## EXECUTIVE SUMMARY

1 - Characteristics of the Country

Madagascar is a large mountainous island located in the South West Indian Ocean, South-eastern Africa, between latitudes 11 ° 57 '- 25 ° 35' South and longitudes 43 ° 14' - 50 ° 27 'East. It covers 587 041 km ² and has 6 603 km of coastline. It extends over 1600 km from north to south and 580 km from east to west.

Overall, Madagascar enjoys a tropical climate, with regional variations. The average annual temperature are between 23 and 27 ° C with an annual temperature range of about 3 ° C in the North and 7 ° 5 in the dry Southwest. The 3 700mm to 400mm rainfall varies across the island:: it is hot and humid in the East and semi-arid and hot in the West and South West, The Highlands, the Western Region and the South have two distinct seasons: rainy season extending from November to April and a dry season from May to October. Whereas in the eastern region, it rains almost all year round and dry season is almost non-existent. The hurricane season and major floods happen between December and May**.** A dozen tropical storms will go through the region of Madagascar every year; three of these can reach the stage of tropical cyclone and hit the Island.

Forest resources contain a wealth of invaluable fauna and flora biodiversity. They extend over a total area of 12 291 052 hectares, including degraded forests, covering less than a third of the country. This area corresponds to a coverage rate of 18.5% (IEFN, 2000) broken down into natural forests to degraded forests (98.2%) and afforestation (1.8%). The eastern side is occupied by rain forest vegetation, the western side by dense forests, dry highlands with an altitude forests and wooded savannas. The South, Southwest and Far Northern areas are home to thorny thickets and xerophytic vegetation adapted to drought. Madagascar is a country rich in biodiversity but degradation is permanently threatening this environment.

In terms of socio-economic development, the population, 7.9 million in 1975 against 18.6 million in 2005, has an annual growth of 2, 3 %, with a density of 29.2 inhabitants per square kilometer. Its is a young population: 43.8% are under 15 years of age, 53.1% are between 15 and 64 and 3.1% are 65 and older. The urban population represents 26.8% against 73.2% in rural areas (HDR 2007/2008). Women slightly outnumber men

With respect to human development index (HDI), Madagascar ranks 143rd out of 177 countries. With a 0.533 index it is in the category of medium human development countries (MSY 2007/2008). The GDP per capita was 288 USD / year in 2005. The average economic growth rate was 4% per year up to 2001, there was an exceptional 12% decrease in 2002, then it went up 4.9% in 2006 and reached 6.5% in 2007 thanks to significant investments in the mining sector.

The economy is primarily based on agriculture, livestock, fisheries / aquaculture, textile, mining and tourism.

As for education, 66% of the Malagasy population has reached primary school education at least. Nearly 63% of individuals aged 15 and over can read, write and do quick arithmetics. If this literacy rate is 76% in urban areas, it is only 59% among the rural population. The country has six public universities distributed in the administrative centres of the six former provinces and a dozen private Colleges in some of the major towns in the Regions. Primary and secondary schools are present almost everywhere across the country.

As far es the Health sector is concerned, the major diseases afflicting the country are respiratory infections, tuberculosis, malaria, diarrheal diseases and sexually transmitted infections. In terms of infrastructure, there are basic health centers in all communes, health centers in all county towns and university hospitals in most major towns.

In the energy sector, power is currently produced by hydro and thermal plants. The hydraulic potential of the country is around 7800MW, but only about 250 MW are exploited, representing approximately 3%. The country has to import oil products to meet its needs in energy and the national coverage of electricity is only about 21% (Ministry of Energy Policy Letter).

The ancillary energy - approximately 2.000kWh/m²/yr - puts Madagascar among the solar energy rich countries in terms of potentials.Solar energy is currently used for water heating, drying agricultural products and generating power for telecommunications, lighting, drugs storage and pumping. Many opportunities are also offered by thermic solar energy in urban areas**.**

The resources in wind energy are substantial; however, they are not uniformly distributed throughout the country. This form of energy remains competitive for pumping and power generation especially in the Northeast and Southeast areas

In terms of road infrastructure, Madagascar has all types of communication network: tarred national roads connecting most major cities, railways connecting some regions, sea lanes connecting the major coastal cities- 3 of which are international ports - national and international airlinks, a few waterways and quite developed NITC networks

2 - Inventory of greenhouse gas

Being a ontracting Party to the United Nations Framework Convention on Climate Change since 1998, Madagascar has established its first national inventory report on greenhouse gas emissions through its initial national communication, submitted to the UNFCCC Secretariat in 2003 . The inventory report has been prepared in accordance with the 1996 guidelines and it takes 1994 as baseline year.

