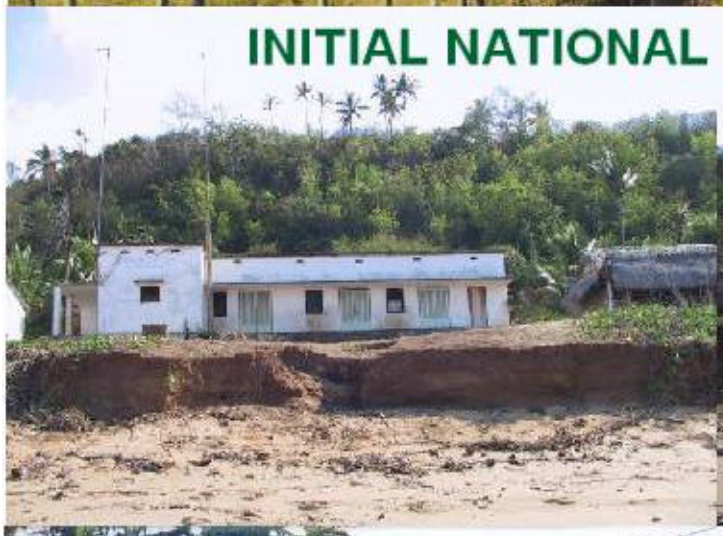
UNION DES COMORES

Unity - Solidarity - Development

United Nations Framework Convention on Climate Change

INITIAL NATIONAL COMMUNICATION



December 2002

Union des Comores

Unity – Solidarity – Development

Ministry of Development, Infrastructures, Post and Telecommunications and International Transports

General Directorate of Environment

United Nations Framework Convention on Climate Change

Initial National Communication On Climate Change

Executive Summary

December 2002

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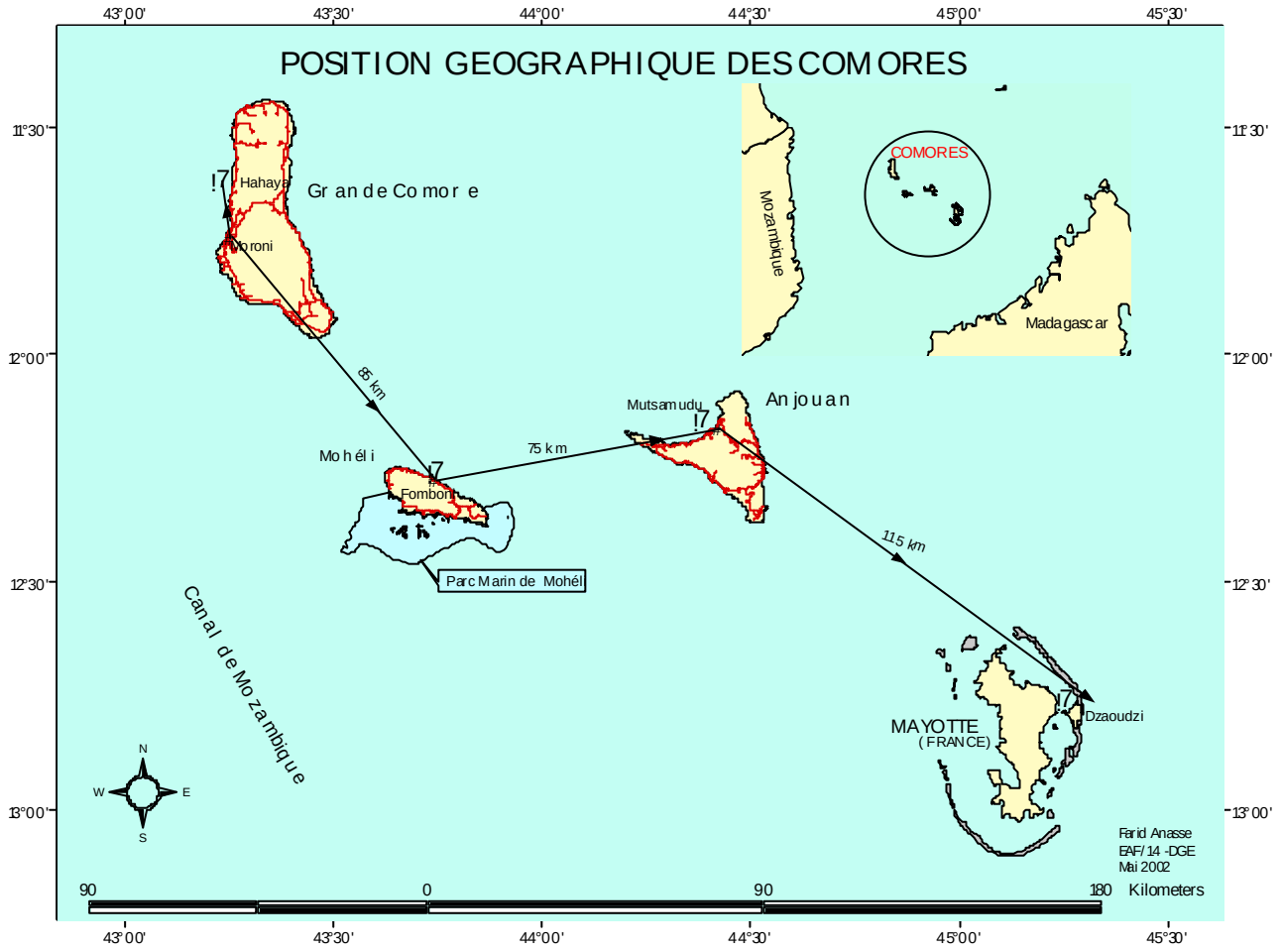
POSITION GEOGRAPHIQUE DES COMORES
43°00'
43°30'
44°00'
44°30'
45°00'
45°30'
11°30'
12°00'
12°30'
13°00'
Grande Comore
Hahaya
Moroni
85 km
Mohéli
Fomboni
Parc Marin de Mohéli
75 km
Mutsamudu
Anjouan
115 km
MAYOTTE
(FRANCE)
Dzaoudzi
Canal de Mozambique
Mozambique
COMORES
Madagascar
N
W
E
S
90
0
90
180
Kilometers
Farid Anasse
EAF/14 -DGE
Mai 2002

