EXECUTIVE SUMMARY

1. National Circumstances

The period covered by the second national communication from the Democratic Republic of Congo coincides with a period of conflicts that has caused three million deaths and four million displacements, particularly in the East of the country. Notable environmental degradation has been recorded.

The impacts of climate change are already noticeable throughout the country, in particular by the persistence of excessive heat waves, violent rain, soil degradation, especially by furrowing erosion, a prolongation of the dry season, an increase of the drought sequences during the rainy seasons, and floods.

Furthermore, at the socio-economic level, despite the enormous potential in various resources that abounds in the Democratic Republic of Congo, the Gross Domestic Product per capita is less than 1 US dollar per day. The unofficial sector (> 70%) and the rural sector, with a low capacity for creating well-paid jobs, prevail at the national level. As against an embryonic industrial sector.

Rural activity is weighed down by the rigour of the climatic conditions, by environmental degradation, by the high cost of transport, and by a lack of credit mechanisms in support of private initiatives.

Access to drinking water and energy is inadequate throughout the entire extent of the territory (6% of the Congolese population, of which 30% are in an urban environment and 1% in a rural one). The domestic consumption of energy for various vital activities is based almost totally on the use of firewood and embers, even in the urban and semi-urban areas, and is one of the causes of the deforestation and the emissions of GHG. Moreover, the low level of cover in electrical energy entails a strong push towards the uncontrolled use of fossil-fuel-fired generators.

Notoriously practised itinerantly after controlled burning, the local agriculture fails to ensure the population's food security.

At the medical level, the emergence of communicable infectious diseases can be identified, some of which some had been previously eradicated, and a renewed outbreak of dental decay and malnutrition, as well as some non-communicable chronic diseases. The reforms that have been implemented have led to the adoption of new mining, forestry, investment and labour codes, in order to attract private sector investment and to restore transparency in sectors that have traditionally been opaque.

For the environment sector, the Mining Code, promulgated on 11 July 2002, envisaged provisions that sought to ensure its protection, by the means of the Environmental Attenuation and Rehabilitation Plan, before the start of any mining activity, and the Environmental Management Plan, which in particular includes the protection of slopes from erosion, the protection of upstream waters and rivers, biological diversity conservation, soil conservation, public healthiness, improvement of the living environment and protection of the human environment. These elements have a direct incidence on climate change.

Furthermore, with regard to forestry reform, a forestry code was promulgated in August 2002 and created provincial forestry advisory boards whose role is to supervise the forestry management of the provinces and other decentralised entities, and to deliver opinions in the context of forest classification or declassification projects.

Meanwhile, research projects that could lead to a control of climate change have not been officially enshrined within the research programmes of the institutions that could best carry them out.

2. Greenhouse Gas Inventory

2.1. GHG Emissions and Sequestrations Assessment Between 1999 and 2003

The data of the GHG emissions and sequestrations assessment (in Gg CO_2 equivalents) (CO_2, CH_4 and N_2O) are presented in Table 1, while Figure 1 shows the trend between 1999 and 2003. The positive values correspond to the emissions and the negative values represent sequestrations. This data takes account of the potential gas-related global warming evaluated and integrated over 100 years of all the sectors of energy use in DR Congo.

Table 1: Greenhouse Gas Emissions and Sequestrations Assessment (in Gg CO2 Equivalents)

	CO_2 Emission (Gg CO_2 Eq)	**CO_2 Sequestration** (Gg CO_2 Eq)	**CO_2 Assessment** (Gg CO_2 Eq)	**CH_4 Emission** (Gg CO_2 Eq)	**N_2O Emission** (Gg CO_2 Eq)	**GHG (GES) Assessment** (Gg CO_2 Eq)
1999	497322.00	-548068.00	-50746.00	50750.00	9238.00	9242.00
2000	275963.11	-562679.74	-63216.63	51657.00	6785.46	-4774.17
2001	146700.90	-500357.10	-189857.20	47582.25	6362.30	-135912.65
2002	320927.65	-496998.80	-176072.15	47697.25	6317.60	-122057.30
2003	377841.53	-495334.02	-117491.49	47904.50	6362.30	-63224.69

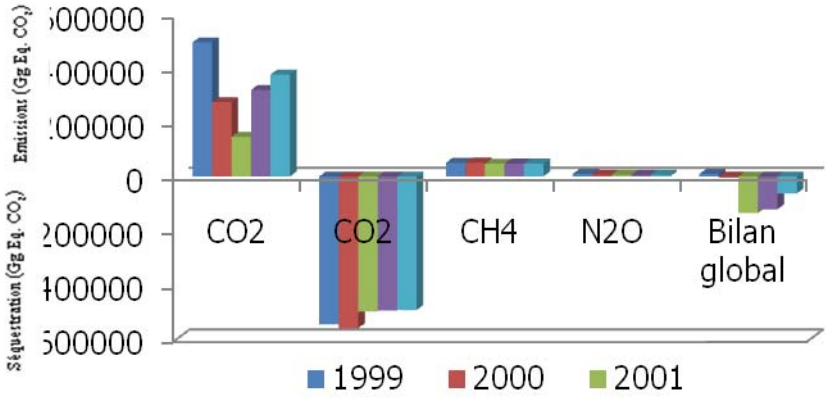

Figure 1: Emission and Sequestration Trend Between 1999 and 2003

It emerges overall from this GHG Inventory (IGES) that the net assessment for the year 2003 gives a CO_2 sequestration of 63,224.69 Gg CO_2 Eq, which still ranks the DRC as a carbon dioxide sink thanks to its vast forestry resources. However, compared to the first inventory made in 1994, the net sequestration assessment obtained in 2003 has seen a reduction of almost 52%.

From 1999 to 2003, the annual assessments present a general tendency towards a reduction of emissions for CO_2 (31%), CH_4 (± 6%) and N_2O (45%) and a notable increase of the sequestration (114%) between 1999 and 2003. The latter is fairly significant during 2001 and 2002, compared to 1999 and 2003. Indeed, in 1999, the established assessment shows a surplus of GHG emission. The inventory shows furthermore that during this period, CO_2 was contributing more than 85% of the total GHG emissions, followed by methane (nearly 10%).

2.2. Aggregated CO_2 Emission / Sequestration Assessment Per Sector

Table 2 refers to each sector's contribution to the overall emission/sequestration of greenhouse gases between 1999 and 2003.

Table 2: CO_2 Emission / Sequestration Assessment (in Gg)

	1999	2000	2001	2002	2003
CO_2 Emissions (Gg)	**553188.00**	**330351.56**	**196796.17**	**370944.71**	**428233.27**
Use of Fossil Fuels	3487.00	3627.51	3822.00	3682.00	3657.00
Industrial Processes	79.00	207.78	96.00	117.00	157.00
Land Use and Forestry	501889.00	280344.68	147418.19	321786.94	378708.82
Agriculture	40281.00	38506.61	37454.14	37258.17	37317.29
Solid Waste Management	7452.00	7664.98	7867.84	8100.60	8393.16
International Bunkers	-	-	138	-	-
CO_2 Absorption/Sequestration (Gg)					
Land Use and Forestry	**-548068**	**-562679.74**	**-500357.10**	**-496998.80**	**-495334.02**
Net Assessment	**5120.00**	**-232328.18**	**-303560.93**	**-126054.09**	**-67100.75**

The Land Use, Land-Use Change & Forestry sector is the one that emits the most CO_2 into the atmosphere. It is followed by Agriculture, then by Waste. The Industrial Processes sector emits insignificant amounts.

2.3. Aggregated CH_4 Emissions Assessment (Gg)

The sectors involved in this assessment are those that are involved with the use of fossil fuels, agriculture, waste, particularly solid, and that of international bunkers.

Table 3: Aggregated CH_4 Emissions Assessment (in Gg)

	1999	2000	2001	2002	2003
Use of fossil fuels	34	34.67	36	37	38
Agriculture	1391	1417.71	1378.9	1372.31	1372.95
Forest and Prairie Conversion	281	280.63	140.31	140.31	140.31
Solid Waste	324	333.26	342.08	352.2	364.92
International Bunkers	-	-	6	6.07	-
Total CH_4 Emission	**2030**	**2066,28**	**1903,29**	**1907,89**	**1916,18**

2.4. Assessment of Greenhouse Gases Other Than CO_2 and CH_4

Table 4 presents an assessment of the emissions of nitrogen oxide (N_2O and NO_x), carbon monoxide (CO), non-methane volatile organic compounds (NMVOC) and sulphur protoxide (SO_2). Among these, carbon monoxide (CO) is the gas that has the highest emissions

Table 4: Assessment of N_2O, CO, NO_x, NMVOC and SO_2 Emissions in DRC (1999 to 2003)

	1999	2000	2001	*2002*	*2003*
N_2O (Gg)	31	22.77	21.35	21.2	21.35
CO (Gg)	39 942.00	40 805.26	38 721.39	38 735.85	38 861.40
NO_x (Gg)	816	831.1	781.48	780.87	781.48
NMVOC (Gg)	63	66.02	68	69	72
SO_2 (Gg)		0.01			

The carbon monoxide emissions are considerable. In terms of quantities emitted into the atmosphere, this gas comes in third place (7%), after carbonic gas (83%) and methane (8%). However, the N_2O (less than 2%), despite the relatively small quantities, requires more attention in relation to the other gases, because of its very high Global Warming Potential (GWP).