Under the Second National Communication, the inventory was conductedin aéccordance with the new guidelines for the preparation of national communications of non Annex I Parties to the Convention which were adopted by the COP during its Eighth Session in 2002, decision 17CP.8, and whose baseline year is 2000. The inventory also contains information on the evolution of emissions of greenhouse gases from 1995 to 2004

The inventory was developed using the guidelines of the Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories, a 1996 revised version, IPCC recommendations on best practices and management of uncertainties for national GHG inventories and good practice guidance for the land use sector, land use change and forestry.

As in the first national communication, areas considered for the inventory are Energy, Industrial Processes, Agriculture, Waste and Land Use, land use Change and Forestry .

The inventory includes estimates of direct GHG emissions such as carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), hexafluoride hexafluoride (SF6), and indirect greenhouse gases such as nitrogen oxides (NOx), sulfur dioxide (SO2), sulfur hexafluoride (SF6), carbon monoxide (CO) and non methane volatile organic compounds (NMVOC).

Regarding the findings of the 2000 inventory, just as with 1994, Madagascar remains a carbon sink with a net emission (Σemissions +ΣAbsorptions) of – 231,821 Gg CO2 (1 Gg = 1000 tons).

The table below ( in line with Annex Table 1 of Decision 17/CP.8, recommended to be used for presentation) details the GHG emissions and absorptions based on the categories of GHG sources and sinks from different sectors in 2000.

Table. 1 – Results of GHG inventory. All sectors. Year 2000

| **Catégories de sources et de puits de gaz à effet de serre** | Emission de CO2 (Gg) | Absorption de CO2 (Gg) | $CH_4$ (Gg) | $N_2O$ (Gg) | $NO_x$ (Gg) | CO (Gg) | COVNM (Gg) | $SO_2$ (Gg) |
|---|---|---|---|---|---|---|---|---|
| **Total des émissions et absorptions nationales** | **1 747,4** | **-233 568,4** | **343,0** | **66,7** | **27,6** | **893,7** | **92,9** | **39,81** |
| **1 Energie** | **1 722,7** | **0,0** | **42,3** | **0,4** | **22,1** | **650,1** | **88,9** | **39,76** |
| A Combustion (méthode sectorielle) | 1 722,7 | | 42,3 | 0,4 | 22,1 | 650,0 | 88,6 | 39,76 |
| 1 Industries Energétiques | 301,8 | | 15,0 | 0,0 | 1,1 | 100,3 | 30,1 | 14,79 |
| 2 Industries manufacturières et Construction | 355,8 | | 0,2 | 0,0 | 1,4 | 8,9 | [2] | 2,01 |
| 3 Transport | 936,6 | | 0,1 | 0,0 | 9,9 | 44,2 | 8,4 | 0,99 |
| 4 Autres secteurs | 128,5 | | 26,9 | 0,3 | 9,7 | 496,6 | 49,8 | 21,97 |
| 5 Autres | SO | | SO | SO | SO | SO | SO | SO |
| B Emissions Fugitives | 0,0 | | 0,0 | | 0,03 | 0,04 | 0,36 | 0,00 |
| 1 Combustibles Solides | | | 0,0 | | 0,00 | 0,00 | 0,00 | 0,00 |
| 2 Pétrole et gaz naturels | | | 0,0 | | 0,03 | 0,04 | 0,36 | 0,00 |
| **2 Procédés Industriels** | **24,7** | **0,0** | **0,0** | **0,0** | **0,0** | **0,0** | **3,9** | **0,05** |
| A Produits minéraux | 24,7 | | | | | 0,0 | 0,0 | 0,02 |
| B Industrie chimique | 0,0 | | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,00 |
| C métallurgie | 0,0 | | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,00 |
| D Autre Production | 0,0 | | | | 0,01 | 0,03 | 3,9 | 0,04 |
| E Production d'hydrofluorocarbures et Hexafluorure de soufre | | | | | | | | |
| F Consommation d'hydrofluorocarbures et Hexafluorure de soufre | | | | | | | | |
| D Autres | SO | | SO | SO | SO | SO | SO | SO |
| **3 Utilisation de solvants et autres produits** | | | | | | | | |
| **4 Agriculture** | | | **284,1** | **66,3** | **2,2** | **126,8** | **0,0** | **0,0** |
| A Fermentation entérique | | | 245,8 | | | | | |
| B Gestion du fumier | | | 9,2 | 11,5 | | | SO | |
| C Riziculture | | | 24,3 | | | | SO | |
| D Sols agricoles | | | NE | 54,8 | | | SO | |
| E Brûlage dirigé de la savane | | | 4,8 | 0,1 | 2,2 | 126,8 | SO | |
| F Brûlage sur place des résidus agricoles | | | NE | NE | NE | NE | SO | |
| G Autres | | | SO | SO | SO | SO | SO | |
| **5 Changement d'affection des terres et foresterie (1)** | **0,0** | **-233 568,4** | **13,4** | **0,1** | **3,3** | **116,9** | **0,0** | **0,0** |
| A Evolution du patrimoine forestier et Autres stock de Biomasse ligneuse | | -154 870,2 | | | | | | |
| B Conversion de forêts et de prairies | 15 542,6 | | 13,4 | 0,1 | 3,3 | 116,9 | | |
| C Abandon de terres exploitées | | -135 147,2 | | | | | | |
| D Emissions et Absorptions de CO2 par les sols | 40 906,3 | | | | | | | |
| E Autres | SO | SO | SO | SO | SO | SO | | |
| **6 Déchet** | | | **3,2** | **0,0** | **0,0** | **0,0** | **0,0** | **0,0** |
| A Mise en décharge des déchets solides | | | NE | | NE | | NE | |
| B Traitement des eaux usées | | | 3,2 | NE | SO | SO | SO | |
| C Incineration de déchets | | | | | NE | NE | NE | NE |
| D Autres | SO | SO | SO | SO | SO | SO | SO | SO |