1.0 Introduction

The studies made in the context of this Initial National Communication on Climate Change are based on the findings of the Intergovernmental Panel on Climate Change (IPCC) [1] study on impacts and adaptation of Indian Ocean small island states. Changes in climate to be anticipated in Comoros by year 2050 are estimated to be a raise in mean annual air temperature to an average of 28°C, a change that represents a 1°C increase compared to the current situation. A sea level increase of 4 mm/year for a total increase of 20 cm by 2050 is also expected.

Expected impacts are the intrusion of salted water in the coastal aquifers; an increase in the occurrence of malaria and of collective food poisoning resulting from consumption of marine animals [2]; a decrease in crop yields, agricultural production and fisheries; the displacement of 10% of the country's coastal inhabitants whose habitat would be flooded; and lastly, the destruction of coastal infrastructure and habitat for an estimated value of 400 million USD, 2.2 times Comoros Gross Domestic product (GDP) for 2001.

Vulnerability and adaptation assessment studies were made for agriculture, coastal infrastructure and resources, health, and water.

2.0 National circumstances

The archipelago of Comoros comprises four islands: Grande Comore, Anjouan, Moheli and Mayotte. In spite of the country's access to independence in 1975, Mayotte remained under French administration and is not accounted for in Comoros National Initial Communication. The country is located in the north access of the Channel of Mozambique in Indian Ocean, on the shipping line of the giant tankers that carry crude from the Middle East to Europe and North America. Total land area is 1861 km^2.

Located at equal distance between Madagascar and the African continent (300 km), the islands are separated by deep oceanic trenches, 30 to 40 km wide. The islands are of volcanic origin and the last eruption on Grande Comore dates back to 1977.

2.1 Climate

The country has a tropical humid climate. During the warm season or rainy season (mid-November to mid-April), the average air temperature is 27°C, with highs between 31 and 35°C and lows around 23°C. The temperature during the colder season, from June to September averages 23 to 24°C. Highs are around 28°C and lows are 4 to 5°C lover than those of the warm season.

Mean annual rainfall for the islands is 1000 mm. In Grande Comore it varies between 1398 mm and 5888 mm, in Anjouan between 1371 mm and 3000 mm, and in Moheli between 1187 mm and 3063 mm. Comoros is known for its many microclimates.

2.2 Population

The Comoros islands were populated by waves of migrants from the Persian Gulf and East Africa, and in later times were enriched by population exchanges with Madagascar.

