REPUBLIC OF RWANDA

MINISTRY OF LANDS
RESETTLEMENT AND
ENVIRONMENT

NATIONAL STRATEGY AND ACTION PLAN FOR THE CONSERVATION OF BIODIVERSITY IN RWANDA

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1. GENERAL INTRODUCTION

1.1 Convention on biological diversity

To day, all mankind agrees that biological resources are vital for the economic and social development of present and future generations. These resources constitute an invaluable wealth. However, they are seriously threatened by man's activities, resulting in an alarming extinction of species and a regression and/or destruction of ecosystems.

Faced with this worrying observation, the United Nations Environment Programme (UNEP) launched initiatives, particularly the meeting of the Special Group of Experts on Biodiversity held in November 1988 to consider ways and means of preserving threatened biological resources.

In May 1989, UNEP established the working group of legal and technical experts responsible for studying the biological diversity in order to prepare an international legal instrument for the conservation and sustainable use of biological diversity.

In February 1991, the ad hoc group was transformed into an Intergovernmental Negotiating Committee.

On 22 May 1992, UNEP organized the Nairobi United Nations Conference, which adopted the agreed text of the Convention on Biological Diversity with three fundamental objectives, namely:

a) conservation of biological diversity
b) sustainable use of its components
c) fair and equitable sharing of the benefits arising from the utilisation of genetic resources

After its adoption, the "Convention on Biological Diversity" (**CBD**) was open for signature on 5 June 1992 at the United Nations Conference on Environment and Development (Earth Summit). It remained open until 4 June 1993 by which time it had received 168 signatures. The Convention entered into force on 29 December 1993.

Rwanda signed the International Convention on Biological Diversity in Rio on 10 June 1992 and ratified it on 18 March 1995. This act offered a formal framework that enabled the Government of Rwanda to confirm its concerns for the conservation of its biological diversity since the 1920s with the creation of national parks (Akagera National Park 1934, the Volcanoes National Park 1925) and forest reserves (the Nyungwe Forest Reserve 1933).

After the ratification, Rwanda, like other signatories of this Convention, undertook to implement the provisions of the Convention on Biological Diversity, including Articles 6 and 7 relating to the general measures for conservation and sustainable use and to identification and monitoring.

Article 6, which stipulates that "Each Contracting Party shall, in accordance with its particular conditions and capabilities":

a) Develop national strategies, plans or programmes for the conservation and sustainable use of biological diversity or adapt for this purpose existing strategies, plans or programmes which shall reflect, *inter alia*, the measures set out in this Convention relevant to the Contracting Party concerned;

b) Integrate as far as possible and as appropriate, the conservation and sustainable use of biological diversity into relevant sectoral and cross-sectoral plans, programmes and policies.

Article 7, which stipulates that "Each Contracting Party shall, as far as possible and as appropriate, in particular for the purpose of Articles 8 to 10 (see Convention, Annex I):

a) Identify components of biological diversity important for its conservation and sustainable use, having regard to the indicative list of categories set down in Annex I of the Convention;

b) Monitor, through sampling and other techniques, the components of biological diversity identified pursuant to subparagraph (a) above, paying particular attention to those requiring urgent conservation measures and those which offer the greatest opportunities for sustainable use;

c) Identify processes and categories of activities which have or are likely to have significant negative impacts on the conservation and sustainable use of biological diversity and monitor their effects through sampling and other techniques; and

d) Maintain and organize, by any mechanism data, derived from identification and monitoring activities undertaken pursuant to subparagraphs (a), (b) and (c) above.

1.2 Institutional foundation of the National Strategy and Action Plan

The implementation of the provisions of the Convention on Biological Diversity falls under the Ministry in charge of Environment. Based on its prerogatives, the Ministry of Environment and Tourism (MINETO), in 1997, requested and obtained financial support from the Global Environment Facility (GEF) for the project called "**Biodiversity Strategy and Action Plan** (BSAP in short)".

Pursuant to the decisions of the First Conference of the Parties, MINETO put in place a coordination mechanism of the project BSAP composed of a National Coordinator assisted by a Secretary. It then established a Planning Team and a Monitoring Committee composed of 7 and 17 persons respectively taken from Ministries and other State institutions, higher institutions of learning and research institutes, Non Governmental Organizations, projects engaged in the protection of nature and biodiversity.

These structures, starting from the Ministry of Environment and Tourism (MINETO) to the current Ministry of Land, Settlement and Environment Protection (MINITERE) through the Ministry of Agriculture, Livestock, Environment and Rural Development (MINAGRI), coordinated and monitored the development of the national strategy and action plan for the conservation of biodiversity.

1.3 Methodology of development and participatory process

The process of development of the National Strategy and Action Plan on Biodiversity was successively supervised by the above mentioned Ministries.

This process involved several actors engaged in the management and use of biological resources who, in various degrees, participated in the development of the strategy. These actors include the Planning Team, the Monitoring Committee and Consultants with the assistance of the National Coordinator and the Secretary from the Ministry, local authorities, representatives of local communities, NGOs, farmers, stockbreeders and technical units falling particularly under the Ministries of Agriculture, Livestock, Environment, Natural Resources, Tourism and Education.

The development of the strategy went through five stages:

1. survey phase of the existing data on national biodiversity
2. evaluation phase of these data through a two-day national workshop with the support of an international consultant
3. training and introduction phase of organizers of regional seminars (national consultants, members of the planning team and monitoring

committee) to the techniques of strategic planning in the field of biodiversity

4. identification phase of strategic options and regional plans for the conservation and management of biodiversity
5. development phase of the national strategy and action plans on biodiversity

The National Strategy will be implemented by all the stakeholders in the field of biological resources, particularly the Ministry of Lands, Resettlement and Environment.

In the framework of the national decentralization policy, implementation of the National Strategy on Biodiversity will be carried out by the Community Development Committees (CDC).

The Strategy is translated into action by a National Action Plan, which defines the activities to be carried out, the expected outcomes, the actors, and the appropriate resources for the realization of the activities and the implementation time frame.

2. INTRODUCING RWANDA AND ITS BIODIVERSITY

2.1 Geographical Context

2.1.1 Physical Features

2.1.1.1 Relief

Rwanda is a small country in the heart of Central Africa. It covers 26,338 km^2. It is situated between 1°04' and 2°51' of latitude south and between 28°53' and 30°53' of longitude east. Rwanda is a landlocked country: it is surrounded in the north by Uganda, in the east by Tanzania, in the south by Burundi and in the west by the Democratic Republic of Congo (former Zaire). The shortest distance to the Ocean is 1,200 km.

Rwanda's altitude ranges between 1,000 m in the southwest (Bugarama) and 4,500 m in the northwest (Volcanoes Range). The relief is laid out in tiers in three distinct compartments from west to east. In the west of the country, there is the Congo-Nile ridge which overhangs Lake Kivu, then the Volcanoes Range and the Central Plateau, and finally the eastern lowlands.

The Congo-Nile ridge is dominated in the North East by a range of volcanoes facing WSW-ENE and consisting of five volcanic massifs. From West to East, there are Karisimbi (4,507 m), Bushokoro (3,711 m), Sabyinyo (3,634 m), Gahinga (3,474 m) and Muhabura (4,127 m). At the foot of these volcanoes with steep slopes stretches a vast peneplane.

The central part of the country, with an altitude of between 2,000 and 1,500 m, characterized by a relief of stretched hills with more or less round tops and separated by large valleys, covers almost half the country. It is this type of relief that has earned the country the name of "Country with a thousand hills".

In the east, from Kigali to the border with Tanzania, between 1,000 and 1,500 m, the relief of the hills gives place to a vast monotonous region cut up in big hardpan strips strewn with a multitude of lakes and marshes.

2.1.1.2 Climate

Rwanda has more or less constant annual temperatures ranging from 16 to 17°C for the high altitude region, 18 to 21°C for the Central Plateau and 20 to 24°C for the lowlands in the East and West.

The climate is of the equatorial temperate type (AW3) according to the KOPPEN

classification. Annual rainfall varies between 700 and 1,400 m in the eastern and western lowlands, between 1,200 and 1,400 m in the Central Plateau and between 1,400 and 2,00 m in the high altitude region.

The rainfall regime has a strong influence on the hydrological regime. The country experiences floods during the long rainy season (March – May) and floods subside during the long dry season (June – September). Low water levels are very marked. Currently, there are disturbances both in the distribution and quantities of rainfall and temperatures. Rwanda experiences continued droughts, which tend to be cyclical and persistent. This situation could be related to the climatic changes recorded in the world due particularly to global warming.

2.1.1.3 Hydrography

Rwanda has a dense hydrographic network divided in two unequal watersheds which are situated on either side of the Congo-Nile ridge: the Congo basin and the Nile basin. The Congo basin consists only of insignificant and short rivers, which flow into Lake Kivu. River Rusizi in the south is its outflow towards Lake Tanganyika. The Nile basin covers the greatest part of the territory. Most rivers originate from the slopes of the Congo-Nile ridge. The two main rivers, namely Nyabarongo and Akanyaru, together with their numerous tributaries form, downstream from Lake Rweru, the river Akagera which drains the best part of Rwanda's waters towards the Nile, forming the border with Burundi in the south and Tanzania in the east.

Rivers Nyabarongo and Akagera are closely associated with vast marshes and numerous shallow lakes found along these rivers. The ecology of these ecosystems is very dynamic and complex; the vegetation of marshes and the size of the lakes change continuously with the rainfall and the flow rate of the rivers.

2.1.1.4 Soils

Rwanda's soils come from the physical-chemical alteration of schistose, quartzite, gneissic, granite and volcanic rocks, which make up the superficial geology of the country. There are six groups of soil:

- **Soils derived from schistose, sandstone and quartzite formations** found in the Congo-Nile Ridge, part of the Central Plateau and on highlands in Byumba

- **Soils derived from granite and gneissic formations** found around Gitarama (Central Plateau) and in the Mutara plains

- **Soils derived from intrusive basic rocks** in the north of Kigali and west of Byumba

- **Alluvial and colluvial soils of marshes and valleys** which comprise mineral soils found in the valleys of the east and the organic soils of the valleys of Akagera, Nyabarongo and Rugezi

- **Soils derived from recent volcanic materials** found at the piedmont of volcanoes

- **Soils derived from old volcanic materials** found in the plateau of Cyangugu in the south west of the country

The aptitude map of these soils shows that more than half of the soils in Rwanda are unsuitable for demanding crops. Soils have been degraded due to high rainfall, uneven relief conducive to erosion and agricultural overfarming. Highly suitable soils are limited. They amount to some parts of the Central Plateau, the volcanic region, Bugarama and part of the Mutara region.

The morphology, the layering of the relief, the variety of soils and regional climatic differences have endowed Rwanda with diversified ecosystems rich in biological diversity.

2.1.2 Socio-economic data

2.1.2.1 Demography

Rwanda's population has been on a very high increase, growing from 1,595,500 inhabitants in 1934 to 7,155,391 in 1991. It was estimated at 7,567,000 inhabitants at the beginning of 1997 and at 8 millions in 1999.

Estimates show that the population will reach 9,446,559 inhabitants in 2005. According to available statistics, there has been two major disasters, which led to a drastic reduction of the population. First, the great famine Matemane – Ruzagayura which plagued the country and caused substantial emigration and considerable increase in mortality; then the April – July 1994 massacres and genocide which led to the death of more than a million people and sent several other millions in exile to neighbouring countries.

The population growth in Rwanda is the result of a high rate of natural increase, which continued to rise since 1950. Currently, the natural rate of increase is 3.1% (Est. 1996). This rate of increase is the combined effect of the decline of mortality, and the high birth and fertility rates.

Rwanda's population is young. According to the 1996 socio-demographical survey, people aged less than 15 years represented 45.7%; those between 15 and 64 years 51.5% and those above 65 years accounted for 2.8% of the population.

Table 1: Population growth and density from 1934 to 2013

Year	Population	Physical Density (2.336 km^2)	Physiological Density (18.740 km^2)
1934	1.595.400	61	85
1940	1.913.322	73	102
1948	1.806.371	69	96
1950	1.954.870	77	104
1960	2.694.990	102	144
1970	3.756.607	143	200
1978	4.831.522	188	263
1991	7.155.391	272	382
1996	6.167.000	234	329
2000	8.109.754	308	433
2005	9.446.559	359	504
2013	c	458	644

Source: 1. ONAPO, *Population Growth in Rwanda and Framework for its solution; vol.2, 3.*

The consequence of the continuous increase of the population is increased density and the reduction of arable land per capita. In fact, the physiological density increased from 85 inhab./km^2 in 1934 to 433 in the year 2000; it is likely to increase further.

This drastic population growth will require (whatever the innovations in terms of human settlement and land organization) a two-fold increase of agricultural production, double the quantity of water for domestic use, double the sources of energy, etc. Natural resources are on high demand. A new more daring population policy is necessary so as to limit the consequences of demographic explosion, which is likely to put the future in serious jeopardy.

2.1.2.2 Economy

Rwanda is a very low-income country ranked among the 10 least developed countries of the world. According to MINECOFIN *(Major Indicators of the National Economy, Kigali, 1998)*, the Gross National Product per capita was 251 US dollars/year in 1998. The primary sector dominated by agriculture, employed 91.1% of the working population in 1996 (Est. 1996, pg. 28). Agriculture contributes up to 45% of GDP and accounts for 93% of export earnings through coffee and tea at 49% and 44% respectively.

Animal breeding is an important activity in the economic life of Rwanda. It is widespread in the country and practised at the family level. Nonetheless, there is to day a noticeable rapid development of ranching in the east of the country and in the former forest of Gishwati. Animal species that are bred in the country are cattle, sheep, goats, pigs, poultry and bees.

By-products of animal breeding such as meat, milk, hides and skins, butter, cheese... are sold at the national level. The contribution of animal breeding to the national economy is not insignificant. Hides and skins contributed 4% of export earnings in 1998.

Fisheries is practised in lakes and often very little in rivers. It is a small-scale activity whose contribution to the economy is low and its productivity is limited. At present, the share of fisheries in the diet and economy has become very insignificant. In 1998, fisheries accounted for less than 1% of GDP.

Forests have a big commercial value deriving from the use of different forest products. In fact, wood is the principal source of energy in Rwanda. 96.2% of households use wood as a source of energy and 31.4% use it as a source of lighting. More than 60% of the urban population use charcoal as a source of energy. Wood is also very much used in construction.

The sale of wood processed products generates significant incomes to the different actors involved. Forest products accounted for 1.1% of GDP in 1998.

Tourism in Rwanda generates significant revenue. Each year, millions of tourists visit national parks and national reserves. In addition to admission fees to tourist sites, tourist taxes levied on different services (transport, accommodation, various purchases) contribute to the rapid development of the national economy. Approximately, revenue realized from tourism amounted to about 10 millions of US dollars in 1988 and to 110 thousands in 1999. This fall can be explained by the tragic events (war and genocide) that befell Rwanda in 1994.

Secondary and tertiary sectors are not much developed. They employ 1.7 and 6.5% respectively of the working population.

Furthermore, the industrial fabric was partly destroyed during the war and 40% of industries could not resume production until 1995. This is mainly agro-industry. At the moment, industry in Rwanda has virtually reached its 1990 production level.

Services comprise trade, catering and hotel business, communication, information technology and insurance, and account for 31% of GDP. Currently, their growth is in full swing due to the rapid expansion of telecommunications,

tourism and trade.

The informal sector (crafts, family unit processing, trade...) contribute significantly to the national economy and employment creation, even though the flows of this sector are not recorded in the national economy.

