abbatus sur la chaussée, brèche - construction de dalots, enlèvement éboulement, réparation ravienement de chaussée, construction de radier, construction de ponts	2,425.0	1,469.7		2,500.0	1 (UE)		
Ankerana PK 0 - Digue Belle Vue PK 9+700 - digue Ilôt Madame PK 10+161	Digues deja retablies						
Digues ilôt Madame PK 10+161 à Lokintsy PK 26+500	Reconstruit par UE						
Talus au PK 17+500	180.0	109.1					
Financement interne:TVA+RPI		**(inscrit, 2008)**	**1,040**				
Financement interne:TVA+RPI (demandé pour 2009)			**8,800**				
		Contribution FER (2008-2009)	**7,519**				
TOTAL	**108,436.5**	**65,719.1**	**17,359**	**39,425.0**	**15.8**	**51,652.5**	**31,304.5**

USD$'000

Total Needs	65,719.1
Contribution Government	10,521
Contribution Donors	24,443.5
Net Gap	30,755.0
Minus Early Recovery	350
Net Needs w/ Major Priorities	15,583.4

2367

TRANSPORT AND PUBLIC WORKS

2. Rehabilitation of Rail Transport (Ministry of Transport)

Priorites	Axes	Region	Type of Damage	Total Needs (Millions Ar)	Total Needs ($'000)	Government Commitment (Millions Ar)	Donor Commitments (Millions Ar)	Donor Commitments (Millions Euros)	Net Needs (Millions Ar)	Net Needs ($'000)
	Sud	Haute Matsiatra et Vatovavy Fitovinany	Eboulement rocheux Arbres abbatus Affaisement Toiture bâtiment	31.4	19.0	38.7			(7.30)	-4.4
	Nord	Atsinanana, Alaotra Mangoro, Vakinakaratra	Eboulement rocheux Arbres abbatus Affaisement	1,955.9	1,185.4	31.6		3.0	1,924.30	1,166.2
			TOTAL	1,987.3	1,204.4	70.3	7576	3.0	1,917.0	1,161.8

3. Rehabilitation of River Works (Ministry of Transport)

Priorites	Axes	Region	Type of Damage	Total Needs (Millions Ar)	Total Needs ($'000)	Government Commitment (Millions Ar)	Donor Commitments (Millions Ar)	Donor Commitments (Millions Euros)	Net Needs (Millions Ar)	Net Needs ($'000)
		ATSINANANA	Sedimented canal (covered with water jacinth)	3.3	2.0	0		0	3.30	2.0
			TOTAL	3.3	2.0	-		0	3.3	2.0

4. Rehabilitation of Aerial Traffic Works (Ministry of Transport)

Priorites	Axes	Region	Type of Damage	Total Needs (Millions Ar)	Total Needs ($'000)	Government Commitment (Millions Ar)	Donor Commitments (Millions Ar)	Donor Commitments (Millions Euros)	Net Needs (Millions Ar)	Net Needs ($'000)
		ANALANJIROFO	Aérogare, tour, hangar SLI	75.0	45.5	0		0	75.0	45.5
			Installation électriques, groupes, divers équipements	180.0	109.1	0		0	180.0	109.1
			Affouillement des berges	50.0	30.3	0		0	50.0	30.3
		ATSINANANA	aérogare	20.0	12.1	0		0	20.0	12.1
			clôture	50.0	30.3	0		0	50.0	30.3
			autres	15.0	9.1	0		0	15.0	9.1
			TOTAL	390.0	236.4	0		0	390.0	236.4

5. Rehabilitation des of Maritime Traffic (Ministry of Transport)

Priorites	Axes	Region	Type of Damage	Total Needs (Millions Ar)	Total Needs ($'000)	Government Commitment (Millions Ar)	Donor Commitments (Millions Ar)	Donor Commitments (Millions Euros)	Net Needs (Millions Ar)	Net Needs ($'000)
			Quai	53.7	32.5				53.7	32.5
		ATSINANANA	Bâtiment	30	18.2				30.0	18.2
			TOTAL	83.7	50.7				83.7	50.7

	US$'000
Sub-Total Call for Funds Roads and Public Works	15,583.4
Aerial Traffic	236.4
Maritime Traffic	50.7

		US$'000
Total Needs All Transport	#	67,212.6
Government Contribution	#	10,563.2
Donor Contribution	#	28,485.5
Early Recovery	#	350.0
Gap		27,813.9

Total Call for Funds GFDRR	15,870.5

Incremental costs of 4 bridges to norms

	US$'000
Remaining Gap	11,943.4

Communal roads in Analanjirofo; Incremental costs of RNT23, RN5, RN22, RN3A, RN33B, Morondava-Mahabo, Berge Mahabo, Belo-Ankihizabo

Rehabilitation of aeroguardes in Analanajirofo and Atsinanana

Summary of Needs for Madagascar Cyclones 2008

For further infrormation, please contact meef_min@moov.mg, brajaonson@worldbank.org, dissoa@gmail.com et sbettencourt@worldbank.org

ENVIRONMENT

Environment Sector (Ministry of Environment, Water, Forest and Tourism)

Priority	Name	Region	ha	Unit Cost (Million Ar)	Total Needs (Million Ar)	Total Needs ($'000)	Government Commitment (Millions Ar)	Donor Commitments (Millions Ar)	Donor Commitments ($'000)	Net Commitments (Millions Ar)	Net Commitments ($'000)
2	Reinforced Surveillance of Affected Areas	Analanjirofo						5	3		
		Menabe						9	5		
		Alaotra Mangoro						9	5		
		Atsinanana									
		Melaky									
		Total	2,992,170.0	273.8/ha	819.2	496.5		23	13	796.0	482.4
		Analanjirofo	158.8								
		Menabe	19.7								
		Alaotra Mangoro	24.6								
		Atsinanana	39.0								
		Melaky	16.8								
1	Systematic Inventory Towards Adjudication of Affected Areas	Total	258.9	0.090	23.3	14.1		23.3	14.1	0.0	0.0
4	Restoration of Affected Areas	Analanjirofo									
		Menabe									
		Alaotra Mangoro						68	41.2 *		
		Atsinanana									
		Melaky									
			258.0	800.0	340.2	206.2		68	41	272.2	165.0
3	Restoration of Zetra and Reintroduction of Bando (Indigenous Species of Lemur)	Alaotra Mangoro			15.2	9.2		0	4.2	15.2	5.0
		Total			**1,197.9**	**726.0**	0.0	205.7	126.7	1,083.4	652.4

* Allocation for Alaotra is US$1,350 for FY08.

	US$' 000	
Total Needs	726.0	
Government Contribution	0.0	
Donor Contribution	126.7	
Gap	599.3	
Total Proposed Gap	170.0	Restoration of 212 ha
Total Call for Funds GFDRR	**170**	**Restoration of 212 ha of forest with indigenous species**
Remaining Gap	429.3	

Summary of Needs for Madagascar Cyclones 2008

For further questions, please contact razakanaivom@yahoo.fr, rakotoson@un.org, dissoa@gmail.com et sbettencourt@worldbank.org

DISASTER RISK MANAGEMENT

Disaster Risk Management (through BNGRC and CPGU)

1. Development de National Cyclone Proof Norms for Transport Infrastructure and Irrigation Infrastructure

Type	Total Needs (Million Ar)	Total Needs ($'000)	Government Commitment (Millions Ar)	Donor Commitment (Millions Ar)	Donor Commitment ($'000)	Net Needs (Millions Ar)	Net Needs ($'000)
Development of preliminary cyclone norms 1 expert international @ 1 mois	41.3	25.0		41.3	25.0	0.0	0.0
Professional Training in Hydro-Morphology and Erosion/Sedimentation at UNESCO/IHE 3 Young Professionals (10 months)	383.6	232.5				383.6	232.5
Training in Risk Management in Delft TU (3 national experts x 1 month)	44.5	27.0		44.5	27.0	0.0	0.0
Ajustment and finalization of national norms (roads/bridges and irrigation systems)							
Total	**469.4**	**284.5**	50.0	85.8	52.0	**383.6**	**232.5**

2. Development of National Cyclone Proof Norms for Habitat Infrastructure

Type	Total Needs (Million Ar)	Total Needs ($'000)	Government Commitment (Millions Ar)	Donor Commitment (Millions Ar)	Donor Commitment ($'000)	Net Needs (Millions Ar)	Net Needs ($'000)
Development of national norms and training materials (1 expert @ 1 month)	25	15.2		25.0	15.2	0	0.0
Training for technicians/builders/consultants/NGOs in habitat norms (traditional and non-traditional) to cyclone and fire-proof (at HIMO/Antisrabe)	40.0	24.2				40	24.2
Adaptation and dissemination of the norms in areas at high risk	50.0	30.3		50.0	30.3	0	0.0
Total	**115.0**	**69.7**	50.0	75.0	45.5	**40.0**	**24.2**

3. Population Awareness and Extension of the Early Warning System

Type	Unit Costs (Million Ar)	Total Needs (Million Ar)	Total Needs ($'000)	Government Commitment (Millions Ar)	Donor Commitment (Millions Ar)	Donor Commitment ($'000)	Net Needs (Millions Ar)	Net Needs ($'000)
1. Community Training in Disaster Risk Management for Fokontany in 35 Districts already trained in 2007 (3237 FKT)	5.7	2,448.0	1,483.6					
2. Training in DRM in Fokontany in 42 Districts not yet trained in 2007 (3264 FKT) - including 7 remote districts	5.7	2,546.0	1,543.0					
3. Materials of early warning: megaphones (6,501 FKT)	0.2	1,300.2	788.0					
4. Materials of early warning sirenes (6,501 FKT)	0.5	3,250.0	1,969.7					
5. Materials of early warning: wind-up radios (6,501 FKT)	0.078	507	307.3					
Total		**10,051.2**	**6,091.6**	951.7	0	0	**9,099.5**	**5,514.8**

