

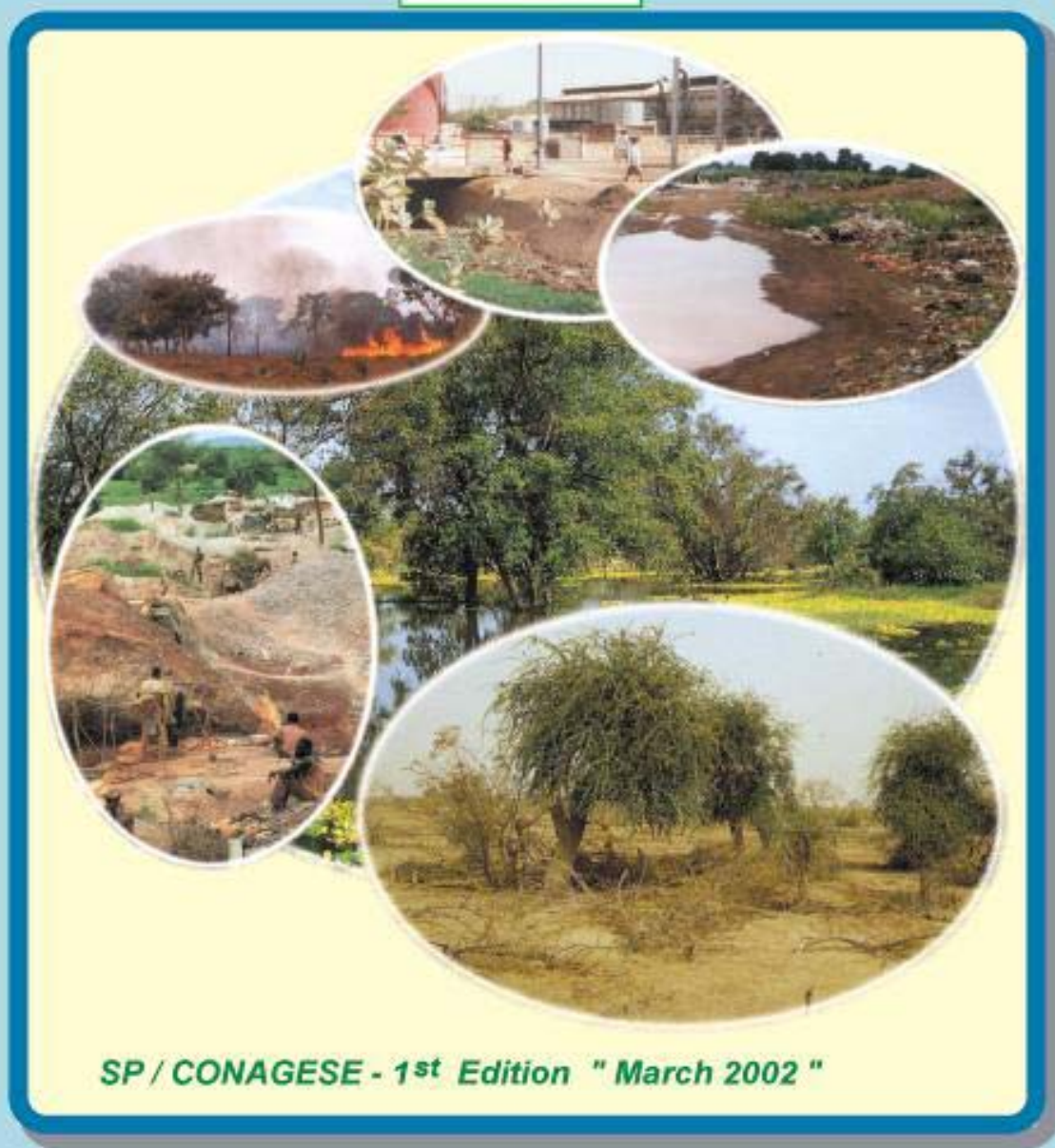


BUKINA FASO



# STATE OF ENVIRONMENT REPORT FOR BURKINA FASO

## SUMMARY



*SP / CONAGESE - 1<sup>st</sup> Edition " March 2002 "*

## BURKINA FASO

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## **Introduction.**

Burkina Faso is experiencing numerous environmental problems caused and / or aggravated by drought and desertification and many other various sources. Further knowledge of these problems in particular and the state of the environment in general is a prerequisite to sound decision-making and to the establishment of operational mechanisms for environment preservation and sustainable management. The first report on the state of environment in Burkina Faso (REEB) was designed and validated in March 2002 in response to such strategic and historic imperative.

The first report on the state of environment in Burkina Faso (REEB) worked out under the aegis of CONAGESE constitutes a reference document on environmental information, a basic tool for the planning of actions and programmes related to environment, an instrument of negotiation between the state and cooperation partners.