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[1] IPCC, 2001 in « Assessments of Impacts and Adaptations to Climate Change (AIACC/START/TWAS), AIACC Research Project – Indian Ocean, April 9, 2002». IPCC, 2001

[2] Intoxication par la consommation d'animaux marins (ICAM)

The population was 572 000 habitants in 2002. Population mean density for the three islands was 285 inhabitants per square kilometre, but it varied from one island to another. Half of the population lives in the coastal areas. The population is young: about 56% of the people are less than 20 years of age. The last population census (1991) shows a national fertility rate of 7 children per female. It is estimated that 35% of the population lives abroad. Projections estimate the population to be 1 583 996 inhabitants in 2050, a national density of 862 inhabitants per Km², four times the density of 1991.

2.3 Economy

The national economy is dominated by agriculture. The primary sector accounts for 41% of the GDP and three crops (vanilla, ylang-ylang and clove) for 90% of total country's export. The secondary sector constitutes less than 5% of the GDP. Over the past 70 years, the tertiary sector grew from 33% to 48% of the country's GDP. It mostly comprises the trade of imported goods, which contribute to the deficit of the country's balance of payment. It is estimated that 50% of the population lives in absolute poverty.

2.4 Energy

The profile of Comoros' energy supply is dominated by fuel-wood (78%) and petroleum products (22%). Wood is collected by hand, by individual households, which use it as their primary source of energy. It is also used in the distilleries of ylang-ylang, resulting in overall depletion. At a national scale, the harvest is smaller than tree growth.

Petrol and diesel products are imported and used for transportation (fuel) and in the diesel electric stations. Electricity in the Comoros is essentially produced by diesel generators.

2.5 Water and waste

The water problem in Comoros is two-fold: access and quality. The islands of Anjouan and Moheli traditionally relied on surface water supply. In Anjouan, where forest clearing is paramount, there used to be over 40 rivers to supply the island population with water. Today, there are fewer than 20 rivers left. In Moheli, where some 20 rivers can be accounted for, surface water dries up during the warm season. In Grande Comore, 60% of the population relies on uncovered water containers and 40% on coastal aquifers.

Coastal aquifers constitute the main underground water of Grande Comore. They rest on salted water, and their salt content varies from 2gr/litre to 6gr/litre, depending on the distance between the well and shore and/or sea level, which influences their overall salinity.

Comoros has no waste management system. Waste is dispersed along the seashore and in the vicinity of the various villages and cities. The open dumps that can be seen along the roads in the coastal areas are ideal sites for the potential development of vectors of infectious diseases and vermin. They also constitute a source of contamination for underground water and, once carried to the sea by heavy rainfall, can smother the corals.

2.6 Farming and livestock

Four different farming systems are found in the Comoros: the open field culture, traditional agroforestery, food production under natural forests and monoculture.

Open field culture is used for annual crops with very little or no associated trees. Fields are farmed from year to year without any crop rotation, ploughing, and intake of organic matters, and are sensitive to erosion. This system is currently expanding in Moheli and Anjouan because of the pressure for food. The traditional agroforestery system associates the production of food crop and fruit stocks in the same lot. It is a highly stable system that features a permanent vegetation cover of the soils and maximizes the use of space. The food production under a

natural forest system is the typical encroachment of the forests by farming. In most cases, banana trees and a tuber crop such as yam are planted in a natural forest, under the tallest trees. The system first appears stable but soon, under demographic pressure, evolves towards the gradual deforestation of the area. Many species of trees, some of them endemic, are threatened by that system.

Although less frequently found, the Comoros host a *monoculture* system used for the intensive culture of coconut grove, clove and ylang-ylang.

Table 1 : Type of farming system, by island, per number of hectares (1987)

Island	Open field culture	Traditional agroforestery	Farming under natural forest	Monoculture	Total
Grande Comore	----	17 446	10 083	583	28 112
Anjouan	7 251	13 428	6 118	1 964	28 761
Moheli	38	7 741	1 904	299	9 982
Total	7 289	38 615	18 105	2 846	66 855

Source AGRAR-UND HYDROTECHNIK, RFIC

Food production meets 49% of national population needs. Agriculture in Comoros faces constraints linked to it's the extreme fragility of the soil (the islands are young and soil cover is almost non-existent), as well as erosion and an overall decrease in soil fertility. Its highly complex land tenure system resulting from the co-existence of various systems of law (traditional, muslim and colonial), constitute a major obstacle to agricultural land reclamation.

Livestock resource in Comoros is only marginal. Output of livestock commodities is beef, goat, sheep and chicken. There are no grazing fields as such in the country. Local cattle production does not meet the national demand and around 2000 tons/year of meat are imported. The semi-intensive poultry industry yields a good production and supplies the demand for eggs, but chicken meat is still imported.

