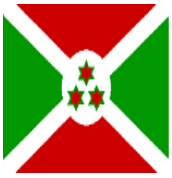
REPUBLIC OF BURUNDI *UNITED NATIONS DEVELOPMENT PROGRAM*



Ministry of Water, Environment,
Land Management and Urban Planning

PROJECT: *"BURUNDI EMPOWERMENT TO PREPARE ITS SECOND NATIONAL COMMUNICATION TO THE UNITED NATIONS FRAMEWORK AGREEMENT ON CLIMATE CHANGE."*

EXECUTIVE SUMMARY OF THE SECOND NATIONAL COMMUNICATION ON TIC CLIMATE CHANGE

Bujumbura, January 2010

I. **BURUNDI SPECIFIC CHARACTERISTICS**

With its area of 27,834 square km² (around 10,748 square miles), Burundi is characterized by five (5) climatic and ecological areas, namely, the low Imbo flat country, the steep mountainous area of Mumirwa, the mountainous Congo-Nile watershed area, the central plateaux and the Kumoso and Bugesera depressions. Burundi is located between the 29° and 30°25 eastern meridians and between the 2°20 and 4°25 southern parallels.

Burundi's climate is tropical and humid. It is influenced by the altitude which varies from 773 meters to 2670 meters and is characterized by alternating rainy and dry seasons. Burundi belongs to two hydrographical basins, namely the Nile Basin with an area of 13,800 km² (about 5,328 square miles) and the Congo basin with an area of 14,034 km² (nearly 5,419 square miles).

According to the provisional general census results of August 2008, Burundi population is estimated at 8,036,618 inhabitants in 2008 with nearly 51.1% of women and nearly 48.9% of men. With its density of 289 inhabitants per km² against an average density of 18 inhabitants per km² in Central Africa, Burundi is among the African countries with the highest densities.

Burundi is an essentially agricultural country. Agriculture and animal husbandry contribute a part usually estimated between 40 and 60% of the Gross Domestic Product (GDP). Agriculture exports (coffee, tea, cotton…) constitute 70% to 85% of the export revenues.

Burundi GDP was 318 billion Burundi Francs in 2006, that being 255 million American dollars. Its actual growth rate is estimated to 5.5%. Per capita annual income has decreased since the year 1990: it went from US$ 214.4 in 1990 to US$ 182 in 1995 and to US$ 109 in 2006, that being a decrease of more than a half in 10 years, because of the production decrease due to the socio-economic crisis that the country has undergone since the year 1993 (see Republic of Burundi, 2006).

Socio-economic activities usually depend on soil quality, temperature and precipitations in the different climatic and ecological areas. Thus, differences in the spatial and temporal sharing of precipitations and temperatures due to climate change will often have a negative impact on the Burundian population living style. The main sectors affected by climatic changes are those of energy, agriculture and livestock, forestry, water resources, natural ecosystems, landscapes and health.

Burundi has already taken measures to create conducive environment to the management of environment in general and of climate change in particular. At the institutional level, Burundi Geographic Institute (IGEBU) was designated by the Ministry in charge of Environment as the CCNUC Focal Point. The General Directorate for Environment and Forestry was designated by the same Ministry as the institution to see to the operation of projects in matters of climate changes.

At the policy level, Burundi has set up many tools giving pertinent orientations for the management of environment and the reduction of harmful effects due to climate change.

At the judicial level, Burundi has an Environment Code. It has also promulgated a Forestry Code, a Mining and Petroleum Code, and a Health Code. A Land Law is in the process of being adopted today and will soon be promulgated.

I. GREENHOUSE GAS (GHG) INVENTORY

II.1. PRESENTATION OF GHG EMISSIONS IN BURUNDI

Agriculture: On a total amount of emissions of 26,829.56 Gg ECO_2, 97.81% are due to agriculture soils, manure management counting for only 0.21%. These emissions are the most dominant in the agriculture sector. Enteric fermentation, rice culture and manure management bring about considerable methane emissions amounting to 535.58 Gg ECO_2, of which 91.72% are generated by cattle enteric fermentation. Nitrogen oxide emissions and carbon monoxide emissions are both generated by on-the-spot leaf burning such as sugar cane leaf combustion at Kumoso Sugar Factory (SOSUMO).