Table 2: Gross Domestic Product per branch of activity (millions Frw) from 1994 to 1998

Sector of Activity	Years				
	1994	1995	1996	1997	1998
Food crops	95 605	123 806	146 541	152 776	171 049
Cash crops:	1 347	8 456	6 266	6 176	6 104
Coffee	1 140	8 214	5 719	5 554	5 339
Stockbreeding	13 283	11 040	18 183	19 095	20 432
Fisheries	762	838	1 090	1 144	1 179
Sylviculture	4 355	4 815	6 792	5 929	6 521
Agriculture	115 351	148 956	178 871	185 120	205 285
Industry	36 655	55 719	68 646	84 258	93 814
Services	97 162	135 195	141 240	167 333	178 307
Gross Domestic Product	250 939	337 200	390 639	440 714	483 003

Source: Development Indicators for Rwanda 1999 (MICOFIN)

As the above table shows, the share of agriculture to the Gross Domestic Product has been increasing since 1994. The predominance of the primary sector in the structure of the national economy and lack of alternatives cause high pressures on the biological resources currently available.

2.2 State of biodiversity in Rwanda

Despite its territorial small size, Rwanda is covered by diversified ecosystems: natural ecosystems consisting of mountain rainforests; gallery forests, savannas, wetlands and aquatic lands and ecosystems that have been altered by man's activities consisting of afforestation and cultivated areas. All these ecosystems accommodate a flora and fauna wealth. The flora comprises hundreds of higher and lower plant species. Some of them have been domesticated for years and are today the basis of human diet; others are meant for commercial and medical uses.

2.2.1 Natural ecosystems

The natural ecosystems of the country comprise mainly of forests, savanna, lakes, rivers and marshes. They have a biodiversity adapted to each environment. These ecosystems contain important protected areas, including

the Volcanoes National Park, the Akagera National Park, the natural forest of Nyungwe which shelter a natural heritage of national an international importance.

2.2.1.1 Mountain rainforests

The mountain forests comprise of: the natural forest of Nyungwe, which was the widest with 89,150 hectares in 1999, the forest of Mukura (1,600 ha) very marginalized and threatened by man's activities, and the forest of Gishwati whose rate of deforestation is so high that it will soon be extinct. These ecosystems of mountain forest are part of Albert Rift afro- mountain forests and constitute an important habitat of biodiversity. In their capacity as the main ecosystem, they represent a complex ecology and are mutually related. However, they are undergoing rapid environmental degradation and change following accelerated deforestation, soil erosion, landslides, loss of habitat and genetic erosion.

2.2.1.1.1 The Natural forest of Nyungwe

The forest of Nyungwe represents an afro- mountain rainforest which is extremely rich, unique and threatened but quite remarkable at the world level. Dominating the shores of lake Kivu in the south west of Rwanda, the forest of Nyungwe, which is adjacent to the national park of Kibira in Burundi, is probably the largest mountain rainforest in the whole of Africa, with a surface area of 970 km^2 in 1997. It stretches at an altitude ranging between 1600 and 2950 m and shelters a complex mosaic of types of vegetation.

This rich variety of flora is accompanied by an equal variety of fauna, including several species of birds and primates. A high percentage of these species are endemic and are found only in the forests surrounding Albert Rift. There are more than 1,200 plant species among which are found at least 50 species of fodder and 133 species of orchids. More that 250 wood species have been identified, including 10 tree species which were described for the first time in Rwanda during the 1999 survey (Ewango, 2000)

With more than 275 species of birds, 24 of which are endemic to Albert Rift, the forest of Nyungwe ranks among the most important regions of the world for the conservation of birds. Thirteen types of primates have been identified, representing 1/5 of Africa's primate species among which is the most threatened, namely the **monkey with an oval face** (*Cercopithecus hamlyni*) and the golden monkey (*Cercopithecus mitis kandti*)

Nyungwe has also one of the remaining biggest populations of chimpanzees of the east *(Pan troglodytes schweinfurtii)*. The Angola colobus *(Colobus*

Angolensis) is generally found in stable groups of between 300 to 400 individuals. This is a well-known attribute of Nyungwe that is found nowhere else in the world for species of tree monkeys. The natural forest of Nyungwe is one of Rwanda' s water towers: it shelters 60% of the country's waters. In addition, the source of the Nile is found in this same forest. Finally, about 39 plant species are threatened with extinction: some of them are rare.

2.2.1.1.3 The Volcanoes National Park

The Volcanoes National Park stretches in the southern part of the Volcanoes range which constitutes Rwanda's northern border with the Democratic Republic of Congo and Uganda. At present, its surface area is 12,760 ha. Long ago, the Volcanoes National Park was very wide, but continued land reclamation has reduced it to half of what it was in 1924 when it was established. It had then more than 30,000 ha.

This park is characterized by an altitudinal layering of vegetation, from the bamboo forest (at 2300 – 2600 m) to the afro-alpine vegetation resembling that of the tundra from 4200 m up to the summit of Karisimbi (4507m). This park is the sanctuary of mountain gorillas (*Gorilla gorilla beringe*), star of Rwanda's tourism and endemic to the volcanoes range and the National Park of Bwindi in Uganda. The special ecology (high altitude, high rainfall, cool temperatures….) results in a diversified biodiversity.

The Volcanoes National Park is home to 245 species of plants, including 17 dominant ones of which 13 are internationally protected orchidaceas, 115 species of mammals, 185 species of birds, 27 species of reptiles and amphibians and 33 species of invertebrates (Fischer, E and Hinkel, H., 1992; Gapusi R.J., 1999; Kabuyenge J.P., 1997).

Some of these species are endemic and others are internationally protected. Among the plant species protected by CITES (Convention on International Trade in Endangered Species) are 13 orchidaceas: *Hilichrysum guilelmi, Disa starsii, Polystachya kermessia, Arisaena mildbraena, Calanthes sylvatica, Chamaengis sarcophyhlla, Cyrtorchis arcuata, Habeanaria praestans, Polystachya kermessia, Virectoria major, Stolzia cupugliera, Eulpphia horsfallii, etc.*

Some of the animal species of this forest that are protected by CITES are *Gorilla gorilla berengei, Rana angolensis, Chameleo rudis, Leptosiaphos graueri*, etc.

2.2.1.1.3 The Akagera National Park

The Akagera National Park is situated in the eastern part of the country, straddling the provinces of Kibungo and Umutara, and it constitutes the border

with Tanzania. Its surface area has reduced to 90,000 ha in 1999 from 267,000 ha in 1960. The biggest reduction of the national park took place after 1994 when more than 2/3 of its surface area was given away for the resettlement of the repatriated population.

In the west of the national park, there used to be the Mutara hunting fields (MHF) whose surface area was reduced from 64,000 ha in 1960 to 22,000 ha in 1996. The Akagera National Park is a unique ecological entity (landwise) situated between 1,300 m and 1,825 m of altitude.

The eastern part of the national park is bordered by a vast wetland consisting of the Akagera river-lake depression that represents a typical immersion landscape. The lakes and the marshes cover about 100,000 ha.

The plant formations are quite diversified. They shelter more than 900 species of plants, including 60 internationally protected orchids. The bigger part of the landscape is covered by shrubby or arborescent savannas of *Acacia combretum* where is found a shrubby vegetation on anthills. The *Acacia senegal* is generally dominant. In the more arid zones of the Akagera National Park, the vegetation tends towards a combination of *Acacia-Commiphora*, whereas in the wetter areas, *Acacia senegal* tends to be replaced by *Acacia polycantha* and *Acacia sieberana*.

Grassy savannas consist mainly of *Themeda, Hyparrhenia, Sporobolus and Botriochloa*. The fauna constitutes the park's major attraction. It comprises 47 species of big mammals, more than 500 species of birds, 9 species of amphibians and 23 species of reptiles. The four animal species protected by CITES are the following:

- *Loxodonta africana*
- *Sincerus caffer*
- *Panthera leo*
- *Tragelaphus oryx*

2.2.1.1.4 Gallery forests

Gallery forests are strips of swampy forests that were extensive in times past. To day, they have been reduced through man's activities: search of land for cultivation, wood, fires, etc... These forests are all found in the eastern part of the country, mainly in the Akagera river-lake system. They cover a surface area of about 163 ha.

Despite the small size of these gallery forests, there are home to an important biodiversity with endemic and rare species. The most important of these gallery

forests is the Ibanda-Makera forest. Most of the plant species found there are used in traditional medicine, diet and other activities practised for the survival of the local population.

In its research activities, modern pharmacopoeia resorts to some of these plants to reveal important biochemical extracts. This is the case for example with *Blighia unijugata, Grewia forbesi, Rhus vulgaris, Pterygota mildbraedii and Ficus sp* (Ruzigandekwe, F., 1997, p. 40).

2.2.1.1.5 Wetlands and aquatic lands

Wetlands and aquatic lands are generally represented by lakes, rivers and marshes associated with these lakes and rivers.

In Rwanda, these areas cover a surface area of about 254,847 ha, representing 10% of the national territory, of which 5.71% is for lakes and rivers and 3.9% for marshes. In the Congo basin is found only Lake Kivu while the Nile basin has five groups of lakes, namely:

- the lakes of the north, namely lakes Bulera and Ruhondo and other small lakes of less importance such as lake Karago
- the lakes of the centre: Muhazi
- the lakes of Bugesera: Rweru, Cyohoha south, Cyohoha north, Kidogo, Gashanga, Rumira, Kilimbi, Gaharwa
- the lakes of Gisaka: Mugesera, Birira and Sake
- the lakes of the Nasho basin: Mpanga, Cyambwe and Nasho
- the lakes of the Akagera National Park: Ihema, Kivumba, Hago, Mihindi, Rwanyakizinga

With regard to rivers, Rwanda is at the top of the Nile basin. The most important rivers are: Akagera, Nyabarongo, Akanyaru, Ruhwa, Rusizi, Mukungwa, Kagitumba and Muvumba.

As for marshes, the biggest are found around the above mentioned rivers. Most of them are of low altitude, and Kamiranzovu and Rugezi are the only major high altitude marshes.

The following table shows the surface areas of the lakes and 6 biggest marshes of Rwanda.

Table 3: Surface area of lakes and associated marshes

Category		Surface area in ha.
Associated marshes	Nyabarongo	24,698
	Akanyaru	12,546
	Akagera	12,227
	Kagitumba	7,00
	Rugezi	6,294
	Kamairanzovu	1,300
Lakes	Kivu	100,000
	Lakes of Bugesera	
	Lakes of ANP	+12,000
	Lakes of Gisaka	5,980
	Bulera	5,500
	Lakes of the Nasho basin	4,300
	Muhazi	3,412
	Ruhondo	2,800

Source: Nezehose, J.B., 1990, Gashagaza, J,B., 1999

All these ecosystems accommodate a diversified biodiversity that is rich in plant and animal species (more than 104 flower species are found there), except Lakes Kivu, Bulera and Ruhondo which have some limnologic problems.

Generally, wetlands are very much liked by the population for farming. They moreover play a determining role in the regulation of the hydric regime.

Lake Kivu has a rather poor water flora. There are few macrophytes on its banks and the density of the phytoplankton is relatively low due to lack of a mix of layers (nutrients are trapped at the bottom of the lake). The water fauna is equally poor due to the physical isolation of the lake. There are no crocodiles nor hippopotamuses.

There are 26 species of fish, 15 endemic species of *Haplochromis*, 3 of *Tilapiines*, 2 of *Clarias*, some barbets, *Raiamas moorei* and *Limnothrissa miodon* that were introduced there by the end of the 1950s. There are several species of protozoa, groups of *Platerminthes, Aschelminthes, Achanthocephalus*, the group of crustaceous, etc. The bird fauna is rich and diversified. There are more than a hundred species of different birds divided in more than 30 families.

Most of **the lakes of the Akagera National Park** are quite rich in biodiversity: the phytoplankton consists mainly of *chlorophyceae, cynophyceae and diatomophyceae*. The flora is dominated mainly by *Cyperus, Phragmithes, Phoenix, Potamogeton, Aeschynomene, Thelypteris,* etc. Water hyacinth *(Eicchornia crassipes)* is present and has started covering big areas of the lakes, representing a threat to their biological diversity. The lakes of the Akagera National Park are among the richest in fish species in the whole country, and considerable populations of *haplochromis* and other fluvial species are dominant

(Plisner, 1990; Micha and Frank, 1991). The ornithologic fauna represents 2/3 of the birds species found in the park (more than 300 species) and there are also species of migratory birds from Europe and other African countries. Some lakes, such as lakes Cyambwe, Rwampanga and Rweru are particularly rich in hippopotamuses and crocodiles.

The lakes of Nasho basin have a very rich phytoplankton in biodiversity. The flora is dominated by the papyrus *(Cyperus papyrus)* mixed with *Miscandium violaceum and Nymphea nouchallii*. All these lakes are associated with gallery forests found on their shores and on small islands. The dominating species are those of the genus of *Phoenix, Bridelia, Ficus, Aeschynomene and Echinochloa*. The fish fauna consists of several aboriginal and fluvial species. Lake Rwampanga is distinctly richer in fish species than the other two. Lakes Rwampanga and Cyambwe have important populations of hippopotamuses and crocodiles given their direct connection with the river Akagera. The ornithologic fauna found in the Akagera National Park is also found in the lakes that in fact constitute its continuity.

The lakes of Gisaka are not surrounded by papyrus though there is a fringe of papyrus where they meet river Nyabarongo. There are also ferns and in some places there is *Echinochloa pyramidalis* vegetation. These lakes have a very rich phytoplankton in species, especially the phytoplankton (P.D.P.A, 1993). This phytoplankton consists of chlorophyceae, cyanophyceae, bacillariophyceae and pyrophytes. The fish fauna is distinctly less rich than the one found in the lakes of Akagera, a good number of which having been introduced in these lakes. The mammal populations that inhabited these lakes in the past have quite diminished. The specific composition of the fauna and flora of these lakes is found in the distribution tables and the many species listed in this report.

Almost all **the lakes of Bugesera** are very rich in plankton and there are, from time to time, blossomed cynaphyceae which reduce the transparence to less that 20 cm (Verheust, 1986; Munyangaju, 1990; P.D.P.A., 1993). The macroflora of these lakes is mainly dominated by *Cyperus papyrus* which form the wetlands that separate them from the rivers of which they are tributaries. There are reports of considerable colonizations of *Nymphea nouchallii* and *Nymphea lotus* which have become scanty all along river Nile. With the exception of lake Rweru, all the lakes have a poorer fish fauna than the other lakes. Migratory and especially river species such as *Synodontis Schilbe*, *Barbus* and *Labeo*, are less abundant. Some lakes such as Rumira, Gashanga and Mirayi are quite rich in *Haplochromis* (64% of total catches) like in the lake of Mugesera (Verheust, 1986). Some lakes still have crocodiles and hippopotamuses, but this is changing. Apparently, there are no otters in these lakes.

With regard to **the lakes of the north** (Bulera and Ruhondo), the aquatic flora and fauna are poor because of the physical-chemical situation which is quite unfavourable for their colonization and the isolation of the two lakes. The concentration of the plankton is less significant in lake Bulera than in lake Ruhondo; there are 48 species distributed in 4 families *(Chlorophyceae, Cynaphyceae, Pyraphytes and Bacillariophyceae)*. The vegetation of the banks is generally dominated by *phragmites* and *Typha capensis* which merge with *Pennisetum* hedges which are interrupted in some places by small islands of *cyperus papyrus*. The submerged vegetation consists of the species *Potamogeton, Ceratophyllum Ottelia and Laorasipon*. The fish fauna is relatively poor, and about ten species of fish, including 3, have been introduced. There are about ten or so species of birds that are currently known.