4. Coordination du Relèvement précoce au Niveau National, Régional et Local

Type	Total Needs (Million Ar)	Total Needs ($'000)	Government Commitment (Millions Ar)	Donor Commitment (Millions Ar)	Donor Commitment ($'000)	Net Needs (Millions Ar)	Net Needs ($'000)
Coordination of the Network of Early Recovery at National Level, and Implementation of Risk Management at the Regional and Local Level	495.0	300	0	0	0	495.0	300.0

Total Needs	6,745.8
Total Government Commitment	637.4
Total Donor Commitment	97.5
Gap	6,011.0
Minus Early Recovery	250
Total Gap	5,761.0
Total Call for Funds GFDRR	**5,300.0**
Remaining Gap	461.0
Contingency Fund	606
Net Gap	-145.0

Including Early Warning Materials in all Fokontany at high risk, training in DRM in 60% Fokontany at high risk, and development of norms and national capacity building in cyclone-norms for key infrastructure

Summary of Needs for Madagascar Cyclones 2008

LIVELIHOODS

For further information, please contact cruciani@ilo.org; GSEMp_Recon@Ilo.Org; sbettencourt@worldbank.org; tmahefasoa@worldbank.org

Livelihoods

Concerned Ministries	Type	Number	Region	Unit Cost (Million Ar)	Total Needs (Million Ar)	Total Needs ($'000)	Potential Commitments (Million Ar)	Potential Commitments Donors (Millions Ar.)	Net Needs (Millions Ar.)	Net Needs ($' 000)
MDAT	Expansion of market places	5	Atsinanana		412.5	250.0			412.5	250.0
	(1 market per district most	2	Menabe		165.0	100.0			165.0	100.0
	affected/at risk)	4	Alaotra Mangoro		330.0	200.0			330.0	200.0
		5	Analanjirofo		412.5	250.0			412.5	250.0
		4	Analamanga		330.0	200.0			330.0	200.0
		2	Vatovavi Fitovinany		165.0	100.0			165.0	100.0
		2	Boeny		165.0	100.0			165.0	100.0
		4	Sofia		330.0	200.0			330.0	200.0
		2	Haute Matsiara		165.0	100.0			165.0	100.0
		30		82.5	2,475.0	1,500.0	0.0	0.0	2,475.0	1,500.0
MDAT	Establishment of Employment Information Units	1 per region	16 high risk regions							
				82.5	1,320.0	800.0	0.0	0.0	1,320.0	800.0
MDAT	Vocational training for local youth	5 per region	Atsinanana		50.0	30.3				
			Menabe		50.0	30.3				
			Alaotra Mangoro		50.0	30.3				
			Analanjirofo		50.0	30.3				
			Analamanga		50.0	30.3				
			Diana		50.0	30.3				
			Atsimo Atsinama		50.0	30.3				
			Vatovavy Fitovinany		50.0	30.3				
			Boeny		50.0	30.3				
			Sofia		50.0	30.3				
			Melaky		50.0	30.3				
			Haute Matisara		50.0	30.3				
				10.0	600.0	363.6	0.0	0.0	600.0	363.6
MDAT	Training for rural professional	25	Atsinanana		41.3	25.0				
MAEP	associations	10	Menabe		16.5	10.0				
	(5 per market place)	20	Alaotra Mangoro		33.0	20.0				
		25	Analanjirofo		41.3	25.0				
		20	Analamanga		33.0	20.0				
		10	Vatovavi Fitovinany		16.5	10.0				
		10	Boeny		16.5	10.0				
		20	Sofia		33.0	20.0				
		10	Haute Matsiara		16.5	10.0				
		150	Total	1.65	247.5	150.0	0.0	0.0	247.5	150.0
MDAT	Strengthening the capacity of decentralized public services		Regions at highest risk							
					2,475.0	1,500.0	0.0	0.0	2,475.0	1,500.0
			Total		7,117.5	4,313.6	0.0	0	7,117.5	4,313.6

	US$'000
Total Needs	4,313.6
Government Contribution	0.0
Donor Contribution	0.0
Early Recovery	0.0
Gap	4,313.6
Proposed Amount for Call for Funds	1,013.6

Including training for professional associations, vocational training for youths, and construction of 1/3 of market places

Total Call for Funds GFDRR	**1,013.6**	**Construction of 10 market places, training for professional associations and vocational training for youths in high-risk areas**
Remaining Gap	3,300.0	

Annexes

Annex 1: Housing

Methodology used to calculate average unit costs

The following assumptions were used in the damage assessment:

Hard construction: 9x9 m², 3 rooms, single story
- Value of damages (original construction costs) = AR. 30,000,000
- In the event of partial destruction, damage was estimated at 30 percent.

Semi-hard construction 9x9 m², 3 rooms, single story
- Value of damages (original construction costs) = AR. 14,000,000
- In the event of partial destruction, damage was estimated at 30 percent.

Local construction
- Local materials construction: 3x4 m², one (1) room
- Value of damages (original construction costs) = AR. 892,000

Rubble clearance is estimated to account for 7 percent of reconstruction and/or rehabilitation costs.

Value of Goods and Equipment was estimated as follows:

- For hard and semi-hard construction dwellings (which typically contain a bed, a living room set, household appliances, and cooking utensils), assessed value is AR. 300,000 (of the 30 percent damage figure);
- For locally constructed dwellings (which typically contain a bed, a radio, a table, some chairs, and cooking utensils), assessed value is AR. 125,000 (of the 40 percent damage figure).

Temporary rental

If a hard construction dwelling is completely destroyed, it was assumed that householders (i.e., the owners) were obliged to rent another house for 12 months, at a cost of AR. 60,000 per month.

Impact on Balance of Payments

The estimated cost of materials to be imported:

- For hard construction is estimated at 50 percent of construction costs;
- For semi-hard construction is estimated at 10 percent of construction costs;
- For local materials construction is estimated at 5 percent of construction costs.

Table 82: Distribution of damage and losses by region (Ar. Millions)

HOUSING AND PUBLIC BUILDINGS SECTOR

REGIONS	DISASTER EFFECTS			SECTOR		EFFECTS ON	
	Damage	Losses	TOTAL	Public	Private	BOP	Fiscal sector
ALAOTRA MANGORO	3 612.3	439.9	4 052.2	1 850.0	2 202.2	1,135.0	
AMORON'I MANIA							
VATOVAVY FITOVINANY	1 525.3	507.3	2 032.6		2 032.6	733.9	
ANALAMANGA	949.1	109.6	1 058.7		1 058.7	163.5	
ANALANJIROFO	109 402.4	5 338.5	114 740.9	7 410.0	107 330.9	27,073.4	
ATSINANANA	55 648.6	6 993.4	62 642.0	7 485.0	55 157.0	18,882.1	
BONGOLAVA							
BOENY	1 164.8	213.4	1 378.2		1 378.2	860.5	
DIANA	2 526.3	403.5	2 929.7		2 929.7	1,860.7	
HAUTE MATSIATRA	318.0	105.8	423.8		423.8	153.0	
ATSIMO ANDREFANA							
IHOROMBE	0.7		0.7		0.7	0.1	
MENABE	3 625.7	224.3	3 850.0	1 650.0	2 200.0	668.9	
SOFIA	5 079.9	816.8	5 896.8		5 896.8	3,735.9	
ATSIMO ATSINANANA	3 747.6	598.5	4 346.1		4 346.1	2,760.3	
BESTIBOKA							
MELAKY	6 771.6	348.5	7 120.1	4 020.0	3 100.1	1,625.9	
TOTAL	**194,372.3**	**16,099.5**	**210,471.7**	**22,415.0**	**188,056.7**	**59,653.2**	

Table 83: Estimated cost of imported reconstruction materials (Ar. Millions)

REGIONS	IMPORTED MATERIALS
ALAOTRA MANGORO	1 135.0
AMORON'I MANIA	
VATOVAVY FITOVINANY	733.9
ANALAMANGA	163.5
ANALANJIROFO	27 073.4
ATSINANANA	18 882.1
BONGOLAVA	
BOENY	860.5
DIANA	1 860.7
HAUTE MATSIATRA	153.0
ATSIMO ANDREFANA	
IHOROMBE	0.1
MENABE	668.9
SOFIA	3 735.9
ATSIMO ATSINANANA	2 760.3
BESTIBOKA	
MELAKY	1 625.9
TOTAL	**59 653.1**

Table 84: Distribution of recovery and reconstruction costs by region (Ar. Millions)

REGIONS	RECOVERY AND RECONSTRUCTION		
	Early recovery	Medium/long term	TOTAL
Alaotra Mangoro		**1850.0**	**1850.0**
Amoron'i Mania			
Vatovavy Fitovinany			
Analamanga			
Analanjirofo		**7,410.0**	**7,410.0**
Atsinanana		**7,485.0**	**7,485.0**
Bongolava			
Boeny			
Diana			
Haute Matsiatra			
Atsimo Andrefana			
Ihorombe			
Menabe		**1,650**	**1,650**
Sofia		**540**	**540**
Atsimo Atsinanana			
Betsiboka			
Melaky		**4,020**	**4,020**
TOTAL		**22,955.4**	**22,955.4**

Annex 2: Transport

Table 85: Summary of Transport sector Needs for Medium and Long-term Recovery and Reconstruction

Recovery and reconstruction needs	Amount (Ar Million)	Amount (in 1,000 US$)
1. Roads and works rehabilitation (MTPM)	105,799.5	64,120.9
2. Railroads Works Rehabilitation (MTPM)	1,987.3	1,204.4
3. River Traffic Works Rehabilitation (MTPM)	3.3	2.0
4. Air Traffic Works Rehabilitation (MTPM)	390.0	236.4
5. Maritime Traffic Works Rehabilitation (MTPM)	83.7	50.7
TOTAL	**108,263.8**	**65,614.4**