3. Vulnerability and Adaptation to Climate Change

3.1. Climate Change Scenarii

From all the 20 models of global circulation proposed in MAGICC/SCENGEN 5.3, the CCSM-30, GFDLCM20, GFDLCM21, GISS-EH and GISS-ER models were concordant, within an acceptable margin of uncertainty, with the climatic parameters observed in DR Congo. Furthermore, the scenarii with or without aerosols do not bring significant differences to the projected levels (2025, 2050 and 2100) obtained for temperature, precipitation and atmospheric pressure. Table 5 gives an overall summary of the range of projected variations (extreme values, minimum and maximum, across both scenarii) for 2010, 2025, 2050 and 2100 with regard to temperature (°C), precipitation (%) and atmospheric pressure (hPa) throughout the entire country.

Table 5: Field of Climatic Parameter Variation after Projection with the Model

Parameter	2010	2025	2050	2100
Temperature (°C)	0.45 to 0.52	0.91 to 1.03	1.72 to 2.08	2.69 to 3.22
Precipitation (%)	0.3 to 2.5	0.4 to 4.2	0.3 to 7.5	0.8 to 11.4
Atmospheric Pressure (hPa)	-0.08 to -0.006	-0.16 to -0.13	-0.29 to -0.25	-0.5 to -0.39

3.2. Water Resources and Climate Change

The lacunae noted in respect of the DRC's Hydrologic Departments, ill-equipped as they are with reliable meteorological and hydrometric facilities, just as the difficulties encountered in the management of the database data that is essential for correctly responding to the water resource quantification issues - both surface and underground - orient this heading towards an evaluation of the hydrologic or surface water.

3.2.1. Rainfall

The study was carried out on the basis of the rainfall records of 17 posts or stations representing the country's four Hydrologic Sub-basins, which coincide with the four Climate Areas in the country defined by the climate change projection models, by 2100.

The disparity of the observation periods and the number of posts/stations per Sub-basin has meant that the data has had to be homogenised, by taking, by hydrologic sub-entity as reference, the station that has provided the longest series. It is a question of these stations: Boma (Climate Area I), Kinshasa/Binza (Climate Area II), Bukavu (Climate Area III), and Lubumbashi/Kipopo (Climate Area IV). The data relating to these Hydrologic Sub-basins is included in Table 6.

Table 6: Annual or Seasonal Acreage and Rainfall Averages of the Hydrologic Sub-Basins or Climate Areas

Hydrologic Sub-basin	Composition	Acreage (Km^2)	Average Annual / Seasonal Precipitation (mm) 2005
I	Low-Congo	54,078	1.000
II	Kinshasa + Bandundu + Equator + Eastern Province + ¼ Western Kasaï	1,251,396	1.800
III	North Kivu + South Kivu + Maniema + ¾ Eastern Kasaï	382,965	1.700
IV	Katanga + ¾ Western Kasaï + ¼ Eastern Kasaï	656,656	1.100

3.2.1.1. Precipitation and Temperature Trend Projections Up Until 2100

In view of the fact that MAGICC-SCENGEN 5.3 has no detailed information on the DRC, Version 2.4 has been used, in order to achieve the best simulation of the climatic trend - of rain and temperature in particular – over the entire country, and to delineate the DRC into four climate areas for the period from now until 2100.

Furthermore, as more than two thirds of the country's acreage is located within the SADC's socio-political configuration, use was made of the simulations during the use of MAGICC-Scengen, proposed by default by the IPCC for this part of the world.

The HADCM2 general circulation model and the IS92a scenario, the restitutions of which for the precipitations and the temperatures were seen to be the most significantly close to the current data at the threshold of 0.05 over a 75-year calibration period (1926-2000), have been validated and used to operate the climatological projections of two variables taken into account until 2100. Lastly, per Climate Area, the evaporation part has been estimated by taking account of the thermal behaviour.

3.2.1.2. Current Water Resources Assessment Per Climate Area

This assessment is presented in Table 7, per Hydrologic Sub-basin or Climate Area stemming from the projections.

Table 7: Current (2005) Surface Water Resources Assessment Per Climate Area

Climate Area	Total Volume (litres)	Evaporation (%)	Flow & Infiltration (litres)
I	$540{,}780 \times 10^8$	77	$124{,}379.4 \times 10^8$
II	$22{,}525{,}128 \times 10^8$	77	$5{,}180{,}779.44 \times 10^8$
III	$6{,}510{,}405 \times 10^8$	80	$1{,}302{,}081 \times 10^8$
IV	$7{,}223{,}216 \times 10^8$	84	$1{,}155{,}714.56 \times 10^8$

The annual rain and temperature trends (Table 8) and water volume trends (Table 9) according to the geographical areas, show on the one hand an increase of rain over most of the country, and on the

other, a reduction of which the dimension is worsening with effect from Area 3 (MANIEMA), passing through the coastal fringe regions (Low-Congo), and finally in Area 4 (especially the extreme South of the country, including Katanga).

Table 8: Annual Average Rain (mm) and Temperature (ºc) Trends of the Four Climate Areas

Area	Town/Marker Years	Rain (mm)	Temperature (°C)
I	Boma / Matadi 2005	1000	25.2
	2050	900	28.4
	2100	850	29.1
II	Kinshasa 2005	1800	25.0
	2050	1840	27.5
	2100	1900	28.2
III	Kindu 2005	1700	25.2
	2050	1650	28.2
	2100	1630	29.1
IV	Lubumbashi 2000	1100	20.4
	2050	1000	23.7
	2100	900	24.7

The details perceptible from the monthly totals distinctly predicate a shortening of the rainy season period which increases as one approaches the extreme South. Katanga in particular will in the long run – as from 2020 – have a rainy season of less than 5 months as against 7 at this time. On the one hand, the entire country will continue to suffer from global warming, which will increase.

Table 9: Water Volume Trend (litres)

AREA	2005	2050	2100
I. Boma – Matadi	124380. 10^8	111940. 10^8	105720.10^8
II. KINSHASA	5180779. 10^8	5295907. 10^8	5468600. 10^8
III. KINDU	1302081. 10^8	1263784. 10^8	1248466. 10^8
IV. LUBUMBASHI	1155715. 10^8	1050649. 10^8	945585. 10^8
TOTAL	**7762955 x 10^8**	**7722280 x 10^8**	**7768371 x 10^8**

Table 10: Water Volume Trend As Percentages Per Area

AREA	2005	2050	2100
I. Boma – Matadi	1.6 %	1.4 %	1.3 %
II. KINSHASA	66.7 %	68.6 %	70.4 %
III. KINDU	16.8 %	16.3 %	16.1 %
IV. LUBUMBASHI	14.9 %	13.7 %	12.2 %
TOTAL	**100 %**	**100 %**	**100 %**

On the other hand, the total volume delivered by the River Congo has been estimated on the basis of its average flow, which is 40,000 m^3/s; that is to say 4 x10^7 l/s. Which gives, in 365 days, a volume of 126,144 x10^{10} litres; and in six hours, a volume of 864 x10^9 litres. In total therefore, the Congo Basin empties 1,262,304 x 10^9 litres of water into the Atlantic Ocean per annum.

3.2.1.3. Population and Water Need Projections

The National Institute of Statistics (INS, 1995) has estimated the average rate of annual increase of the Congolese population to be 3%. The demographic projections until the year 2100, according to each geographical area, are included in Table 11.

The water need trend until the year 2100 is reported in Table 12.

Table 11: Population Projections (Inhabitants)

AREA	2005	2050	2100
I. Boma – Matadi	3,315,087	12,531,029	54,997,293
II. KINSHASA	38,830,189	146,778,114	643,804,533
III. KINDU	8,374,533	31,655,736	138,849,757
IV. LUBUMBASHI	7,224,587	27,308,939	119,783,653
TOTAL	**51,242,267**	**218,273,818**	**957,435,236**

Table 12: Water Ned Trend (litres) Per DRC Area

AREAS	2005 (50 litres per person per day)	2050 (250 litres per person per day)	2100 (500 litres per person per day)
I. Boma – Matadi	60,500,337,750	1,143,456,396,250	10,037,005,972,500
II. KINSHASA	708,650,949,250	1,339,350,290,2500	117,494,327,272,500
III. KINDU	152,835,227,250	2,888,585,910,000	25,340,080,652,500
IV. LUBUMBASHI	131,848,712,750	2,491,940,683,750	21,860,516,672,500
TOTAL	**1,053,835,227,000**	**199,174,858,992,500**	**174,731,930,570,000**

The projections show that as a whole, the country will not be vulnerable in terms of water resources by the year 2100, especially since it empties millions of cubic metres of fresh water per day into the Atlantic Ocean, thus constituting an alternative source of water supply.

Furthermore, per Climate Area, even though only Area 1 (Low-Congo) will not vulnerable in terms of water resources by the year 2100, it is also necessary to note the worsening rainfall in the Eastern part of the country (Maniema, Kivu) accompanied by a fall of the water level of the Lakes (as is the case with Tanganyika), the melt of the snow on Mount Ruwenzori mount, as well as a notorious lessening of the rainfall in the South-Eastern part (Katanga).

Furthermore, the reduced rainfall observed or projected in Area 4 (Katanga) and in Area 1 (Low-Congo) could be explained by the relevant changes of the Inter-Oceanic Confluence (IOC) which is the basic pluviogenetic entity in the northern part of the DRC. Indeed, it appears that the Area (Katanga) would therefore benefit increasingly less from the dynamics of the Inter-Oceanic Confluence (IOC) in its convergence phase. Area 1 (Low-Congo) would for its part be more subjected to the trade winds drenched with cold water due to the upwellings coming from the St-Helena Anticyclone..

In addition, other forms of water-related vulnerability at the national level should be emphasised:

- Vulnerability of the population from the point of view of water accessibility: Although it has a potentially enormous amount of fresh water at its disposal, the population of the DRC

paradoxically has extremely difficult access to this commodity. Indeed, apart from a few inhabitants in certain cities, the large majority of the town folk and the totality of the peasants continue, at this time, to make do with water from rivers, wells, rain and troughs, the total sum of water resources, rarely of good quality and usually of insufficient quantity. The population's vulnerability from limited access to water in DRC stems basically from its poverty, which is also exacerbated by the precariousness of the State Departments that are required to deal with this problem.