Lake Muhazi is closed, isolated and its fish fauna is quite poor. There are three endemic species and nine others that were introduced. The phytoplankton of this lake is quite rich. Descy (1987 in ex-Mouton 1988) established that there were 47 species divided into five families: *cynophyceae, pyrophytes, euglenophyceae, bacillariophyceae and chlorophyceae*. Other groups that have been identified include the invertebrates, with 8 species of gasteropods and 1 species of lamellibranchia in the category of mollusks; the representatives of 11 orders of the family of insects; the annelids including 2 families, *Tubificidea* and *Hurudidae*, and some representatives of arachnids. Among the macrophytes, phragmites were found on almost 90% of the banks while bays are occupied by papyrus plants.

The marshes megaflora consists especially of large stretches of papyrus plants with, in some places, areas with *Miscanthidium*. The lower layer is covered by the *Cyclosorus* stratus. The fauna of big rivers and associated marshes consists of ungulates, carnivores, primates, rodents, lagomorphs, insectivores and birds.

2.2.2 Agro-ecosystems

Agricultural biodiversity or agro-biodiversity applies to the variety and variability of animals, plants and micro-organisms living on earth which are important for food and agriculture and which are the result of interaction between environment, genetic resources and management systems and practices used by the population. Agro-biodiversity concerns not only genetic species and the diversity of agro-ecosystems as well as different manners in which land and water resources are utilized in production, but also the diversity of cultures which influence human interaction at all levels.

The agro-system or agricultural system refers to those ecosystems used in agriculture under similar conditions, with similar components, interaction and conditions. Included in agro-systems are monocropping, mixed farming and

associated crops, including agro-pastoral systems, agroforestry, aquaculture, grassland, grazing land and fallow land.

2.2.2.1 Biodiversity in the agricultural systems

According to literature, Rwanda was covered by natural ecosystems. These ecosystems have been greatly altered on over 90% of the national territory by population pressure. Human settlements, diversified agro-pastoral practices, consumption of forest products, bush fires and urbanization caused the disappearance of this climatic formation. These disturbances have resulted in the appearance of secondary formations consisting mainly of graminaceous plants and countless seasonal or perennial species alternating with crops.

Agricultural land today covers about 70% of the country. This land is under permanent cultivation. The period between harvest and the next planting season is the only period of rest. A variety of crops are cultivated and they play a dominating role in the national economy. These crops are usually grouped in two categories: food crops and industrial crops.

Among the food crops are the sorghum *(Sorghum)*, the bean *(Phaseolus vulgaris)*, the finger millet *(Eleusine corocana)*, the coco yam *(Colocasia antignorum)*, the maize *(Zea mays)*, the rice *(Oryza sativa)*, the wheat *(Triticum sp)*, the barley *(Hordeum vulgare)*, the garden pea *(Pisum sativum)*, the soya bean *(Soja hispada)*, the groundnut *(Arachis hypogea)*, the sweet potato *(Ipomea durcis)*, the Irish potato, the cassava *(manihot esculenta)*, the banana *(Musa)*.

These different crops constitute the basic food of the population in Rwanda. The importance of each crop varies according to the regions. Some of them, like the banana, the Irish potato, the sweet potato, different varieties of wheat and barley, the sorghum and the bean are sold on a large scale. The Irish potato, the bean, the cassava and the banana are found everywhere and in every day's diet of the people.

The so called industrial crops are very few: these are coffee, tea and pyrethrum. They contribute up to 93% of the country' s export earnings.

The agricultural production systems accommodate also many related wild species, the most common being *Eragrostis spp, Bidens pilosa, Digitaria spp, Conyza sumatrensis, Cyperus spp*,….

2.2.2.2 Pastoral areas

In Rwanda, much of animal breeding is done at the family and small scale level (a few heads of cattle per family). Since agriculture occupies most of the land, cattle grazes on bush pasture, road sides and on some marginal parts of land. This forces animal breeders to adopt semi-permanent stalling and to plant forage crops, including *Tripsacum laxum, Setaria spp, Desmodeum spp, Pennisetum purpureum, Mucuna pruriensis, Cajanus cajan, Calliiandra calothyrsis, Leucaena diverifolia, Sesbania sesban*…

However, ranching is developing in Umutara and Gishwati. The other pastoral areas are very small and scattered throughout the country.

These areas are victims of bush fires, treading and sometimes overgrazing. Overgrazing is the greatest culprit for the reduction of biological diversity in the sense that it results in the extinction of the most grazed species and low bromatologic value pyrophyle species such as *Eragrostis spp, Sporobolus spp, Digitaria spp…* (KALIBANA, 1997, P.12

Table 4: Animal Races bred in Rwanda

Type of breeding	Bred races (native and non native
Cattle breeding	*Ankole* *Sahiwal* *Frison* *Alps brown* *Australian Milk Zebu* *N'Dama*
Goat breeding	*Alpine* *Anglonubian*
Sheep breeding	*Karakul* *Merinos* *Dörper*
Pig breeding	*Large White* *Landrace* *Piétrain*
Poultry	*Leghorn* *Rhodes Island Red* *Derco* *Sykes* *Anak*
Fish farming	*Tilapia* *Clarias*

2.2.2.3 Wooded areas

Tree cultivation in Rwanda was confined to some plants around homes such as *Ficus thoningii, Euphorbia tirucalli, Erythrina abyssinica, Vermonia amygdlalena, Dracaena afromontana, etc.* But cultivation of woody perennials for timber, energy or service wood was not in the people's customs. As a result, there was massive exploitation which quickly proved its limitations. The first afforestation took place between 1920 and 1948 and consisted only of Eucalyptus. Later, other species were introduced. These included *Pinus spp, Callistris spp, Grevillea robusta, Cedrella spp, Cupressus.* The Arboreum of Ruhande (ISAR station) has 206 species, including 146 hardwood, 56 softwood and 1 bamboo species. These species have proved dangerous for biological heritage in that they exhausted and acidified areas that were already acidic, resulting in the reduction even the destruction of the undergrowth. In so doing, the installation of these species was conducive to soil erosion. In 1998, it was estimated that wooded areas covered 256,300 ha. Despite efforts for diversifying forest species, it is estimated that 99% of afforestation consists of Eucalyptus.

The conversion of these agro-forestal species-based afforestations such as *Grevillea, Cedrella, Maesopsis, Calliandra, Leucana*... proved to be essential. It is for this reason that agro-forestal practices have tended to become widespread even in agricultural areas.

2.2.3 Policies, laws and institutions related to the conservation of biodiversity

Major policy and strategic thrusts for the protection of biodiversity exist for certain fields of biodiversity such as forests, aquatic areas, agro-biodiversity (agriculture, animal breeding and fisheries) and protected areas.

Various State, parastatal and private institutions are involved in the conservation and use of biological resources on the basis of existing policy documents and legal texts which are in most cases scattered, incomplete and old.

2.2.3.1 Policy thrust

a. Forests

From 1920, Rwanda has been applying a reforestation policy necessitated by the continuous increase of the demand for wood products. The introduction of non native rapidly growing species such as the Eucalyptus, the Cypress was given special weight. Later in 1976, the tree day was institutionalized and afforestation became widespread in the whole country through community work (Umuganda) and several agricultural and forest development projects.

This policy continued until 1986 when the National Forestry Plan was prepared covering a period of 10 years, from 1986 to 1997. The main benefits of this policy were:

- Constitution and long term conservation of the forestry heritage which is environmentally balanced over the whole country.

- Increased forestry production.

- Improved use and appraisal of the decline of forests

Other undertakings included, among others, the promotion of sylvo-pastoralism and agro-forestry wherever possible, the finalisation of the action plan for the management and conservation of the savannas of the east, the preparation of plans for the development and management of forests, assisting Districts in implementing community forestry development plans and facilitating the emergence of wood processing units through private initiative. It was essentially planned to encourage Districts and individuals to undertake afforestation under the decentralization of forestry management services.

b. Aquatic areas

The 1987 – 1997 development plan prepared by the Ministry of Agriculture considers marshes from the point of view of their potentiality only for agricultural production. The Bill for the development of marshland prepared in 1987 requires consideration of safeguarding Environment through the development of marshes. It is envisaged to undertake a study on the impacts on the environment which will be done in accordance to the decision of the Ministry responsible for environment.

The National Environment Plan adopted in 1991 advocated for a compromise between the need to safeguard and the necessity to develop. It was necessary to harmonize the actions, establish a classification of marshes between areas requiring protection, areas requiring development and reserved areas, reduce to the minimum disruptive effects of developmental activities (by environmental impact assessment) and control the use of chemical inputs in the marshes and on slopes. These objectives remain valid as long as no new marshland development policy has been established yet. The instructions of the Ministry of Agriculture of 1997 aim at minimizing the procedures for the distribution of plots in the marshes, but an appropriate policy for the development of marshland is yet to come.

c. Crop areas and grazing land

The long advocated priority objectives of the former agricultural development policy (1991) focussed on the following lines:

- Intensive agriculture through increased use of agricultural inputs such as fertilizers, pesticides and selected seeds;
- Erosion control;
- Marshland development;
- Fisheries and fish farming development;
- Increased wood production.

The basic question is this: How do we guarantee increased agricultural, animal, fish and forestry production and preserve at the same time natural resources, the quality of human life, the sustainability and the diversity of the biological systems?"

In fact, cultivation of marshland results in the loss of part of their biological diversity if it is not well coordinated. There are many badly harnessed marshes which have not accomplished their mission. However, the policy envisages the protection of soil against erosion, increased production of wood through reforestation on soils that are unsuitable for agriculture and wherever appropriate, as well as the development of fisheries and fish farming which will contribute to the preservation of biological diversity and its enrichment.

The new agricultural development policy (1997) aims particularly at making the agricultural sector become professional. It aims also at the specialization and regionalization of crops so as to relieve the agricultural sector and promote increased production. Concerning animal breeding, the policy rests on the development of fodder farming and on nitrogen-fixing agro-forestry species being used as fodder. It recommends also the use of concentrates, the introduction of exotic breeds and artificial insemination. This will certainly have consequences on native plant and animal species.

d. Protected areas

In Rwanda, protected areas are the Volcanoes National Park classified as a reserve since 1925, the forest of Nyungwe since 1933, the Akagera National Park and the hunting fields since 1934. The Volcanoes National Park and the Akagera National Park are under ORTPN, while the rainforests of the Congo-Nile ridge are managed by MINAGRI. These natural reserves have been classified for their multiple roles, including their ecological, economic, cultural and social role. The major objective for their preservation is the conservation of species and various habitats of biodiversity for educational, tourism and research purposes.

These areas have been affected by various changes, including the reduction of space due to different causes such as the resettlement of the population in the special case of the Akagera National Park where 2/3 of the hunting fields have been given away for the resettlement of the people returning from exile.

2.2.3.2 Existing laws

There are legal instruments for the legislation of some fields of biodiversity such as forests, aquatic areas; agro-biodiversity referring to agriculture, animal husbandry and fisheries as well as protected areas. Some of the instruments are old, unknown to the public or totally ignored.

a. Forests

The existing legislative instruments in the field of forestry are as follows:

Decree of 18/12/1930 concerning the cutting and selling of wood. The main idea of the decree is that any cutting or sale of wood requires prior authorization. The decree provides for penalties to offenders and fixes taxes to be paid before the issue of the permit to cut or buy wood.

Law No. 47/1988 on the organization of forestry. This law was published in the Official Gazette No. 3 of 1989. It addresses a number of concerns, including the readjustment of the law to current and future contingencies; filling the gaps in the various modes of use and classification of forests; measures for the conservation of soil fertility and for avoiding erosion; new resources put at the disposal of the government for streamlining lumbering. The law provides for the establishment of a forestry unit, the creation of the State forestry estate as well as a management committee of a national forestry fund created by the Presidential Decree of 13/3/1992.

Rwanda's criminal code provides for soft penalties to any individual who, in fenced or unfenced areas, wickedly destroys or damages trees, crops, agricultural implements, knowing that they belong to the State.

b. Aquatic areas

With regard to aquatic areas, the following instruments are applicable:

- Order No. 221/116 of 20/5/1958 on bathing in lakes and rivers.

The first Article of this order recommends to provincial administrators to take measures for safeguarding the cleanliness, the tranquility or public order on

lakes and rivers.

Decree of 6/5/1952 on easements relating to underground water, water from the lakes and rivers as well as the use of such water.

This decree spells out the conditions, the scope, the modes of application and the extinguishment of natural and legal easements. Water being a primordial element in the material wellbeing and economic advancement of any society, measures for its safeguarding were applied as early as the colonial era.

Order of 1/7/1914 on pollution and contamination of water sources, lakes and rivers and parts of rivers.

Article 1 of this order instructs provincial administrators to determine protection areas for water sources, lakes, rivers or parts of rivers used or that may be used as water supply.

Article 2 stipulates that in such areas, it is prohibited to build houses, cabins, huts or straw huts; to establish factories, commercial houses, butcheries, kraals or cattle pens; to establish graves; to dig excavations; to create agricultural fields; to throw or bury rubble or refuse, debris, bodies or rubbish of any kind; to enter or walk or graze animals.

The same order prohibits to ret, soak or ferment any substance of whatever kind and to pour or throw grass, soil, stones, fallen branches, materials, rubble, refuse, bodies, debris or rubbish of whatever kind.

A bill on the drainage code was prepared by the Ministry of Public Works in February 1997. It provides for, among others, the general conditions for the disposal of used water; the collection and drainage of rain water; the collection, the disposal and treatment of solid waste; authorization of disposal; pollution and atmospheric nuisances and offences and their repression.

A bill on the use of marshland exists since 1988. Its objectives are to extend land for agricultural use in the country; to increase agricultural productivity through intensive agriculture on lands that are no longer suitable; to raise the standards of living of farmers and promote activities of farmers' associations and private initiatives and contribute to the general development of the country's economy.

The same bill subjects the launching of any major project for the development of marshland to prior studies of environmental impacts. Work cannot start before the publication of the findings of the study on the basis of which the Ministry responsible for environment may authorize or not the launching of planned works.

The classification of marshland according to their location, their size, their soil and hydraulic potentialities; in brief, their ecology constitutes another key element of this bill. It is from this classification that choice should be made as to which marshes should be developed and which should be preserved for their crucial role in the conservation of biodiversity, given that marshes constitute favourite habitats for species of mammals, birds and reptiles.

c. Protected areas

For the purpose of preserving natural wealth, which is mankind's heritage found on Rwandan soil, protected areas were established and consist of natural forests, national parks and hunting fields. These protected areas are governed by special legal instruments that determine their borders. These legal instruments are the following:

Decree of 26/11/1934 (Belgian Congo Institute of National Parks)- establishment of the Akagera National Park.

R.U.O. No. 52/48 of 23/4/1957 establishing the hunting fields of Mutara in the territory (province) of Byumba.

Articles 1, 2 and 3 refer to the establishment and borders of the hunting fields in the territory of Byumba directly adjacent to the Akagera National Park. Article 3 sets out the conditions for being allowed to carry out hunting. Articles 5 and 6 lists the competent authorities for authorizing hunting, the animals to be hunted and the appropriate periods for fishing, as well as taxes for the slaughter of certain animals.

The use of traps and piston guns is prohibited to hunters both native and non native, except with the special authorization of the General Deputy Governor.

R.U.O provides for penalties to offenders.

- Decree of 26/11/1934 (Belgian Congo National Park Institute) fixes the borders of former Albert National Park since 1925, of which Rwanda's side became known as the Volcanoes National Park whose borders were fixed by the decree establishing also the Akagera National Park in 1934.

R.U.O. No.83a/Agri of 12/12/1922 establishing two forest reserves in Rwanda.