2.7 Coastal zone and fisheries

Mangroves cover roughly 215 hectares of the coastal areas. Negative impacts of more frequent storm surges, decreased salinity during high intensity rainfall events and increased coastal erosion are likely. The reef is young and constitutes a narrow platform around the islands. Reefs are highly vulnerable to the climate change scenarios predicted. More frequent and higher intensity cyclones will cause physical disturbance to reef systems. The situation is further aggravated by coastal erosion and waste in the coastal areas. Water eutrophication smothers the coral while coral death and bleaching, caused by raised sea-surface temperature, result in the pullulating of toxic algae responsible for collective intoxication by consumption of marine animals.

The islands feature many sandy beaches but the limited availability of concrete building material results in the use of sand from the beaches, in spite of a law that prohibits it. Pollution and the over-fishing of species that feed on them threaten sea grass beds. Comoros waters are host to a rare endangered species of universal interest. The coelacanth (*latimeria chalumnae*) is a 350 million year old fossil fish that lives in the Comoros coastal zone. The island of Moheli is also the most important nesting area for sea turtles in the Indian Ocean. These rare marine species are threatened by beach degradation, diminution of sea grass beds and poaching.

Comoros has an interesting potential in fisheries. While its continental shelf is narrow (900 km^2), the country's Economic Exclusive Zone (EEZ) covers 160 000 km^2 and is very little exploited. The number of fishermen has been on the increase since 1993 when it was estimated to be 8000. Most fishing units are restricted to the coastal areas, hence providing for intense pressure on coastal pelagic species. Comoros has no offshore industrial tuna fishery.

Its tuna resources are the object of international fishing agreements and are exploited by distant fishing nations. It contributes only remotely to the development of the country.

Most cities are located in the coastal areas of the three islands. It is also where 41% of the country's population lives. Most infrastructures (ports, airports, diesel electric stations, petroleum depots, major roads, monuments, canal dykes and embankments) are built near the ocean, most of them at less then 6 meters above sea level. Their upkeep is expensive and important degradations of shore protection are already noticeable.

3.0 National Greenhouse Gas (GHG) Inventory

The five emission sectors/categories that are considered in this report are: *Land-Use Change and Forestry, Agriculture, Energy, Waste,* and *Industrial Process Sectors*. The national inventory was conducted according to the methodology developed by the IPCC, and the values reported have been calculated using the Revised 1996 IPCC methodology. The directives for Non-annex 1 countries recommend accepting only the contribution to the radiation effect of the direct greenhouse gases (GHG), carbon dioxide (CO_2), methane (CH4), and nitrous oxide (N_2O), for the base year 1994. Emissions of carbon monoxide (CO) and Non Methane Volatile Organic Compounds (NMVOC) are included in the Comoros inventory. The emissions from sources and uptakes by sinks are converted to CO_2 equivalents (CO_2-Eq).

In order to assess Comoros net GHG emissions, we accounted for the uptakes by sinks for the same year. The difference between emissions and uptakes gives the following national inventory results.

Comoros' emissions of GHG in 1994 = 1 315 888 tons CO_2-Eq - corresponding to mean emission per inhabitant of 2.63 tons CO_2-Eq

CO_2	**835 757 tons**
CH4	**73 660 tons**
N_2O	**406 471**

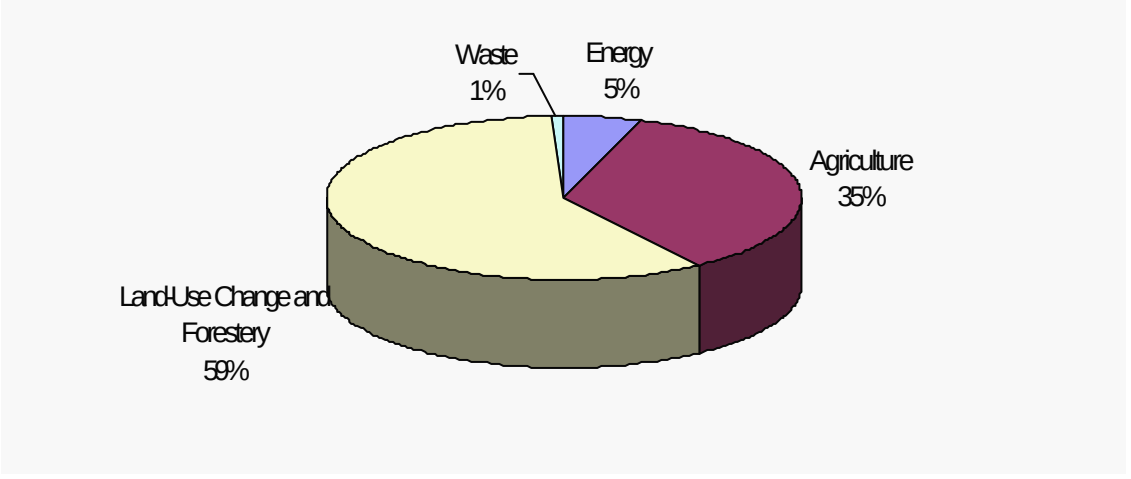
National uptakes of GHG by sinks, in 1994 = - 1 670 566 tons CO_2-Eq