Lands use, Lands use changes and Forestry (LULUCF) exploitation for consumption and commercialisation contribute for 49.98% of the gas emissions, the land under annual agricultural exploitation, for 42%, pasturelands, for 6.17%, and forest conversion for 1.82% of CO_2 emissions. About CO_2 absorption, pasturelands occupy the first rank with 68.64%, followed by hardy plants and trees outside forests (17.88%) and bushes and forests (13.46%). Methane and carbon dioxide are the gases mostly traced in the proportions of 86.46% and 9.26% respectively. Both methane and carbon dioxide total nearly 96% of the traces of emitted gases.

Energy: Gases emitted in the energy sector amount to 2318.45 Gg ECO_2 in the year 2005. The greatest bulk of this amount is attributed to the residential sector with 2091.13Gg ECO_2, that being 90.195%.

Industrial process: In this sector, gas emissions are generally made up of non methane volatile organic compounds (NMVOCs) whose quantity is estimated at 1.1Gg. Only the crude activities of Murama Lime Manufacturing (CAMU) generate CO_2 emissions estimated at 0.16Gg.

Waste: Gas emissions from sewage are far higher in amount than any other source of emissions and represent 207.94 Gg ECO_2, that being 93.87%. Gas emissions from waste material discharges are estimated at 11,025 Gg ECO_2, that being 5.3% of the total emissions. The high quantity of nitrogen monoxide (N_2O) is due to the fact that the heating potential of this gas is also very high.

II.2. GHG EMISSION LEVEL IN BURUNDI IN 2005

The agricultural sector is by far the most responsible for GHG emissions with 91.4% of emissions. It is followed by far by the energy sector (7.9%). The sector of changes in land affectation and forestry is the most important GEG well and takes alone 50% of the emissions.

II. MEASURES AND POLICIES OF MITIGATION REDUCTION

III.1. PROJECTION OF GHG EMISSIONS IN 2050

In the reference scenario, we suppose that no single policy and no measure aiming at reducing GHG emissions have been taken.

Agriculture and Animal Husbandry: At the horizon 2050, animal husbandry will generate GHG estimated at 8168.2Gg ECO_2. Concerning the burning of agriculture crop residues, the projection made concerning GHG emissions in 2050 is estimated at 26.27Gg ECO_2. Rice culture produces GHG emissions evaluated at 495.81Gg ECO_2. For cultivated lands, the projections made estimate

GEG emissions at 529,408.4Gg ECO_2 and nitrogen manure utilization will see an increase rate estimated at 20% at least every five years starting with the year 2005.

The sector of Lands use, Lands use changes and Forestry: In this sector, CO_2 emissions will be about forest exploitation with 6529.93Gg ECO_2, woodland transfer with 2887Gg ECO_2, land affectation, utilization and changes in land affectation which accounts for 5488Gg ECO_2. In general, the projection of gas emissions and absorptions show that the volumes of the wells are still potentially capable of taking up the CO_2 produced in the country at the same ATCATF level until 2030 when gas emissions appear.

The energy sector: GHG emissions increase in relation to the increase in energy demand. The energy sector totals an amount of 2483.3Gg ECO_2.

The industrial process sector: According to the results of GHG anthropic emission inventories in the year 2005, the industrial sector is the one which has less GHG emissions. However, the emissions due to the industrial processing sector will eventually increase because of the population increase. Carbon dioxide (CO_2) emissions will increase from 0.16Gg in the year 2005 to 0.29Gg in the year 2050, this being an increase of 1.8 times the initial quantity.

Waste: Methane emissions will go on increasing in relation to solid waste materials produced at the horizon of 2050. Moreover, there will be an increase of nitrogen hemioxide emissions until the year 2050.

III.2. SCENARIOS FOR GHG MITIGATION ON THE HORIZON 2050

On the basis of measures taken, programs and technological options, mitigation scenarios on the horizon 2050 were devised for all the sectors concerned by GHG inventories.