This Order creates as a reserve the Natural Forest of Nyungwe situated in the mountainous massifs of the Congo-Nile ridge, the dividing line between Congo and Rwanda.

Decree-law of 26/04/1974 confirming and modifying the decree of 18/6/1973 establishing the Tourism and National Parks Authority (ORTPN).

ORTPN replaced the National Park Institute established by the decree of 26/11/1934 and the Tourism Authority established by the decree of 4/8/1959 and took over all its rights and obligations falling to Rwanda.

ORTPN's main objectives are to promote tourism and use all means likely to contribute to the development of tourism and to protect nature, more particularly the fauna and the flora, to enhance scientific research and tourism insofar as the latter two activities are compatible with the protection of nature.

ORTPN's heritage consists of the Akagera National Park and its annexes; the Umutara hunting fields and its annexes; the Volcanoes National Park and its annexes, and national parks and hunting fields established by decree and to be established later.

Under this decree, hunting, fishing, living and scientific research not authorized by the Managing Director or his deputy are prohibited in all the protected areas.

Order No. 52/175 of 23/05/1953 on bush fires. This order prohibits bush or undergrowth fires, mulch, wood, live plants or dead cover fires whose immediate aim is not development or crop management.

Decision No. 3 of the Cabinet sitting on 29/7/1997 on new borders of the Akagera National Park.

The new borders of the Akagera National Park have been reviewed following the resettlement and the need for land for agro-pastoral activities for the repatriated people.

Since their return in 1994, these people have occupied a big part of the park such that the Government had to step in to save 1/3 of the former land of the park.

A bill is being finalized on the new borders of the park in its present form.

d. Agro-biodiversity

Order No. 325/Agri of 16/10/1947 relating to the introduction of foreign fish species.

Under this order, it is prohibited to bring in fish species or species of fish eggs

that are foreign to Rwanda's waters.

R.U.O. No. 52/25 of 3 February 1955 on prohibition of fishing using fish-killing means.

This order prohibits fishing using narcotics in all the lakes and rivers in Rwanda.

R.U.O. No. 5520/97 of 02/06/1959 prohibiting seine fishing in inland lakes.

Seine fishing is prohibited in the lakes, except lake Kivu.

R.U.O. No. 52/160 of 16/11/1955 establishing regulations for fishing in the lakes.

It is prohibited in all the lakes in Rwanda to fish using nets whose meshes are less than 4 cm wide. In these same lakes, it is prohibited to used nets whose length is more than 1 km. It is prohibited to lay a fixed net at less than 50 m from the shore.

Order No. 51/162 of 4/5/1955 on the possession, cultivation, propagation, sale and transport of *Eicchornia crassipes* known as water hyacinth.

It is prohibited to import, possess, grow, propagate, sell and transport *Eicchornia crassipes* known as water hyacinth.

Circular No. 1900/07/24 of 11/12/1997 from the Ministry of Agriculture, Livestock, Environment and Rural Development concerning Fishing Regulations.

The circular repeats the main points of the Regulations on fishing with a view to updating the existing legal instruments.

2.2.3.3 Involved institutions

The major institutions involved in the conservation and sustainable use of biological resources include Ministries, public and private institutions, local and international non governmental organizations, international bodies and co-operating agencies as well as research and/or higher institutions of learning.

a. Ministries

Ministry of Lands, Resettlement and Environment (MINITERE)

In addition to planning and land resource management, the development and supervision of sustainable and viable national resettlement policies, MINITERE is responsible for formulating and monitoring the implementation of plans for the

preservation and protection of our natural resources such as the fauna and the flora, and ensure that developmental activities are carried out in such a manner as to protect environment.

It is also responsible for the development and application of environmental policies and programmes as well as environmental regulations and active co-operation with international bodies involved in the protection of environment.

Ministry of Commerce, Industry, Investment Promotion, Tourism and Cooperatives (MINICOM)

MINICOM is responsible for initiating, developing and administering programmes aimed at promoting a balanced and viable growth of national industries, including agro-industry, handicrafts, mines and tourism. It is also the duty of MINICOM to make follow up of the management of national tourist sites, including parks; promote internal and external trade growth; develop and manage systems for quality assurance of products and services. The promotion of ecotourism and sharing of benefits derived from tourist activities benefit the people living in the vicinity of protected areas and other natural tourist attraction reserves.

Ministry of Agriculture, Livestock and Forestry (MINAGRI)

MINAGRI's mission is to initiate, develop and administer programmes for the transformation and modernization of agriculture; develop and promote appropriate systems for the growth and improvement of agricultural marketing; develop and manage programmes for the promotion and improvement of stockbreeding, including fisheries; and develop and manage as soundly as possible national forestry resources without damaging the ecology and integrating them in other agricultural activities and in the national economy.

Falling under this Ministry are also soil conservation and improvement activities and the development of marshland, together with food security, without adversely affecting the sustainability of biological resources and environment.

Ministry of Infrastructure (MININFRA)

MININFRA is responsible for road and highways construction, public buildings, town planning, land, air, lake and river transport, as well as the coordination of meteorological services and networks. This is the Ministry that is the most appropriate for carrying out studies on interaction between climatic conditions and socio-economic activities, cross-border movement of living organisms and make available reliable climatological and agro-meteorological data which are indispensable for the promotion of a viable and sustainable agriculture. Once

available, these data could help to make a better follow up of climatic phenomena and their consequences on biological resources.

MININFRA is also responsible for formulating policies and strategies for appropriate management and use of national natural resources, including water, and initiating and promoting actions aimed at rational use of non conventional sources of energy such as solar, wind, biogas, peat energy, etc...

Prime Minister's Office

The Office of the Prime Minister is responsible for coordinating and making follow up of Government policies; activities of international organizations, NGOs and various socio-economic operators, both public and private. Programmes for the conservation of biodiversity and protection of environment are prepared by MINITERE but are endorsed and approved by the Office of the Prime Minister for inclusion in the overall Government policies.

b. Public institutions

Public institutions involved in the protection of biodiversity include the Tourism and National Parks Authority (ORTPN), the National University of Rwanda, the Institute for Agricultural Science (ISAR) and the Institute for Scientific and Technological Research (IRST).

Tourism and National Parks Authority

ORTPN was established in 1974 with the following objectives:

- To promote tourism and use all resources likely to contribute to the development of tourism
- To protect nature, more particularly the fauna and the flora, enhance scientific research and promote tourism provided that it is compatible with the protection of nature
- To propose to Government negotiation of agreements or conventions directly or indirectly related to the protection of nature and tourism
- To determine sites and propose the classification of buildings of a historic, scientific, anarcheological or tourism interest.

Institute for Agricultural Science (ISAR)

ISAR's mission is to promote the scientific and technological development of agriculture and stockbreeding; carry out research and experimental studies for the development of agriculture and stockbreeding; and publish and disseminate their findings.

ISAR has twelve research and experimental stations covering a total of 4,664 ha of experimental fields found in the whole country and according to specific crops grown in the region. It has already carried out experiments and disseminated 21 varieties of beans (more than 10 pre-dissemination varieties); 7 varieties of soya beans; 1 variety of garden peas; 3 varieties of groundnuts; 6 varieties of maize; 14 varieties of sorghum; 11 varieties of wheat; 9 varieties of sweet potatoes; 6 varieties of cassava; 9 varieties of Irish potatoes (more than 6 pre-dissemination varieties); 6 varieties of coffee trees; 4 varieties of pyrethrum and 8 varieties of avocado trees. ISAR has also disseminated various varieties of citrus fruits, papaya trees, pineapples, apple-trees, guava trees and orange trees, several exotic and native forestry and agro-forestry species for different ecological zones and several uses.

ISAR contributes also to the improvement of animal production through selection and adaptation of breeds to environmental conditions or through the introduction of exotic breeds. In the field of agrostology, ISAR has maintained a good collection of fodder plants in two stations: Karama (south-east) and Rubona (south). There are at least 14 species of plants. It is currently carrying out a study on species resistance *(Pennisetum, Tripsacu*m and *Desmodium distrortum)* to drought and on the possibility of conserving them by drying.

The Ruhande branch of ISAR deals especially with the promotion of forestry. It maintains an arboretum which is rich in native and non native species (ex-situ conservation).

In its near future research programmes, ISAR will introduce genetic material and concentrate on the transfer of appropriate technologies for root disease control (bean) and the production of voluble beans; technologies for the production and use of vitamin A and iron-rich foods; technologies for the production of high quality fodder and pastures (small ruminants); technologies for the rapid propagation of cassava, sweet potato and maize. ISAR contributes to the improvement and management of soil fertility through the transfer of technologies for the production of diversified species of agro-forestry trees to counter the shortage of mulching material and firewood, erosion and improve soil fertility.

Other future perspectives will consist of the improvement of crops and stockbreeding by reducing the principal constraints facing the agricultural sector (crop protection, soil conservation, soil fertility, cropping system), by strengthening the national research system, by controlling genetic manipulation, in vitro techniques and biotechnology. The acme for improvements is set to year 2010. To this end, ISAR will have of necessity to collaborate with international and UN NGOs, MINAGRI's agricultural projects and scientific, agricultural and

technological international research institutes.

National University of Rwanda (UNR)

Established in 1963, the National University of Rwanda has the mandate to train managerial staff the country needs in several fields. It also carries out basic and applied research in keeping with its training programmes. With regard to the conservation and rational use of biological diversity, UNR has the faculty of Agriculture, currently with researchers in the departments of biology, chemistry, geography and the Faculty of medicine, who are capable of providing the necessary knowledge to the students.

The role of UNR in the preservation of biological resources includes training senior staff in this field, but above all creating among the students awareness of issues related to rational management of biodiversity and getting them to participate more in finding solutions to such issues, as well as developing among them the sense of individual and collective responsibility towards resources and the strong will to become committed to the cause of sustainable development. UNR contributes also to the strengthening of the role of scientists and researchers in natural science, the improvement of knowledge and methods of conservation and use of biological diversity with a view of an environmentally viable development.

Institute for Scientific and Technological Research (ISRT)

The Institute for Scientific and Technological Research was established in 1989, replacing the National Institute for Scientific Research (INRS). Its mission is to carry out scientific and technological research related activities in direct relationship with the country's socio-economic development. It is involved in environmental preservation biased technology. In this regard, there is a Centre for Energy which is well versed in the economy of wood through the use of renewable sources of energy such as solar and biogas energy; the management of liquid waste or waste water. ISRT has also a Research Centre involved in the conservation of useful herbs in the Herbarium that can be consulted for the purpose of research or study (ex-situ conservation).

There is also a Pharmacopeae and Traditional Medicine University Centre (CURPHAMETRA) responsible for the development of medicinal plants. It manufactures curative plant-based modern drugs such as ointments, tablets, disinfectants, syrups from local plants that the population uses also in traditional medicine to treat many and varied diseases which are estimated to reach about one hundred (Rwangabo, 1993).

Kigali Institute for Science, Technology and Management (KIST)

The mission of the Kigali Institute for Science, Technology and Management is to train senior technicians in the field of science, technology and management. It has the faculty of technology with researchers in the field. It is involved in technology favourable to environment protection, particularly with its centre whose objective is to economize on wood through the utilisation of renewable sources of energy such as biogas and waste management.

Rwanda Standardisation Authority

The Rwanda Standardisation Authority was established in 2002 with the aim of promoting activities for the development of standards, quality management, metrology, and ensuring their implementation in the country. Compulsory standards must be applied in the fields of public interest, hygiene, human and animal health, food security and environment.

c. International Non-Governmental Organizations

International Non- Governmental Organizations in Rwanda play a part in several sectors of life. They are involved in the rehabilitation of basic infrastructure such as schools, health centres, water supply and construction of shelters for the returnees. However, in addition to these humanitarian activities, some NGOs carry out activities for the protection of environment and conservation of nature.

These NGOs are CARE International which has been operational since 1984, OXFAM-QUEBEC in the country since 1983, OXFAM-GB since 1977, Euro Action ACCORD since 1979, WORLD VISION since 1989, AFRICARE since 1984, TROCAIRE IRELAND since 1994, Catholic Relief Services, World Lutheran Federation, etc. The major activities carried out for the protection of environment and conservation of nature include, especially, integrated agriculture, reforestation, agro-forestry, apiculture, drainage, promotion of improved hearths for the economy of wood, erosion control and soil conservation, land use, tree plantation in resettlement areas for the returnees and in newly built villages, etc. Specific activities for the conservation of biological diversity are carried out particularly by the International Programme for the Conservation of the Gorillas (IPCG), the Project for the Conservation of the forest of Nyungwe (PCFN), the Karisoke Research Centre (KRC), the Dian Fossey Gorilla Fund (DFGF).

The IPCG is an international programme whose principal mandate is to ensure the long term survival and conservation of mountain gorillas and afro-mountain forests and medium altitude habitats in Rwanda, the Democratic Republic of Congo (former Zaire) and Uganda. It is a regional project. It has been operating in Rwanda since 1978, though its actual take off was in 1991 with the creation of

a national project. The activities of IPCG are carried out through the Tourism and National Parks Authority (ORTPN) and concentrate mainly on staff technical training, the provision of technical conservation equipment for ORTPN and the Volcanoes National Park; the reforestation of the borders of the Volcanoes National Park and creating environmental awareness of the population living in the vicinity of the park on the importance of the survival of this forest with its plants and animals, including the mountain gorilla which constitutes the international prestige of the Volcanoes National Park.

The Dian Fossey Gorilla Fund is also involved in the programme for the conservation of the mountain gorilla through support to research activities in the Volcanoes National Park. It finances the Karisoke Research Centre in its research on the fauna and the flora. Currently, the Dian Fossey Gorilla Fund (Europe) focuses its activities on community-based management of biodiversity, and this is done at the regional level. Awareness seminars are organized regionally. Among these are the one held in Kabale, Uganda, in November 1997 which brought together participants from Uganda, the Democratic Republic of Congo and Rwanda involved in the preservation of biological diversity and sustainable use of biological resources, with more involvement of the population.

The Project for the conservation of the forest of Nyungwe (PCFN) is a project that was initiated by Wildlife Conservation Society with the aim of collaborating with ORTPN and other Ministries involved in the conservation of the forest of Nyungwe. It started in 1988 and contributes to the conservation of this forest through tourism programmes, environmental research, education, environmental awareness and training of local staff in biological diversity conservation.

d. International Agencies

These are multilateral and/or bilateral institutions through which development aid is channeled to the people of Rwanda. Many of them are represented in Kigali. They include the United Nations Development Programme (UNDP), the United Nations Food and Agriculture Organization (FAO), the United Nations Education, Scientific and Cultural Organization (UNESCO), the German Development Agency (SAD/DED), the Netherlands Development Agency (SNV), the German Technical Cooperation (GTZ), the United Nations Children's Emergency Fund (UNICEF) and Cooperation Agencies such as the Canadian Cooperation Agency, the United States Agency for International Development (USAID), the Swedish International Development Agency (SIDA).

UNDP

UNDP has been mandated by the United Nations Environment Programme (UNEP) to assist countries to meet the challenge of rational management of

environment. The four pillars of UNDP mission are the fight against poverty, good governance, gender mainstreaming in development, improved environment and rational management of natural resources.

UNDP is by far the international organization most involved in programmes for the protection of environment, particularly within the framework of the Convention on Biological Diversity, the Convention on Climatic Changes, the Convention on Desertification Control and the establishment of environmental legislation. With the financial support of the World Environmental Fund (WEF) through UNDP, Rwanda has prepared a National Strategy for the Conservation of Biodiversity and its Action Plan, with the financial and technical assistance of UNEP, also through UNDP. The Government of Rwanda is in the process of developing a framework law on environment which will no doubt constitute the legal and institutional instrument for the management and protection of the country's biological resources.