- Vulnerability relating to hydrometric crises ascribable to climate change: Extreme hydrometric crises, namely strong intensities of rain and extreme spates of rivers, are leading to an increasing number of lost human lives, are causing furrowing erosion, destroying basic infrastructures and swallowing up houses throughout the country. This other kind of vulnerability of hydrometric origin needs special attention, the more so as it is at present the reason for diminishing water resource quantities;

- Transborder vulnerability: DRC is under increasing pressure from many countries suffering from water stress that is accentuated by climate change.

3.2.2. Strategy for Adapting to the Variability of the Limnometric Heights and the River Flows in Kinshasa.

The proposed strategy relates to:

- The evaluation and monitoring of the water resources, particularly those of the River Congo system and its tributaries at the Kinshasa level, as well as the quality of the surface and underground water;
- An evaluation of the impact of this system on the quantity and quality of the underground water for enhanced resource allocation planning;
- The characterisation and development of the watersheds identified in the city of Kinshasa for control of the surface run-off;
- The protection of the water resources against pollution;
- Recourse to adaptation infrastructures capable of supporting the projected hydrological variations , and the economic, social and ecological costs of the adopted measures;
- The establishment of communities on the Kinshasa hill areas, after development, and on the Batéké Plateau in order to protect them from the injurious effects of floods.

3.2.2.1. Agriculture, Land-Use Change & Forests

In view of the national circumstances and certain special conditions, in particular the size of the country, the diversity of the ecological conditions and the inexistence of relevant data throughout the country, the study of the vulnerability and the impact of the climate change on the land and forest resources, has been restricted in the North-West of the DR Congo, particularly in the Gemena/Kungu/Budjala Region. The results obtained during this study could be extended to similar ecosystems of the DR Congo

3.2.2.2. Impacts of the Climatic Parameter Changes in the Region and Vulnerability.

On the basis of the results of the projections obtained with MAGICC SCENGEN in the Region under examination, the estimated variation of the climatic parameters will be as follows:

- An increase in the average annual temperature, rising from 23°C to somewhere between 23.5-24°C in 2025, 24-24.5°C in 2050. and 24.5-25°C in 2100;
- An increase in the average annual precipitation, rising from 1,758.1 mm to somewhere between 1,758.1-1,810.8 mm in 2025, 1,810.8-1,866.8 mm in 2050. and 1,866.8-1,925.8 mm in 2100;

This estimated climatic parameter trend, combined with the area's deforestation, should entail a change in the micro-climate. Thus the temperature increases could be accompanied by heatwaves and longer droughts, which would contribute to the risk of the desert's advance, which is a weighty matter in this area.

Among the impacts on the natural balance of the environment that should occur, the following can be identified:

- A change in the natural ecology tending towards the area becoming a savannah;
- A regression of the CO_2 storage capacity in the area;
- A change in the area's floral composition, with its implication on the original biodiversity by a change to the natural habitats, the possible appearance of certain harmful diseases and insects, and a change within the existing symbioses between certain species that are to be found in the area;
- A renewed outbreak of certain human diseases;
- An ever-increasing risk of bush fires following the dryness of the litter in the undergrowth;
- A modification in the production systems of ligneous substances, and of forestry products other than wood;
- Changes to the level of the capacity of the vegetation in place with regard to soil conservation.

At the agricultural production level, the climatic disturbances should have a direct incidence on the populations' food security. The repercussions of climate change should in general lead to a reduction of certain crop yields, even in the event of a minimal temperature rise, owing to the fact that the normal conditions of growth of those crops are close to the thermal tolerance level, according to the species, the varieties, and the soil characteristics.

In the case mentioned above a short analysis of the situation is presented in Table 13 for the main agricultural productions identified in the Gemena/Kungu/Budjala Region.

Table 13: Changes of Temperatures and Precipitations on the Main Crops in the Gemena/Kungu/Budjala Region.

Crops	Ecological Conditions (1)	Observations
Maize	Plant with fairly high temperature requirements at germination, with an optimum of 25°C,	The adopted temperature projection scenario should not present any issues.
	Drought particularly detrimental at the time of sowing, with a stronger negative influence on the yield at the time of flowering.	Need for taking care to block the crop cycle in order to reduce the risk of drought at the flowering.
Manioc	The annual rainfall appropriate for this plant varies from 600 to more than 4,000 mm. The maximum rate of growth occurs between 25 and 29°C.	The adopted temperature and precipitation projection scenario should not present any problems.
Sweet Potato	Foliage growth is maximal between 21° and 28° C; an annual rainfall of 750 to 1.000 mm is optimal.	The adopted temperature and precipitation projection scenario should not alter the current situation.
Groundnut	Temperatures below 15° and above 45°C slow down or block the growth, the optimum being between 25°C and 35°C. Rainfall ranging between 500 and 1.000 mm during the crop season usually ensures a good harvest.	The adopted temperature projection scenario should be somewhat advantageous for this crop
Banana Plantain	The optimal temperature is close to 28°C. Beyond 35-40°C, anomalies occur. Its water needs are met with 125 to 150 mm per month.	The adopted temperature and precipitation projection scenario should not alter the current situation.

Despite the alarming conditions that are appearing on the horizon because of climate change, the Gemena/Kungu/Budjala Region, presents, at the conclusion of this study, some special circumstances: the change of temperature and rainfall, according to the scenario in question, should not have any direct particular negative incidence on the yields of the area's main crops.

However, the incidence of these changes on the natural ecosystems should have a negative effect on the soil characteristics; which, in return, will not spare the possible negative incidences on the agricultural production yields, especially as the advance of the Sahara Desert towards the South should lead to less precipitation.

3.2.2.3. Measures of Adaptation or Attenuation of the Vulnerability to Climate Change

The adaptation objectives in the Gemena/Kungu/Budjala Region for the "Agriculture, Land-Use Change and Forests" sector should target the preservation of the natural ecosystems in relation to its various functions: habitats for flora and fauna, support for agriculture, maintenance for soil conservation and fertility, etc. Consequently, the following adaptation measures are proposed:

- The creation of a zoning for land use, in order to limit the areas to be allocated specifically to agricultural activities;
- The implementation of reforestation programmes in deforested areas;

- The promotion (i) of the cultivation practices allowing agricultural activities to become relatively sedentary, (ii) improved sowings, and soil enrichment techniques accessible to the peasants;
- Support for the organisation of distribution chains and for a policy for pricing the sale of agricultural products that remunerates the agricultural producers;
- The promotion of the projects enabling the populations to be reoriented towards economic activities with less impact on the forest ecosystems;
- The involvement of the local populations in the management of their local forest ecosystems;
- The supervision of quality for the benefit of peasants in their agricultural activities, the support for agricultural inputs, and the reinforcement of agricultural extension;
- The promotion of agronomic research for the improvement of the yields of the most widespread crops;
- The upgrading of the local populations' traditional knowledge relating to the conservation of the ecosystems;
- The rehabilitation of the infrastructures of the roads of agricultural interest.

3.3. The Coastal Area

3.3.1. Coastal Area Vulnerability to Climate Change

The coastal erosion is caused by the conjunction of the topography and the sandy nature of the rock, particularly under the effect of oceanic dynamics (height of the swells, speed of the breaking of the waves, tides, storms, and so on). This phenomenon has intensified since 1980. Indeed, on the basis of some historical landmarks (Mangroves Hotel, Nsiamfumu Lighthouse, residence of the former president Kasa-Vubu) and collected testimonies, it appears that the ocean has won a score of metres from the continent on the Banana-Muanda segment. Furthermore, the retreat of the coast line has been estimated at 2,300 metres at the level of the City of Muanda and at 3,800 metres at the level of Vista.

The coastal area floods were of two different kinds: marine flooding and flooding due to the post-precipitation spate of the River Congo. Thus, in the low topography sectors, Banana-Muanda and Tshende-Yema, the land is regularly flooded by sea water at high tide. Historical data shows that this sea rise can reach a height of two metres at those places and can sometimes last for more than two months. The ensuing consequences are:

- Invasion of the mangroves and of certain inhabited sectors;
- Saline intrusion affecting the water tables and the mangrove soil;
- Loss of the biodiversity of the mangrove marine park;
- Material and agricultural production losses;
- Sand deposits (deposits of up to 80cm have been recorded on the Banana-Muanda segment), etc

Floods relating to the spates of the River Congo and local precipitation are regularly recorded in many coastal area sectors, on Mateba Island in particular.

Table 14 summarises the impact of the major environmental issues identified in the coastal area.