*(1) Pour le CO2, la valeur représente le montant estimatif net des émissions (Emissions - Absorptions)*

*SO : Sans Objet*

*NE : Non Estimé*

**(Pour mémoire)**

| **Catégories de sources et de puits de gaz à effet de serre** | Emission de CO2 (Gg) | Absorption de CO2 (Gg) | $CH_4$ (Gg) | $N_2O$ (Gg) | $NO_x$ (Gg) | CO (Gg) | NMVOC (Gg) | $SO_2$ (Gg) |
|---|---|---|---|---|---|---|---|---|
| **Combustibles de soute utilisés dans les transports internationaux** | **80,6** | | **0,0** | **0,0** | **0,0** | **0,0** | **0,0** | **0,0** |
| Transport aérien | 66,0 | | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 |
| Transport maritime | 14,5 | | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 |
| **Emissions de $CO_2$ provenant de la biomasse** | **16 167,6** | | | | | | | |

Concerning the fluorinated gases, HFC emissions were estimated at 0.25 Gg in 2000. These emissions come from the use of HFCs for solvents

As for key sources, as defined in the manuals of the Intergovernmental Panel on Climate Change (IPCC) on GHG inventory, a key source category is a "source category that has a significant effect on the total inventory of greenhouse gas emissions directly from a country as far as the absolute level of emissions, the trend, or both."

The table below shows the key source categories identified for "Energy", "industrial processes", "Agriculture" and "Waste" as well as the related emission estimates. It is worth noting that identification was made according to the "Level 1 method" .

Table. 2 – Key source categories clés

| Sectors | Key Sources | Direct GHG | Identification Criteria | Estimate for 2000 (Gg) | Estimate for 2000 (Gg eq. CO2) |
|---|---|---|---|---|---|
| Agriculture | agricultural soil | N2O | Level, Trend | 54,764 | 16 976,823 |
| Agriculture | Enteric fermentation | CH4 | Level, Trend | 245,837 | 5 162,567 |
| Agriculture | Manure management | N2O | Level, Trend | 11,452 | 3 550,225 |
| Energy | Transportation (combustion) | CO2 | Level | 936,627 | 936,627 |
| Energy | Other sectors (Combustion) | CH4 | Level | 26,900 | 564,894 |
| Agriculture | Rice farming | CH4 | Level, Trend | 24,252 | 509,295 |
| Energy | Power Ind. (Combustion) | CH4 | Trend | 15,047 | 315,987 |
| Agriculture | Savanna controlled fire | CH4 | Tendance | 4,829 | 101,401 |

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Table. 3 - Indirect GHG total emission in the energy sector and the country's total emission. 2000

For indirect greenhouse gases in relation to baseline year 2000, emissions from the energy sector stand out. Indeed, apart from CO, emissions for each type of gas from this sector represent over 80% of the total national emissions. It should be noted that emissions from the sector are mainly due to the fuel combustion in the various activities of the sector.

| Indirect GHG | $NO_x$ | CO | COVNM | $SO_2$ |
|---|---|---|---|---|
| Emissions from the Energy sector (in Gg) | 22,1 | 650,1 | 88,9 | 39,76 |
| Country total emissions (in Gg) | 27,6 | 893,7 | 92,9 | 39,81 |

Regarding carbon monoxide (CO), 72.7% of emissions come from the energy sector. The rest is due to the agriculture and LULUCF with emissions roughly equal in quantity. For these two sectors, emissions come from the "controlled bush fire" in the Agriculture sector while for LULUCF, the conversion of forests and grasslands is source of CO emissions.