Being a country in the process of reconstruction and with limited resources, Rwanda will have to continue receiving financial, material and technical support of the UNDP and the above mentioned financial and technical cooperation institutions, each in its own field.

FAO

FAO is mainly responsible for the promotion of agriculture and animal breeding with a view to guaranteeing food security without compromising sustainable development based on rational use of biological resources.

FAO is particularly involved in sustainable agriculture, desertification control and natural disasters such as famine, integrated land management as well as the development of marshes.

German Technical Cooperation

This is an implementing agency for integrated rural development programmes, management and protection of natural resources. It finances the project for the Protection of Natural Resources, the main component of which is devoted to the protection of the Akagera National Park in its new borders and the socio-economic development of outlying area.

UNESCO

UNESCO is involved in the conservation of biodiversity by providing support to education and training in the importance of environment and biodiversity, which should be incorporated in the schools curriculum and research programmes, as

well as in the programmes for the promotion of knowledge exchange among researchers, scientists and the general public.

UNESCO has initiated the Man and Biodiversity (MAB) programme which will contribute to a better protection of Rwanda's protected areas which are part of the world heritage such as the Volcanoes National Park.

World Bank

The World Bank is the institution responsible for financing investments focused on people's development all over the world. It will play a major role in the implementation of the National Strategy on Biodiversity and its Action Plan, as well as in environmental legislation by integrating the component of environment protection in the projects it finances in Rwanda. It is also involved in the promotion of the poverty reduction policy by facilitating to the poor access to sustainable and viable economic alternatives of existence.

USAID

USAID finances the development of agriculture and stockbreeding, of which environmental protection constitutes a priority and a prerequisite.

Integrating the environmental dimension in all the development programmes supported by the World Bank and USAID through the impact studies of these programmes on environment constitutes an important action for the conservation and safeguarding of environment.

Other partners such as the European Union, UNICEF, the German Development Agency, the Netherlands Development Agency do play also an important role in the protection of environment and conservation of biodiversity by supporting activities in the fields of tourism, forestry, natural resources protection, agro-forestry, hygiene and sanitation, fight against poverty, improved health, training and formal and informal education of the people.

e. Local Non-Governmental Organisations

Local NGOs have powers to mobilize financial, material, technical and human resources. Their intervention is direct and is not subject to cumbersome administrative bureaucracy. Major local NGOs that are involved in the conservation and rational use of biological resources include the following:

- *Land-use planning research and support Association (ARAMET)* whose principal mandate is the promotion of rural development with a view to optimal management of space in the face of problems related to the country's

limited resources. ARAMET is particularly involved in the adequate development and rational management of pastures and small marshes as well as reforestation, especially in semi-arid regions in the south east of the country.

- *Rwanda Association for integrated Development (ARDI)* whose objective is the promotion and consolidation of rural development groups, particularly by providing them with material, financial and organizational support. ARDI is particularly concerned with modern apiculture which is oriented towards the conservation of forestry ecosystems that accommodate biodiversity.

- *Association for the Conservation of Nature in Rwanda (ACNR)* whose major objective is to stimulate the interest and curiosity of the population, particularly the youth, to the importance of biodiversity in Rwanda and its conservation with a view to contributing to the promotion of research and knowledge of the fauna and the flora as well as the functioning of ecosystems in Rwanda.

- ACNR is particularly involved in creating awareness and environmental education in schools (primary, secondary and higher institutions) and at grassroots communities where it encourages and stimulates the establishment of nature clubs. It produces environmental education guides to students, pupils and the public so as to create in them awareness and positive attitudes towards environment and biodiversity protection. ACNR carries out research on birds with a view to protecting the most threatened of them.

- *Rwanda Association for Environment and Integrated Development (AREDI)* whose objectives are basic environmental education in schools and peasant communities, specialized training for trainers at the district level and other partners, and the promotion of environmental awareness. AREDI gives special weight to development projects that are appropriate and conducive to biodiversity conservation and enhances environmental assessments of all the projects with a view to safeguarding environmental quality and enhance biodiversity conservation. This integrated approach is the pillar of the Association.

- *Rwanda Association of Environmentalists (ARECO RWANDA NZIZA)* whose objective is to create awareness among the population in the conservation and protection of nature, develop tourism environment and promote a sound and pleasant environment for a sustainable, durable and harmonious socio-economic development.

  ARECO carries out awareness campaigns in primary and secondary schools

through drawing, poem and song competitions, environmental tours and production of environmental education posters.

- *Rwanda Rural Rehabilitation Initiative (RWARRI)* aims at promoting the socio-economic development of grassroots communities. It is involved in domestic energy saving technologies, agro-forestry, soil conservation, fruit tree and flower plantation in population clusters or villages or "Imidugudu".

- *Green Environment Conservation (GEC)* is primarily concerned with the reduction of energy (wood) deficits through the dissemination of improved hearths, the use of new and renewable energy, termites control and reforestation.

- *The Rwanda Environment Awareness Services Organization Network (REASON)* aims at environmental education of the public so as to ensure a sustainable future through training of grassroots leaders, organization of seminars for pupils and students, production of environment-related teaching materials and management of biological resources, awareness creation of the people living in the vicinity of the Volcanoes National Park and other activities related to awareness creation of majority groups such as the youth, the women, groupings, etc.

The activities carried out by these NGOs should be encouraged, particularly those that are related to education, training, sensitisation, people's involvement and rational management of resources.

Some of them deal with the youth or the women or with agro-stockbreeders in the rural areas, while others are involved with student communities and local authorities. All these initiatives strengthen the development and implementation of the biodiversity conservation strategy which aims at involving as many actors as possible, particularly the local communities.

3. MAJOR THREATS TO BIODIVERSITY IN RWANDA

3.1 Natural Threats

3.1.1 Erosion

Rwanda's relief consists of high mountains, steep-sloped hills and depressions. High altitude regions are the most wet and water runoff on steep slopes, coupled with the natural fragility of the soil, carries along soils towards valleys and depressions. A big chunk is swept along outside Rwanda. On its way out at Kagitumba, the Akagera carries along about 30kg of soil per second. Maximum land loss is estimated at 557 tones per hectare per year. These soil degradations affect a big part of the territory, particularly fragile ecosystems of mountain regions in the North and in the West.

Whether by wind or by water, erosion ends up by causing a reduction of soil fertility by removing the arable layer and, consequently, it contributes to the extinction of some plant formations and to the loss of the fauna's habitat.

Landslides result in vertical infiltration of rain water which is facilitated by the low cohesion structure of the soil. Land is dampened and reaches the point of saturation, and this leads to the movements of parts of the hills towards valleys and depressions, part of which is carried away outside the country. There are enormous damages and losses of biodiversity are almost total in the whole area of mountains in the north and south west of the country.

3.1.2 Floods

During extremely heavy rains, rain water causes floods in the valleys and depressions. Species become extinct during the rise in the water level through asphyxiation or are carried away by water. This case is remarkable in the wet ecosystems (marshes, gallery forests,...). Siltation of lakes such as North Cyohoha resulting from floods and erosion constitutes also a serious threat to the biodiversity of aquatic areas. It causes the rise of the water level which, later, may flow out above the alluvial barrier, particularly for the lakes in the east and the destruction of spawning grounds, which are places for the reproduction of fish. Leaching of rocks results sometimes in the geo-chemical pollution of rivers in these flooded valleys.

3.1.3 Drought

For some time, Rwanda has been experiencing climatic changes which cause a rise in temperatures and a remarkable rainfall deficit and, consequently, a

reduction of the water level in lakes, rivers and the depletion of water sources. Prolonged drought affects biodiversity habitats and leads to a drastic reduction of varieties and species because it does not allow certain species to regenerate. This phenomenon of drought, combined with the high degradation of land, contributes to the rapid progress of the desertification process in the eastern region.

3.1.4 Proliferation of competitive species

The proliferation of certain competitive species inhibits the regeneration of ligneous and grassy species. This speeds up, among other factors, the formation of clearings. Such is the case with *Sericostachys scandens* in the forest of Nyungwe. For a long time, this plant has been living in balance with other ligneous plants thanks to herbivores which grazed it; to day, with the extinction of these herbivores, this creeper, with some varieties of the fern, have become intrusive and destructive.

3.1.5 Diseases and Pests

Some components of biodiversity are the target of various diseases and pests. In normal times, the damage is not very noticeable. It however happens that epidemics occur and cause massive destruction as was the case with the destruction of cypress reforestation by the *Cinnera cupressis* by the end of 1980s, the destruction of crops and other plants by caterpillars in the eastern half of the country and in Mayaga in 1998, the destruction of *Pinus* forests in the Congo-Nile ridge in 1998. Food crops and industrial crops are regularly attacked by diseases, insects and different pests. For example, the cassava mosaic prevents any harvest, the black Sigatoka, etc.

3.1.6 Other threats

Windfalls are a collection of trees that have been felled, uprooted or broken following climatic accidents most of the time (wind) due to bad harvesting or old age. In certain forests, loss of biodiversity goes up to 10% of the existing vegetation cover. In the case of Rwanda, it is a limited and sporadic phenomenon generally found in the natural forest of Nyungwe.

In Rwanda, like elsewhere in the world, though rich and diversified, biological diversity is seriously threatened. The destruction of habitats resulting from population pressure, weak institutions and lack of clarity in the institutional mandates account for much in this. Protected areas, which are the sanctuary of wild plant and animal species, are subjected to reduction. Regulations of access to biological resources in protected areas, wet areas and aquatic areas, are not respected. Many uncontrolled introductions of wild or domestic plant and animal

species result in the disturbance of the native biological heritage which leads to the extinction of some species. A national strategy, which is in harmony with the objectives of the Convention on Biological Diversity that Rwanda signed on 10/06/1992 and ratified on 18/03/1995, is therefore essential for the preservation of national biological resources. In this way, Rwanda will have contributed to the world's efforts for the preservation of biological resources.

3.2 Man-induced threats

In Rwanda, man-induced threats are many and more harmful than natural threats. The main ones are:

1. Population pressure
2. Population resettlement
3. Overexploitation of biological resources
4. Uncontrolled introduction of exotic species
5. Poaching and pirating
6. Bush fires
7. Conflicts and wars

3.2.1 Population pressure

The population of Rwanda has been extremely growing and this has put pressure on natural ecosystems. The effect of this pressure is an increased demand of natural resources (land, water, energy, foodstuffs, etc), land clearing for agriculture and grazing, house building, removal of species for traditional medical purposes, etc, modification and destruction of habitats and deforestation which, ultimately, lead to the extinction of some species.

Land clearing lead to loss of genetic resources with ecological, medical, food, industrial and cultural value. Habitats for the fauna and the flora are thus destroyed. The following table illustrates the regression of forest formations and wooded savannas from 1960 to 1999.

Table 5: Evolution of natural forest areas and wooded savannas (in ha) 1960 – 1999

Forest	Years						Rate of regression 1960 – 1999 in %
	1960	1970	1980	1990	1996	1999	
Nyungwe	114 025	108 800	97 000	97 000	94 500	189 150	21.8
Gishwati [1]	28 000	28 000	23 000	8 800	3 800	-	-
Mukura	3 000	3 000	2 000	2 000	1 600	1 600	46.7
Birunga	34 000	16 000	15 000	14 000	12 760	12 760	62.5
Akagera	267 000	267 000	267 000	241 000	220 000	90 000	66.3
M.H.F.2	64 000	45 000	45 000	34 000	22 000	-	-
Galleries wooded savannas	150 000	150 000	90 000	50 000	20 000	-	86.7
Total	660 125	617 800	539 000	446 800	382 660	-	42.0

Source: Gapusi, R.J., 1998

Land reclamation and the development of marshes and depressions cause hydric imbalances of wet ecosystems, and this affects the fauna and flora of these ecosystems. Most of the marshes in Rwanda have been reclaimed without appropriate facilities for good water management (irrigation - drainage), which resulted in the extinction of some aquatic plant species. The phytoplankton and spawning grounds are destroyed, leading to the depletion of the ichtyological wealth and other river and marsh-living animals.

Population pressure has led to the depletion of arable land. In fact, arable surface area per capita has fallen from 47 ares in 1970 to 13 ares in 2000 when in Sub-Saharan Africa, the average was estimated at 26 ares in the same year. Faced with this reduction and lack of intensification technologies, man is compelled to look for new land for agriculture, stockbreeding and settlement.

The modification and destruction of natural ecosystems result in the loss of the fauna and the flora of these areas. Some plant and animal species become totally extinct, others become very rare or are remarkably reduced. The loss of the fauna and the flora is aggravated by poaching activities. This is the case, among others, of:

- the leopard in the Volcanoes National Park and the forest of Nyungwe which was last seen in 1971;
- the hyena, the elephant and the buffalo which once were many in the Volcanoes National Park and the forest of Nyungwe but have now become very rare;

[1] There are still some remnants

- the giant forest pig and wildcat which have become extinct from the Akagera National Park;
- the chimpanzee, the *mone*, the *potto,* the green monkey, the bush baby and the harnessed bushbuck...which have become extinct or are very rare in the Akagera National Park;
- the *Entandophragma excelsum, the Faurea saligna, the Symphonia globulifera, the Hagenia abyssinica, the Parinari excelsa, the Podocarpus latifolius ...*which have become rare following their selective felling for sawmill products, *the Polyscias fulva, the Markhamia lutea, Arundinaria mildbraedii* which have become very rare n the gallery forests of the east;
- the bamboo plantations which have become less at the foot of the volcanoes;
- the forest of *Neobutonia macrocalyx, the Dombeya goetzenii* and *the Prunus africana* which have become extinct from the Volcanoes National Park.

The regression of natural ecosystems is always accompanied by the loss of biodiversity. Thus, current research has shown that about 115 plant species are threatened with extinction in Rwanda.

Studies carried out in the Akagera National Park and the Umutara hunting fields on the evolution of certain animal species between 1947 and 1999 have shown a worrying regression as illustrated by the following table.

Table 6: Evolution of some animal species between 1947 and 1999 in the Akagera National Park and Umutara Hunting Fields

Species	1947	1969	1991	1999	Regression in % 1991-1999
Buffalo	1000	6900	10000	2261	77
Impala	4000	6250	30000	5665	81
Topi	2000	1570	7500	2024	73
Warthog		670	1500	378	75
Eland	700	670	325	-	-
Cobe defassa	500	410	1600	351	78
Cobe redunca		1030	1890	-	-
Rouanne	150	110	145	-	-
Oribi		2575	2655	-	77
Zebra	2000	1700	3800	3048	20
Lion		150	300	-	-

Source: Ndayambaje J.D., 1999, pp.23

3.2.2 Resettlement of the population

During and after the 1994 genocide, there was considerable movement of the

people in the country. In addition, many houses and social infrastructure were destroyed. After these events, the country faced the resettlement of the returnees and internally displaced persons.

This resettlement which was carried out in an emergency situation constituted a serious threat to biodiversity. In fact, the tons of wood consumed during this process of resettlement sped up deforestation. For lack of other public land, community administrations were often made to sacrifice whole forests to accommodate resettlement sites.

At the same time, spontaneous occupation of these natural ecosystems aggravated this deforestation: the cases of Gishwati (in the north of the country), Umutara hunting fields and the Akagera National Park (in the east of the country) are the most critical. In fact, these two ecosystems which are naturally fragile were forced to accommodate considerable numbers of people and cattle greatly exceeding their environmental capacity.

Furthermore, it has been observed in these ecosystems that there was serious pressure on biological resources and increased demand of water and land.