This scientific and informative document presents the state of environment with objectivity and much as possible, according to a systemic and holistic approach. The interest and originality of this approach are to collect, process and analyse the maximum of data in a “crossed” way without altering their quality. Thus, the first report on the state of environment aims at both respecting and enabling the implementation of information and sustainable development principles.

It evidences the strengths and weaknesses of the environmental policy of the Ministry of Environment and Water.

Thus, the original REEB document included more than 200 pages with 11 maps, 26 boxed pieces of texts, 15 figures, 20 photos and 57 tables. It is structured as follows: a preface of the Minister in charge of environment gives the importance of the of the process and the design of the REEB for Burkina Faso; then follow the introduction of the document drafting, critical reading and finalisation teams, acronyms and abbreviations, the foreword and introduction which give more details on the objectives, the scope, the methodology and the limits of the report.

The body of the report includes chapters describing the state of the environment and natural resources (chapter 1 on political and economic framework, chapter 2 on natural resources, chapter 3 on human beings and their activities), chapters presenting pressures (problems) on environment (chapter 4 on sources of pressures on environment, chapter 5 on environmental issues) and the listing of some responses to issues in chapter 6.

The REEB also includes bibliographical references and annexes on ongoing and developed programmes and projects as well as the conventions ratified by Burkina Faso.

The main authors of REEB are specialists of earth and human sciences. The representatives of PNGIM member structures and coordinating body carried out the technical and administrative coordination. The members of the PRECAGEME “environment” section working group, personalities, central and technical directors of the Ministry of Environment and Water as well as resource persons from semi-public and private sectors and the civil society also brought their contributions.

The objective of this summary of the report on the state of environment in Burkina Faso is to give the substance of the said report by following the same methodological approach “state-pressures-responses”. The impacts of the state of problems and the responses to problems are dealt with in each of these sections.

Indeed, this first report has objective weaknesses related to available outdated collected data. Its periodic publishing every four years will undoubtedly improve this pioneering document.

## **1 Status of environment and natural resources**

### **1.1 Political and economic framework**

After the independence in 1960, Burkina Faso former Upper Volta until 1984, experienced four republican regimes interrupted by six regimes of military coup d'état. The fourth and current regime dates back in 1991. This republic was born following the instauration of multiparty democracy, official renunciation of Marxism- Leninism, a referendum on a constitution and the promulgation of this constitution on June 11<sup>th</sup> 1991.

Presidential, legislative and municipal elections took place. The electoral process evidenced institutional stability and confirmed the instauration of multiparty democracy, the separation of powers, the setting up of consultative bodies and the emergence of a civil society.

The Parliament and the House of Representatives detain the legislative power. The President of Faso chairman of the council of ministers leads the executive power and appoints the Prime Minister who is the Head of the Government. The President also appoints the CES (Social and Economic Council), the CSI (the body in charge of regulating the media), the Ombudsman and the advisory body of the legislative power. The civil society plays an interface role between the government and citizens who demand decentralisation.

Decentralisation processes were carried out by almost all former regimes. The fourth republic regime institutionalised and legislated a CND (National Commission for Decentralisation) in 1993 and adopted texts on decentralisation in 1994. Laws on Decentralisation Guiding Texts (TOD) were passed by the Parliament in 1998. This process is original because of the recognition by traditional structures and other organisations that the CND proposes to state interventions.

The CND through the TOD proposed and agreed to consider the province and the communes as decentralised local communities, to create rural and urban communes and to plan the establishment of 500 communes by the horizons 2010. The recent territorial organisation divides the country into 13 regions. It is in this political framework that economic and administrative reforms were implemented under the influence of the World Bank and the IMF.

The economy is marked by the SAP (Structural Adjustment Programme), which was signed in 1991. It was already stabilised under the CNR (National Revolutionary Council), but was marked by the stagnation of industry and services, obliging the Popular Front to sign the SAP in 1991 and to choose the option of market economy. Economic performances were thus recorded in 1995 but proved insufficient to stop the aggravation of poverty. The government had to work out a poverty control framework approved by the World Bank and the IMF in 2000 and to adopt a good governance plan from 1998 to 2003.

The economy, based on a primary sector with poor productivity, a secondary sector in an embryonic state and not very dynamic, a tertiary sector in full expansion, is hampered by high costs of inputs and poorness of human capital.

Despite a decade of massive assistance, economic reforms carried out in the framework of the SAP, poverty control and satisfaction of social needs remain very limited and social indicators are very low. Concerning the UNDP development index, Burkina Faso is ranking 172<sup>nd</sup> out of 174 countries.

The consequences of poverty control under current land development conditions, the multiplication of dams and hydro agricultural developments will undoubtedly affect natural resources.

## **1.2 NATURAL RESOURCES**

### **1.2.1 THE PHYSICAL ENVIRONMENT**

#### **1.2.1.1 THE CLIMATE**

##### *1.2.1.1.1 REGIONAL FEATURES OF THE CLIMATE OF BURKINA FASO*

The climate of Burkina Faso is of tropical type in the tropical belt due to its location in sahelian region; consequently, the country experiences sahelian type climate marked by a rainy season and a dry season.