Annex 3: Electricity

Table 86: Damages and Losses to Power Plants

Zone/sector	Damage noted	Damage (AR. '000)	Losses (AR. '000)
Mananara Nord	Loss of plant roof	2,454.40	
Sainte-Marie	Loss of plant roof	7,373.80	
Vavatenina	Partial loss of plant roof	9,984.60	
	Power generator flooded		
	Fencing flattened/destroyed		
	Transformer hangar totally destroyed		
Soanierana Ivongo	Loss of plant roof	3,810.70	
Vatomandry Ambodiriana	Destruction of visitors' house	1,598.00	
	Damage to plant boat landing		
	Loss of roof of hydraulic plant		
Volobe	Damage to dam and intake structures	21,800.00	
	Damage to outbuildings		
	Damage to civil works protecting access paths and ferry		
	Damage to left- and right-bank storage sheds, dam		
Toamasina	Diesel thermal off-set, cost of fuel and services		526,508.83
	Damage to exhaust pipe of Generator 1502	219,247.33	
	Loss of roof of TM2 dispatching shed		
	Damage to GO TM3 unloading room		
	Partial damage to plant		
TOTAL		**266,268.83**	**526,508.83**

Source: Consultant to JIRAMA General Directorate/Power Production Directorate

Table 87: Assessment of damage to power production: CIVIL ENGINEERING

DIRECTORATE	ZONE/SECTOR	DAMAGE	DAMAGE (Ar '000)
DIR Toamasina	Vavatenina	Transformer cabin for central elevators of diesel thermal plant: rehabilitation needed	6,312.30
	Sainte-Marie	Rehabilitation needed for low-voltage meters at source at diesel thermal plant. Replacement of plant supervisor's roof.	54,320.67
	Fénérive-Est	Rehabilitation needed for roofs and transformer units at diesel thermal plant	46,419.46
	Toamasina	Replacement of fencing at Tamatave III diesel thermal plant. Replacement of roofing for offices and housing.	6,551.21
TOTAL			**113,603.64**

Source: Consultant to JIRAMA General Directorate/Power Production Directorate

Table 88: Operations Directorate for Tananarive Interconnected Network
(*Direction Exploitation Réseau Interconnecté de Tananarive* – DERI)

SHUT DOWN OF ANDEKALEKA PLANT	KWH	DAMAGE (Ar. '000)	LOSSES (Ar. '000)
Hydraulic power lost for 6 days	7,700,000.00		
Diesel thermal plant off-set, fuel costs, and services	5,000,000.00		1,531,915.00
Load-shedding	2,700,000.00		675,000.00
Spare parts (Cestidure gaskets, oil)		2,000.00	
Labor		2,000.00	
TOTAL		**4,000.00**	**2,206,915.00**

Source: Consultant to JIRAMA General Directorate/*DERI*

Table 89: Summary of Damage and Losses to Power Production

	DAMAGE (Ar. '000)	LOSSES (Ar. '000)
Civil engineering, regions	113,603.64	
Regions	266,268.83	526,508.83
DERI Antananarivo	4,000.00	2,206,915.00
TOTAL	**383,872.47**	**2,733,423.83**

Source: Consultant to JIRAMA General Directorate

Table 90: Assessment of Damage and Losses to High-Voltage Lines and Stations

ZONE/SECTOR	DAMAGE NOTED	DAMAGE (AR. '000)	LOSSES (AR. '000)
Toamasina I	Damage to high-voltage lines: Cables, 7.5 kilometers Concrete pylons, 2 units Crossbeams, 7 units Metal struts, 9 units	438,494.67	
TOTAL		**438,494.67**	

Source: Consultant to JIRAMA General Directorate/ *Toamasina Department*

Table 91: DERI *(Direction Exploitation Réseau Interconnecté de Tananarive)*

	DAMAGE NOTED	DAMAGES (AR.' 000)	LOSSES (AR. '000)
138 KV HIGH-VOLTAGE LINE Andekaleka-Antananarivo	Civil engineering repairs needed: flange of pylon no. 138 on 138 KV line	50,000.00	
TOTAL		**50,000.00**	

Source: Consultant to JIRAMA General Directorate/*DERI*

Table 92: Summary of Damage and Losses to High-Voltage Lines and Stations

	DAMAGE (AR. '000)	LOSSES (AR. '000)
Regions	**438,494.67**	
DERI Antananarivo	**50,000.00**	
TOTAL	**488,494.67**	

Source: Consultant to JIRAMA General Directorate

Table 93: Assessment of Damage and Losses to Power Distribution Networks

DIRECTORATE	ZONE/SECTEUR	DAMAGE (AR. '000)	LOSSES (AR. '000)
DTA	Antananarivo	93 647.241	50 720.800
DIRTANA I	Ambatondrazaka	100 393.607	6 369.676
	Manakambihiny		185.928
	Amparafaravola	4 214.868	300.925
	Tanambe	4 038.255	1 855.000
	Andilamena	14 837.825	2 714.750
	Subtotal	**217 131.796**	**62 147.079**
DIR Toamasina	Vavatenina	29 369.359	1 412.628
	Soanierana Ivongo	10 939.626	1 848.000
	Mananara Nord	9 946.672	
	Antanambao Manampotsy	5 577.303	
	Foulpointe	78 293.898	
	Sainte Marie	403 189.415	85 167.000
	Brickaville	8 852.159	
	Fénérive-Est	242 108.114	35 424.000
	Toamasina	932 271.236	
	Mahanoro	17 452.450	
	Subtotal	**1 738 000.232**	**122 439.000**
DIR Antsirabe	Antsirabe	4 129.185	
	Morondava	18 798.905	5 027.930
	Mahabo	12 286.762	64.987
	Belo Tsiribihina	5 596.922	
	Ambositra	1 025.628	
	Subtotal	**41 837.402**	**5 092.917**
DIR Fianarantsoa	Fianarantsoa	33 156.746	
	Farafangana	26 272.083	
	Ranomafana	20 982.334	
	Ifanadiana	16 943.173	
	Ambohimahasoa	17 199.400	
	Mananjary	26 488.700	
	Manakara	49 976.176	
	Vohipeno	8 928.994	
	Ambalavao	29 291.870	
	Ihosy	17 535.751	
	Subtotal	**246 775.229**	
DIR Antsiranana	Nosy Be	143 236.013	33 045.60
	Antsiranana	4 007,348	
	Anivorano Nord	498,157	
	Ambilobe	951,187	
	Subtotal	**148 692.705**	**33 045.60**
Purchase of poles		**52 276.300**	
Transportation of poles		**40 474.614**	
TOTAL		**2 485 188.278**	**224 137.224**

Source: Consultant to JIRAMA General Directorate/Distribution Directorate

Table 94: Assessment of damage to power distribution: CIVIL ENGINEERING

DIRECTORATE	ZONE/SECTEUR	DAMAGE	DAMAGE (AR. '000)
DIR Toamasina	Vavatenina	Repairs needed to offices, lodging	3,156,150
	Sainte Marie	Repairs needed to business office and lodging	27,160,333
	Fénérive-Est	Repairs needed to fencing, offices, Reconstruction of storehouses	69,629,196
	Toamasina	Repairs needed to operations garage, offices, Reconstruction of storehouses	6,551,210
TOTAL			**106,496,889**

Source: Consultant to JIRAMA General Directorate.

Table 95: Summary of Damage and Losses to Power Distribution

	DAMAGE (AR. '000)	LOSSES (AR. '000)
Power distribution network	2,485,188.278	224,137.22
Civil engineering (business office, storehouses)	106,496.89	
TOTAL	**2,591,685.17**	**224,137.22**

Source: Consultant to JIRAMA General Directorate/*Antananarivo Department*

RISK REDUCTION MEASURES:

I) Pilot project – Development of cyclone resistance standards for calculation of mechanical stresses to overhead lines (CA.ME.LIA.) and assessment of other preventive measures

a) Visits by MEM and JIRAMA technicians to neighboring islands in the Indian Ocean to examine risk reduction measures.

Table 96: Cost assumptions of technician vists

	10 employees	Total in US$
10-day stay	10 x 10 x US$400	40,000
Travel	10 x US$1,000	10,000
TOTAL		**50,000**

b) Purchase of computer equipment and software, plus salary of one consultant: US$60,000
c) Re-fitting of pilot sites, to be determined on the basis of studies: US$150,000
d) Others (including contingencies): US$40,000

Table 97: Total cost of pilot project

	COST IN US$
TRAVEL AND PER DIEM COSTS OF TECHNICIANS	**50,000**
COMPUTER EQUIPMENT AND CONSULTANT'S SALARY	**60,000**
RE-FITTING OF PILOT SITE	**150,000**
OTHER/CONTINGENCIES	**40,000**
TOTAL	**300,000**

Table 98: Phased replacement of low/medium-voltage overhead networks with underground networks (for all centers at risk)

NETWORK	LENGTH (kilometers)	UNIT COST (AR. '000/kilometer)	TOTAL (AR. '000/kilometer)	TOTAL US$
Low-voltage	50	13,835.60	691,780.00	
Medium-voltage	60	12,471.00	748,260.00	
TOTAL	**110**		**1,440,040.00**	**872,752**

Table 99: Phased replacement of wooden poles with concrete pylons in neighborhoods at highest risk

TYPE OF POLE	NUMBER	UNIT COST (AR. '000)	TOTAL (AR. '000)	TOTAL US$
Concrete 12 x 400	900	751,152	676,036,800	
Concrete 12 x 600	30	853,930	25,617,900	
Concrete 12 x 800	20	964,659	19,293,180	
TOTAL	**950**		**720,947,880**	**436,938**

Table 100: General Summary of costs

	TOTAL IN US$
PILOT PROJECT	300,000
CONVERSION FROM OVERHEAD TO UNDERGROUND	872,752
REPLACEMENT OF WOODEN POLES W/ CONCRETE	436,938
TOTAL GENERAL	**1,609,691**

CYCLONE PROTECTION MEASURES:
Re-fitting of structures to mitigate impacts of future disasters