Net balance = - 354 678 tons CO_2-Eq

Related to the country's population of 500,000 inhabitants in 1994, result is a mean net uptake of 0.71 tons CO_2-Eq per inhabitant (-354 678 / 500 000 = -0.71)

The analysis of emissions per source shows the predominance of the *Land-Use Change and Forestry Sector* that constitute the main source of emissions with 775 454 tons CO_2-Eq, followed by *Agriculture* 459 957 tons CO_2-Eq, E*nergy* 70 524 tons CO_2-Eq and *Waste* 9 963 tons CO_2-Eq.

Emissions by sources, in tons E-CO_2



The analysis of emissions by gas shows that the carbon dioxide (CO_2) is by far the most important GHG in Comoros, with 835 757 tons, ahead of the other direct radiation effect GHG: CH_4 (73 660 tons CO_2-Eq) and N_2O (406 471 tons CO_2-Eq). Other GHG included in the inventory are carbon monoxide (CO), which accounts for 4 445 tons CO_2-Eq, and nitrous oxide NOx at 140 tons CO_2-Eq.

Emissions from the *Land-Use Change and Forestry Sector* are 765,233 tons CO_2-Eq and represents 59% of the country's total emissions of CO_2 . Land clearing, slash-and-burn cultivation, absence of crop/land rotation and forest converted to cropland are the main activities resulting in emissions.

GHG emissions from the *Energy Sector* result from the use of fuel-wood by households and distilleries, and of petroleum products in transportation and for the production of electricity. Emissions of carbon dioxide CO_2 (70 524 tons CO_2-Eq) accounts for 8% of total national emissions of CO_2 (835 756 tons). This low contribution reflects the little industrialization of the country and absence of steady scheduled international airline services to the archipelago.

Emissions of GHG from the *Agriculture Sector* amount to 459 947 tons CO_2-Eq, which represents 35% of the country's total emissions. Those emissions are generated by enteric fermentation, on-site burning of plant detritus and cultivated soils.

In the Comoros, emissions from solid waste landfills and human sewage are generally not covered with soil so they do not generate methane. It explains why emissions from the *Waste Sector* total only 9 963 tons CO_2-Eq and account for 1% of national emissions.

Total CO_2 emissions of GHG from the *Industrial Process Sector* result from the chemical reactions linked to production processes. In Comoros, it consists of non-significant emissions of Non Methane Volatile Organic Compounds (NMVOC) totalling 7 140 tons CO_2-Eq generated by the paving of roads and bakeries.

Anthropogenic activities that modify land-use can either lead to emissions or sequestering of carbon dioxide, depending of the use that is made of disturbed soil. When cleared-land is used for agriculture, it becomes a sink of carbon. In Comoros, the estimated uptake of CO_2 resulting from the use of disturbed soil for agriculture is - 264 477 tons CO_2-Eq. The sequestering power of the country's total biomass is estimated to be - 1 406 090 tons CO_2-Eq, for a total up-take of - 1 670 567 tons CO_2-Eq.

Difficulties encountered in the inventory were due to lack of national data. Also to the recommended IPCC methodology that do not enough account for native species of plants.

4.0 Mitigation options

The analysis of carbon dioxide emissions sources and sinks suggests that mitigation actions in the *Energy Sector* would contribute to reduce Comoros' GHG emissions. Alternatives to the use of fossil fuel resources are the hydroelectricity, solar energy, wind energy and geothermal energy.

A study of Anjouan et Moheli[3] main rivers conducted in 1989 showed that in Anjouan, a hydroelectricity development on river Tatinga, that has a potential hydropower of 3000 kW, could cover the demand for electricity of the island for the coming years. In Moheli two hydroelectricity developments could be made, a first one on river Ouamlémbéni and a second one on river Deoua. The Comoros are an ideal site for the use of solar energy. It is mostly

[3] SOGREAH. Ressources en eau et potentiel hydroélectrique; étude hydrologique. Comores, 1986.

sunny all year long. The greatest constraint to the development of solar energy is its initial cost. The use of wind energy requires minimum wind power that constitutes an absolute threshold for feasibility. Data on annual mean wind power on the islands are currently not available.