Table. 3 - CO emissions by sector (Year 2000)

| Sector | Quantity of CO emission (in Gg) | Percentage |
|---|---|---|
| Energy | 650,1 | 72,7% |
| Industrial processing | 0,0 | 0,0% |
| Agriculture | 126,8 | 14,2% |
| LULUCF | 116,9 | 13,1% |
| Wastes | 0,0 | 0,0% |
| Total | 893,7 | 100,0% |

During 1995-2004, no significant progress could be observed regarding the trend of country total direct GHG emissions; the same can be said about the distributions of emissions in terms of gas and source category: they remain relatively stable.

Regarding the direct GHG emissions (CO2, CH4, N2O), between these two years, a 25%. growth has been recorded. Taking into account the economy growth between these two years, i.e. 29%, we can say that the increase in emissions is slightly lower than that of the economy. However, it should be noted that if these growth rates continue in the coming years, we expect a substantial increase in emissions –because if the annual growth of the economy varied between - 0.1% and 4,6% between the two years, now it remains above 5% / year, and a higher rate is expected as of 2010**.**

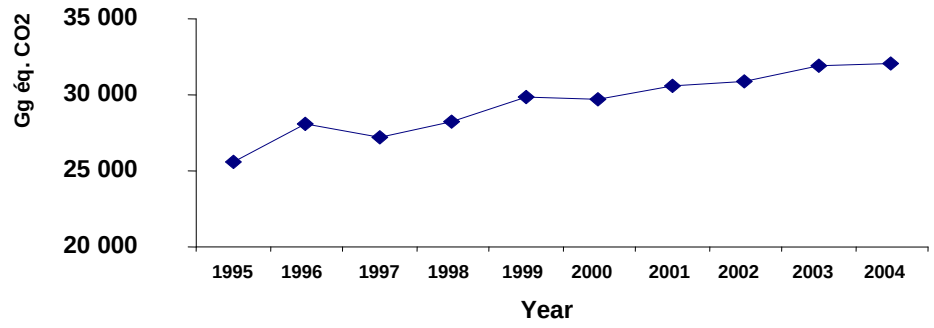
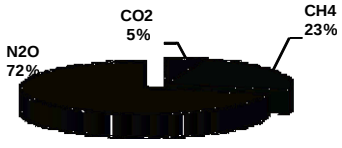
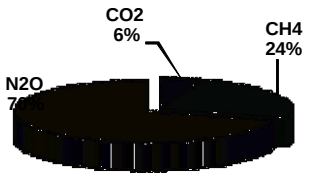



Figure 1 – Evolution of direct GHG emissions




Total des émissions : 25 647,0 Gg équivalent $CO_2$

Figure 2 – Distribution of direct GHGs in 1995




Total des émissions : 32 101,6 Gg équivalent $CO_2$

Figure 3 –Distribution of direct GHGs in 2004

The absorption of CO2 recorded was 233 568.4 Gg in 2000 and experienced an upward trend for the 1995-2000 period But given the various actions conducted under Madagascar current policy in the management, protection, reforestation and afforestation, a net increase in GHG sequestration capacity is to be expected in the coming years**.**

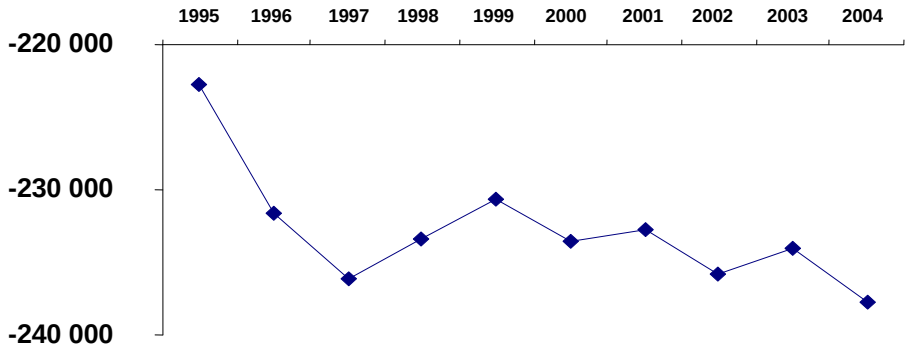



Figure 4 - Evolution of $CO_2$ Absorptions

## 3 – Analysis of GHG mitigation options

As a country which is non Annex I of the United Nations Framework Convention on Climate Change, Madagascar is not obligated to reduce its greenhouse gas emissions (Art. 4 of the Convention). As such, Madagascar plans to undertake mitigation actions that could help improve its economic development and reduce poverty.