For the agricultural sector:
concerning domestic animals, GHG emission reduction measures and programs aim at the following:

- improving the composition and utilization of cattle food that may reduce the amount of emissions to 75%;
- intensifying animal husbandry, which will reduce GHG emissions by 3156.29Gg- ECO_2, that being 36.6%;
- reducing traditional animal husbandry by 5%, which will permit GHG emission reduction by nearly 278.1Gg- ECO_2, that being 3.4% of the total GEG emissions due to domestic animals;
- reinforcing management systems of manure and composting practices, which permit a reduction of methane emissions by 1.05%;
- improving the management of liquid manure by adopting biogas technology, which will lead to a potential reduction of methane emissions by 80%.

Concerning on-the-spot burning of crop residues, it was advised to reduce GHG emissions by using harvesting machines.
Concerning rice culture, it was advised to make grass residue composting before incorporating them in rice fields, to emphasize the exploitation of swamps according to MINEEATU master plan and to develop short-term plant species.
Concerning cultivated soils, three measures were suggested in order to reduce GHG, namely:

- reducing the utilized amount of nitrogenous manure and using it by optimally reducing almost all the losses by percolation, leaching, denitrification, etc.; the emissions thus avoided will amount to 12%;
- using organic matters and other bio-fertilisers, which will permit to reduce losses by denitrification and *ipso facto* reduce nitrogen oxide emissions by 100% provided a certain rate of technology is adopted;
- exploiting the maximum opportunities offered by plants that can fix nitrogen; this would permit a total reduction of nitrogen hemioxide provided a considerable number of people adopt this agricultural technique.

In general, with these GHG reduction measures and programs for the agricultural sector, emissions will substantially increase from 2010 to 2020 because of a low rate of assimilation by the population, but they will considerably decrease from 2020 to 2050. It is therefore information, education, sensitization and training that will bring about a sufficient rate of assimilation.

Concerning the sector of land affectation, changes in land affectation and forestry, reduction measures and programs include the country's policies, particularly:

- promoting joint management of domanial afforestations;
- intensifying livestock production and promoting coverage plants;
- fighting erosion;
- promoting animal husbandry to permanent stability.

Technological options include among others the BITI oven, which permits to save at least 43% of the wood weight and the use of charcoal hearths, which permits to save 20%.

In general, the amount of emissions emitted and absorbed is negative from 2005 to 2050. This means that there will always be absorption of CO_2, which supposes that all alternatives reduction will have been implemented and that no other source of emission will have been created.

For the energy sector, reduction measures of gas emissions include the use of equipments aiming at saving wood and charcoal, especially improved wood hearths which permit to save 20% of firewood and to introduce the use of solar energy. GHG emissions will tend to decrease in comparison to the scenario reference and emissions will continue to diminish depending on the measures set up.

For the sector of industrial processes, reduction measures are not very necessary because the emissions issued from industrial processing are negligible. However, all industrialists are recommended to promote importation of appropriate equipments and technologies to partake in the reduction of GHG.

For the sector of waste materials, advanced technological options of reduction include composting organic wastes and making charcoal bricklets from organic waste. Composting permits to recycle waste materials for agriculture. Taking into account the 2.7% average annual growth rate of the population in Burundi, and a growth rate of the waste materials evacuated at Buterere and estimated at 7%, there will be a slight reduction of the greenhouse effect gases.

III.3. EVALUATION OF THE IMPACT OF THE GHG REDUCTION MEASURES

Taking into account the programs, policies and national strategies, the emissions avoided will be 253,251.6 Gg-ECO_2.

III. MEASURES AND POLICIES OF ADAPTATION TO CLIMATE CHANGE

IV.1. PROJECTION OF CLIMATE PARAMETERS WITH OR WITHOUT CLIMATE CHANGE

Globally, climatic projections display an increase of precipitations from 2010 to 2030, followed by a diminution of precipitations until 2040 and another increase until 2050. The dry season tends to be long, and this is translated by a late resumption of the rainy season which has an effect on the A agriculture season. For the B agriculture season, the early end of rain precipitations tends to prevail. It is also projected an increase in annual average temperature from 1°C to 3°C during the 2010-2050 period.

IV.2. SECTOR VULNERABILITY

Since some years, **hydraulic resources** have constantly decreased following a bad geographical and temporal repartition of precipitations. A general analysis of water resource development in relation to the climatic changes projected has shown a 7% increase in the annual average precipitations from now to 2050. Water resource future vulnerability is shown by the drying-up of lakes and rivers, more erosion from rains and silting up of certain rivers.