Eventually, the occupation of the forest of Gishwati and part of the Akagera National Park has caused considerable loss of Rwanda's biodiversity.

3.2.3 Overexploitation of biological resources

In Rwanda, overexploitation of biological resources has been one of the most important threats to biodiversity.

In fact, the age-old use of certain irrational techniques and practices has resulted in the gradual reduction of the production and productivity of biological resources, the reduction of genetic potential and, ultimately, the extinction of some species.

The immediate economic interest of certain biological resources has increased their overexploitation by the population living in the vicinity who often neglect or ignore other alternative sources of income.

For example, the fish wealth of lakes is threatened by the use of nets with very fine meshes which hold the fries.

Likewise, continued use of the soil without adding fertilizers or soil amendments or without biological practices is harmful to the soil's fauna and flora. Consumption of young performing males, particularly domestic species (future spawners) constitutes a typical case of overexploitation of local biological

resources.

This large-scale consumption leads to the reduction of genetic wealth and, ultimately, external dependence with regard to genetic material.

Selective and intensive hunting for commercial purposes has to day led to the extinction of some animal species such as the elephant and the mountain buffalo in the forest of Nyungwe and the porcupine in the Akagera National Park.

The unrestrained search for high value timber (*Entandophragma excelsum, Faurea saligna, Prunus africana, Polyscias fulva)* in certain ecosystems has led to selective felling of these ecosystems.

3.2.4 Uncontrolled introduction of exotic species

Uncontrolled introduction of new species in an ecosystem, be it deliberate or accidental, may be harmful to native biodiversity. The risks that go with uncontrolled introduction of exotic species include the following, among others:

- dominance of exotic species over native ones;
- competition, loss and lack of appreciation of the identity of local species and varieties;
- introduction of new uncontrollable diseases;
- uncontrolled cross-breeding;
- dependence on the outside for certain species; and
- colonization of certain areas by exotic species.

Very often, the introduction of plant varieties and animal breeds is carried out informally (particularly from neighbouring countries) by peasants and traders without prior authorization by competent technical authorities.

With regard to wild plant species, there is for example the invasion of the water hyacinth *(Eicchornia crassipes)*, introduced in river Mukungwa, which has spread to day in the entire hydrographic network downstream: lake Mihindi in the Akagera National Park is almost totally covered and other lakes are threatened.

Another case is that of the *Lantana camara* (umuhengeri) plant which was introduced for ornamental purposes and has colonized cultivated fields, particularly in the east of the country.

3.2.5 Poaching and pirating

Protected and wet areas shelter a varied fauna and flora which are subjected to poaching and bio-pirating for domestic consumption or trade.

Poaching, which for a long time has been practised for domestic purposes by the people living in the vicinity, has to day become a business extended beyond nearby communities. This has contributed to drastic reduction of the most targeted animal species such as the elephant, the Royal antelope, the sitatunga, the buffalo, the gazelle, the boar, the porcupine, the partridge, the colobus... Most of these animals are sought because they constitute trophies with high commercial value.

The nature and extent of the problem of biopirating is not well known to day. It will be necessary to create particular awareness in order to assess quantitatively the harvesting done in the past and understand the channels through which this pirating is done as well as the uses of these harvests.

3.2.6 Bush fires

Bush fires are a serious threat to the fauna and the flora. Periodically, protected and non protected areas are devastated by deliberate, criminal or accidental fires. The negative effects of these bush fires include the following:

- extinction of the microfauna and microflora;
- disturbance and damage to the microfauna and microflora;
- disturbance of the hydric regime which may lead to the depletion of water sources;
- acceleration of erosion and modification of the physico-chemical composition of the soil;
- atmospheric pollution which may aggravate the problem of climatic change through the emission of gas with greenhouse effects.

Areas that are mostly affected by these fires are: the forest of Nyungwe, the Akagera National Park and the savannas of the east, the valleys of Nyabarongo, Akagera and Akanyaru.

3.2.7 Conflicts and Wars

Rwanda has experienced conflicts and social crises since 1959, and these have resulted in the loss of human lives and the destruction of ecosystems. The recent and most flagrant case is the war that prevailed since 1990 and culminated in the 1994 genocide and massacres with the following consequences on biodiversity:

- loss of institutional records and acquired knowledge for the conservation of biodiversity;
- population movements resulting in the degradation and colonization of

ecosystems;

- loss of skills in the field of environment and biodiversity;
- loss of germoplasms (in research stations of ISAR such as Rubona, Songa, Karama, Rwerere, etc...;
- discontinuance of protection of formerly protected areas;
- decimation of a considerable number of wild animals in protected areas and domestic animals (80% of cattle, 90% of ruminants and 95% of pigs, rabbits and poultry); and
- loss of considerable stocks of local seeds.

3.3 Threats associated with policy, legal, institutional shortcomings and human resources

3.3.1 Policy-related Threats

Sectoral policies concerning biodiversity are for the most part old and need updating, while others are clear and well elaborated but are not respected or properly implemented. Some do not exist or are in the process of development. The policies dealt with in the following paragraphs concern forestry, aquatic areas, habitat, agriculture and stockbreeding and protected areas.

3.3.1.1 Forestry policy

In this field, the policy developed in 1997 aims at preserving enough forests so as to protect biological diversity, conserve fragile ecosystems and maintain the functions that forests and trees, particularly in wooded watersheds, play in environment.

This mission has not been fully accomplished because up to now, illicit clearings, poaching, fraudulent cutting of timber and other products, fires as well as mining in forests continue to be practised and compromise the policies for the conservation and protection of environment and its biological diversity. Furthermore, the monospecificity of forests and the predominance of the Eucalyptus indicate the limited choice of species. Finally, this forestry policy does not give sufficient importance to native species, and yet they are more adapted to Rwanda's ecosystems and are less degrading.

3.3.1.2 Wetlands management policy

Threats against wetlands come particularly from agricultural pressure. This results in the loss of diversity and the disturbance of the ecological functions of

wetlands. The absence of a clear wetlands management and conservation policy makes them more vulnerable and exposes them more to unplanned and unsustainable cultivation. For example, marshlands face another threat of anarchical exploitation of clay and sand quarries.

Mention should also be made of pollution from various origins, among which are domestic/human and industrial establishments, agro-chemical products applied to watersheds that cause harmful effects on the biological diversity of wetlands.

Policies in the field of fisheries and fish-farming have been implemented in an anarchical and uncontrolled manner. There have been serious failures in terms of introduction of exotic species. An adequate policy framework should be established for sustainable use of wetlands resources.

3.3.1.3 Agricultural and stockbreeding policy

The intensive agricultural policy involves increased use of mineral and organic fertilizers, pesticides and selected seeds.

Misuse of agro-chemical products has harmful consequences on natural and artificial biocenosis and on man's health. The effects of these products may also become apparent through deep changes in biological balance. Concerning the policy for the use of selected seeds on the basis of biotechnology and genetic engineering, it is accompanied by a reduction of genetic variety and variability in local genetic material. This introduces new risks on which we do not have control.

The policy of stockbreeding development puts emphasis on the introduction of performing pure breed or crossed animals. Without compromising food security, agricultural and stockbreeding policy should give particular weight to the use of local seeds.

3.3.1.4 Settlement policy

In rural areas, the dispersion of traditional settlements complicates further the problem of agricultural space, the creation of grassroots infrastructure and various facilities. Generally, houses (ingo) are built on fertile land with slight drop, while family agricultural farms are found on marginal land that is inappropriate for agriculture such as protected areas, natural reserves, artificial forests, marshes accommodating different components of biodiversity. In such conditions, it was virtually difficult to provide socio-economic infrastructure to the entire population.

With a view to resolving this problem and its consequences on biological resources, Rwanda adopted in 1996, a settlement policy aimed at reorganizing the dispersed settlements into agglomerated settlements. However, actions

related to this policy were undertaken on the ground before its adoption so as to deal with post-war emergency cases. Consequently, the trial and error method in the implementation of this policy resulted in losses of biodiversity, particularly when resettlement sites chosen were communal forests or even protected areas such as the Akagera National Park and the natural forest of Gishwati. Furthermore, the settlement policy did not benefit from associated measures that were to contribute to its success such as the land and agrarian reform and the land use planning policy.

With regard to urban areas, there are many man-made problems resulting from his activities: road transport, road network and buildings. The direct agents of these damages caused to environment are generally human waste, kitchen originated waste (solid, liquid, gas), refuse from various institutions originating from administrative buildings, carpentry, tailoring and welding workshops and garages.

The anarchical settlements that characterize Rwanda's towns aggravates the problem of collection and disposal of waste such that these are found everywhere and are reached by rainwater which scatters them widely with their polluting and contaminating effects.

There is an urgent need to adopt a coherent policy for the management of rural and urban areas as well as well defined administrative measures in the field of land use planning.

3.3.1.5 Protected areas policy

Protected areas play an environmental, economical and cultural role. Despite their importance, protected areas have been and continue to be subjected to pressure from man's activities. What emerges from this is that policies and strategies which have been adopted at various periods were often amended or totally dropped or contradicted depending on the conditions and the reality of the moment or lack of seriousness from those concerned with their implementation.

3.3.2 Legal framework related threats

In Rwanda, the legal framework suffers from lack and/or non application of regulations governing environment. As a result, there are harmful consequences to the conservation of biodiversity such as:

- anarchical management of biodiversity;
- lack of harmonization of preventive and corrective measures;
- lack of phyto and zoosanitary control in the formal and informal introduction

of animal or plant species;

- lack of mechanisms for compensating the people in case of damages caused by big game and protected species;

- lack of regulations for aquatic areas.

3.3.3 Institutional framework related threats

In its current situation, the institutional framework for the conservation and use of biological diversity in Rwanda has weaknesses, the most important of which are the following:

- lack of an adequate and effective coordination framework at all levels of intervention, be it in the ministries, parastatals, non governmental organizations, private enterprises and local communities;

- shortcomings of government, parastatal and private institutions involved in the socio-economic development of the country, related to the inadequacy of material, financial and human resources;

- overlapping and duplication of some interventions from various origins for the same beneficiaries, for example MINITERE in the management of marshlands, MINAGRI and MINALOC in the management of forests;

- inadequate prioritization of actions for biodiversity conservation for submission to donors;

- lack of integrated approach among actors involved in the conservation and use of biodiversity in Rwanda, be it at the level of donors, ministries, public and private institutions, as well as non governmental organizations;

- lack of an information and management system for database on biodiversity used by various actors;

- the political and administrative decentralization is still in its early days: but the role of decentralized structures and grassroots communities is not yet well understood so as to be able to integrate conservation and rational use of biodiversity in their daily activities;

- lack of structures for the popularization and transfer of findings of researches carried out in the field of biodiversity.

All these shortcomings show that the current institutional framework in the field of management and conservation of biodiversity has weak points, particularly with regard to the framework for coordination, joint action and dialogue among

all the actors, be it ministries, decentralized structures, non governmental organizations, private enterprises, local communities and the population. It is important to build capacities for a bigger membership and participation of all those concerned with the programme for the conservation of biodiversity so as to avoid overlapping and duplication of actions from various origins for the same beneficiaries.

3.3.4 Constraints related to human, material and financial resources

Constraints related to inadequate human resources were already there even before the April 1994 tragedy that came to worsen considerably the situation. The principal weaknesses in human and financial resources which are a threat to biodiversity become apparent from the following:

- Shortage of skilled senior staff in the field of environment protection and conservation of biodiversity.

- Inadequate material, financial and human resources for better integration of the component Environment/Biodiversity in the process of planning the country's socio-economic development.

- Inadequate educational programmes adapted to the genuine problems of the country in the field of the conservation of biodiversity.

- Inadequate teaching materials for sustainable development focused training.

- Lack of an integrated approach "education – population – resources" at the level of the Ministry of Education.

- Lack of environmental awareness and a sense of sustainable development on the part of most of the planners, decision makers and politicians.

4. NATIONAL STRATEGY AND ACTION PLAN FOR THE CONSERVATION OF BIODIVERSITY

Chapters 1 and 2 show that Rwanda has significant wealth in terms of biological resources and that this wealth was being depleted considerably as a result of natural factors, but particularly due to man's activities. This depletion became faster over the last years following the rapid growth of the population which depend essentially on natural resources of which biodiversity is an essential component. Aware of the need to conserve its biodiversity, Rwanda acceded to the International Convention on Biological Diversity. Among the obligations of the Parties to this Convention, Article 6, stipulates that "each Contracting Party shall, in accordance with its particular conditions and capabilities":

(a) Develop national strategies, plans or programmes for the conservation and sustainable use of biological diversity or adapt for this purpose existing strategies, plans or programmes which shall reflect, *inter alia*, the measures set out in this Convention relevant to the Contracting Party concerned;

(b) Integrate as far as possible and as appropriate, the conservation and sustainable use of biological diversity into relevant sectoral and cross-sectoral plans, programmes and policies.

(c) It is in this context that the national strategy and action plan were developed.

4.1 National Strategy

The first step in the development of the national strategy was to define the aims and objectives. On this basis, the strategy was built around twelve objectives deduced from five major aims. These are:

1. Improved conservation of protected areas and wetlands
2. Sustainable use of the biodiversity of natural ecosystems and agro-ecosystems
3. Rational use of biotechnology
4. Development and strengthening of policy, institutional, legal and human resource frameworks
5. Equitable sharing of benefits derived from the use of biological resources.

4.1.1 Improved conservation of protected areas and wetlands

All protected areas and wetlands in Rwanda are today threatened by man's activities, and the consequences of these activities are the worrying degradation and space reduction, leading to a depletion of biodiversity. These activities are linked to the repatriation and resettlement of the population, population growth which does not match with the growth of resources, various pressures associated with poverty and lack of alternatives; lack of motivation/incentives for the population to preserve protected areas; inadequate institutional, legal and policy capacities for the protection and management of protected areas, and lack of human and material resources.

4.1.1.1 Objectives and strategies

In order to successfully and effectively preserve protected areas and wetlands, it will be necessary to realize the following two objectives:

a. Improved protection and management of protected areas and wetlands

Since their establishment, protected areas in Rwanda are supposedly shielded against any destructive action of man. However, they are regularly eroded gradually by clearings, both officially and clandestinely. In order to mitigate this situation, the Government has taken measures aimed at limiting the damages through the establishment of buffer forests around these protected areas and supplementing natural regeneration of thinnings. In spite of these efforts, threats still continue to be quite serious.

With regard to wetlands, they are subjected to agricultural, quarrying, fishing and other uncontrolled activities. The proliferation of these activities results in considerable loss of biological resources and the disturbance of the hydric regime of these areas.

Improved protection and management of protected areas and wetlands could be done through the following three strategies:

- Development and implementation of land use and management plans for each protected area;
- Involvement of the population living around in the conservation of protected areas;
- Development of a master plan for the use and management of wetlands.

b. Improved knowledge of the biodiversity of protected areas and wetlands

Studies and researches carried out in Rwanda on biodiversity are restricted and sometimes partial. In addition, due to the absence of a national biodiversity coordination framework, studies are scattered and several related documents are abroad without national cataloguing. This situation leads to lack of awareness of the components of the biodiversity of protected areas and wetlands.

In order to improve the knowledge of the biodiversity of protected areas and wetlands, two strategies are envisaged:

- Inventory and characterization of the components of the biodiversity of protected areas and wetlands;
- Regular monitoring of the state of the biodiversity of protected areas and wetlands.

4.1.2 Sustainable use of the biodiversity of natural ecosystems and agro-ecosystems

Apart from protected areas and wetlands, there are other natural ecosystems and agro-ecosystems (gallery forests, grazing land, cultivated areas, savannas) the management of which is not governed by any regulation. The consequence of this situation is that the biodiversity of these ecosystems is depleted significantly by man's various activities, particularly agriculture.