Table 14: Impact of the Coastal Area's Main Ecosystem and Infrastructure Issues

Issues	Causes	Impacts
Coastal Erosion	- Speed of the waves breaking on the coast; - Anarchistic occupancy of certain coastal spaces; - Deforestation and soil denudation	- Loss of large areas of continental land; - Loss of coastal biodiversity; - Threats to the basic infrastructures; residential houses, roads, hotel establishments
Water and Soil Pollution	- Multiplication of off-shore oil rigs - Discharge of hydrocarbon and toxic products into the sea; - Rejection and deposits of refuse along the sea; - Plant remains carried by river water into the estuary;	- Destruction of the quality of the habitat; - Contamination and reduction of the biodiversity elements that are the most sensitive to heavy metals; - Eutrophisation of the estuary area; - Reduction of fish stocks and halieutic productivity; - Contamination of sediments and groundwater; - Disfigurement of the beaches
Destruction of the Mangrove Marine Park	- Deforestation of the mangrove due to the strong demand for ligneous energy; - Insufficient local community knowledge of the ecosystem's resources	- Loss of habitat for certain coastal area species
Flooding	- Topography of the various sectors; - River Congo spates	- Destruction of production units and crops; - Saline intrusion into the mangroves and the underground water; - Threats to the road infrastructures; - Outbreak of water-related diseases
Sand silting of the lower course of the river	- Uncontrolled deforestation; - Lack of forestation and reforestation policies	- Disturbance of navigation at the level of the area divergent from the maritime reach; - Attack on certain facilities
Socio-economic	- Coastal Erosion - Anarchistic occupancy of certain coastal spaces; - Deforestation and soil denudation	- Loss of socio-economic infrastructures in a fair part of the town of Boma; - Crop destruction; - Destruction of the agropastoral activities of the low-lying islands of the divergent region; - Exacerbation of the sand silting phenomenon in the divergent region of the maritime reach; - Population migration; - Random and arbitrary occupancy of land belonging to other communities

3.3.2. Measures of Adaptation or Attenuation of Climate Change

The impacts of climate change on the Muanda shore and the adaptation measures identified in the various socio-economic sectors are summarised in Table 15.

Table 15: Risks, Vulnerability and Adaptation Strategies in the Coastal Area

Sectors	Vulnerability Indicators	Climate Change Impacts	Adaptation Measures
Shore	- Intensity of the breaking waves and the height of the swells - Higher seal levels - Saline intrusion	- Erosion of the shorelines - Low area flooding - Saline intrusion - Destruction of population clusters - Destruction of tourist sites - Abandonment of agricultural land - Destruction of vegetation and loss of marine habitat; - Disappearance of fishing beaches - Destruction of basic socio-economic infrastructures	- Regulation of mangrove development - Coastal era development policy - Delineation of building and residential areas - Raising population awareness - Diversification of activities and rationalisation of farmers fishermen
Agriculture	- Frequent droughts - Lower than average rainfall (- 10 to 20% by 2050) - Reduction of the vegetative cycle - Less water availability - Soil leaching - High erosion rate - Soil salination - Flooding	- Less agricultural production of pluvial and irrigated crops - Lower crop yields - Food shortages - Increased water demand - Excessive water table development - Lower livestock productivity	- Use short-cycle varieties, maize, rice and beans in particular - Develop livestock breeding - Upgrade alternative crops (peanuts and beans) - Reinforce soil conservation activities - Build reservoirs and water retention ponds - Develop intensive livestock breeding - Integrated crop protection
Land and Ecosystem Degradation	- Increase of the surface flow and hydrous erosion - Reduction of the surface water and the ground water - Reduction of fodder resources - Reduction of the soil's natural regenerating capacity - Shortage of forestry products - Less biological diversity	- Reduction of rural population income - Famine	- Develop reforestation and soil conservation programmes - Development of more efficient agro-sylvo pastoral management methods - Promotion of renewable energies and domestic fuels as substitution for ligneous fuels - Participative and community management of natural resources by the civil society and the rural communities
Need for a database for integrated shore management			

3.4. **Climate Change and Human Health in DR Congo**

The climatic variability that is the most frequently taken into account in climate change narratives – health - is the influence of ENSO events (El Niño Southern Oscillation) on the emergence of diseases. Indeed, climatic factors have a notable impact on health. However, this impact is difficult to quantify with an acceptable degree of confidence. Thus, the approach adopted in the context of the study of the vulnerability and the impact of climate change on health in DR Congo is of an "epidemiologic" nature, by the search for statistical correlations that are established between the diseases and certain climatic parameters, in particular the temperature and precipitations or the SOI Climatic Index for the ENSO. Furthermore, the availability of the data for the period concerned by this second national communication has dictated the choice of the physiological states that have been treated.

3.4.1. Impact of Climate Change on the Population's Health

3.4.1.1. Malaria

The population vulnerability study in relation to malaria was conducted for the provinces of Low-Congo and Kinshasa.

In Low-Congo, the trend of the malaria cases and deaths for the period between 1960 and 2007, shows a broken trend with effect from 1985 relating to a distinct renewed outbreak of the disease and its exacerbation, which can be associated with the El Nino effects of the years 1996-1998. In addition, on the basis of the Malaria indices and the climatic parameter indices, it appeared that occurrence of malaria cases in Low-Congo was strongly related to the low precipitation and to a relatively high minimum temperature. Moreover, the projections made up until 2050 on the basis of minimum temperatures show that malaria cases will triple with the temperature increases resulting from climate change.

In addition, the information obtained from the Lomo Medical Centre of Kinshasa shows that the average precipitation and minimal temperatures for the three months prior to the medical consultation were identified as determinants in the understanding of the variability of the prevalence of malaria in Kinshasa. Indeed, the malaria there presents a seasonal variation marked by the change of the dry and the rainy season. This seasonal variation has been altered by the global circulation conditions of the atmosphere, influenced mainly by the anomalies of El Nino phenomenon, with which the correlation is highly significant. Furthermore, during the year 1997/1998, known as the El Nino year, the prevalence of malaria remains higher than the study period average, while the year 1999/2000, known as the Nina, shows a reduction of malarial infection.

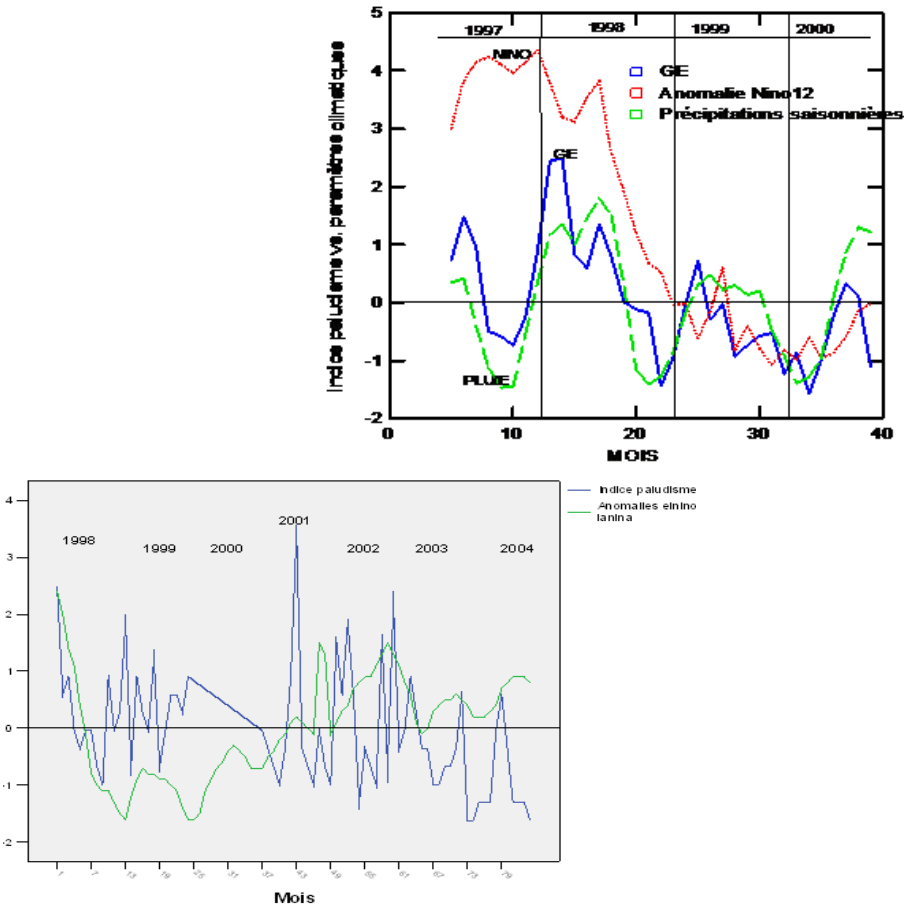

Figure 2 : Prevalence of Malaria and Climatic Condition Trend Between 1997 and 2004.

3.4.1.2. Cerebral Vascular Accident (CVA)

(i) Cerebral Vascular Accidents in urban environments

CVA is the leading cause of patient admission into intensive care in the University Clinics of Kinshasa. The CVA being of the ischemic variety for 47.2% of patients and of the hemorrhagic variety for 52.8%, with an ischemic/hemorrhagic ratio of 0.9. With regard to the influence of the seasons, it emerges that there are as many patients admitted for acute CVA during the dry season as during the rainy season.

During the 1999 to 2003 episode, the acute CVA occurrence rate varied most significantly, the lowest rate being observed during the El Nino years of 1998 and 2003, whereas the acute CVA rates increased in the post El Nino year 1998 (1999, 2001 and 2004). Furthermore, the 2002 and 2003 El Nino episodes show a risk of the occurrence of CVA of the hemorrhagic variety that was twice as great as that of the La Nina years (2001 and 2004).

Furthermore, the CVA occurred more among patients of at least 60 years of age. For these patients, a respective concordance has been observed between the peak of the CVA occurrence and the peak of the occurrence of climatic anomalies, particularly during the 2002 El Nino year.