1- COST OF REPLACING ONE (1) KILOMETER OF LOW-VOLTAGE OVERHEAD NETWORK WITH UNDERGROUND NETWORK

1. HGE aluminum cable (HN33S33) NFC32-321: 4 x50 mm^2 = AR. 8,181 x 1,000 = AR. 8,181,000
2. Ground: 2 x AR. 874,091 = AR. 1,748,182
3. Distribution box:2 x AR. 174,273 = AR. 348,546
4. Switch box: 10 x AR. 355,780 = AR. 3,557, 800

TOTAL (use of HGE3S33 aluminum cable, 4x50 mm^2 = AR. 8,181,000) = AR. 13,835,528/kilometer

Technical option: HGS aluminum cable (HN3S33)

2- REPLACEMENT COST OF ONE (1) KILOMETER OF MEDIUM-VOLTAGE OVERHEAD NETWORK WITH UNDERGROUND NETWORK

1. 3 x 50 mm^2 + 25 mm^2: AR. 11,673 x 1,000 = AR. 11,673,000
2. Earth ground: 2 x AR. 874,091 = AR. 1, 748,182
3. Additional ground rods: AR. 6 x 71,551 = AR. 429,306
4. External cable 12/20KV: 2 x AR. 315,126 = AR. 630,252
5. 24 KV lightning rod, 5KA discharge capacity, with support: 2 x AR. 528,027 = AR. 1,056,054

TOTAL: AR. 15,536,794/kilometer

- Reclamation of discarded materials (salvageable)

- Scrap metal, rigid pole armature (NVR1, *nappe voûte rigide*): 10 x AR. 96,573 = AR. 965,730
- Scrap metal, inclined arms: 12 x AR. 19,151 = AR. 229,812
- Insolator: 18 x AR. 56,333 = AR. 1,013,994
- Rigid insulator NHT20: 30 x AR. 28,539 = AR. 856,170

TOTAL: AR. 3,065,696/kilometer

SUMMARY:
AR. 15,536,794/kilometer – AR. 3,065,696/kilometer =
AR. 12,471,098/kilometer

Table 101: Sales of electricity in Madagascar, 2001-2007 and 2008, in kWh

	January	February	March	April	May	June	July	August	September	October	November	December
2001	35494208	36562025	36255518	36841242	38306151	40509097	39106032	40602311	34747898	35216145	42079387	36388240
2007	70197178	63647682	57039397	62236785	60623537	65232480	66401468	64011268	63880924	73207577	64949917	72413804
2008	67393641	61636963										

Annex 4: Telecommunications

Table 102: Damage and losses in the telecommunications sector, by region

	Disaster effects			Ownership by sector		Effects on:	
Subsector Component	**Damage**	**Losses**	**Total**	**Public**	**Private**	**BOP**	**Fiscal sector**
Analanjirofo	**591.70**	**130.4**	**722.10**	**338.2**	**382.90**	**582.2**	**104.8**
Post offices	9.5	102.4	111.9	107.5	3.4		102.4
Radio and television broadcasting	228.3	2.4	230.7	230.7	0	228.3	2.4
Cell phone operators	353.90	25.6	379.50	0	379.5	353.9	
Telma	262.4	1.7	264.1	0	264.1		
Orange	75.00	10.9	85.90	0	85.90		
Celtel	16.50	13.00	29.50	-	29.50		
Atsinanana	**199.10**	**13.5**	**212.60**	**204.3**	**17.30**	**199.1**	**0**
Post offices	0	0	0	9	0		0
Radio and television broadcasting	195.3	0	195.3	195.3	0	195.3	0
Cell phone operators	3.80	13.5	17.30	0	17.3	3.8	
Telma	0	3	3	0	3		
Orange	3.80	6	9.80	0	9.80		
Celtel	-	4.50	4.50	-	4.50		
Alaotra Mangoro	**14.00**	**19.5**	**33.50**	**0**	**24.50**	**14**	**9**
Post offices	0	9	9	0	0		9
Radio and television broadcasting	0	0	0	0	0	0	0
Cell phone operators	14.00	10.5	24.50	0	24.5	14	
Telma	6.4	0	6.4	0	6.4		
Orange	7.60	6	13.60	0	13.60		
Celtel	-	4.50	4.50	-	4.50		
Menabe	**48.80**	**36.5**	**85.30**	**20**	**63.90**	**46.8**	**0**
Post offices	1.4	0	1.4	0	0		0
Radio and television broadcasting	20.6	0	20.6	20	0.6	20	0
Cell phone operators	26.80	36.5	63.30	0	63.3	26.8	
Telma	20.8	15	35.8	0	35.8		
Orange	6.00	17	23.00	0	23.00		
Celtel	-	4.50	4.50	-	4.50		
Analamanga	**23.50**	**0**	**23.50**	**0**	**23.50**	**23.5**	**0**
Post offices	0	0	0	0	0		0
Radio and television broadcasting	0	0	0	0	0	0	0

Cell phone operators	23.50	0	23.50	0	23.5	23.5	
Telma	0	0	0	0	0		
Orange	23.50	0	-	0	-		
Celtel	-	-	-	-	-		
Betsiboka	**10.00**	**0**	**10.00**	**0**	**-**	**0**	**0**
Post offices	0	0	0	0	0		0
Radio and television broadcasting	10	0	10	0	0	0	0
Cell phone operators	-	0	-	0	0	0	
Telma	0	0	0	0	0		
Orange	-	0	-	0	-		
Celtel	-	-	-	-	-		
Melaky	**358.00**	**0**	**358.00**	**58**	**300.00**	**350**	**0**
Post offices	8	0	8	8	0		0
Radio and television broadcasting	50	0	50	50	0	50	0
Cell phone operators	300.00	0	300.00	0	300	300	
Telma	300	0	300	0	300		
Orange	-	0	-	0	-		
Celtel	-	-	-	-	-		
Boeny	**126.50**	**-**	**126.50**	**126.50**	**-**	**126.50**	
Post offices							
Radio and television broadcasting	126.50	-	126.50	126.50	-	126.50	-
Cell phone operators							
Telma							
Orange							
Celtel							
Sofia	**71.00**		**71.00**	**71.00**	**-**	**71.00**	**-**
Post offices							
Radio and television broadcasting	71.00	-	71.00	71.00	-	71.00	-
Cell phone operators							
Telma							
Orange							
Celtel							

Table 103: Damage and losses in the radio and television broadcasting sector (in AR. millions)

	Location	Public radio	Public television	Private radio	Total
Damage	Mahabo	20		0.6	**20.6**
Losses		0.1		0.1	**0.2**
Total		**20.1**		**0.7**	**20.8**
Damage	Sainte-MARIE		83.5	0	**83.5**
Losses			2.4	0	**2.4**
Total			**85.9**		**85.9**
Damage	Fénérive-Est	5			**5**
Losses					
Total		**5**			**5**
Damage	Toamasina	20	40		**60**
Losses					
Total		20	40		**60**
Damage	Mahanoro	0	20		**20**
Losses					
Total		0	20		**20**
Damage	Brickaville		76.6		76.6
Losses					
Total		**76.6**			**76.6**
Damage	Vavatenina	1.4			
Losses					**1.4**
Total		**1.4**			**1.4**
Damage	Soanierana Ivongo		20		**20**
Losses					
Total			**20**		**20**
Damage	Foulpointe	1			**1**
Losses					
Total		**1**			**1**
Damage	Soalala	10	106.56		**116.56**
Losses		0	0		**0**
Total					**116.56**
Damage	Mitsinjo	10			**10**
Losses					
Total					**10**
Damage	Kandreho	10			**10**
Losses					
Total					**10**
Damage	Mampikony	10			**10**
Losses					
Total					**10**
Damage	Port-Bergé		20		**20**
Losses					
Total					**20**
Damage	Befandriana-Nord		20		**20**
Losses					
Total					**20**
Damage	Bealanana	10	20		**30**
Losses					

Total				**30**
Damage	Besalampy	10		**10**
Losses				
Total				**10**
Damage	Morafenobe	10		**10**
Losses				
Total				**10**
Damage	Antsalova	10		**10**
Losses				
Total				**10**
Damage	Ambatomainty		20	**20**
Losses				
Total				**20**

Table 104: Damage and losses in the telephony sector (in AR. millions)

Operator	Location	Damage	Losses	Total
Telma	Morondava	20.8	15	**35.8**
	Sainte-Marie	200	1	**201**
	Fenerive-Est	62.4	0.7	**63.1**
	Ambatondrazaka	6.3	0	**6.3**
	Toamasina		3	**3**
	Bealanana		0	
	Besalampy	300	0	**300**
	Total	**589.5**	**19.7**	**609.2**
Orange	Morondava	6	17	**23**
	Sainte-Marie	29.4	2.5	**31.9**
	Ambatondrazaka	11.4582	0	
	Toamasina		6	
	Moramanga		0	**17.4582**
	Soanierana Ivongo	13.0728	0	
	Foulpointe		0	
	Fenerive-Est		12.5	**25.5728**
	Total	**109.97**	**38**	**148**
Celtel	Sainte-Marie	16.5	5	
	Fenerive-Est		8	
	Soanierana Ivongo		0	
	Foulpointe		0	**29.5**
	Total	**16.5**	**13**	**29.5**
TOTAL		**715.97**	**70.7**	**786.7**

Table 105:Weekly revenue of Telma Morondava (in AR. thousands)

Date	Revenue
February 11-16	940
February 18-23	778
February 25 - March 1	2815
March 3 - 8	988
March 10 -15	1339
March 17-22	1778

Source: *Telma Morondava*

Table 106: Weekly revenue of Telma Fénérive-Est (in AR. thousands)

Date	Revenue
February 4 - 8	1869
February 11-15	805
February 18-22	507
February 22-29	419
March 3-7	1500

Source: *Telma Fénérive-Est*

Table 107; Monthly revenue of the Sainte-Marie post office (in AR. thousands)