The analysis of mitigation options was conducted in five areas including agriculture, forestry, energy, industrial processes and waste management.

### *3.1- Agriculture*

The scenarios considered are analyzed through the two sub-sectors, namely agriculture and livestock. Various gases are emitted by "farming activities". However, only methane is considered in the context of these mitigation measures because of the importance and quantity issued and the traditional farming practice in Madagascar.

It is worth noting that Madagascar agricultural policy is now focused on increasing productivity and expanding the area farmed for food self-sufficiency. This policy does not promote the reduction of GHG emissions in Agriculture

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However, the Government of Madagascar is promoting off-season farming practices They increase the yield in crops other than rice, which will lead to stagnant or reduced greenhouse gas emissions such as CH4 from the rice farming

Other agricultural activities by the Government of Madagascar to help reduce emissions of greenhouse gases include improved seeds and farming practices and techniques
The following options are taken into considerations as mitigation measures:
For breeding:
Ranching in the regions;
Promoting genetically improved breeds (cattle and goats);
Promoting traditional poultry farming;
Considering any agricultural action related to livestock breeding;
Fight against pastureland fire.

In terms of agriculture and in order of decreasing feasibility and capacity to reduce GHG
Technical support and intensive supervision of farming techniques;
Gradual reduction of areas of flooded rice farming and promotion of rainfed rice farming;
Shifting from permanent to intermittent flooding system in order to air the soil in the rice fields;
Reducing organic amendments to a minimum and substituting them with small doses of mineral fertilizers

*3.2- Forest sector*

Mitigation, under the policy of the Ministry of Environment and Forests, is reflected in reforestation effort (Afforestation and Reforestation) and conservation (avoided deforestation). Both scenarios are thus selected in the sector.
The forest sector in these scenarios has used COMAP (Comprehensive Mitigation Assessment Process) , the software suggested by the IPCC, in the preparation of scenarios for mitigating emissions in Madagascar forest sector .

Persuant to the inventories, the key sources identified are: conversion of forests 9 791.4 Gg (representing 60% of emissions in this sector) and conversion of grasslands: 6 512.3 Gg (representing 40% of emissions) . The iideal scenarios are thus those that reduce emissions. These options are as follows:
Reduction of forest conversion and degradation;
Reduction of the conversion of grassland into pastureland and farmland

-. Emissions from conversion of forests can be mitigated by protecting the forests
- Emissions in the conversion of grassland will be mitigated through reforestation

*3.3- Energy sector*

Over the total GHG emissions from the energy sector in 2000, CO2 accounts for most emissions (1 722 Gg), CH4 emissions are estimated at 42 Gg or 888 Gg CO2 eq, and those of N2O at 0,37 Gg or 113 Gg CO2 Eq.
The main contribution to emissions from energy has come from energy industries (production of fossil fuels, electricity and heating) which have provided 34.1% of emissions from energy, transport sector ranking second, with 32.1%.

The current emissions and, in the short term, in the energy sector is not in Madagascar a major threat in terms of GHG emissions. However, measures can be taken for each sub-sector as prevention efforts, namely:

- *Energy Industry*: Efforts to produce power from hydropower are needed
- *Industry*: Energy control schemes can be initiated.
- *Transport*: Substitution of oil-based fuels by biofuels is being developped and needs to be supported. In addition, plans with a view to renewing the rolling stock and for energy efficiency in the sector must be put in place together with rules on the importation of new vehicles.
  *Residential:* Given the harmful effect of GHG emissions on health, especially CO2 and CO, restritive measures would be timely**.**

The anticipated improvements in this sector are

- Promoting the use of biofuels
- Recycling used lubricants
- Developing hydropower
- Promoting alternative sources of renewable energy

- Promoting energy conservation and energy efficiency in all sectors (energy-saving lamps, coupling industry and reforestation industry, behavior changes within the CSI ...)

### *3.4- Industrial process sector*

To reduce greenhouse gases in the industrial process, efforts should focus on CO2 which represents 90.14% of the total emissions
The mitigations proposed are:
ratio clinker / cement reduction by using qualified additions (fly ash). It consists in reducing the proportion of clinker in cement production, that is to say substitute fly ash for part of the clinker in the cement
CO2 sequestration and storage . These concern the CO2 emitted both by decarbonation and by combustion. CO2 is recovered by a duct system and then compressed into specific cylinders
Raising awareness of stakeholders (industrialists and policy makers) to the dangers of the CC, how it impacts the climate, health and the environment

### *3.5- Solid and liquid wastes*

The solid and liquid urban wastes may be sources of GHG emissions depending on their physical and chemical conditions, their management and infrastructures leading to the need for mitigation measures to address climate issues.