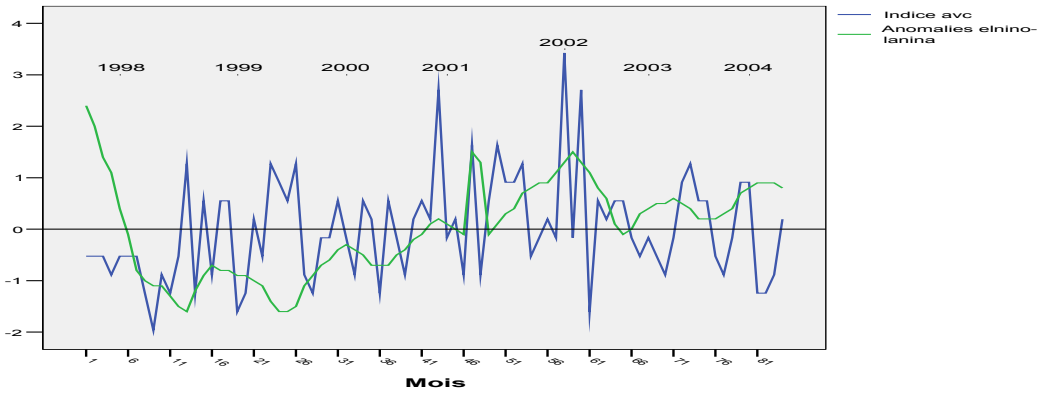

Figure 3: Relation between El Nino anomalies and CVA-related cases.

The projections made up until 2050 on the CVA-related cases and deaths show that, with climate change, their frequency will be doubled.

(ii) Cerebral Vascular Accidents in Rural Environments

The incidence of the disease in rural environments has been evaluated in Kisantu (Low-Congo) over a 12-year period (1991 to 2002), giving an incidence rate for the period estimated at 1.42% and an annual CVA incidence rate of 0.12%. Of all patients, 43.8% had been admitted to the Hospital during the pre-El Niño period (1991-1997) and 56.2% during the El Niño event (1998-2002). 39.3% of the patients were admitted to the Hospital during the dry season.

It should be noted that the statistical analysis of these results has not established any significant link between El Niño and the parameters taken into account, namely: gender ratio, arterial hypertension, sugar diabetes, cardiovascular disease, CVA relapse, coma, death and risky behaviour.

3.4.2. Health Sector Adaptation to Climate Change

3.4.2.1. Health Risk Management

A risk management system based on a monitoring of the medical phenomena and the reactivity of the partners to be involved in the event of their occurrence would be an asset for attenuating climate change and/or for adapting the population's health to it. This risk management should be conducted according to a multidisciplinary approach calling upon the sectors involved in the management of medical, environmental and social phenomena: clinicians, epidemiologists, entomologists, biologists, meteorologists, climatologists, geographers, sociologists, and so on.

- *Epidemiological Monitoring*

The Democratic Republic of Congo should be able to detect and forewarn on all medical phenomena, including the most unexpected. This should induce the government to promote the monitoring of the signs and the syndromes, far more significant, to the detriment of a traditional approach that seeks to monitor the diseases, but which is less and less efficient in meeting the challenge of the

unpredictable. The epidemiological monitoring should require the development of specific indicators (human, veterinary, environmental, etc) and thresholds of alert that should provide a better understanding of the impacts of climate change on the population's health, in the light of the extreme speed with which communicable diseases spread, primarily because of air travel, and the extreme sensitivity of public opinion, and therefore of the leaders.

- *Reactivity from Clinicians, Researchers, and the Pharmaceutical Industry*

The fundamental option remains the installation of a management system for the new diseases brought by global warming, which will involve clinicians, biologists and epidemiologists who have the necessary capacities to diagnose and treat rare diseases that become frequent, remote diseases that become close, and historical epidemics that become current once again. Moreover, a reactive pharmaceutical industry for instinctively meeting the new needs that will have been identified will need to be developed.

3.4.3. Formulation of a Priority Action Programme

A priority action programme in terms of health and social action, specific to climate change, should be set up in the perspective of achieving general objectives such as the improvement of the population's access to public and community health services for infectious diseases and non-communicable chronic diseases (sugar diabetes, arterial hypertension, cardiovascular diseases, and renal diseases), the frequency of occurrence of which is linked to climate change, as shown in the studies on health's vulnerability to climate change in DR Congo.

A second objective is the organisation of a medical-oriented weather forecast system together with an early warning system adapted to climate change in DR Congo and the creation of a multidisciplinary research centre on climate and health.

3.4.4. Various Adaptation Measures

- Reinforcement of the medical personnel's professional capacities,
- Identification and destruction of the pathogens' hideouts,
- Organisation of preventive actions against vectorial diseases,
- Reinforcement of the cleansing system,
- Organisation of the population's education and training, and the raising of its awareness,
- Improvement of the food supply system.
- Popularisation of the use of anti-mosquito grids,
- Use of impregnated window screen,
- Eradication of mosquito deposits,
- Mosquito eradication on a national scale
- Reinforcement of the population's nutritional capacities ,
- The fight against social exclusion and community promotion
- Mapping of the habitat areas at climatic risk

4. Evaluation of Technological Needs

The inventory of the greenhouse gases carried out in DR Congo has shown that the sectors that predominantly emit them are Land-Use Change & Forestry**,** followed by Agriculture and Waste. The Energy Use sector, particularly in terms of fossil fuels, is at the bottom of this list. This ranking reflects the national circumstances that prevailed at the time of this inventory. However, for the years to come, with the improvement of the country's political and economic situation and the lifting of the international embargo that had weighed on the country, one is allowed to admit that the industrial sector will resume its rise, as will the supportive sectors, which are great fossil energy users. Thus, the technological needs have been evaluated in terms for two components, one of which relates to Land-Use Change & Forests and Agriculture, and the other to Energy, Industrial Processes and Waste.

4.1. Land-Use Change & Forests and Agriculture Components

The intervention axes should relate to the improvement of rural environment income, the development of scientific research and the improvement of the country's macro-economic framework.

With regard to the improvement of rural environment income, it is a question of:

- Introducing a new vision that incorporates the promotion of peasant community development and the development of the nation;
- Promoting and reinforcing the capacities of rural population organisations and groupings
- Sustainable natural resource management;
- Improving productivity and controlling the agricultural and animal production machine;
- Rehabilitating the basic rural infrastructures.

Furthermore, a contribution from agronomic research is required in order to help:

- The peasant community to improve its living conditions by an increase of agricultural production (good quality seeds and sires, reclamation of the soil potential, water control and management, improvement of cultivation techniques, acquisition of production inputs);
- Agriculture to become an alternative source of income for the State with a view to financing its development activities;
- The researcher to grow through knowledge of the results that he or she obtains.

Moreover, the improvement of the macro-economic framework should lead:

a) To the development of agricultural loan systems;
b) To the reinforcement of marketing and production-oriented investments;
c) To the reinforcement of research structure, popularisation and supervision capacities.

4.1.1. Priority Options for Providing Immediate Solutions

The priority options and the actions adopted in the context of this national communication are summarised in Table 16.

Table 16: Priority Options for Providing Immediate Solutions

Options	Activities
Modernising the production machine and improvement of the productivity	- Developing the support services for the popularisation and the production of the inputs, in particular the seeds (field peasant schools, agricultural research, and so on); - Promoting the transformation activities of the various vegetal, animal and forestry productions, as well as the professionalization and the synergies within the sectors; - Setting up central workshops in order to produce/popularise the production plant adapted in all of the country's provinces; - Introducing agricultural produce conservation and transformation techniques.
Developing alternative agricultural production technologies	- Promoting biotechnology, mainly the fabric-crop for certain food crops; - Promoting the cultivation methods suitable for the soil and the agro climatic areas; - Popularising the use of appropriate technologies.
Defining strategic agronomic research fields	- Developing and promoting the appropriate technologies for increasing the agricultural and agro-pastoral productivity: Rational management of the basic natural resources (soil, ground water, etc); integrated fight against plant and animal pests and diseases; - Promotion of family pisciculture and livestock production and integration of pisciculture, plant production and livestock production; - Developing and promoting appropriate post-harvest technologies for the transformation and conservation of the agricultural produce; - Looking further into integrated research for development purposes; - Reinforcing the capacities of information and dissemination of agricultural research information/results; - Conducting socio-economic studies for the purpose of orienting technology transfer campaigns; - Reinforcing the scientific and technical capacities in the agronomic research field
Rehabilitating rural Infrastructures and tracks (including waterways)	- Opening up rural agricultural areas of strong potential; - Mobilising the means for implementing the maintenance and rehabilitation strategy for roads, rural tracks and waterways; - Supporting SMEs or other local organisations that specialise in road maintenance; - Promoting rural environment means of transport; - Rationalising rural environment agricultural mechanisation.
Ensuring the reinforcement of human capacities (transversely to the other fields, training of researcher training, popularisers, and rural organizers).	- Recycling of the personnel in each development project/programme; - Particularly in certain key sectors (research, popularisation, natural resource management, and so on); - Developing a researcher training strategy: Master's, Doctorate, Post-Doctorate; - Developing a training strategy for middle-level personnel working in the agricultural sector; - Ensuring of on-going trainer training: popularisers, rural organisers, and so on; - Recycling and regularly upgrading the qualified researchers.
Ensuring the reinforcement of rural organisation capacities	- Supporting basic community development; - Support sector professionalization and structuring; - Reinforcing the capacities and the training of the Peasant Organisations (PO) and groupings.
Improving the distribution chains and setting up agricultural produce markets	- Supporting the reconstitution of distribution chains and private operators; - Supporting the development of products enjoying comparative advantages and reinforcing the promotion of those products on target markets;

Options	Activities
	- Improving the price and contract information systems with establishment of regional sector monitoring stations; - Supporting micro-finance development.

4.2. Energy, Industrial Processes and Waste Component

Here it is a question of improving access to clean energy for domestic, residential or transport needs, as well as for industrial activities, by:

- Reduction of the dependence on ligneous fuels and their derivatives
- Improvement of electricity generation and distribution
- Powering of industries by clean energy sources
- Substituting fossil-fuel energy by renewable energy sources and incorporating the policies of using clean technologies in the transport sector.
- Promoting and using biogas technology
- Promoting the rational use of energy (PURE)

4.2.1. *Recommended Priority Options for Providing Immediate Solutions*

The priority technological options have been grouped together in Table 17.