Date	Revenue
December 2007	4119
January 2008	4203
February 2008	2166
March 2008	1679
April 2008	1800

Source: *Sainte-Marie post office*

Table 108: Monthly revenue of the Fénérive-Est post office (in AR. thousands)

Date	Revenue
January 2008	6380
February 2008	1395
March 2008	1750
April 2008	1102.8

Source: *Fénérive-Est post office*

Table 109: Monthly revenue of the Ambatondrazaka post office

Date	Revenue
January 2008	763066
February 2008	143880
March 2008	60038
April 2008	13017

Source: Ambatondrazaka post office

Table 110: Damages and Losses caused by Cyclones Fame and Ivan by region

Region	Disaster effects			Ownership by sector		Effects on:	
	Damage	Losses	Total	Public	Private	BOP	Fiscal sector
Analanjirofo	591,70	130,4	722,10	338,2	382,90	582,2	104,8
Atsinanana	199,10	13,5	212,60	204,3	17,30	199,1	0
Alaotra Mangoro	14,00	19,5	33,50	0	24,50	14	9
Menabe	48,80	36,5	85,30	20	63,90	46,8	0
Analamanga	232,50	0	23,50	0	23,50	23,50	0
Betsiboka	10	0	10	10	0	0	
Melaky	358	0	358	58	300	350	0
Boeny	126,50	0	126,50	126,50	0	1226,50	0
Sofia	71,00	0	71,00	71,00	0	71,00	0

Annex 5: Water Supply and Sanitation

Table 111: Presumptions for the estimation of damages and losses

	DAMAGE ESTIMATES	LOSSES ESTIMATES
WATER SUPPLY		
URBAN AREA	data gathered from Jirama on physical damages	data gathered from Jirama: i.e. duration of water cut off, volume of unsold water
	damage costs estimates provided by Jirama	
RURAL AREA	all open public wells are polluted (inventory of wells delivered by MEM)	all open wells to be disinfected
	physical damage costs ~ 5% of new improved well (estimated)	furniture of WASH kits
	about 30% of the number of existing working water supply systems in rural areas are damaged (estimated)	estimation of the unsold water quantity (1000 people, 30 l/day/pers, 6 months)
	physical damage costs estimated to 10 % of full rehabilitation costs of the damaged system	
SANITATION		
URBAN AREA	data gathered from municipalities on physical damage	pumping, dewatering operations (data gathered from municipalities)
		cleaning operations costs, manpower (data gathered from municipalities)

Table 112: Presumptions for estimation of early recovery and medium/long term recovery

	EARLY RECOVERY	MEDIUM/LONG TERM RECOVERY
WATER SUPPLY		
URBAN AREA	physical damage	
RURAL AREA		
Public wells	40 % all open public wells to be replaced by improved wells (equipped with hand pumps, fencing, cleaning area)	60 % all open public wells to be replaced by improved wells (equipped with hand pumps, fencing, cleaning area)
Water supply networks	out of the 30% of the defected rural water supply system, 40% will be rehabilitated	out of the 30% of the defected rural water supply system, 60% will be rehabilitated
SANITATION		
URBAN AREA		
Rain and waste water network	Rehabilitation of rain water and waste water network (30%-40% of total estimated length)	Rehabilitation of rain water and waste water network (60%-70% of total estimated length)
solid waste	furniture of dustbins, truck	truck

Annex 6: Education

Table 113: Recapitulation of needs, by region

	Reconstruction	Repairs	*Water and sanitation
MENABE	522..4	0	21
Alaotra	1,619.3	0	69
Analanjirofo	8,775.6	3073.2	822
Atsinanana	5,954.9	392.0	312.75
Haute matsiatra	365.6	47.0	22.5
Sofia	1,201.4	47.0	58.5
Vatovavy fito	156.7	0	6.75
Boeny	0	62.7	9
Betsiboka	0	31.4	0
Amoron'I Mania	0	125.4	18
Melaky	574.6	31.4	29.25
Ats Atsinanana	0	0	0
Ats Andrefana	0	0	0
Ihorombe	0	0	0
Bongolava	156.7	0	6.75
Analamananga	2141.7	15.7	94.5
DIANA	0	31.4	4.5
TOTAL	21468.9	3857.2	1474.5

TOTAL NEEDS	**26,802.1**

*Water and sanitation: 0.75 of the number of schools affected by Ivan and Fame.

*Unit cost: AR. 3 million.

Annex 7: Health

Table 114: Hospitals and CSBs damaged by region

Region	Hospitals Damaged	CSBs Damaged	*Total*
Analanjirofo	2	38	40
Alaotra Mangoro		7	7
Menabe		2	2
Atsinanana	1	35	36
Melaky	1	6	7
Diana		2	2
Amoron'Imania		0	0
Atsimo Atsinanana		5	5
Haute Matsiatra	1	49	50
Betsiboka		0	0
Sofia		5	5
Bongolava		7	7
Analamanga		0	0
Boeny		3	3
Vatovavy Fitovinany	1	8	9
Atsimo Andrefana		0	0
Ihorombe		0	0
TOTAL	6	167	173

Assumptions behind rehabilitation and reconstruction figures are as follows:

- Rehabilitation/reconstruction of 167 health centers and six hospitals in compliance with anti-cyclone standards;
- Unit cost of the reconstruction of a CSB in accordance with anti-cyclone standards – Ar. 144 million; and
- Refitting of these centers – Ar. 5 million per hospital center.

Annex 8: Food Security and Nutrition

Methodology

In conducting the assessment, the team used such tools as national statistical reference documents as well as specific data on post-cyclone damage, including:

O1 – DALA training documents

- ⇨ Assessment of the BNGRC rescue response in the wake of cyclones “Fame” and “Ivan”
- ⇨ Periodic Household Survey, 2004
- ⇨ Madagascar population map

The methodology used for this evaluation consisted of the following:

- ⇨ gathering of data for the November 2007- March 2008 period from the following sources:
  - The Ministry of Agriculture, Livestock and Fisheries (central and regionalized departments): Market and farmer prices for staples, and forecasts of food stock availability after cyclone passage
  - The Ministry of Health, Family Planning and Social Protection (central and regionalized departments): Rate of malnutrition among children seen at health centers, and number of children admitted to the in-patient Nutritional Rehabilitation Center
  - The *Office national de Nutrition:* Proportion of underweight children among those under the age of 5
  - NGOs involved in the sector: Damage caused by cyclones
- ⇨ Field visits for verification and groundtruthing
- ⇨ small-scale survey of authorities and affected households visited

Annex 9: Agriculture, Livestock and Fisheries

Table 115: Damages and Losses to the Fisheries Sector by Region

Fisheries Sector Damages and Losses Due to the 2008 Cyclone Season

	Fisheries					Aquaculture			Estimated Damages			Estimated Losses		
	Traditional Fishers	Total Pirogues	Damaged Pirogues	Total Nets	Damaged Nets	Aquaculture Basins	Damaged Basins	Breeders Washed Away	Fisheries	Aquaculture	Total Damages	Fisheries	Aquaculture	Total Losses
									Million Ar.				Million Ar	
Analanjirofo	4528	4,581	554	10264	738.0	9,556	---	---	189.2	---	189.2	963.1	---	963.1
Diana	6342	7,057	353	17,706	1,770.6	---	---	---	23.0	---	23.0	1,015.1	---	1,015.1
Amoron'I Mania	438	361	---	1,662	---	22,468	ca. 900	4800	---	104.0	104.0	---	2,133.3	2,133.3
Vatovavy Fitovinany	5381	7,742	---	16,884	---	4,878	---	---	----	---	0.0	---	---	0.0
Alaotra Mangoro	16800	5,860	145	25200	4,500.0	5,371	180	960	421.1	13.8	434.9	754.3	1,920.0	2,674.3
Atsinanana	5778	7,394	12	18199	28.0	6,727	---	---	2.1	---	2.1	Negligible	---	0.0
Sud-Est	3790	3,126	156	8,967	896.7	547	181	965	10.5	1.4	11.9	450.0	195.7	645.7
Haute Matsiara	538	230	---	1,551	---	16,401	---	---	---	6.4	6.4	---	888.4	888.4
Atsimo Andrefana	8204	10,753	30	14,946	40.0	50	---	---	1.6	---	1.6	51.4	---	51.4
Boeny	4979	5,290	265	10,535	1,053.5	---	ca. 200	1,067	21.7	13.8	35.5	845.6	1,920.0	2,765.6
Sofia	5302	5,847	292	14,213	1,421.3	1,358	---	---	5.7	---	5.7	814.8	---	814.8
Ihorombe	630	45	---	852	---	114	5	27	---	0.4	0.4	---	53.3	53.3
Melaky	1484	2,274	114	3,613	361.3	0	---	---	---	0.4	0.4			0.0
Menabe	5455	2,800	140	13239	655.0	73	---	---	9.0		9.0	759.0	---	759.0
Bongolava	340	124	---	1,167	---	22,768	---	---	---	---	0.0	---	---	0.0
Analamanga	997	1,001	---	7,011	---	19,563	---	---	---	---	0.0	---	---	0.0
Betsiboka	1326	654	52	3,309	655.0	1,204	ca. 30	160	5.8	0.8	6.6	303.5	106.7	410.2
							---	---						
Total All Regions	**72,312**	**65,141**	**2,113**	**169,318**	**12,119**	**111,080**	**1,496**	**7,979**	**689.7**	**141.0**	**830.7**	**5,956.8**	**7,217.4**	**13,174.2**

Losses to Fisheries were estimated for Analanjirofo, Alaotra, and Atsinanana based on actual landings from 2007 and 1st trimester of 2008, and estimated recovery rates of 85% in 2nd trimester, 90% in 3rd trimester, ,and 95% in 4th trimester.
For Menabe, average catch per unit of effort and number of trips per month in 2007 and 2008 in small pelagics and large pelagic fisheries were used to derive the losses.
Price factors during the cyclone were taken into account.
For the other regions, losses and damages were derived by taking into account (a) the relative level of damage inflicted by the cyclone; (b) extrapolations based on fishing effort (no. of nets) based on 2006 agriculture census updated to 2008 using population growth estimates; and (c) available data from DRDR on cyclone damages on fisheries.