Concerning the **energy sector,** annual hydroelectric production and annual silting up of running hydroelectric power station dams will develop in the same way as the precipitations and may lead to the stopping of hydroelectric power stations with a small volume of water. If the rhythm of energy consumption and alternative utilization of wood goes on like today, Burundi may become a desert before a period of less than 100 years. The solutions already contemplated bear on widening of the protection area around dams and power stations, which must be forbidden to agriculture, reinforcing the supporting erections around power stations, reforestation of the hillsides on which power stations are built, especially by agro forestry.

For the **agriculture sector,** the projections of output in case of climatic changes for the seasons A and B show a very steep decreasing tendency from the year 2010, the output in the season A being always less than those in the season B. To face that vulnerable situation, strategies have been set up such as a reasonable exploitation of the swamps for agricultural aims, protection of the hillsides, preparation of the strategic document for the regionalisation of agriculture and livestock in relation to comparative advantages offered by agro-ecological zones.

Concerning **the sector of livestock,** the cattle and domestic goat number continually increase in the absence of climatic changes. With climate change, cattle, goat, sheep and poultry losses will be more considerable following longer and more frequent droughts occurring between 40% and 60% of the time. Production outcome of meat and milk will be more affected and dwindled along with the production of fish in case of drought. To face all those incidences of climate changes, actions to be undertaken include especially adopting livestock in zero grazing accompanied by growing fodder on contour lines, keeping short-cycle animals such as rabbits, pigs, poultry, etc.

Concerning **the sector of landscapes**, the most striking climatic phenomena are short-term torrential rains followed by periods of long droughts.

Seeing the evolution of climatic parameters of precipitations and temperature which will increase as time goes with or without climate change and with more considerable amplitudes in case of climate changes, we can predict the risk of more frequent inundations and with more amplitude in the low lands, great erosion of soils in the fields and along drainage axes in the mountain hillsides of Mumirwa, the rising of the water level in Lake Tanganyika following high precipitations and the reduction of the water level in the northern lakes and an increase drought periods.

Concerning **the sector of land ecosystems,** the combined effects of human activity and climate change will have as consequence the disappearance of some plant species, the aggravation of erosion and of bush fires. In the mountain shady forests, subalpine strata at the height of 2450 meters of altitude will dwindle and even disappear on vast stretches owing to average temperatures that will reach 14°C in 2050. The clear forests will be progressively degraded with the rising of temperatures and precipitations. Some plant species will not resist the new climatic conditions. In the savannas and tree bushes, bush fires will be heightened by severe and long droughts and will bar the constitution of plant formations. Activities considered to protect the ecosystems include especially defending land ecosystems by maintaining diverse types of plant formations in the ecological areas of Burundi and struggling against bush fires.

Concerning **the sector of wet ecosystems,** ***and especially for Lake Tanganyika,*** the projected increase in temperatures of pelagic areas in the absence and in the presence of climate change will entail primary production and zooplankton at a reduced depth. Meanwhile, this situation might generate a phenomenon of lake eutrophisation that might lead to a reduction in fish productivity. However, such conditions would favour the development of plankton-eating fishes. For the littoral area, the rise of the water in the lake and the extension of the lake shore in the littoral plain would be accompanied by water becoming enriched in nutriments in the fish reproduction and growth areas. On the other hand, the risk of occupation of land made available by water receding during the long droughts will be very important. ***Concerning the Rusizi River delta***, plant associations will adapt very rapidly to the water rise and subsiding. If the lake water level remains a long time at the height of 776 meters or above, a major part of the delta will simply become the lake littoral area. Concerning ***the complex lacustrian swamps of the Akanyaru and the Akagera,*** a rise in the temperature will result in the diminution of the water level during the periods of precipitation deficit. In case of high precipitations, the rise of the water level will entail a lateral extension of swamp and lacustrian stretches conducive to plant and animal life. ***Concerning the Malagarazi swamps,*** owing to inundations, the semi-inundated vegetation will develop to their maximum and the fish will take this opportunity to come up to the river tributaries. During the receding period, there is a risk of agriculture extending on the drying areas.

Concerning the health sector, in the absence of climate change, cases of paludism in the targeted provinces at the 2050 horizon will notably increase. With climate change, the cases of paludism will treble (in Rutana) and even quintuple (in Kayanza) during the same period of 2010 to 2050.