#### *Solid wastes*

In Madagascar, there have been no surveys or projects related to mitigation of greenhouse gas emissions from solid wastes. Solid wastes may be composts. However, for composts, the end purpose of waste processing is to get products for soil amendment. This practice can encourage the emission of methane in the atmosphere because of the anaerobic environment .

*Closure of Andralanitra dump site and Clean Development Mechanism in Madagascar*

#### *Liquid wastes*

There is as yet no national program for liquid waste management. It is nevertheless worth noting that some manufacturers have established their individual system of effluent treatment before disposing the effluent into the sewage system. The resulting sludge is often mixed in the city waste or used as spraying in the agriculture according to their quality.

In short, programs for solid or liquid waste may cause greenhouse gas emissions ; they should be geared to the field of economic development and contribute to the mitigation of GHG together with the conditions required. To this end, they must be technically reviewed and practiced on a large scale.

## 4 - Vulnerability and adaptation to CC

During the first national communication, surveys on vulnerability and adaptation to climate change addressed the following areas: public health (malaria), forestry, agriculture (rice), cattle breeding, water resources and coastal areas while the second national communication deals with the same topics but without the livestock sector.; it was replaced by shrimp trawling. The second national communication deals with vanilla chain and sugar cane chain

in addition to rice. As for the health sector, in addition to malaria, acute respiratory and diarrheal diseases are discussed.

With respect to the water sector, the study of vulnerability and adaptation focuses this time on demands and needs while in the first national communication , we considered the rainfall patterns and hydrology basins only. Biodiversity in the forest sector has been added in the second national communication. The coastal area around Mahajanga and Morondava was addressed, whereas in the first national communication, Morondava costal area was the object of the survey. All supplements have been dictated to vary the topics and the regions, and extend the survey areas.

The method used is the one recommended by the IPCC assessment of vulnerability and adaptation to climate change. The use of climate change scenarios and trend analysis have given the following results:

- The predominant climate parameters (rainfall, temperature and relative humidity) will increase in 2025, 2050, in almost all the regions of the country. Tropical cyclones affecting the country will be more intense and will remain in the proportion of 3 to 5 a year. Most of them could pass in the north;
- In public health, acute respiratory diseases would be more common as air pollution will be more important, the prevalence rate of malaria would increase as a result of the disruption of climate barriers, and water-caused diarrheal diseases would also experience an increase due to contaminated water resources**;**
- In the Forest Sector / biodiversity, reduced forest cover and degradation of forest resources would be aggravated, some plant and animal species would disappear and the range of those which would survive would change;
- In agriculture (rice, vanilla, cane sugar sectors): yields (rice and sugar cane) will decline due to water stress and parasite development;
- the Increased intensity of tropical cyclones could aggravate the decline of vanilla production and cause loss of revenue for operators;
- The shrimp fishermen's livelihood would become more difficult mangrove areas in the north and north - west; will be flooded as a result of the rise in sea levels;
- needs in water will still be met even in summer (November-April), the water treatment would be more costly (pollution), the biophysical status of rivers and lakes would be affectedduring the dry season, water needs will increase, water management will be more difficult and water conflicts may arise.;
- A portion of the Morondava and Mahajanga coastal areas would disappear from the map in 2100 because the average sea level elevation would be 7.4 mm per year.

The adaptation consists in strengthening the management capacity of the natural resources available (forests / biodiversity, water, soil, fisheries). The protection system for coastal areas against erosion and tropical cyclones should be improved. Information, awareness and public education at all levels should be strengthened as well as prevented in view of the detrimental effects of climate variability and change. These operations should be the primary components of the fight against poverty and the improvement of the population's livelihood**.**

5 - Other relevant information in order to achieve the objective of the Convention

In addition to the information mentioned above, other relevant information is identified to achieve the objective of the UNFCCC. They mainly focus on integrating climate change into sector-based policies, education, capacity building and public awareness, research and systematic observation, transfer of technology and, dissemination of information and networking initiatives in relation to climate change.

Regarding the integration of climate change in sectoral policies, a number of measures have been identified, but the implementation is an issue.
as the measures identified need adapting .Madagascar is putting forward the following measures to promote the integration of climate change policies and national development programs,.