Annex 10: Industry and Commerce

Table 116: Breakdown of damage and losses values due to the cyclones Fame and Ivan by Region and per disaster categories for Industry and Commerce sectors (in Ar. Millions)[33]

	Damage value of buildings		Damage value of equipments	Damage value of stocks		Turnover losses (based on 2 weeks business stop)	
Regions	INDUSTRY	COMMERCE	INDUSTRY	INDUSTRY	COMMERCE	INDUSTRY	COMMERCE
MELAKY	2,58	1,05	4,40	5,00	7,00	0,11	0,05
ANALANJIROFO	25,79	383,70	44,00	50,00	2.558,00	0,07	0,04
DIANA	229,50	12,75	391,60	445,00	85,00	0,02	0,01
AMORON'I MANIA	0	0	0	0	0	0	0
VATOVAVY FITOVINANY	13,64	5,55	23,27	26,45	37,00	0,12	0,06
ALAOTRA MANGORO	24,50	4,95	41,80	47,50	33,00	0,33	0,02
ATSINANANA	109,59	96,60	187,00	212,50	644,00	0,20	0,11
ATSIMO ATSINANANA	10,31	0,60	17,60	20,00	4,00	0,002	0,001
HAUTE MATSIATRA	16,76	10,80	0	32,50	72,00	0,005	0,002
ATSIMO ANDREFANA	0	0	0	0	0	0	0
BOENY	59,31	3,30	101,20	115,00	22,00	0,23	0,122
SOFIA	51,57	3,00	88,00	100,00	20,00	0,00	0,005
IHOROMBE	1,30	0	2,20	2,50	0	0,003	0,001
MENABE	30,94	0,45	52,80	60,00	3,00	0,11	0,06
BONGOLAVA	0	0	0	0	0	0	0
ANALAMANGA	0	7,50	0	0	50,00	0	0
BETSIBOKA	0	0	0	0	0	0	0
TOTAL	**575,79**	**530,25**	**953,88**	**1,116,45**	**3,535,0**	**0,91**	**0,46**

[33] Without agroindustry and other losses which are considered in the core of the report

Annex 11: Tourism

Methodology for calculating damages and losses:

Data collection related to assessment of the damage and losses sustained by the tourism sector took place by conducting interviews with hoteliers, based on the categories outlined below.

Table 117: Format Used for the On-site Survey

Pre-disaster	Post-disaster	Reconstruction
Number of hotels	Number of hotels destroyed	Construction cost of one room
Number of rooms	Number of rooms destroyed	Cost of construction material
Number of tourists/month	Number of tourists/month	Number of rooms rebuilt
Average duration of one tourist's visit	Average duration of one tourist's visit	Duration of construction period
Average expenditure of one tourist during visit	Average expenditure of one tourist during visit	Date of restoration to normal conditions
Other structures: - Boat - Dug out canoe - Motorcycle - Quad bike - Bike - Restaurants	- Other additional expenses related to power cuts and contaminated water Use of generators Candles Purchase of clean water Length of time for which the complex was closed	

These data are baseline data used to complete the reconstruction table and to estimate damage and losses (see Table 118).

A calculation was done of projected regular, pre-disaster revenue until the recovery period (from this point to July), along with revenue projections. Reconstruction cost = damage x 30 percent.

On-site visits were conducted in three of the sixteen regions affected by the two cyclones – Fame and Ivan.

Findings for regions that were not visited were obtained through a process of extrapolation. In the case of the tourism sector, the dominant parameter was wind (that is, wind gusts). Also, after consultation with the other regions, it was discovered that the two cyclones did not cause damage in the thirteen

regions, owing to the fact that they were not in the path of the cyclones. These regions only experienced rain associated with the cyclones.

The following information was obtained from the public authorities (Ministry of Tourism):

- Arrivals for January, February, March, and April 2008
- Average expenditure per tourist
- Revenue for January, February, March, and April 2008
- Occupancy rate
- Average length of stay
- Visa costs
- Taxes paid by tourists

Table 118: Table showing damage and losses in the regions visited (Ar. Millions)

TOURISM SECTOR - MENABE						Post- disaster months									
	Baseline data				Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Estimate of damage															
a) Buildings	27 hotels – 3 damaged, including the restaurant and reception area														
b) Building contents	350 rooms														
c) Other structures	**Baobab walkway** 1. Fallen baobab 2. Flooding of access roads to site 3. Access problems														
Damage - cost				**5.3**											
Reconstruction - cost				**7.6**											
Estimate of losses															
a) Revenue losses															
	Projection of regular non-disaster revenue			**3.1**	**1.5**	**3.1**	**3.1**	**3.1**	**3.1**						
		Regular number of tourist arrivals per month	8												
		Length of stay	2												
		Average expenditure of one tourist Ar/visit		0.4											
		Projection of regular monthly revenue		3.1											
	Projection of post-disaster revenue			**1.2**	**0.6**	**1.2**	**1.2**	**1.2**	**1.2**						
		Regular number of tourist arrivals per month	3												
		Average expenditure of one tourist Ar/visit		0.4											
	Estimated post-disaster losses per month			**1.9**	**1.0**	**1.9**	**1.9**	**1.9**	**1.9**						
b) High operating cost															
	High cost of public services (electricity, sanitation, etc.														
c) Other	Additional post-disaster expenses			**0.6**	**0.3**	**0.6**	**0.6**	**0.6**	**0.6**						
	1. Cleaning of site		30	0.2											
		Cleaning time	15												
	2. Suspension of visits		7												
		Loss of revenue by the local population		0.4											

TOURISM SECTOR - ANALANJIROFO						Post- disaster months									
	Baseline data				Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Estimate of damage															
a) Buildings	56 hotels – 3 damaged, including Saint Marie in East However, 2 damaged	Fénérive. Hotel statistics are still being collected. hotels were visited.													
b) Building contents	520 bungalows in Saint Marie, 32 rooms among the hotels visited														
c) Other structures	**Chalet, generator, toboggans, bridges, boats**														
Building damage - cost															
Damage to other structures –cost				**89.8**											
Building reconstruction - cost				**287.9**											
Reconstruction of other structures - cost				**128.3**											
Estimate of losses				**411.3**											
a) Revenue losses															
	Projection of regular non-disaster revenue			**295.2**	**147.6**	295.	295.2	295.2	295.2						
		Regular number of tourist arrivals per month	232												
		of stay	3												
		Average expenditure of one tourist Ar/visit		1.3											
		Projection of regular monthly revenue		295.2											
	Projection of post-disaster revenue			**40.7**	**20.**	**40.7**	**40.7**	**40.7**	**40.7**						
		Regular number of tourist arrivals per month	32												
		Average expenditure of one tourist Ar/visit	1.												
	Estimated post-disaster losses per month			**254.**	**127.3**	**254.3**	**254.3**	**254.3**	**254.3**						
b) High operating cost															
	High cost of public services (electricity, sanitation, etc)														
c) Other	Additional post-disaster expenses			**3.9**	**1.9**	**3.9**	**3.9**	**3.9**	**3.9**						
	1. Cleaning of beach		30 wks	3.											
		Cleaning time	1mont h												
	2. Repair of bathrooms			0.6											
	3. Electricity fees			0.01											

TOURISM SECTOR - ALAOTRA MANGORO															
						Post-disaster months									
	General baseline data				Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Estimate of damage															
a) Buildings	10 hotels – 8 visited														
b) Building contents	100 rooms														
c) Other structures	Destruction of the Cap Bandro fence Damage to camp entrance														
Damage - cost				**0.04**											
Reconstruction - cost				**0.05**											
Estimate of losses															
a) Revenue losses															
	Projected regular non-disaster revenue			**0.3**	**0.1**	**0.3**	**0.3**	**0.3**	**0.3**						
		Regular number of tourist arrivals per month	17												
		Length of stay	1												
		Park fees	10,000												
		Paddler	5,000												
		Canoe	3 canoes, each with three travelers												
		Projection of regular monthly revenue		0.3											
	Projection of post-disaster revenue			**0.1**	**0.05**	**0.1**	**0.1**	**0.1**	**0.1**						
		Regular number of tourist arrivals per month	6												
		Length of stay	1	0.2											
		Park fees	10,000												
		Paddler	5,000												
		Canoes	3 canoes, each with three travelers												
	Estimated post-disaster loss per month			**0.2**	**0.1**	**0.2**	**0.2**	**0.2**	**0.2**						
b) High operating cost															
c) Other	Additional post-disaster expenses			**0.8**	**0.4**	**0.8**	**0.8**	**0.8**	**0.8**						
	1. Purchase of bottled water			0.05											
	2. Purchase of candles			0.01											
	3. Closing of 9 rooms for three days			0.8											

Table 119: Breakdown of Tourist Arrivals

	2001	**2002**	**2003**	**2004**	**2005**	**2006**	*2007*
January	11,209	7,174	11,861	12,011	16,590	19,908	20,138
February	9,011	2,942	9,919	10,019	13,751	16,089	16,639
March	11,027	2,743	12,763	12,981	18,734	22,294	23,834
April	13,107	2,792	9,364	17,062	22,005	24,667	25,752
May	13,218	1,761	13,179	21,172	22,548	25,765	26,354
June	15,762	3,061	12,139	19,473	25,418	23,733	28,857
July	18,034	5,123	15,053	26,970	28,943	31,956	34,104
August	17,166	6,636	13,953	25,109	27,215	30,628	36,714
September	16,008	6,392	11,707	22,361	27,280	32,165	32,213
October	16,121	7,505	10,124	21,568	26,097	32,364	34 231
November	14,307	7,173	10,036	20,489	24,792	28,511	32,612
December	15,238	8,372	9,132	19,569	23,678	23,650	32,900
TOTAL	**170,208**	**61,674**	**139,230**	**228,784**	**277,052**	**311,730**	**344,348**

Annex 12: Environment

Methodology

The assessment took into consideration:

- The forestry situation before the cyclones
- The assessment of damages and losses caused by the cyclones

The methodology used was based on the data collected on the number of trees per hectare felled by the cyclones; by definition, these trees cannot be reclaimed.