In Grande Comore, advanced studies must be conducted before any geothermal energy development can be considered. In the case where studies are positive about the geothermal potential of the island, exploitation could be envisaged to begin in 2020 [4]. One geothermal deposit would provide enough energy to supply half of the Grande Comore demand of 2020.

Scenarios in which GHG emissions are reduced or mitigated relative to a baseline case (1999) were analysed for the *Energy Sector* for the year 2050. Analysis of the results demonstrates that the development of photovoltaic energy and wind energy would contribute to reduce emissions in Grande Comore by 12%, in Moheli by 86% and 33% in Anjouan, for a total national reduction in GHG emissions of 17%.

Decision-makers must assess mitigation options against each island's unique potential and specificities. The island of Moheli known for its windy shores seems to offers the best prospect for the development of wind energy. In Grande Comore, solar energy combined with the long-term development of geothermal energy could be envisaged, while hydroelectricity appears highly feasible in Anjouan.

5.0 Vulnerability studies

5.1 Agriculture

It is expected that the increase in air temperature combined with high intensity rainfall events would contribute to accelerate the process of soil erosion in Comoros. The main consequence would be a decrease in agricultural production. It should be noted that low intensity rainfall during the dry season would have the same impact on agriculture as heavier rainfall during the rainy season.

Crops cultivated in the open field system would be the most vulnerable to climate changes given the typical lack of vegetation and forest cover of that system of production. The systems that feature mixed cropping (traditional agroforestery and culture under natural forest) would resist climate changes better than monocultures and the open field cultural system.

The small coastal plains where monocultures are found will be threatened by underground and surface salt-water intrusion. The monoculture of coconut palm trees and ylang-ylang are found in the coastal plains, while clove and vanilla grow in the lowland areas. Given their economic importance, the global impact of any loss of earnings resulting from a decrease in production and export, even partial, would cause a serious prejudice to the country's economy.

Farm businesses will be damage-prone to the proliferation of plant diseases resulting from changes in climatic conditions. The incidence of most plant diseases and pest breeding is stimulated by heavy rainfall and extended periods of draught.

Other factors of vulnerability of the Comorian farm businesses are the small size of the units (0.25 to 2.00 hectares) and their lack of equipment (mostly hoes and bush knifes or machetes), which do not make their adaptation to change any easier. The use of agricultural inputs is very small. Most farming is done without the use of any fertilizers or phyto sanitary products.

Adaptation measures to cope with adverse impacts of climate change on Agricultural production are: (1) improving and changing management practices and techniques, (2) managing soil fertility and fighting against plant diseases and agricultural pests, (3) using agrometeorologic information in decision making and agricultural calendars, and optimizing the

[4] Studies required to assess the geothermal potential must be repeated over a number of years.

existence of micro-climate in agricultural production, (4) increasing agricultural production, (5) adopting suitable crop varieties, and (6) providing financial assistance to farming businesses, and promoting small rural irrigation agriculture infrastructure.

5.2 Coastal zone

Estimated rise of sea level would result in the flooding of 734 hectares of low-lying coastal areas on the islands. All infrastructure and fixed assets located in the coastal areas would be affected by the expected increase. Sea level rise anticipated could at time be accompanied by storm surges and cyclones and by earthquake flood. Coastal populations would be greatly exposed.

Projections based on expected population growth estimate that 65% of the country's total population will be living in coastal areas and low lying lands by 2050. Based on available information, the cost of the destruction of coastal infrastructure and assets directly caused by climate changes is estimated to be 400 million USD in 2050, 2.2 times the country's GDP for 2001.

Coral reef systems would be vulnerable to the bleaching caused by the increase of sea-surface temperature, coastal pollution and a break in the zooxanthellae/polyp link critical to coral survival. In 1998 in the Indian Ocean, a 1 to 1.5°C[5] rise of sea-surface temperature caused the bleaching and death of 60% the coral. Coral reefs are important sources of economic and subsistence resources in the Comoros since coastal fisheries are essentially reefal. Death of the reefs would be highly detrimental to the population's food security.

Various technological and institutional mechanisms provide a means for the government of Comoros to minimise the impacts of climate change and sea level rise on the coastal areas.