Table 17: Priority Technological Options

Objective	Activities
To provide clean, sufficient and stable energy in the residential sector	- Installing hydroelectric power stations, rehabilitating existing hydroelectric power stations and their associated networks and operating network interconnection; - Promoting and popularising photovoltaic solar energy technology or other renewable energy sources; - Acquiring the equipment (anemometers, wind vanes) for the installation of wind technology in favourable sites, e.g.: the coast at Moanda, the Batéké Plateau, the Kundelungu Plateau; - Promoting the installation of other forms of renewable energy (e.g.: Biogas, geothermal energy, natural gas, etc).
To improve energy efficiency	- Reinforcing the energy efficiency capacities in buildings, industries, and the residential sector; - Promoting and popularising the use of hearths that make better use of ligneous energy
To promote cleans means of transport	- To develop means of transport using clean energy sources. Controlling the quality of mobile equipment using clean energy; - Monitoring the local completion of infrastructure installation works (roads, railways, inland waterways, and so on); - Recycling human resources - Popularising, encouraging and producing “green” fuel;
Gradually to introduce a production and/or transformation industry ensuring sustainable development.	- Observing international standards for the installation of clean factories and industries by the sectors; - Ensuring all possible waste recycling; - Controlling the operations per plant of the parties that are allowed to emit GHG (GES); - Training and/or recycling human resources ad hoc

4.3. Barriers to Technology Transfers

The principal constraints, their consequences on the transfer of the technologies and the priority actions are reported in Table 18.

Table 18: Main Obstacles and Some Solution Possibilities

Barriers	Consequences	Priority Actions
- Weakness of the legal system, absence of a regulatory body in the industry, energy and transport sectors; - Measures of legislative application in favour of investment and industry; - Insufficient tax incentives for investment in clean technologies	- Discouragement of local and external investors; - Lack of investor confidence because of lengthy arbitration processes, unclear property rights, and so on…	- Reform of the legal system ensuring conformity, property rights and transparency.
- Monopolistic production and distribution structure in the energy sector; - Absence of an advisory assistance system in favour of the Small and Medium-sized Enterprises - Lack of co-ordination between the various users and institutions	- Subjective evaluation system, no signalling of the prices or barriers to the introduction of energy efficiency measures - Lack of information and knowledge about adapting to new technologies;	- Reform and improvement of the overall performances in the sector
- Inexistence of any database on the new technologies - Insufficient mastery of new techniques, methods and management tools by the industrial entities - Lack of qualified maintenance staff; - Relatively low-level technological possibilities compared with other developing countries due to the inexistence or insufficiency of suitable technical labour.	- A lack of competitiveness of the production factor costs compared to other competitor countries; - Economy dependence with regard to rural agriculture (market limited to urban areas) - Weak and non-competitive productivity - A lack of procedures for matching new technologies to new situations - Deteriorating performances in many applications, both operational and maintenance	- Creation of multi-discipline databases; - Ensuring a programme of skills reinforcement, and continuous training and recycling - Development of a critical mass of human capital via appropriate government policies
- Inadequate macro-economic policies; - A lack of suitable financial systems;	- Low rate of foreign investment due to cumbersome transactional procedures; - Low capacity to access external funds for projects and other financial needs;	- Improving financial and administrative efficiency - Ensuring support for productive activities within the economy

This analysis shows that the adjustment and the technology transfer processes are mainly matters for government, which has to create and maintain a propitious environment for an effective and efficient technology transfer via the introduction of incentives. It should furthermore encourage and promote the research organisations and institutions at the national level.

Table 19 presents a summary of the technological capacity reinforcement projects in relation to the attenuation of greenhouse gases.

Table 19: Summary of the Technological Reinforcement Projects for the Attenuation of GHG

Sector	Title	Locality	Est. Cost (USD)	Institutional Responsibility
Agriculture, Land-Use Change & Forests	1. Agro-Forestry Promotion in Savannah Areas	Bandundu, Katanga, Kasaï Kinshasa	1,360,000	Environment / National Reforestation Department
	1. Improving the productivity of the land and the industrial development land	All provinces	1,790,000	Agriculture
	2. Developing a Vade Mecum on Rural Forestry	All provinces	400,000	SNV, NGO (ONG) and S. N. R.
	3. Reforestation in the Low-River Area	Low-Congo	6,000,000	Environment / S. N. R.
	4. Firewood Plantation in Kinshasa (Batéké Plateau), Lubumbashi and Mbuji-Mayi	Kinshasa, Lubumbashi, Mbuji Mayi	22,000,000	Environment / National Reforestation Department
Energy, Industrial Processes, and Waste	5. Pilot Development Installation For 50 Micro Hydroelectric Power Stations In DR Congo	All provinces	361,316,906	Energy / CNE
	6. Pilot Electrification Project For Five Agglomerations By Solar Means In The Kinshasa Hinterland	Kinshasa	3,868,483	Energy / CNE
	7. Anemometric Studies in Moanda (Low-Congo Coast), Mbankana (Batéké Plateau, Kinshasa), Kongolo and Manono (Kundelungu Plateau, Katanga)	Low-Congo, Kinshasa, Katanga	200,000	Energy / CNE
	8. Energy Efficiency Studies In Industries And Air-Conditioned Buildings	Kinshasa, Katanga	2,300,000	Energy / CNE
	9. Popularisation of Improved Carbonisation Techniques	Kinshasa, Lubumbashi, Kananga, Mbuji Mayi, Low-Congo	4,000,000	NGO under the Ministry of the Environment's supervision

5. Systematic Climate Watch

The DR Congo's systematic climate watch is enshrined in the context of the Global Climate Observation System (GCOS), which is a world programme conducted jointly by the WMO (OMM), the Intergovernmental Oceanographic Commission (IOC), UNESCO, UNEP and the International Council for Science (ICSU).

The DR Congo's meteorological observation network is represented by three major stakeholders, which are the National Agency of Meteorology and Teledetection by Satellite or METTELSAT, the Air Routes Authority (ARA) and the National Institute of Agronomic Studies and Research (NIASR). This meteorological observation network does not play the expected role in the context the Global

Climate Observation System (GCOS), whose aim is to ensure that the observations necessary for confronting the climate-related problems, be they of a general or particular order, are correctly defined, implemented, and made available. Furthermore, this data has to contribute to the detection of climate changes and to the indication of their source, to the monitoring of the climatic system and to its application to sustainable economic development.

Moreover, observations on the ground are also carried out by other Public Institutions such as the Waterways Authority (RVF), the Sea Routes Authority (RVM) and the Air Routes Authority (RVA). It should however be admitted that the current legal and institutional framework is unsuited to the GCOS's expectations. Furthermore, the national institutions that are involved therein are working in an uncoordinated fashion and are prey to enormous difficulties that are already prejudicial to the achievement of their primary assignments: insufficient cover of the country for lack of means, non-compliance with WMO standards, lack of equipment and appropriate facilities, irregularity in the collection of weather data, difficulties with the data transmission, no laboratory for maintenance and calibration of the equipment, absence of qualified personnel for the quality control of the data, no research programme, low level of staff remuneration, and so on and so forth.

5.1. Institutions Involved in the Systematic Climate Watch

5.1.1. METTELSAT

As means of meteorological observation, Mettelsat has at its disposal:

(i) A basic synoptic network on the surface made up of 27 stations of which 13 remain operational, however, without compliance with the WMO standards with regard to the frequency of the observations and the calibration of the instruments.
(i) A basic synoptic network at altitude by radiosounding in Kinshasa, Kisangani and Lubumbashi.
(ii) A climatological network consisting of four Rainfall stations installed on the Batéké Plateau for agrometeorological purposes in 1999.
(iii) A receiver of observation data from the European geostationary meteorological satellite METEOSAT 8 (MSG).

The services rendered by Mettelsat relate to the general weather forecasts made once per day and for a 24-hour period as well as the climatic forecasts, the seasonal and decadal forecasts in particular.

The climatological services suffer from several lacunae which obstruct their normal functioning, in particular the lack of archiving of the data collected in the provinces, the reliance on paper, and the lack of quality control and homogenisation testing.

Mettelsat has a GIS system which remains underused for want of sufficient training on how to use it. However, it contributes to the constitution of a geo-referenced database relating to various sectors such as transport, energy and health infrastructures, inter alia.

In hydrology, Mettelsat is not yet making any hydrological observations. It has however been programmed in the past specifically to digitise some data coming from the RVF.

Research activities do not exist within Mettelsat. But the institution lends its support to various tasks completed at university or research centre level. However, the disparity of the recorded data and its lack of exhaustiveness usually impair its quality.

With regard to maintenance, the laboratory for maintenance and weather instrument servicing is lacking both equipment and spare parts. A suitable laboratory clearly has to be established and technicians trained for this purpose have to be mobilised.

5.1.2. National Institute of Agronomic Studies and Research (NIASR)

The agricultural sector is the pioneer of the meteorological watch in the Democratic Republic of Congo. Already in 1911, for the agricultural need, the General Meteorological Office was co-ordinating 780 rainfall stations in Kinshasa. Today, NIASR, successor of INEAC, no longer operates any more than a vestige of the 22 agrometeorological stations, using out-of-date equipment and facilities. The filing and the conservation of the data are still carried out in observation notebooks and on monthly report cards (paper medium).

5.1.3. Air Routes Authority (RVA)

The RVA is in charge of airport infrastructures and the supply of air navigation services. It employs some sixty meteorologists seconded from METTELSAT in order to undertake aeronautical meteorology activities in the airport of Kinshasa/N' djili.