Rwanda's agro-ecosystem is seriously altered by climatic and edaphic conditions. The limited size of the fields and their depletion resulting from continued over-stripping have led to the reduction of production of seasoned varieties and breeds, a result of natural selection which generally fosters the most resistant and less productive genotypes.

Sustainable use of the biodiversity of natural ecosystems and agro-ecosystems must aim at the following four objectives:

1. Conservation of genetic biodiversity of native plant and animal species;
2. Sustainable use of biological resources of natural ecosystems;
3. Sustainable use of agro-biodiversity;
4. Development of an environmentally sustainable and economically viable tourism.

Each of these objectives will be realized through the following strategies:

Two strategies are envisaged for the first objective:

- inventory of native endemic and/or less known species of economic importance and characterization of their genetic diversity
- in-situ and ex-situ conservation of native genetic heritage

The second objective will be realized through two strategies

- development of alternatives to the use of biodiversity (e.g. alternative of energy, fishery aimed at poverty reduction)
- research and promotion of appropriate technologies for rational use of biological resources

For the third objective, the following four strategies will be applied:

- improved performance of native varieties and species
- promotion of sustainable traditional production systems
- prevention of introduction of intrusive species, control and eradication of non native species likely to threaten ecosystems and native species
- development of mechanisms for checking the importation and dissemination of genetic material capable of having harmful effects on biodiversity, particularly on agro-biodiversity.

The fourth objective is “the development of an environmentally sustainable and economically viable tourism”. In fact, natural ecosystems and agro-systems accommodate an attractive biological diversity. Unfortunately, these environments are not known in the country. Similarly, the country does not have an adequate infrastructure to receive tourists who want to visit different areas of attraction. In order to realize this objective, two strategies will be utilized:

- development of ecotourism oriented infrastructure
- promotion of small and medium scale diversified and environmentally viable tourist activities

4.1.3 Rational use of biotechnology

Scientific progress enables the production of genetically modified organisms. Enormous quantities of varied products such as pharmaceutical, chemical, food, cosmetic and phytosanitary products have been imported and others produced in the country. The use of these products has some advantages but also some disadvantages both for man and for the biodiversity of different ecosystems of the country.

On the other hand, several technologies used in Rwanda are not controlled. Rational use of biotechnology must aim at the following two objectives:

1. improved access to and transfer of biotechnology
2. risk-free use of biotechnology

The first objective will enable the country to have access to modern biotechnologies and their operating procedures. In fact, up to now, a very big part of biotechnology products comes from developed countries. Consequently, there is need to transfer biotechnologies from developed countries to developing countries and related exchange of information. In order to attain this objective, the following strategy will be applied. Definition and implementation of mechanisms for the transfer and exchange of biotechnology.

The introduction of biotechnology products is recent in Rwanda, but their use in almost all production sectors in the country is a sign of a greater use in future. However, up until now, there are very few specialized centres in biotechnology and knowledge in this field is still limited. Impacts and risks caused by the use of biotechnology products have not been assessed.

With a view to risk-free use of biotechnology, the following two strategies will be applied:

- improved knowledge of advantages and risks of biotechnology
- development of national procedures and measures for the assessment and management of risks caused by genetically modified organisms

4.1.4 Development and strengthening of policy, institutional, legal and human resource frameworks

Improved conservation of protected areas and wetlands, sustainable use of the biodiversity of natural ecosystems and agro-systems and rational use of biotechnology can only be realized if policy, institutional, legal and human resource frameworks are developed and strengthened. This development and strengthening must aim at the following three objectives:

1. improvement of policy and legal frameworks for sustainable conservation of biodiversity
2. building of institutional and human resource capacities for sustainable conservation of biodiversity
3. strengthening regional and international cooperation for conservation and sustainable use of biodiversity.

In fact, until now, the legal instruments that govern the conservation and use of biological resources are incomplete and not always strictly applied. In order to attain sustainable use of biodiversity, the following two strategies are envisaged:

- development and updating of policies related to the conservation of biodiversity and the creation of an enabling environment for their implementation
- development of an integrated policy and legal framework for the conservation and sustainable use of biodiversity and equitable sharing of benefits derived from biological resources.

The building of institutional capacities and the strengthening of human resources for sustainable conservation of biodiversity will enhance the establishment of a well defined institutional framework for biodiversity. The success of this framework will become effective through the use of the following four strategies:

- establishment of an integrated system of information, formal and informal education and communication for the conservation and sustainable use of biodiversity;
- promotion of a conservation and biodiversity management-focused integrated research-development;
- establishment and strengthening of community management structures of biological resources;
- strengthening of partnership and formation of networks of actors for the promotion of the conservation of biodiversity and sustainable use of biological resources.

In addition to the national efforts by the population, grassroots authorities and various departments involved in the protection/conservation and management of biodiversity, it is necessary to envisage cooperation at the regional and international level so as to consolidate and carry out joint and convergent action in protected areas which, for the most part, have cross-border limits. This is the case with the Nyungwe National Park and the Akanyaru, Rusizi and Ruhwa marshes which are trans-border with Burundi; the Akagera National Park and the Akagera marsh with Tanzania; the Volcanoes National Park with the Democratic Republic of Congo and Uganda.

Regional and international cooperation for the conservation and sustainable use of biodiversity will be strengthened through the following strategies:

- strengthening of regional cooperation for the conservation of protected areas and wetlands
- strengthening of links among the parties, the states and their specialized institutions for the promotion of technical and scientific cooperation related to

biodiversity

- national capacity building for access, use and exchange of information through the clearing house mechanism
- establishment and strengthening of mechanisms at the national level for the mobilization of the necessary financial resources for the implementation of the Convention on Biodiversity.

The following table gives a summary of the strategies which facilitate the realization of established objectives according to specific aims.

Table 7: Planned Strategies according to objectives

Aim 1: Improved conservation of protected areas and wetlands

Objective	Strategies
1. Improved protection and management of protected areas and wetlands	1.1 Development and implementation of land use and management plans for each protected area 1.2 Involvement of the population in the vicinity in the conservation of protected areas 1.3 Development of a master plan for the use of wetlands
2. Improved knowledge of the biodiversity of protected areas and wetlands	2.1 Inventory and characterization of elements of the biodiversity 2.2 Regular monitoring of the state of biodiversity in protected areas and wetlands

Aim 2: Sustainable use of the biodiversity of natural ecosystems and agro-systems

Objective	Strategies
3. Conservation of the genetic diversity of native plant and animal species	3.1 Inventory of native endemic and/or less known species of economic importance and characterization of their genetic diversity
	3.2 In-situ and ex-situ conservation of the native genetic heritage
4. Sustainable use of biological resources of natural ecosystems	4.1 Development of alternatives to the exploitation of biodiversity (e.g alternative of energy, fishery…aimed at poverty reduction)
	4.2 Research and promotion of technologies adapted to a rational use of biological resources
5. Sustainable use of agro-biodiversity	5.1 Improved performance of native varieties and species
	5.2 Promotion of sustainable traditional production systems
	5.3 Prevention of introduction of intrusive species and control and eradication of non native species likely to threaten ecosystems and natives species
	5.4 Development of control mechanisms for importation of genetic material that might have harmful effects on biodiversity, particularly on agro-biodiversity
6. Development of an environmentally sustainable and economically viable tourism	6.1 Development of ecotourism-focused infrastructure
	6.2 Promotion of small and medium scale environmentally viable and diversified tourist activities

Aim 3: Rational use of biotechnology

Objective	Strategies
7. Improved access to and transfer of biotechnology	7.1 Definition and implementation of biotechnological transfer and exchange mechanisms
8. Risk-free of biotechnology	8.1 Improved knowledge of benefits and risks of biotechnology
	8.2 Development of national procedures and measures for assessment and management of risks caused by genetically modified organisms

Aim 4: Development and strengthening of policy, institutional, legal and human resource frameworks

Objective	Strategies
9. Improved policy and legal frameworks for sustainable conservation of biodiversity	9.1 Development and updating of policies relating to the conservation of biodiversity and the creation of a conducive environment for their implementation 9.2 Development of an integrated policy and legal framework for the conservation, sustainable use of biodiversity and equitable sharing of benefits derived from biological resources
10. Institutional and human resource capacity building for sustainable conservation of biodiversity	10.1 Establishment of an integrated information, formal and informal education and communication system for conservation and sustainable use of biodiversity 10.2 Promotion of an integrated research-development focused on the conservation and management of biodiversity 10.3 Establishment and strengthening of biological resources community management structures 10.4 Strengthening of partnership and constitution of actors networks for the promotion of conservation of biodiversity and sustainable use of biological resources
11. Strengthening of regional and international co-operation for the conservation and sustainable use of biodiversity	11.1 Strengthening of regional co-operation for the conservation of protected areas and wetlands 11.2 Strengthening of links between the parties, the States and specialized institutions for the promotion of technical and scientific co-operation in the field of biodiversity 11.3 National capacity building for access, use and exchange of information through the clearing house mechanism 11.4 Establishment and strengthening of mechanisms at the national level for the mobilization of the necessary financial resources for the implementation of the convention on biodiversity

Aim 5: Equitable sharing of benefits derived from the use of biological resources

Objectives	Strategies
12. Strengthening of the rights of grassroots communities for the control and sustainable use of biological resources	12.1 Increased benefits derived by the grassroots communities through the exploitation of biological resources 12.2 Establishment of mechanisms for monitoring and control by the grassroots communities on the exploitation of biological resources

4.2 National Action Plan

In order to implement it, the National Strategy has been translated by a national action plan into a collection of specific activities which should be carried out by specific institutions over a given period of time. The specific actions as defined by the action plan should lead to improved conservation of protected areas and wetlands, sustainable use of the biodiversity of natural ecosystems and agro-systems, rational use of biotechnology and developed and strengthened policy, institutional, legal and human resources frameworks.

The National Action Plan consists of urgent and priority actions which are attainable in a period of 5 years. In order to facilitate its reading, it is presented in the form of a table with the headings of “objective, strategy, priority actions, expected results, responsible institutions, estimated budget and implementation time-frame”.

The following table presents the National Action Plan.

Table 8: Action Plan for the conservation of biodiversity in Rwanda

Objective 1: Improved protection and management of protected areas and wetlands

Strategy	Activities	Expected Results	Responsible institutions	Est. Budget	Timeframe
1.1 Development and implementation of land use and management of each protected area	1.1.1 Delineate and represent physically the borders for each protected area 1.1.2 Define management areas 1.1.3 Develop land use for each unit and determine its management mode	Borders for each protected area delineated Management areas defined Land use and management plans for the forest of Nyungwe, ANP and VNP.	MINITERE MINAGRI MINALOC ORTPN Research institutions		6 months 12 months
1.2 Involvement of the riparian population in the conservation of protected areas	1.2.1 Put in place local grassroots management committees for protected areas 1.2.2 Educate, train and support local management committees	Protected areas rehabilitated and restored Local communities operational around protected areas Members of local communities trained	MINITERE MINALOC MIGEPROFE MIJESPOC MINICOM/ORTPN NGOs		6 months 36 months
1.3 Development of a master plan for the exploitation of wetlands	1.3.1 Make an inventory and characterize wetlands of national and/or regional interest 1.3.2 Define the management mode for the exploitation of wetlands	Master plan for wetlands available Allocation and assignment of wetlands	MINITERE MINERENA MINAGRI MINALOC (decentralized departments) ORTPN Research institutions		3 months 6 months

Objective 2: Improved knowledge of the diversity of protected areas and wetlands

Strategy	Activities	Expected Results	Responsible institutions	Est. Budget	Timeframe
2.1 Inventory and characterization of the elements of biodiversity of protected areas and wetlands	2.1.1 Inventory of the biological wealth of protected areas and wetlands	Inventory report	MINICOM MINITERE MINAGRI		
	2.1.2 Identify endemic species and species in the process of extinction	Inventory report	MINERENA Research institutions		
	2.1.3 Spell out measures for the preservation and sustainable use of biodiversity	Code for the management of endemic species and species in the process of extinction	Ditto		
2.2 Regular monitoring of the state of the biodiversity of protected areas and wetlands	2.2.1 Establishment of monitoring mechanisms: assignment and equipping of the staff	Regular report every 6 months and as and when necessary	MINITER		
	2.2.2 Determine the frequency of updating of the inventory by ecosystem	To be detailed according to the type of each ecosystem	MINITERE		

Objective 3: Conservation of genetic diversity of native plant and animal species

Strategy	Activities	Expected Results	Responsible institutions	Est. Budget	Timeframe
3.1 Inventory of native and/or less known species of economic importance and characterization of their genetic diversity	3.1.1 Make an inventory of native species of economic importance	Inventory report	MINITERE MINAGRI Research institutions MINERENA MINICOM		12 months
	3.1.2 Identify endemic and/or less known species				
	3.1.3 Characterize the genetic diversity of identified species	Directory of endemic and/or less known species	Ditto		3 months
3.2 In-situ and ex-situ conservation of native genetic heritage	3.2.1 Identify and protect environments for in-situ conservation of native species	Species genetic index cards established	Ditto		12 months
	3.2.2 Develop and create favorable environments for ex-situ conservation of native species	Map of conservation areas established	MINITERE MINAGRI MINEDUC		12 months
	3.2.3 Repatriate and reconstitute the native genetic heritage held abroad	Arboretum, botanical gardens, zoos, genes banks, aquarium established	Research institutions MINAGRI MINERENA		36 months
		Genetic heritage repatriated and reconstituted	Research institutions		24 months

Objective 4: Sustainable use of biological resources of natural ecosystems

Strategy	Activities	Expected Results	Responsible institutions	Est. Budget	Timeframe
4.1 Development of alternatives to the use of biodiversity (energy, fishery alternatives) for poverty reduction	4.1.1 Promotion of modern techniques of stockbreeding and agriculture of performing species	Increased income for the riparian population and reduction of pressure on protected areas and natural ecosystems	MINITERE MINAGRI MINALOC MIJESPOC MINICOM NGOs Research institutions		4 years
	4.1.2 Promotion of the exploitation of new and renewable energy and energy saving technologies (biogas, solar energy, improved ovens...)	Ditto	MINITERE MINAGRI MINERENA Private sector Research institutions		4 years
4.2 Research and promotion of technologies adapted to a rational use of biological resources	4.2.1 Encourage use of non degrading technologies for mining, wood cutting, fisheries, agriculture, etc.	Improvement of techniques for the use of biological resources	MINITERE MINAGRI MINERENA Private sector Research institutions		3 years

Objective 5: Sustainable use of agro-biodiversity

Strategy	Activities	Expected Results	Responsible institutions	Est. Budget	Timeframe
5.1 Improved performances of native varieties and species	5.1.1 Make a selection of native germoplasm	Directory of performing individuals made available	MINAGRI. MINITERE		5 years
	5.1.2 Carry out crossings for improvement of performances of native species	Improved hybrids compared to their parents	ISAR, CNIA, Other research institutions		5 years
	5.1.3 Popularize genetic material in production systems	Producers have performing genetic material	Ditto		
5.2 Promotion of sustainable traditional production systems	5.2.1 Identify performing and sustainable traditional production systems	Availability of a directory of performing and sustainable traditional production systems	MINAGRI. MINITERE ISAR, CNIA, Other research institutions		2 years 6 months
	5.2.2 Improve tradition production systems through new technologies inputs	Traditional production systems improved	Ditto		
	5.2.3 Disseminate improved traditional production systems	Production systems improved, used by producers	Ditto MINITERE MINIJUST		24 months
	5.2.4 Regulate introduction of non native species	Legal instrument on imports and exports of biological material put in place	MINICOM, RRA MINAGRI, MINECOFIN		24 months
5.3 Development of mechanisms for the prevention of introduction/imports of species likely to threaten natural ecosystems and agro-ecosystems	5.3.1 Train and educate the staff in charge of importation and exportation of germoplasm	Training of the staff concerned	Rwanda Bureau of Standards, ANT MINICOFIN		6 months
	5.3.2 Monitor non native species likely to threaten ecosystems and native species	Reduction of threatening non native species	RRA, Research institutions MINITERE, MINAGRI		
	5.3.3 Put in place monitoring/assessment of impact of non native species on agro-biodiversity	Monitoring-assessment mechanisms of impact of non native species established	Rwanda Bureau of Standards		