Institutional mechanisms: (1) the development of an institution or program specialized in data collection, modeling of storm surge zones, and monitoring of climate change impacts, (2) the integration of environmental policies related to climate change into economic planning, and (3) the development of land use planning mechanisms, including the development of a coastal zone management program.

Technological mechanisms: (1) the use of building material that can withstand cyclone and high intensity rainfall to replace sod and straw traditionally used in habitats, (2) the building of flood control structures, breakwaters and dykes to protect the country's key infrastructure (power plants, ports, fuel tanks, airports), (3) the building of alternative roads in-land, and (4) the development of national disaster preparedness program to assist the population in case of natural disasters.

5.3 Water

Water resources are already stressed on the islands of Comoros and are vulnerable to negative impacts under GHG scenarios. Supply of water is currently insufficient to meet population needs. The situation is expected to further deteriorate in the future. Current demand is 28 600m^3/day. It will be 46 498 m^3/day in 2025 and 79 200 m^3/day in 2050. If maintained at a constant (2003) the offer will be 6501m^3/day in 2025 and 2050.

Already scarce, water supply in Grande Comore and Moheli is threatened by the fragile equilibrium between fresh water/salted water, potential contamination of underground water by the septic tanks that are buried deep into the ground; sub-standard equipment and insufficient number of water pumps in Grande Comore; and decrease in the number of rivers and overall quality of ground water in Anjouan and Moheli.

[5] Due to El Nino.

The increase of air temperature could bring an increase in evapotranspiration and negatively impact long-term underground water supply. The over-exploitation of underground water and coastal aquifers could easily undermine the equilibrium fresh water/salted water. Sea level rise would also contribute to the disequilibria. The impact of tides on underground water results in change in water salt content. Specific sectoral adaptation strategies include:

Institutional measures: (1) monitoring and improving management of demand for water, (2) monitoring and measuring underground water and ground water piezometry levels, and (3) acting to promote water conservation and awareness of the importance of water resource management.

Technical measures: (1) improved management and maintenance of water supply networks, (2) watershed management and reforestation, and (3) expansion of rainwater storage capacity.

5.4 Health

Health problems most likely to be aggravated by climate changes are malaria and collective food poisoning resulting from consumption of marine animals. Increases in the incidence of both problems are to be expected.

Malaria is endemic in Comoros and ranks first among health problems that require medical advice and follow-up. Malaria transmission is known to be sensitive to both temperature and rainfall. A global rise in temperature would increase vector capacity of the Anophele gambiae (the mosquito that carries the parasite), traditionally confined to lowland areas. Villages located in the high lands, which have so far been spared by their colder temperature, would then be infested. Improved survival of the mosquito would also extend the traditionally seasonal pattern of outbreaks to yearlong infestation.

Likely increase in the incidence of cyclones, storms and flooding would cause the destruction of 17 health centres and 35 nursing stations.

Collective food poisoning resulting from consumption of marine animals would considerably increase. Rise in sea-surface water would cause major coral death that would result in pullulating of toxic algae that causes the intoxication. Several cases of collective food poisoning by consumption of marine animals have been witnessed in Comoros and elsewhere in the Indian Ocean in the past. It is estimated that over 200 coastal communities would be exposed to the danger.

In order to diminish the risks on the population's health, actions must be taken now. It is imperative to diminish morbidity and mortality caused by vector born diseases to the lowest possible rates, so that by the year 2050 they do not constitute any public health concern.

Measures to decrease the risks linked to collective food poisoning by consumption of marine animals include epidemiological surveillance, the monitoring of oceanographic changes and of coral health, and the training of medical care providers.

6.0 Education, Training and Public Awareness

Initiatives have been taken to raise the environmental awareness level of students and teachers. Programs in secondary schools include a small program on ecology.

The project Biodiversity Conservation and Sustainable Development in Comoros UNDP/ GEF/G32 regularly produces environmental education documents on marine ecosystems and flora, and islands' forests and wildlife. It also organized various workshops for environmental

associations (Ulangas) in villages located in the Marine Park of Moheli. The park's eco-guards and guides attended the workshops and were also trained by the Association d'Intervention pour le Développement et l'Environnement (NGO AIDE) on coral reef health monitoring.

Formal workshops on GHG inventory, vulnerability and adaptation were organized for the national team of experts on climate change.

Religious leaders, community traditional leaders, Ulanga associations, environmental NGOs as well as state employees working in environment could all contribute to public awareness campaigns on climate change. Religious leaders and community traditional leaders in particular are highly respected and could be used to transmit information to the most remote villages.