IV.3. MEASURES MITIGATE AND TO ADAPT TO CLAMATE CHANGE

After analysing and regrouping the diverse alternatives suggested in the sectors under study, a global synthesis was made including activities necessary to mitigate and to adapt to climate change in Burundi (see Appendix)

IV. OTHER INFORMATION AIMING AT THE CCNUCC OBJECTIVES

V.1. INTEGRATION OF CLIMATE CHANGE IN THE NATIONAL DEVELOPMENT POLICIES

On the judicial plan, Burundi has elaborated a Code of Environment, but without an application law on climate change. On the constitutional plan, the Ministry in charge of Environment has set up organic structures to deal with questions related to climatic changes and CCNUCC. Burundi has got political tools to manage environment in general and natural resources in particular.

Participating to the implementation of the project "Empowering Burundi to formulate its First and Second National Communications" made it possible for the executives of different institutions to get basic knowledge related to techniques of making inventories and reducing GHG and to vulnerability studies, reduction of and adaptation to climate change.

These studies were accompanied by a formulation of mitigation and adaptation priority projects which took into account the most vulnerable sectors to climate change.

Information and sensitization activities of the population on the climate change problems were comprehensively carried out and a manual of information and sensitization was developed.

V.2. TRANSFER OF TECHNOLOGIES

In Burundi, the failure of modern technology transfer in the domain of climate change is also due to technology ignorance, the exorbitant costs of training seminars in this domain, the lack of technically competent executives, the absence of schools specialising in this domain, etc. However, needs to reinforce capacities in matters of technology transfer were estimated for the mitigation of GHG emissions and for the adaptation to the effects of climate change.

V.3. SYSTEMATIC RESEARCH AND OBSERVATION

Burundi Geographic Institute (IGEBU) has a climatic and hydrological observation system that includes the partially functional climatic network, the synoptic network whose synoptic station of Bujumbura Airport constitutes the National Meteorological Center, and the hydrological network with stations in good shape at 75%. Burundi has a system of collecting, treating and spreading data and these data are made from data stocked in a data bank. At IGEBU, there is an internal system of communication, comprising BLU (SSB) radios for collecting national data in real time, and a regional communication system allowing data exchange between Burundi and the external world on a World Meteorological Organisation (WMO) network called "Global Telecommunication System" (GTS).

At IGEBU, we note a remarkable lack of executives and technicians trained in the domains of meteorology, climatology and hydrology.

In general, the observation system of climate change at IGEBU-Burundi shows lacunae and constraints and reinforcement measures of capacities are more than needed. Hydrological data

gleaned in Burundi are not yet internationally exchanged within the framework of the WHYCOS System which is being currently developed.

The University of Burundi has required materials for research on climate change. However, it does not have enough scientific personnel and faces difficulties of training its scientific and technical staff in the country or abroad.

V.4. REINFORCING HUMAN AND TECHNICAL CAPACITIES IN THE SYSTEM OF CLIMATIC OBSERVATION

It is necessary to reinforce capacities at IGEBU and in national research institutions in matters of observation networks, data collection and treatment, the communication system and information exchange, in the domain of human resources and in the participation to the World System of Climatic Observations (WSCO).

V.5. INFORMATION AND FORMATION OF NETWORKS

In Burundi, there is a need to create a national structure to coordinate studies and ensure the follow-up of climatic changes. This structure will be made up of national research institutions. The projected structure would have two levels of representation, namely a National Consultative Committee made up of representatives of research institutions at the highest level and a National Research Experts network in which each institution would be represented by one or many experts.

V. SHORTCOMINGS AND CONSTRAINTS ENCOUNTERED ALONG WITH NECESSARY FINANCIAL RESOURCES, TECHNICAL MEANS AND CAPACITIES

VI.1. LACUNAE AND CONSTRAINTS RAISED

Many lacunae handicap or slow down the different actions undertaken by CCNUCC. Concerning the legal and statutory aspects, there is a lack of application texts of the Code of Environment in relation to climate change. Concerning the institutional aspect, the national structure in charge of implementing the Convention does not have enough financial and material capacities to carry out the mission given by the CCNUCC. We also note a lack of awareness towards the stake of climate change in matters of development; this makes entails that the “climate change” dimension is not yet integrated in the national policies and strategies of development. Concerning the technical aspect, we note the non availability of enough and trustworthy data and the lack of national technical expertise are in quality and in quantity, and the low contributions in financial resources.