- Improving the "IEC" system by giving more consideration to climate change issues;
- Heightened sensitisation at all levels in order to achieve a better understanding and consideration of the climate change issue;
- Building the capacity of technical staff so that climate change issues are integrated in their respective sectors;
- Specific provisions related to climate change issues in the various environment regulations (MECIE, Environment Code, Law on Waste Management etc. ..);
- Strengthening integration provisions in the various development strategies so that they do take into account of climate change issues (MAP PADR, SNGRC etc ...) and provide for new strategies (new Environmental Action Plan etc ...).

The implementation of Article 6 of the UNFCCC which advocates education, training and raising the public awareness on climate change, is an area that is new, complex and cross-cutting. Nevertheless, the country has already invested efforts to the limit of its technical and economic capacities

In education, Madagascar already has an education policy on the environment or PERE whose implementation is co-piloted by three ministries in charge respectively of the Environment, Education and Population. The National Strategy for Information, Education and Environmental Communication (SNIECE), is currently under discussion
The Ministry of the Environment is currently taking care of Education on Climate Change; they keep on developping various forms of cooperation with other departments, with a few university departments and even some programs or projects that could contribute, directly or indirectly, to the establishment of an appropriate structure. In addition, they also promote such education system, among others, l'Ecole Supérieure des Sciences Agronomiques ou ESSA (University School for Agricultural Sciences), Madagascar National ParK, ACCA/Madagascar, Conservation Internationale, WWF, GTZ and even , and even the World Bank. The development program set out in 'Madagascar Action Plan' (MAP) sees education as a leverage to the Program, now when the Government seeks to improve the education system in the country. Currently, the reflection on the National Strategy on information, education and environmental communication in Madagascar is underway. Last, an agreement for research cooperation in the field of climate change has been signed between the University of Antananarivo and the University of Stockholm, Sweden. The establishment of a policy and an appropriate structure for education on climate change is therefore possible
Several building capacity initiatives have been undertaken for national experts and the members of the National Committee. as well as regional development actors from the public and private sector, and NGOs, These actions fall under the development of national communications as part of the national strategy for implementation of the Clean Development Mechanism
. .
On the other hand, Madagascar has ceased to take part in various training sessions initiated and organized by IPCC. But given the emergency and to avoid being limited to the level of superstructure, it would be better to consider two categories of training on climate change: a) management: staff training and b) mass education after which leaders and employees could achieve a better and easier mutual understand in the various development activities that take account of the climate change dimension**.**

With respect to sensitisation, efforts are focused on various aspects in the UNFCCC implementation and its Kyoto Protocol (a national communication, NAPA and CDM). The three-year campaigns in different regions have helped to show that the public level of

understanding the climate change phenomenon (policy makers, technicians, development actors) is not sufficient but it could improve through the different activity programs or measures taken to address the CC detrimental effects. The technical and financial support is required to conduct appropriate sensitization of Madagascar population of which 85% are farmers.

The General Directorate of Meteorology (DGM) is in charge of research and climate systematic observations and the effects of climate It operates a network of synoptic and climatic stations distributed in different parts of the Island. The results of these observations are processed to meet the customers needs in different sectors of the country's socio-economic activities (transport, agriculture, weather forecast, tourism, etc. Madagascar also participates in the World Weather Watch (WWW) and assists in monitoring climate change in the Indian Ocean Region. Other agencies and departments are also conducting research indirectly related to adaptation to climate change. Examples include, but are not limited to, the National Center for Environmental Research or CNRE, the National Center for Agricultural Research for Rural Development or FOFIFA, the National Institute for Nuclear Science and Technology or INSTN, the National Center for Industrial Research and Technology or CNRIT and Departments at the University.

Research and Systematic Observations in Madagascar deserve to be financially supported and technically strengthened through International Cooperation.

In terms of technology transfer, it should be noted that four additional sectors (construction, energy, industry and transport) have been added to the five areas already addressed in the first national communication (agriculture and livestock, public health, forestry, resources water, coastal areas)

In Madagascar, in the absence of alternatives or environmentally sound technology, endogenous technologies are still used to fight poverty, in particular by certain categories of people who live largely on natural resources. In general, these technologies are essentially founded on a socio-cultural basis closely linked with customs and traditions. The current trend is seeking to reject traditional practices without having free access to modern scientific technologies as the latter are far too expensive for developing countries and even more so for a LDC such as Madagascar.

While many technologies meet the needs of rapid development but not those of sustainable development, other technologies have the qualities of the others combined together (adapted, responding to rapid and sustainable development) but more often than not, they are not accessible or achievable as they require very important technical and financial ressources. .It is therefore important to ensure that Madagascar has endogenous transferable technologies that both meet national needs and respond to global priorities, in order to enable the country to contribute to achieving the ultimate objective of the UNFCCC. To this end, Madagascar would need technical and financial assistance from the international development institutions and networks, e.g equipments adapted to the country.