5.1.4. Waterways Authority (WA) (RVF),

The RVF is a public service in charge of the maintenance of the waterways upstream of Kinshasa. In this respect, it makes hydrological observations of the navigable reach by means of 160 hydrometric stations, five of which are still operational at this time. The parameters measured relate to the liquid and solid river flows, the level of those rivers and lakes as well as the current velocity. On the basis of this data, it formulates its hydrological forecasts, the bathymetric maps and the navigation catalogue with a view to carrying out the beaconing and dredging work. The RVF takes no account of the other hydrological parameters, which are not directly relevant to the waterways' level of maintenance.

Paper is still used for the filing and the conservation of the data. Currently, the observations made within the country are no longer transferred directly to Kinshasa before they are used.

5.1.5. Sea Routes Authority (RVM)

The RVM fulfils the same missions as the RVF in terms of the navigable reach, which is between the Port of Matadi and the river mouth.

5.2. Installation of a Network for Systematic Climate Watch

The organisation of a network for the systematic observation of the climate requires prior reinforcement of the capacities for the installation of an appropriate legal and institutional

framework. A substantial improvement of the infrastructures and equipment for the systematic monitoring of the elements of the climate, for recording and analysing the data, and the training of a qualified member of staff is also necessary in the context of the actions to be promoted.

However, while waiting for the improvement of the legal framework for the systematic monitoring of the climate, the Climate Change Division of the Sustainable Development Directorate of the Department of the Environment of the Democratic Republic of Congo should facilitate better management of the weather and climatic information over the whole of the national territory. This Division should function as a co-ordination system in respect of the synergies that could effectively restore the transnational nature of the climate change, and culminate, on a larger spatial scale, in more appropriate adaptation measures.

6. Climate Change Attenuation Programmes

6.1. National Programme for the Reduction of Emissions related to Deforestation and Forest Degradation

The DRC has launched a national process on the REDD at the time of an inter-agency exploration and planning mission in January 2009, with the participation of nine international organisations and a large number of professionals and partners.

Indeed, the REDD (Reduction of Emissions related to Deforestation and to Degradation of the forests in developing countries) is an environmental finance mechanism that aims at the attenuation of the climate change and the conservation of the forests, in a sustainable development context. Its concept has been developed with the aim of making it a new financial instrument in order to face the urgent environmental challenges at the global level, as well as those relating to sustainable development in the developing countries. Since 2007, the REDD concept has been under discussion at the international level - within the United Nations Framework Convention on Climate Change (UNFCCC) - with like objective of including this mechanism REDD among the battery of Post-Kyoto Protocol agreements and international instruments, which expires in 2012.

The objectives of the REDD strategy are twofold: (i) to reduce the emissions relating to deforestation and degradation and to reduce poverty as described in the Growth and Reduction of Poverty Strategy Document (DSCRP). These objectives may not under any circumstances be dissociated. It is a question therefore for the REDD strategy in DRC of identifying as a priority the “win-win” solutions where all parties have something to gain and for which the opportunity costs are negative or very low.

The DRC is currently benefiting from two international programmes in support of the REDD process at the national level: the UN-REDD Programme (partnership FAO, UNDP and UNEP and the FCPF Programme (World Bank). In May 2009, the three agencies of the UN-REDD programmes (namely: FAO, UNDP and UNEP, and the World Bank through the FCPF organised a joint mission of support at the start of these programmes.

The DRC is actively working on a preparation plan (R-PP) for the REDD regime. This plan, which has to be approved by the World Bank’s Forestry Carbon Partnership Fund by March 2010, will provide precise details of the preparation process of the DRC for the REDD. The following section gives the broad outlines of this preparation for the REDD mechanism.

The technical aspects of this programme are articulated around: (i) the definition of the reference scenario (including the biophysical and socio-economic components), (ii) the installation of a monitoring, reporting and verification mechanism, commonly known as the "MRV" system, and, (iii) the formulation of an REDD strategy for contain the increase or for reducing the GHG emissions caused by deforestation and forest degradation in DRC.

The objective targeted by the reference scenario is:

- To develop, on the basis of the existing data, a national space and/or geographical model for predicting land-use changes and the associated carbon loss or gain;
- To evaluate the opportunity costs and to incorporate the transaction and implementation costs into the estimate of a national REDD programme.
- To develop a sub-national space model of land-use on the basis of recent field data obtained from three or four pilot areas identified according to the variability of the factors of deforestation and degradation of the forests in DRC.

The introduction of a monitoring, reporting and verification system (MRV) with the objective of estimating, in a reliable and verifiable manner, the greenhouse gas emissions caused by deforestation and forest degradation in DRC. These estimates will be included in the DRC's national GHG inventory.

The measurement of the greenhouse gas emissions in the forestry and land-use sectors comprises two main sub-components:

a) The monitoring of the activities causing of the GHG emissions (activity data) that will be carried out thanks to the teledetection tools in DRC, and
b) The inventory of carbon stocks on the ground (emissivities)

The REDD strategy in DRC will constitute one of the main products of the Preparation Process for the REDD for the period 2009 -2011. Its development should last for two years or more, and will start with a very detailed outline defining the fields that call for additional development work. Its formulation will be based on four participative studies which in the long term will provide recommendations for an integrated strategy targeting both a reduction of poverty and a reduction of greenhouse gas emissions relating to deforestation and to forest degradation.

It is a question of:

- ✓ Diagnostic study on the causes and the agents of the deforestation and the degradation of the forests in DRC;
- ✓ Study on the lesson to be learnt from the initiatives in progress seeking alternatives to deforestation and forest degradation;
- ✓ Economic, environmental and social evaluation of the REDD in DRC;
- ✓ Study of the use of the REDD's income.

It should also be noted that activities of Information, Education and Communication (IEC) are in progress, such as: the preparation of IEC materials, the organisation of information and awareness-raising workshops, the preparation and the implementation of a capacities reinforcement plan on

REDD, the organisation of informative sessions, and the training of the trainers at the provincial level in order to build on the REDD strategy more effectively.

6.2. *Ibi Carbon Sink Project/Bateke (PCI/Ibi Project)*

The Ibi/Bateke Carbon Sink Project is a private initiative of the Novacel Company, approved by the DRC's Designated National Authority, which contributes to the clean development mechanisms, in particular by:

- Sequestration of CO_2 from the atmosphere with the plantation, on a grand scale, of fast-growing forestry species, on the Batéké Plateau;
- Reduction of greenhouse gas emissions by the fight against deforestation of the galleria forest, the degradation of the land, and bush fires, current practises on the Batéké Plateau.

The Ibi project has been established on the Batéké Plateau for the purpose of planting stands of Acacia, Eucalyptus and Pine there, and some exotic local species. With a view to:

- Ensuring a regular supply of charcoal for the capital (8 to 10 million inhabitants), produced in a sustainable manner;
- Contributing to the fight against the population's poverty by offering job opportunities to the local communities;
- In the long run, contributing to the Plateau's sustainable development by an extension of the afforestation activities and the regeneration of the local forest species and thus, contributing to the protection of the ecosystems and the biodiversity.

The PCI/Ibi project is thus enshrined within a Sustainable Development and brings beneficial effects at the local, national, regional and world level.

(i) At The Local Level

- Development of a sustainable forestry management mode contributing to the production of ligneous and non-ligneous forestry products;
- Installation of seedbeds for the production of the seedlings, accessible to the community, with the technological knowledge developed for their replication at the local level placed at their disposal;
- Promotion of entrepreneurship and creation of job opportunities in the forestry field, the transformation of the ligneous products and the production of coal by means of improved technologies.

(ii) At the Regional and National Levels

- Substitution, on the market, of coal produced in a non-sustainable manner and coming from the degradation and the deforestation of the natural forests and the galleria forests by coal produced in a sustainable manner by artificial forests**.** The ensuing benefits are numerous: Protection of the biodiversity, reduced soil erosion, maintenance of the water piping system and the water quality, and so on.

- Development of a technological afforestation model on Batéké Plateau, including forestry methods, which can be replicated on savannahs similar to those of the Batéké Plateau, throughout the country and beyond its borders.

(iii) At the World Level

- Through the carbon sequestration, which will be evaluated by a structure established locally for the production of the carbon assessment and the quality assurance of the activities implemented, the project contributes to the reduction of gases to greenhouse effect and safeguarding of the environment against the climate changes.

7. Capacity Reinforcement for Sustainable Environmental Management

The insufficiency of the legal institutional and human capacities continues to represent the principal constraint for the preservation of the environment, not only at the level of the national and provincial structures and the local government agencies, but also at the level of the non-governmental organisations (NGO) and the population in DR Congo.

Furthermore, major issues persist at the policy and strategy formulation level, and with the execution of the development programmes for accepting the environmental challenges with regard to climate change, biodiversity, forests, land, and water resources. Indeed, the programmes and projects put in place on a sectoral basis are not of a kind to ensure:

- The elimination of infringements of a legal, political and institutional nature for all the sectors of the environment;
- The taking into account of questions relating to the control of the environmental dynamic in order to grasp the pressures or better, the improvements implemented at the end of various initiatives undertaken with regard to environmental protection;
- The implementation activities focusing on the generalisation of best practices or the identification of the techniques and technologies appropriate for sustainable environmental management;
- The support strategies for the income-generating activities that have little injurious impact on the environment, for the benefit of producers from rural circles, in order to attenuate the emission of greenhouse gases and the pressures on the natural resources.

Thus, the capacity reinforcement programme for the sustainable management of the environment, the priority actions of which are summarised below, is seeking the installation of a strategic framework of co-ordination of all the activities linked to the reinforcement of capacities for accepting the environmental challenges, for rationalising and harmonising the intervention approaches and for creating a climate propitious for the sustainable management of the environment in DR Congo.