VI.2. NEEDED FINANCIAL RESOURCES, TECHNICAL MEANS AND HUMAN CAPACITIES

Identified needs are, among others:

- needs in financial resources for the implementation of the priority projects to mitigate GHG emissions and adapt to climate change;
- needs in reinforcing operational capacities of institutions and experts;
- information and education of the public.

VI.3. CONTRIBUTION OF BILATERAL AND MULTILATERAL SOURCES

The Environment World Fund (GEF) is practically the only financial mechanism that grants funds to Burundi through diverse projects in order to carry out the CCNUCC. Concerning financial resources within the bilateral framework, they are practically inexistent to date. Burundi is however happy to welcome the United Kingdom initiative which, through its Ministry in charge of cooperation, has funded through the year 2009, a study led by Stockholm Environment Institute on the impact of climate change in Burundi.

VI.4. GHG EMISSION MITIGATION PROJECTS AND/OR CLIMATE CHANGE ADAPTATION PROJECTS

The projects presented in this document are, on one hand, projects identified within the NAPA framework, and on the other hand, those identified within the framework of the preparation of the second national communication on climate change.

APPENDIX

I. Projects identified within the Burundi NAPA framework

1 Improvement of seasonal early warning climate forecasts
2 Rehabilitation of degraded areas

3 Safeguarding of the natural environments

4 Rainwater Valorisation
5 Erosion control in the region of Mumirwa
6 Protection of buffer zones in Lake Tanganyika floodplain and around the lakes of Bugesera
7 Popularisation of short cycle and dryness resistant food crops
8 Zero grazing technique

9 Capacity building to promote energy-wood saving techniques
10 Stabilisation of river dynamics of watercourses and torrents in Mumirwa, including the city of Bujumbura
11 Education on climate change adaptation

12 Increase hydropower micro stations

II. Projects identified within the framework of the Second National Communication on Climate Change

1. Reinforcing national capacities in water resource management for food production.
2. Reinforcing national capacities in evaluating available and exploitable water resources.
3. Improving seasonal climatic predictions for an early alert.
4. Land management of the hillsides for water and soil protection.
5. Reforestation of the hillsides in order to contribute to the restoration of Burundi's eco-climatic system.
6. Supplying drinking water thanks to photovoltaic solar energy.
7. Preventing floods and water level rise in rivers.
8. Reforestation and management of existing forests.
9. Setting up a lasting management program for traditional forms of energy by promoting techniques of saving wood energy.
10. Promoting new renewable forms of energy (photovoltaic solar energy and biogas) in public interest centers and in rural households.
11. Reinforcing the capacity of hydroelectric power production.
12. Educating to climate changes.
13. Preserving natural ecosystems.
14. Rehabilitating degraded areas.
15. Reforestation of degraded mountains and hillsides in Burundi.

16. Reforestation and rational use of wood energy resource.
17. Educating and sensitizing the population on the dangers of bush fires and deforestation.
18. Setting up a national inventory of forests.
19. Protecting and restoring swamp weirs and buffer zones downstream from the northern Lakes of the Bugesera.
20. Managing and restoring biological resources in the swamps and in the often flooded plain of the Rusizi delta.
21. Land management and integrated management of the often flooded littoral of Lake Tanganyika.
22. Protecting the hillsides against erosion and reforesting the degraded areas of the Mumirwa and Congo-Nile watershed.
23. Integrated management of water resources in the Bugesera (Bugabira, Busoni, Kirundo).
24. Monitoring the water dynamics of the rivers and torrents in the western hillsides of Burundi (plains and hillsides).
25. Channelling surface water through the city of Bujumbura (rain water, streams and rivers).
26. Growing oyster mushrooms.
27. Managing middle-altitude swamps in order to grow irrigated rice and food crops.
28. Promoting the cultivation of banana trees.
29. Integrating agro-sylvo-zootechniques.
30. Management of the great hillsides.
31. Community support in the management of the designed sources.
32. Promoting the SANPLAT slab (improved latrines).
33. Promoting the impregnated mosquito net.
34. Preventing, fast alerting and reacting.