The public has access to different forms of information on climate change, on the one hand. On the other, the international treaties relating thereto have been communicated to raise awareness among the country's various official institutions (Parliament, Government, Directorates and departments in the ministries). From a practical point of view, the information is disseminated through various activities initiated by the Ministry of Environment, such as training at different levels, sensitisation of entities concerned, celebration of World Day for Environment, dialogues during work sessions, workshops and meetings, press conferences and publications in the media, and even video conferences organised by promoters and / or donors.

. Moreover, environmental information centers are set up. They develop different items (leaflets, magazines, posters and other documents) in conjunction with national and / or regional FM radio stations and television networks
However, IT network is still underdeveloped: the Ministry is connected with the appropriate enforcement agencies' sites only. As result of this absence of connection between departments, the climate change issue as a subject remains a major problem to be solved . Meanwhile, e-mail is the most developed system of all the NTIC existing in Madagascar..

6 - Constraints and difficulties encountered, financial, technical needs and capacity building

The analysis conducted by national experts during the preparation of the second national communication, has helped to identify and classify the constraints, challenges and gaps identified into two categories: 1) constraints, challenges and gaps related to the preparation of the National Papers and 2) those related to the development of activities and programs for the implementation of the Convention

The quality of future National communications under the Convention on Climate Change depends on the conditions for collecting and processing the data and the information gathered from the documentation in the priority sectors. If these conditions are not favorable and far from satisfactory, preparing them will be humpered by inadequate or missing data and by information that is not available and not accessible. The data are scattered in different departments across the country. In some cases, they are not representative and many gaps are noted**.**
In some sectors, the main difficulties relate primarily to the lack of data on measurements of carbon emissions and use of emission factors that are not country-specific or default values that are not representative of the country's situation. Whereas in other sectors, we note that national statistics do not take into account the different types of a given product and often relate to the total annual product, all types taken together. In such case, it can be explained that, for confidentiality reasons, the data are not accessible.

These findings have been raised by all national experts who have studied the various components including the national inventory of greenhouse gas emissions, the study of vulnerability and adaptation, mitigation options analysis and studies on transfer of technology and research / systematic observation.This inadequacy or failure is due to discontinued and inexploitable data collected at the documentation centers, to the fact that the sector has been and is being restructured, to irregular observations, archaic collection systems, treatment and transfer of observations (stations not being automated ).

The problem caused by lack of mainstreaming in the climate change dimension in the current education system is also key to education, training and public awareness. It is compounded by the lack of involvement of public media professionals who specialize in environmental communication. This problem is due to inadequate or missing capacity building program for the staff of the department in charge of national education in matter of environment and climate change.

Institutional arrangements: One of the problems is the shortage of human resources in the supervising ministry, while language communication difficulties stand out first and foremost in matter of relations with international support organisations

.As for the use of models and methods recommended by the IPCC, the experts have had great difficulties in operating them because the data available do not meet either the quality or the quantity requirements of models (case of PRECIS for Climate scenarios, Forest Gap and Holdridge for the sector of forestry and biodiversity, DSAT for agriculture, WATBAL for water ...)....

Regarding the activities and programs for the implementation of the Convention on Climate Change, the constraints, challenges and gaps are technical and financial; they vary according to national priorities, depend on the form of collaboration with the French Fund for World Environment implementing agencies and other supporting bodires. Thus, capacity building must to deal with these constraints and difficulties need to be addressed in order to improve the preparation of future national communications. To this end, technical,and financial support is required, including capacity building in the development of emission factors, the use of models, estimation of uncertainties, provision of technical and financial resources, establishment of an effective coordination structure at the national level and good organization and planning at the level of international support organisations (with a view to efficient processing and to submitting timely records and queries ).

National programs (Public Investment Programme) and international programs ( Fund for the Global Environment Facility, or bilateral programs - with France, the United States, Germany, Switzerland and Japan) and other multilateral and bilateral programs and activities (World Bank, African Development Bank (ADB), European Union, the French Fund for World Environment (FFEM) and the Global Environment Facility (GEF), implemented in Madagascar, have already contributed to the identification of specific needs for financial resources and technical means. However, this contribution should be increased for it to become an effective tool and improve the preparation of national communications and implement the Convention on Climate Change.

The implementation of measures related to increasing PIP in the environment and climate change areas is an opportunity for effective compliance with the country's commitments vis-à-vis UNFCCC**.**