Objective 6: Development of an environmentally sustainable and economically viable tourism

Strategy	Activities	Expected Results	Est. Budget	Timeframe
6.1 Development of ecotourism focused infrastructure	6.1.1 Assess the requirements for ecotourism focused infrastructure in the vicinity of tourist sites	Requirements of ecotourism-focused infrastructure known		3 months
	6.1.2 Develop adequate infrastructure to and in tourist sites	Ecotourism-focused infrastructure developed		3 years
	6.1.3 Make an inventory, organize and develop undeveloped tourist sites			2 months
				Unspecified
6.2 Promotion of small and medium diversified and environmentally viable tourist activities	6.2.1 Promote and integrate cultural groups in tourist activities	New tourist sites exploited Reduction of negative impact of tourism on the biodiversity of traditional tourist sites		1 years
	6.2.2 Develop attractive handicraft to tourists	Increased tourism generated income		
	6.2.3 Prepare and update a tourist guide at national level	Improved know-how and creativity by craftsmen Quality services offered to tourists		6 months

Objective 7: Improved access to biotechnology

Strategy	Activities	Expected Results	Responsible institutions	Est. Budget	Timeframe
7.1 Definition and implementation of mechanisms for the transfer and exchange of biotechnology	7.1.1 Identify competent institutions responsible for biotechnology, for exchange and define their respective roles	• Production of comprehensive report on inventory of institutions • Production of an analysis report on the mandates of institutions	MINEDUC MINITERE MINAGRI MINICOM National research institutions		3months
	7.1.2 Identify national biotechnology requirements	• Production of report on national biotechnology requirements	MINEDUC MINITERE MINAGRI MINICOM National research institutions		9 months
	7.1.3 Provide to these institutions necessary material, technical and human resources	• Institutions with adequate staff (qualitatively and quantitatively) • Availability of material and technical resources	MINECOFIN MIFOTRA MINEDUC Donors R-D institutions		5 years
	7.1.4 Acquire, assess and disseminate biotechnology products for rational use	• Acquisition of biotechnological sources • Dissemination of biotechnological sources	MINAGRI MINOCOM, NGOs Private sector		5 years
	7.1.5 Train specialists in biotechnology	• Trained critical mass of biotechological specialists	MINEDUC MIFOTRA National research institutions, donors		3-5 years

Objective 8: Risk-free use of biotechnology

Strategy	Activities	Expected Results	Responsible institutions	Est. Budget	Timeframe
8.1 Improved knowledge of the benefits and risks of biotechnology	8.1.1Identify, monitor regularly the impact and risks of the use of biotechnology	• Development and adoption of identification procedures • Production of reports on risk assessment	MINITERE NGOs, Research institutions		Continuous
8.2 Development of national procedures and measures for assessment and management of risks caused by genetically modified living organisms (GMOs)	8.2.1 Establish a technology monitoring and follow up unit	• Establishment of an operational monitoring unit	MINITERE Prime Minister's Office		2 years
	8.2.2 Control introduction, use, transfer (including cross-border movements) of genetically modified living organisms (GMOs)	• Establishment of the necessary identification procedures • Control of introduction, use and transfer of GMOs by competent authorities	Control unit Research institutions MINAGRI MINITERE		Continuous
	8.2.3 Establish an early warning system for the prevention and monitoring of undesirable effects of biotechnologies	• Establishment of an operational early warning system	MINICOM, NGOs MINITERE (+ institutional network)		Continuous

Objective 9: Improved policy and legal frameworks for sustainable conservation of biodiversity

Strategy	Activities	Expected Results	Responsible institutions	Est. Budget	Timeframe
9.1 Development and updating of policies related to the conservation of biodiversity and creation of a conducive environment for their implementation	9.1.1 Assess the integration of biodiversity as a component in the existing policies and make proposals for maintaining coherence between these policies and issues of biodiversity	• Production of a policy assessment and analysis report • Preparation of a paper on proposed policy amendments	MINITERE		4 months
	9.1.2 Develop appropriate policies which enhance promotion of conservation and sustainable use of biodiversity and equitable sharing of the benefits derived from the use of biological resources	• Development and adoption of appropriate policies	MINITERE MINAGRI MINERENA MINICOM		12 months
	9.1.3 Develop programmes and plans for the implementation, monitoring and evaluation of conservation and sustainable use of biodiversity	• Development and implementation of integrated plans and programmes	MINITERE MINAGRI MINERENA MINICOM		5 renewable years
9.2 Development of an integrated policy and legal framework for conservation and sustainable use of biodiversity and equitable sharing of benefits derived from biological resources	9.2.1 Develop a framework law for biodiversity	• Development and adoption of the framework law • Development and updating of the relevant laws			
	9.2.2 Develop and update relevant laws relating to the conservation and sustainable use of biodiversity	• Preparation of mechanisms and guidelines for minimizing conflicts at local level	MINITERE MINAGRI MINICOM		12 months
	9.2.3 Establish mechanisms for conflict management at the local level concerning biodiversity	• Protection of intellectual property rights • Development of an operational legal instrument for the protection of intellectual property rights, including traditional knowledge and technologies	MINIJUST MINALOC MINITERE MINIJUST MINIJUST MINAFFET MIJESPOC MINICOM		12 months 9 months 12 months
	9.2.4 Establish mechanisms for the defense of intellectual property rights relating to biodiversity				

Objective 10: Institutional and human resources capacity building for sustainable conservation of biodiversity

Strategy	Activities	Expected results	Responsible institutions	Est. Budget	Timeframe
10.1 Establishment of an integrated system of information, formal and informal education and communication for conservation and sustainable use of biodiversity	10.1.1 Promote an educational and sensitization programme for the public	• Development and dissemination of an educational and sensitization programme • Awareness promotion of the national community on the value of biodiversity	MINITERE MINAGRI MINERENA MINICOM Local and international NGOs		Continuous
	10.1.2 Strengthen and/or develop at all levels educational programmes on biodiversity	• Better knowledge and understanding at all level of education of the value of biodiversity	MINEDUC MINITERE		5 renewable years
10.2 Promotion of an integrated R-D focused on conservation and management of biodiversity	10.2.1 Identify research topics to be carried out for conservation and sustainable management of biodiversity	• Production of report on identified and hierarchical inventory of research topics	MINEDUC MINERENA MINAGRI		6 months
	10.2.2 Develop research programmes on identified priority topics	• Creation of a national network and facilitation of exchange of information • Researches are carried out by research institutions	MINITERE		12 months
	10.2.3 Mobilize necessary resources for building technical capacities for implementation of these research programmes		MINITERE MINRDUC MINECOFIN MINITRACO		2 years
10.3 Creation and strengthening of structures for community management of biological resources	10.3.1 Support structures for community management of biological resources	• Establishment of operational structures of community management			
	10.3.2 Study and establish a system for the motivation of the communities in the conservation /management of biological resources	• Determination and implementation of modalities for the establishment of a	MINITERE MINICOM ORTPN		2 years

10.4 Strengthening of the partnership and constitution of networks of actors for the promotion of conservation of biodiversity and sustainable use of biological resources	10.4.1 Develop an information system which enables the acquisition and quick analysis of data and information on biodiversity 10.4.2 Establishment of appropriate tools which enable easy, quick and large scale access of data and information on biodiversity by different actors in the field of biodiversity	motivation system • Determination of the requirements for the establishment of the information system • Development of the information system • Operationalisation of the system and facilitation of information exchange	MINALOC MINITERE MINICOM MINALOC MINAGRI NGOs MINITERE MINITRACO Donors NGOs Research institutions MINITERE MINITRACO Partners		12 months 3 years Continuous

Objective 11: Strengthening regional and international co-operation for the conservation and sustainable use of biodiversity

Strategy	Activities	Expected results	Responsible institutions	Est. Budget	Timeframe
11.1 Strengthening regional co-operation for conservation of protected areas and wetlands	11.1.1 Participate in the establishment of mechanisms and framework for shared management of biological resources of conflicting interests	• Active participation by Rwanda in preparatory and adoption meetings • Respect for financial and technical obligations	MINITERE MINERENA MINAGRI MINICOM MINAFFET MINECOFIN Donors		
	11.1.2 Cooperate with parties involved in the development and implementation of regional programmes of mutual interest aimed at conservation and sustainable use of protected areas and wetlands, taking into account Rwanda's specific needs and interests	• Development and implementation of regional programmes in collaboration with Rwanda • Better management and sustainable use of protected areas and wetlands	MINITERE MINECOFIN MINAFFET Donors		
11.2 Strengthening links between parties, States and their specialized institutions for the promotion of technical and scientific co-operation with regard to biodiversity	11.2.1 Develop an appropriate approach for strengthening technical and scientific co-operation with relevant institutions and organization in the field of conservation and sustainable use of biodiversity	• Determination of procedures and modalities of co-operation			
	11.2.2 Make the necessary arrangements so as to be a stakeholder in all the relevant conventions relating to biodiversity	• Ratification of conventions and agreements • Honouring obligations			
	11.2.3 Adoption of joint research programmes for developing appropriate technologies in the implementation of conservation on biological diverstiy	• Adoption of joint research programmes for developing appropriate technologies			
	11.3.1 Establish a national clearing house mechanism to facilitate exchange of				

	technical, scientific and socio-economic information on biodiversity and biosecurity 11.4.1 Establish a trust fund for the mobilization of financial resources meant for the conservation of ecosystems of world importance and endangered species 11.4.2 Strengthen existing national institutions for mobilizing the necessary external funds in the preparation and execution of projects for the implementation of the convention on biodiversity 11.4.3 Adopt national capacity building measures and initiatives for attracting external support (financial and technical) in the implementation of conservation of biodiversity	• Determine the requirements for the operationalisation of the clearing house mechanism • Establishment and operationalisation of the clearing house mechanism • Establishment of the trust fund • Improvement of the knowledge of human resources in national institutions • Preparation of projects, mobilization of funds and good execution of financed projects • More conducive environment (policy and socio-economic)			

Objective 12: Strengthening of the rights of grassroots communities for the control and sustainable use of biological resources

Strategy	Activities	Expected results	Responsible institutions	Est. Budget	Timeframe
12.1 Increased benefits obtained by grassroots communities from the use of biological resources	12.1.1 Identify and determine quantitatively the economic value of elements of biodiversity	• Production of a comprehensive report on environmental accounting	MINITERE NGOs, Donors, Research institutions		
	12.1.2 Multidisciplinary studies to determine appropriate arrangements governing equitable sharing of benefits in local communities	• Production of the report of multidisciplinary studies (socio-economic and environmental) and adoption of arrangements	MINITERE NGOs, Donors, Research institutions		
	12.1.3 Create job opportunities for local communities	• Increased job for local communities	MINALOC, NGOs Private sector Donors		
	12.1.4 Putting in place appropriate programmes for providing local communities with alternative or sources of income	• Significant increase of incomes for local communities	MINALOC MINITERE MINICOM		
12.2 Establishment of monitoring and control mechanisms by grassroots communities for the use of biological resources	12.2.1 Carry out necessary studies to determine procedures and modalities for the establishment of grassroots control and monitoring mechanisms for the use of biological resources	• Preparation and dissemination of appropriate guide of control and monitoring mechanisms	MIJESPOC NGOs, Private sector, donors		
	12.2.2 Create control and monitoring structures at the local level for the use of biological resources	• Creation and operationalisation of control and monitoring mechanisms	MINITERE MINICOM MINALOC NGOs, donors		
	12.2.3 Strengthen control and monitoring structures through the mobilization of adequate resources (material, financial and human)	Increased (material, financial and human) capacities of control and monitoring structures	MINITERE MINICOM MINALOC NGOs, donors MINECOFIN, NGOs, donors		

5. IMPLEMENTATION OF THE NATIONAL STRATEGY AND ACTION PLAN FOR THE CONSERVATION OF BIODIVERSITY

In order to implement the National Strategy and Action Plan for the conservation of biodiversity, there will be established an institutional framework for mobilizing financial resources and a coordination and monitoring-evaluation mechanism for programmed activities.

5.1 Institutional coordination framework: National Coordination Unit on Biodiversity (NCUD)

The mission of NCUD will be:

- To ensure the management/conservation of biodiversity
- To mobilize financial resources for projects focused on biodiversity
- To coordinate and evaluate on-going projects
- To ensure monitoring-evaluation of the state of biodiversity
- Jointly with the parent Ministry, to represent Rwanda in matters concerning biodiversity

In addition to its own human resources, the National Coordination Unit on Biodiversity will seek the support of other Ministries involved in the management/conservation of biodiversity, including MINITERE, MINAGRI, MININFRA, MINALOC, MINICOM, MINADEF, MIDEDUC, and local and international NGOs.

The National Coordination Unit on Biodiversity will be composed as a matter of priority of persons who have worked in the field of biodiversity and shown great interest in this field. Its Board of Directors must include representatives from Ministries, Authorities and NGOs involved in the field of Biodiversity. It will have 12 regional branches, i.e. 1 in each Province (11 Provinces) and 1 in the city of Kigali.

5.2 Implementation and monitoring-evaluation mechanism for the National Strategy and Action Plan

The implementation of the National Strategy and Action Plan will follow the following stages:

- Review of the legal instruments
- Establishment of the coordination unit
- Establishment of regional branches
- Development of implementation time chart of the Action Plan for the conservation of biodiversity

The monitoring-evaluation process will be as follows:

- Evaluation of the execution of planned activities and the production of reports on progress achieved in the implementation of the strategy
- Monitoring the use of funds allocated to the implementation of the strategy
- Analysis of impacts of actions carried out on biodiversity and the socio-economic consequences of the conservation of biodiversity

This evaluation will be carried out in 2 stages: mid-term evaluation which will enable to undertake an eventual rescheduling of the time chart of activities and a final evaluation after a period of 5 years to determine the updating of the National Strategy and Action Plan on Biodiversity.

5.3 Financing Mechanism

Implementation of the National Strategy and Action Plan on Biodiversity will require considerable financial resources. The participation of the State, given its poor financial resources, will be limited to certain actions, including awareness creation, community work in conservation and protection, and application of the law on repression against those who destroy or disturb biodiversity. The big part of financing the implementation of the National Strategy and Action Plan will come from international co-operation through the Global Environment Facility (GEF) and bilateral co-operation.

Considering that certain components of biodiversity are sought for use, part of the financing might come from financial arrangements with interested private or public institutions.

5.4 Constraints and opportunities

Implementation of the National Strategy and Action Plan for the conservation of biodiversity will encounter problems which are of concern to the country to day. These problems are:

- Poverty
- Lack of human resources qualified in biodiversity
- Lack of effective management skills of biodiversity by local communities

Nonetheless, the implementation of the National Strategy and Action Plan for the conservation of biodiversity could benefit from opportunities available in the country to day. These include:

- The process of decentralization and accountability of the Community Development Committees (CDC)
- The land policy and law which will reduce human pressure on protected areas.