The subject matter is new to Comoros and Comorians know little about climate change in general, which impedes efforts to raise public awareness. Awareness of climate change impacts and possible mitigation and adaptation solutions at all levels of development must be promoted among decision-makers and stakeholders in particular. Once a sufficient level of information is available, larger public awareness campaigns could be organized.

7.0 Actions taken in Support of the Convention

In addition to its efforts to fulfill its obligations to the United Nations Framework Convention on Climate Change, the country has a number of environmental policies, programs and action plans already in place that can directly or indirectly contributes to the objectives of the Climate Convention.

7.1 Institutional and legal frameworks

The Department of Environment (Direction Générale de l'Environnement - DGE) is the focal point for the Convention. It is also in the Department of Environment that all environmental projects implemented in the Comoros are based. Two research institutes, the National Institute for Research on Agriculture, Fisheries and Environment (Institut National de Recherche pour l'Agriculture, la Pêche et l'Environnement – INRAPE) and the National Centre for Scientific Research and Documentation (Centre National de Documentation et de Recherche Scientifique – CNDRS) offset the absence of universities in the country.

Comoros has an Environmental National Policy and a Framework Law on Environment. All orders and secondary legislations have not yet been drafted and the legislation should be revised to be more specific on environmental impact assessment and GHG emissions, and to integrate climate change concerns in general.

Comoros Agricultural National Policy was promoted in 1994 and subsequently revised in 2001, and a draft of Framework Law on Forestry is currently under study. The state also considers adopting legislation on the use of pesticides and fertilizers. A decree on marine pollution has been drafted and is currently being studied by the relevant authorities.

7.2 International Cooperation

The project Biodiversity Conservation and Sustainable Development in Comoros UNDP/GEF32 (1998-2003) is currently being implemented. Overall project goals and objectives are to strengthen capacities for biodiversity conservation also, to develop the financial, legal, institutional and operational frameworks and capacities required to co-manage and make sustainable use of national biodiversity.

The Comoros are a member of the Indian Ocean Coral Reef Monitoring Network (Réseau Éco-Tox). Since 1994, the country has ratified over ten international environmental conventions. In

spite of its lack of resources, the government makes every effort to integrate its international commitments into the national legislation.

8.0 Capacity strengthening and financial needs

8.1 Research and systematic observation

Climate research and monitoring are also commitments Parties have under the Convention. The Comoros has yet to create an institution or unit within an existing institution to monitor climate change in order to:

a) develop emission factors and vulnerability indices adapted to national specificities,
b) monitor change in water quality,
c) monitor and measure underground water volume, recharge and piezometry levels,
d) monitor and measure ground water flows,
e) monitor coastal erosion and coral reef health, and
f) monitor oceanographic changes such as sea-surface temperature, sea level rise and swells, and marine currents.

The Comoros need to strengthen the capacity of its Meteorological Service Agency. At the present time, it is barely functioning because of the lack of proper equipment.

8.2 Vulnerability and adaptation

Climate changes are expected to have a negative impact on the country's already vulnerable agriculture. It is urgent that Comoros gains a better understanding of expected impacts on agriculture production and acquire the skills required to develop appropriate mitigation measures. The country needs to:

a) Better train its experts on vulnerability, impact assessments and adaptation of the agriculture sector to climate change,
b) Acquire an assessment methodology suited to mixed cropping and associated cultures production in order to properly assess risks associated to climate change on local crops, soil and forests,
c) Develop short-term and long-term adequate policies, and a coherent legal framework as required for the implementation of the adaptation measures identified,
d) Integrate climate change concern into the country's relevant sector legislation, and
e) Raise public awareness about climate change impacts and adaptation.

8.3 Financial needs

Unless additional financing from the international community is available, it will be very difficult for the country to implement the adaptation measures identified and to reduce its emission of GHG. The adaptation of the economy to climate change is a new concern that already calls for urgent actions to be undertaken. In spite of its lack of resources, the Comoros wish to make all possible efforts to honour its commitment to the Convention.

Three projects for GHG mitigation have been drafted. The first project relates to the studies required to assess the use of geothermal energy in Grande Comore. The promotion of non-metal local material to be used instead of wood in the construction is the main focus of the second project, whereas the third project outlines measures and alternatives to reduce the use of fuel-wood. The three projects total 1 760 000 USD.

Five adaptation projects were also drafted. Two of them deal with water and two are related to population health, for a grand total of 28 620 000 USD. Implementation cost of the adaptation measures identified in the *Agriculture Sector* are estimated at 6 667 000 USD.