Damages were calculated on the basis of an estimate of the cost of restoring the damaged areas. Primary forest restoration was assumed to cost an estimated US$800/hectare.

Losses were estimated on the basis of an assessment of environmental services lost as a result of the destruction of these trees. The loss of environmental services was estimated at US$56/hectare/year. Moreover, these losses were projected over a period of 20 years, i.e., the period during which the damaged forests will regain their capacity to renew these environmental services.

Three scenarios were formulated for calculating the current net values (discount rate at 3 percent, 7 percent, and 10 percent).

Regional Assessment:

A.1.1. MENABE REGION

The total area under forest cover is 1,370,811 ha, including 1,105,121 ha of forest and 265,690 of protected areas.

Table 120: Forest cover, Menabe region

Type	Area (in hectares)
Dense, dry Dalbergia, Commiphora, and Hildegardia forest	679 429
Degraded, dry Dalbergia, Commiphora, and Hildegardia forest	162 567
Riparian forest	231 499
Mangroves	31 626
Total	**1 105 121**

Source: Regional environmental trend chart (TBER), Menabe, National Office for the Environment (ONE) 2007 (Image processing 2007).

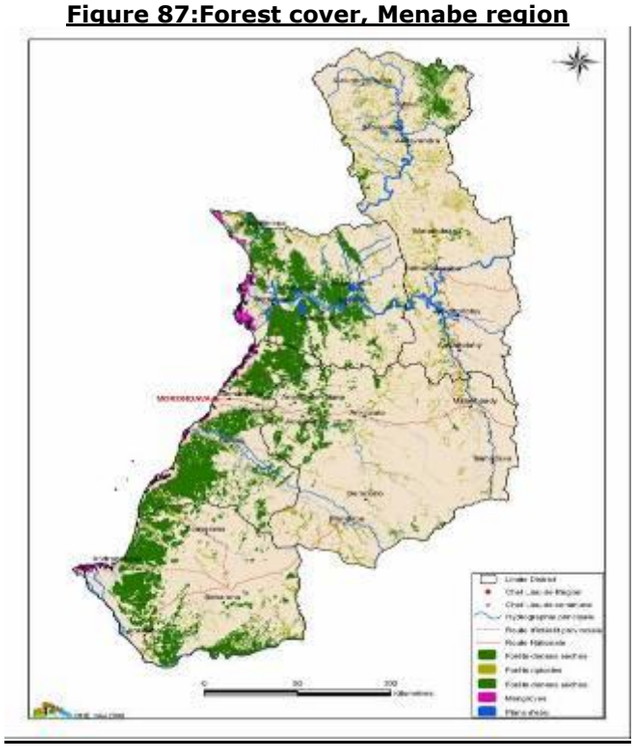
Table 121: Protected areas, Menabe region

Name of protected area	Status	Date of creation	Area (hectares)	Natural habitat	Management
Andranomena	RS	Decree n°58-13 of 28/10/58	6 420	Deciduous dense dry forest	ANGAP
Kirindy Mitea	PN	Decree n°97-1453 of 18/12/97	109 200	Deciduous dense dry forest	ANGAP
Ambohijananhary	RS	Decree n° 58.08 of 28/10/58	24 750	Dense dry forest	DREEFT
Menabe Central Antimena	SAPM	Order No. 4532/2006 of 28/03/06 (Temporary protection)	125 000	Dense dry forest Mangrove Lac Bedo	FA NAMBY
Valley of Baobab	Natural monument	Order No. 16.231/2007 of 25/09/07 (Temporary protection)	320	Baobab tree-covered savannah	FANAMBY
TOTAL			**265 690**		

Source: Regional Office for the Environment, Water, Forests, and Tourism (DREEFT), Menabe, April 2008.

Abbreviations used in this and other tables:
RS = Special reserve
PN = National park
RNI = Integral nature reserve
SAPM = System of Protected Areas of Madagascar

Figure 87:Forest cover, Menabe region



Translation of legend:

District border
Principal town of region
Principal town of commune
Main rivers
Provincial road
National road
Dense dry forests
Riparian forests
Dense dry forests
Mangroves
Bodies of water
Kilometers]

ANALANJIROFO REGION

The total area under forest cover is 2,445,497 ha, including 1,739,835 ha of forest, 430,483 ha of protected areas and 275,179 of potential protected areas.

Table 122: Forest cover, Analanjirofo region

Type of forest	Vavatenina	Soanierana Ivongo	Sainte Marie	Maroantsetra	Mananara Nord	Fénérive Est	Total	%
Dense, wet forest	62 898	220 989	261	455 755	182 824	61 111	983 839	44.98%
Degraded, wet forest	191 179	119 731	3 632	114 323	130 156	195 804	754 825	34.51%
Littoral forest		636	46			489	1 172	0.05%
Total	**254 077**	**341 356**	**3 939**	**570 079**	**312 981**	**257 403**	**1 739 835**	**79.54%**

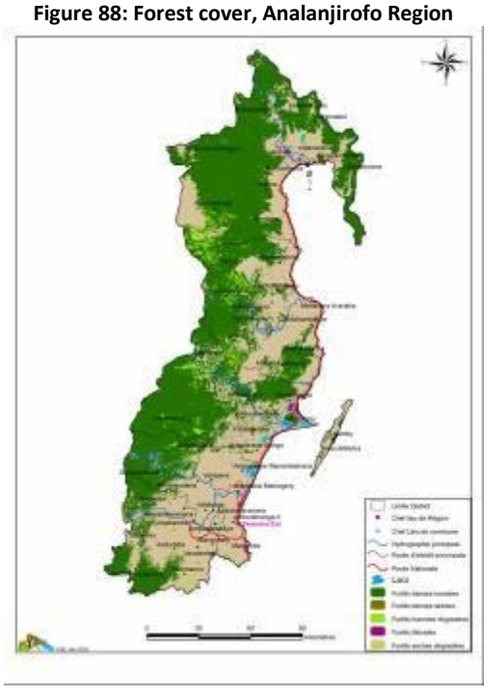
Source: ATLAS de la Végétation de Madagascar, 2005.

Table 123: Size of protected areas of Madagascar, Analanjirofo region

Type	Surface area in region (hectares)	Status	Date of creation	Total surface area (hectares)
Currently protected areas (managed by National Association for the Management of Protected Areas in Madagascar (ANGAP))				
Masoala	36 166	PN	No. 97/141 of March 2, 1997	230 000 (land) 10 000 (marine)
Mananara Nord	23 753	PN	No. 89/216 of July 25, 1989	23 000 (land) 1 000 (marine)
Zahamena	41 301	PN	No. 97/1044 of August 7, 1997	64 378 (land)
Nosy Mangabe	444	RS	No. 65/795 of December 14, 1965	520 (land)
Ambatovaky	24 869	RS	No. 58/10 of October 28, 1958	60 050 (land)
TOTAL (Currently protected areas (PA))	126 536			
New protected areas (NPA)				
Makira	303 947		Partially in region (managed by World Conservation Society)	540 000 (land)
TOTAL NPA	303 947			
Potential sites	275 179			
TOTAL potential sites	275 179			

Source: Analanjirofo Regional Development Program (PRD), 2005; Ministry of the Environment, Water, Forests, and Tourism (MINENVEF), 2007.

Figure 88: Forest cover, Analanjirofo Region



ALAOTRA MANGORO REGION

The total area under forest cover is 1,063,506 ha, including 905,724 ha of forest and 157,782 ha of protected areas.

Table 124: Forest cover, Alaotra Mangoro region

Type of forest	Moramanga	Anosibe An'Ala	Andilamena	Amparafaravola	Ambatondrazaka	Region	% Region
Wet forest	186 141	78 121	84 272	21 667	152 456	522 657	19.55%
Degraded wet forest	170 163	189 054	2 692	10 341	10 817	383 067	14.33%
Total	**356 304**	**267 176**	**86 964**	**32 007**	**163 273**	**905 724**	**33.88%**

Source: Atlas de la végétation de Madagascar, 2007 (ONE map processing).

Table 125: Size of protected areas, Alaotra Mangoro region

Type	Surface area in region (hectares)	Status	Date of creation	Total surface area (hectares)
Currently protected areas (managed by ANGAP)				
Mantadia	Relating to decree: 15 480 hectares; Relating to database: 15 456 hectares (ANGAP)	***PN***	Lim. ch.: Aug. 7, 2002	
Analamazaotra	Relating to decree: 810 hectares; Relating to database: 887 hectares (ANGAP)	***RS***	June 21, 1970	
New protected areas				
Marais de Torotorofotsy	8 300 hectares (study by ZIMMERMAN in 1999)	Ramsar site: complex of wet zones composed of 4 swamps		
Lac Alaotra	20 000 hectares	Ramsar site:		
Corridor Zahamena Ankeniheny		SAPM (Temp. order)		**425 000**
Anjozorobe				**52 200**
TOTAL	**157 782.41**			

Source: ANGAP; Durrell Wildlife Conservation Trust (DWCT); Mitsinjo NGO; Fanamby NGO.

Figure 89: Forest cover, Alaotra Mangoro region

[Translation of legend:
District border
Principal town of region
Principal town of commune
Provincial road
National road
Bodies of water
Dense wet forest

Kilometers]

ATSINANANA REGION

The total area under forest cover is 931,413 ha, including 442,181 ha of forest, 64,028 ha of protected areas, and 425,204 ha of potential protected areas (tables 5, 6 and map 3).