Furthermore the envisaged actions contribute to the promotion of good environmental governance in order to anticipate and to manage the challenges, and to the improvement of the income of the rural producers by promotion of and support for income-generating activities that are environment-friendly.

7.1. Summary of the Priority Actions for the Capacity Reinforcement Programme

7.1.1. *Climate Change*

Table20: Priority Intervention Framework

Intervention Context	Priority Actions
Legislative and Regulatory	Promulgation of the Environment Act
Institutional	- Structuring and reinforcing the capacities of the National Climate Change Committee - Creating and equipping the provincial Climate Change Secretariats
Sectoral Policies	- Improvement of the capacity of individuals to manage and protect the environment - Reinforcement of the teaching time on meteorology, climatology and general hydrology in the higher education and university channels of natural sciences - Installation of national Quality Assurance programmes for all current and/or future industrial processes in the country - Introduction of audio-visual broadcasts on climate topics into the programmes schedules - Rehabilitation of the network for collecting meteorological, climatological and hydrological data throughout the national territory - Creation at the level of each province of a unit for the regular evaluation of the vulnerability to climate change and for the inventory of endogenous knowledge about the climate - Raising basic individual and community awareness of questions relating to the climate change of their circles - Organisation of thematic training courses for the benefit of target groups - Facilitation of forest-oriented lifestyles (support for small forestry companies, promotion of local community forests)

7.1.2. Land and Forests

Intervention Context	Priority Actions
Legislative and Regulatory	- Promulgation of the water Code - Application texts of the Land Act and the Forest Code - Popularisation of the Land Act and the Forest Code - Legislation and regulation in terms of land development - Land zoning
Sectoral Policies	1. Sustainable forestry development and Zoning of the forests - Mastery and control of the land degradation process and restoration and rehabilitation of degraded land - Improvement of the productivity of degraded ecosystems and protection of ecosystems that are under threat - Incentive measures for the development of afforestation and reforestation campaigns 2. Training / Education / Awareness-raising of the Players * Formulation of eligible projects for international funds or financial mechanisms on the fight against land degradation and deforestation * Participative and decentralised management of natural resources * Good environmental governance * Identification and diversification of income-generating activities

Intervention Context	Priority Actions
	* Structuring/Organising basic communities and local development initiatives * Savings and loan systems and improvement of the technical production routes * Use of alternative energies

7.1.3. Biodiversity

Intervention Context	Priority Actions
Legislative and Regulatory	- Finalisation and adoption by the National Assembly of the framework bill on the environment and the various nature conservation bills; - Formulation of the Act on the management and trade of the phytogenetic resources; - Formulation of the regulations on impact studies - Finalisation and adoption by the National Assembly of the fishing bill
Institutional	- Refocusing the role of the administration around the kingly missions of the State, in particular: * Development and monitoring of policies, programmes and strategies * Formulation of the legislative, regulatory and normative framework * Planning with a view to translating the policies and strategies into coherent blueprints
Sectoral Policies	- Development of alternative activities to poaching such as livestock breeding and pisciculture * Revision of the blueprint for the development of fishing * Revision/development of blueprints for the National Parks * Transparent allocation of forestry and protected area concessions * Forestry and faunal control : fights against illegal forestry development and poaching

8. Environmental Information, Training and Education

8.1. Information and Raising Population Awareness

The participative process adopted at the time of the formulation and implementation of the programmes relating to the preservation of the environment is generally limited to a restricted representation of all the interested parties, for lack of means for greater mobilisation, contrary to the 10th Principle of the Rio Declaration (1992), which stipulates: *"Environmental issues are best handled with participation of all concerned citizens, at the relevant level. At the national level, each individual shall have appropriate access to information concerning the environment that is held by public authorities, including information on hazardous materials and activities in their communities, and the opportunity to participate in decision-making processes."*

Just as in its Article 53, the Constitution of the Democratic Republic of Congo sanctions the right for each citizen to enjoy a healthy environment and imposes the duty to defend it.

However, despite the efforts made by the Department of the Environment, the issues relating to poor environmental governance are still increasing, are threatening the living environment to an ever

greater extent, are dangerously affecting the biodiversity, are contributing to the destruction of the ozone layer and are alimenting climate change.

In addition, the absence of environmental documentation and the lack of specialist newspapers and other means of information and of raising public awareness, plus the insufficiency of the information and experience exchange framework, constitute an obstacle to an efficient contribution from the population to the fight against environmental pollution.

It should however be noted that a free weekly "Environment Information" newspaper, appearing since 1997, is published by the NGO "Antenna for the Recognition of the Environment in the Congo" (AREC), with a circulation of 1,000. This newspaper constitutes the sole weekly digest of scientific and technical information on the environment, tourism, good environmental governance and related fields that is published in DR Congo.

Moreover, it is necessary to pinpoint the television broadcasting of two programmes on the environment, one of which on the national television channel (RTNC), and the other on a private channel (Congo Web TV). The programmes were structured in such a way as to discuss big topics, in particular on the state of the national environment and the news about the national and international environment.

The capacity reinforcement needs are however required to support the efforts, of the "Environment Information" newspaper in particular, to disseminate to many readers both within the country (189 Territories, 28 Districts and 10 Provinces) and outside the country, to ensure a broad circulation inside the Country, to open and maintain the newspaper's website, and finally, to install a specialist environmental radio service which can broadcast by feed over the entire extent of the country.

This project for the installation of an environmental radio service is seeking to guarantee, in a sustainable manner, environmental information, training, awareness-raising and education over the entire extent of the country, to serve, by means of communication, as support for the environmental and social evaluation process in progress in the country, and finally to promote the protection of the forests and the fresh water of the Congo Basin.

The AREC initiative is also seeking to produce a special issue, in tabloid format, every three months and to distribute it free to pupils throughout the country, together with a quarterly environmental promotion magazine.

8.2. Environment and Climate Change Training

The Congolese education system is organised around secondary, higher and university education, as well as primary school and kindergarten education.

The curricula operated within these institutions do not incorporate specific matters on the environment, climate change or desertification. The subjects taught in connection with the sciences that have link with the environment are articulated around basic and/or applied biology and the related disciplines. It should however be noted that, with regard to those disciplines, since the last teaching reform in 1971, when teaching Biology for example, one will talk about Ecology and Nature Conservation instead of Botany and Zoology. Moreover, the general Ecology course will be enshrined within the students' training in Agronomic, Biological and Earth Sciences.

The Ecology course will serve as support not only for addressing the links that exist between the components of the biosphere, but also as a discussions framework around the problems generated by Man in his relationship with his environment. But it was quickly realised that this discipline did not recover all aspects of the human environment. This is why one is gradually moving - at least in certain institutions - towards the creation of options with a purely environmental vocation.

At the University of Kinshasa, for example, a special Environmental Management Diploma was created in 1983, which was attached to the Biology Department and later, in 2003, the Environmental Sciences Department was set up as an entity independent of the Biology Department within the Faculty of Science. The tendency to incorporate the environmental dimension into the curricula is currently gaining ground, as is the case with the Cardinal Malula University, within which there is a Faculty of Environmental Science, and at the University of Kinshasa, with the creation of a Department of Natural Resources Management, which functions with two options Soil & Water, or Flora & Fauna, and the Regional School for the Development of Tropical Forests (ERAIFT).

However, it must be admitted that the road ahead is still long for lead the general public to take a full and correct part in the search for environmental solutions to the issues arising in their environment, especially for those relating to climate change.

It is also worth mentioning that there is no explicit legal text on Education and Environmental Information which would contribute, via training, to the preservation of the natural resources and the environment. It should further be pointed out that the current curricula do not necessarily encourage the teachers, in particular those of human sciences, to incorporate the environmental dimension into the subjects that they teach.

Human resources are available for ensure quality teaching in the environmental field. However, one can only deplore their numerical inferiority, taking into account the vastness of the territory and the issues linked to the current state of the world environment. Indeed, the DRC has less than a dozen qualified specialists (those who give lessons and who have equipped and functional laboratories) on environmental issues.

8.3. Teaching Tools for Training Communities

The current curricula are not in tune with current environmental realities. At the higher and university education levels, aspects relating to the water environment are usually only evoked in the general context of the lessons included within the curriculum. Furthermore, the absence of funding in the teaching sector reduces the teacher's possibilities of accompanying his or her lesson with adequate teaching aids, drawn from his or her environment.

Moreover, the lessons remain essentially theoretical and are not accompanied by laboratory handling, which would enable the learners to familiarise themselves with the various forms of handling and to address concrete cases of environmental issues. Nevertheless, the students who complete their end-of-course theses on environmental issues have a better understanding of those problems and sometimes have the benefit of doing some handling within certain laboratories.

Because of this, the use of other teaching aids in addition to the traditional works used by teachers is essential in order to inform the community and raise its awareness of the problems of the degradation of the environment and the related issues.

Multimedia tools represent an important instrument in this context, despite the high cost demanded for the dissemination or publication of the information and the lack of qualified personnel in the organs of the press who can act as relays of the university professors. In this context, visual aids following in the form of images, photographs, posters and cartoons should occupy a special place in the popularisation process in order to reach the majority of the Congolese population whose educational level is generally low. Indeed, photographs and drawings catch the eye, focus the attention and take part in the construction of mental representations.

Sound supports: sketches, theatre, concerts… and visits to various places of historical, cultural or tourist attraction can also be used as tools for raising the population's awareness.

The academic world can develop other trump cards such as the organisation of training workshops, seminars, conferences and guided laboratory tours of the in order to convey the message on the management of the environment which would help the population to change its behaviour in relation to its environment and to pay constant attention to the problems of its degradation and climate change.

Diversification of the written media should also be envisaged, such as newspapers, magazines, folders and teaching guides on environmental education intended for schools, as well as the creation of websites for wider circulation of information to well-targeted groups.