Table 126:Forest cover, Atsinanana region

Type of forest	Tamatave II	Brickaville	Vatomandry	Mahanoro	Marolambo	Antanambao Manampotsy	Region
Forest (hectares)	**102,997**	**196,434**	**10,521**	**23,377**	**94,482**	**14,369**	**442,181**

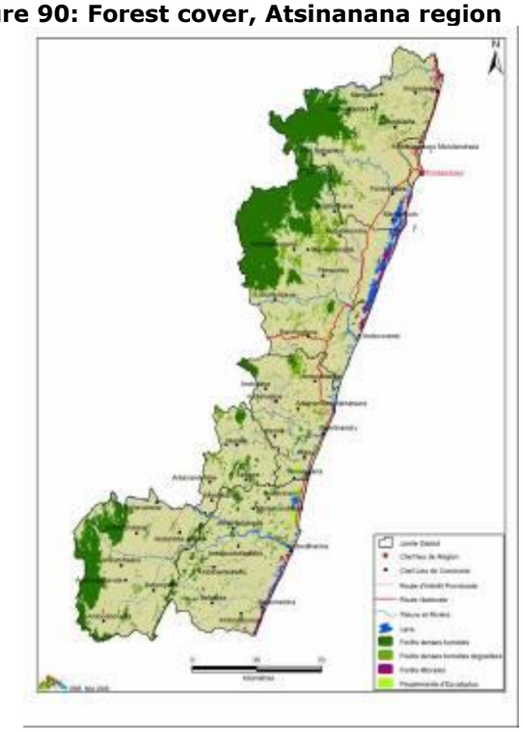
Source: Atsinanana PRD; National Ecological and Forestry Inventory (IEFN) 1.

Table 127: Size of protected areas, Atsinanana region

Type	Surface area in region (hectares)	Status	Date of creation	Main habitat	Observations	Total surface area (hectares)
Currently protected areas (managed by ANGAP)						
Betampona	2228	RNI			District of Toamasina II	2228
Mangerivola	11900	RS			District of Brickaville	11900
Sandrangato	49900	RS			District of Brickaville	499000
Total AP (ANGAP)	**64028**					**64028**
New protected areas						
Zahamena – Ankeniheny		Temporary protection	Dec 05		Partly in region – managed by CI	425000
Analalava forest	204	Temporary protection	Sep 06		Foulpointe Commune – managed by MBG	204
TOTAL						**425,204**

Source: General Directorate for the Environment, Water, and Forests (DGEEF), 2007.

Figure 90: Forest cover, Atsinanana region



MELAKY REGION

The total area under forest cover is 1,039,584 ha, including 837,649 ha of forest and 201,935 ha of protected areas.

Table 128: Forest cover, Melaky region

REGION	Dense dry Dalbergia, Commiphora, and Hildegardia forest	Riparian forest	Degraded dry Dalbergia, Commiphora, and Hildegardia forest	Mangroves	Dense dry Didiereaceae forest	Region
MELAKY	420,049	267,150	100,739	49,189	522	837,649

Source: ONE, Image processing 2007.

Table 129: Protected areas, Melaky region

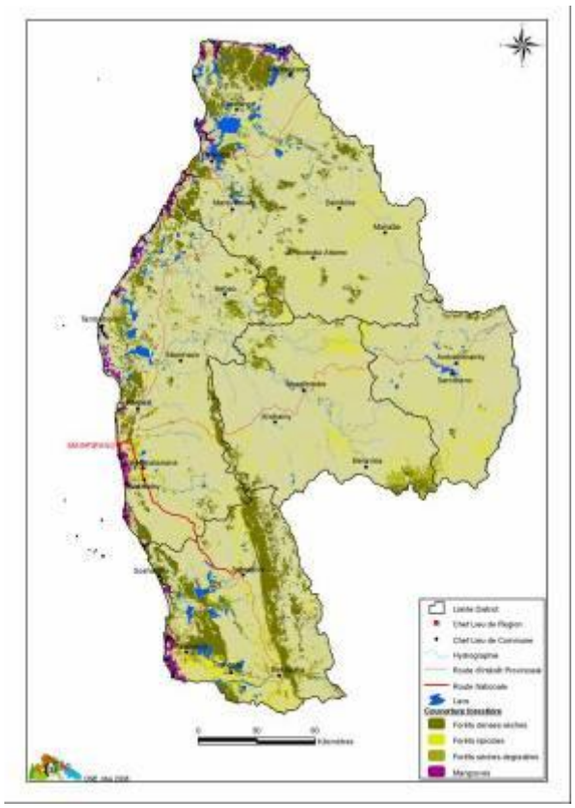
Protected area	District	Status	Date of creation	Surface area relating to decree (hectares)	Management
Maningoza	Besalampy	RS	Decree 96 208 of Dec. 20, 1956	7 900	
Bemarivo	Besalampy	RS	Decree of Sept. 10, 1956	11 575	
Ambohijanahary	Morafenobe	RS	Decree 58 08 of Oct. 28, 1958	24 750	
Tsingy de Bemaraha	Antsalova	RNI	Decree 66 242 of June 1, 1966	85 370 72 340	ANGAP
Total				**201 935**	

Source: Maintirano District Office for the Environment, Water, and Forests (CIREEF), 2005.

Zones reserved for SAPM, Melaky region:

- Manambolomaty lake system
- Cap St André
- Mangroves of Masoarivo

Figure 91: Forest cover, Melaky region



Assumptions made in estimations:

Damages to forests were estimated as follows: Ha of forests damaged x Costs of Restoration

Losses to forest were estimated as follows:

Ha of forests damaged x annual value of losses x 20 years (where the value of losses was assumed to be equivalent to US$56/ha/ha).

Table 130: Assessment of damages and losses of forests, by discount rates (in Ar. Millions)

DISCOUNT RATE	DAMAGES	LOSSES	TOTAL
3%	340.2	438.1	**778.3**
7%	340.2	398. 8	**739.0**
10%	340.2	372.9	**713.2**

Table 131: Assessment of damages and losses of zetra, Alaotra Mangoro region, by discount rates (in Ar. Millions)

Discount rates	DAMAGES	LOSSES	TOTAL
3%	11	3.7	**14.7**
7%	11	3.3	**14.3**
10%	11	3.0	**14.0**

Additional Notes:

Table 132: Explanatory note on calculation of forest recovery and restoration costs

Total forest area of affected regions	**2 992 170 ha**
Total damaged forest area	258.8 ha
Unit cost, post-cyclone inventory	30,000 Ar
Number of man-days/hectare	3
Unit cost, forest patrol, per hectare	273.8 Ar
Short-term recovery = systematic inventory	23. 3 million Ar
Short-term recovery = patrol	819.2 million Ar
Medium/long-term recovery = damages = restoration	340.2 million Ar

Table 133: Explanatory note on calculation of zetra recovery and restoration costs

Short-term recovery	= reintroduction of animals
Medium/long-term recovery	= planting of zetra

Bibliography

Andrianjaka, N. H. and Milazzo, A. (2008) Travaux publics à haute intensité de main d'œuvre (HIMO) pour la protection sociale à Madagascar : problèmes et options de politique, Version définitive. Banque Mondiale, Madagascar, Juin 2008.

CERCI (1984) Shore protection manual, 4th edition, Coastal Engineering Research Center, US Army Corps of Engineers, Vicksburg, USA

CETMEF (2001) ROSA 2000, Recommendations pour le calcul aux etats-limites des ouvrages en site aquatique, Ministere del'equipement, des Transports en du Logements, CETMEF, Compiegne, France

CIRIA , CUR Building and infrastructure, CETMEF (2007),
The rock manual, the use of rock in hydraulic engineering, C683, CIRIA, London

Bank protection pilot project, FAP 21, Government of Bangladesh, Ministry of Water Resources, Guidelines and design manual for standardized bank protection structures, december 2001

DGM (2008). Le Changement Climatique à Madagascar. Direction Générale de la Météorologie, Antananarivo, Madagascar, March 2008.

Delft Hydraulics Mott Mac Donald Nespak February 1996 Indus Basin River Regime Study, part III guidelines and implementation, Delft Hydraulics, Delft, the Netherlands

Hoffmans, G.J.C.M. en Verheij, H.J. (1997) Scour manual, AA Balkema, Rotterdam, The Netherlands, 1997

Directoraat-Generaal Rijkswaterstaat Hydraulische randvoorwaarden 2001, voor het toetsen van primaire waterkeringen Ministerie Verkeer en Waterstaat, Delft, december 2001

Jansen, P.Ph., van Bendegom, L., van den Berg, M. de Vries,M. en Zanen, A. (1994) Principles of river engineering: the non-tidal alluvial river, Pitman, London,

Leopold, L.B. and Wolman, M.G. (1957) River channels patterns-braided, meandering and straight, US Geological survey

Melville, B.W. and Coleman S.E. (2000) Bridge scour, Water resources publications, LLC, Colorado, United States.

May, R., Akers, J. and A. Kirby (2002) Manual on scour at bridges and other hydraulic structures, C551, CIRIA, London,

Pilarczyk, K.W. (2000) Geosynthetics and geosystems in hydraulic and coastal engineering, AA Balkema, Rotterdam

Sarker, M.H. (1996) Geomorphology and channel dimensions, River Survey Project (FAP 24), special report no 7

Schiereck, G.J., Introduction to bed, bank and shore protection, Delft University Press, Delft, The Netherlands, 2001

USACE, Engineer manual (1993) River hydraulics, engineering and design, EM 1110- 2- 1416, US Army Corps of Engineers, CHL-ERDC, WES, Vickburg, United States

Varma, C.V.J., K.R. Saxena and M.K. Rao (1989) River behaviour management and training, Publication no 204, Volume I, Central Board of Irrigation and Power, New Delhi, India

wb329148
C:\Documents and Settings\wb329148\Desktop\Madagascar JDLNA Report Final.doc
11/13/2008 1:59:00 PM