Burkina Faso, continental country at the threshold of the Sahara, is predisposed to a diurnal and inter-annual variability of climatic elements.

The climate is particularly influenced by sun radiance, which varies from 1778 to 2129 J/Cm<sup>2</sup>/day respectively in December and March.

##### *1.2.1.1.2 CLIMATIC STRATIFICATION:*

Climatic zoning in Burkina is based on the spatial spreading of annual rainfalls namely the two annual rainfalls isohyets (600mm and 900mm), which enable to define three climatic zones (map 1):

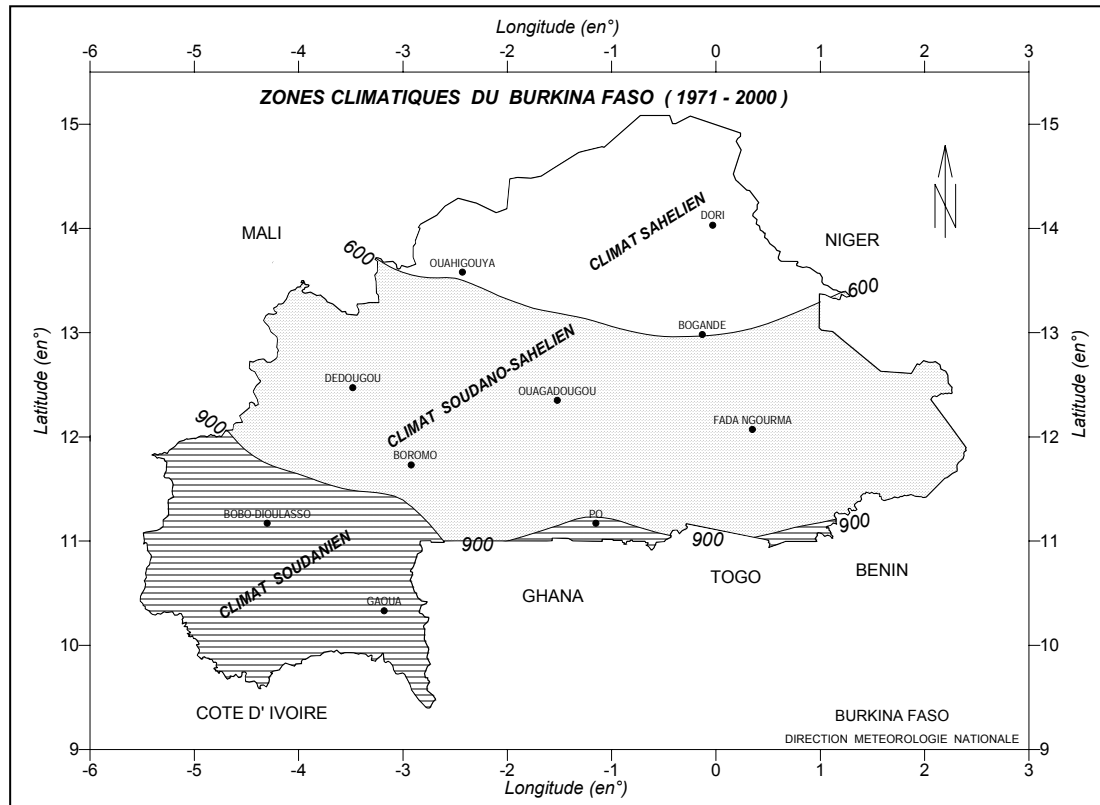
- ✱ The **sahelian zone** (north): it is marked by an annual average rainfall below 600mm, a short rainy season (4 months maximum), a great inter-annual and spatial-temporal variability of rains, high diurnal and annual heat amplitudes and consequently, very high Potential Evapotranspirations (ETP) during hot periods (March to June);
- ✱ The **sudano- sahelian zone** (centre): it is marked by an average annual rainfall between 600mm and 900mm, a rainy season lasting about 5 months, diurnal

and annual heat amplitudes which are less important than in the northern part with moderate Potential Evapotranspirations (ETP);

- \* The **sudanian zone** (south): it is marked by an average annual rainfall above 900mm, a rainy season lasting almost 6 months, diurnal and annual amplitudes of temperatures and low Potential Evapotranspirations (ETP).

For these three zones, the rainy season is often marked by dry periods particularly at the beginning and end of the season.

**Map 1 : climatic zones of Burkina Faso (1971 – 2000)**



The analysis of climate evolution is based on climatic parameters such as global sun radiance, duration of sunshine, air temperature, wind (speed in m/s and frequency), pluviometry and Potential Evapotranspiration.

- \* Overall sun radiance: an important average temporal variability (27%) since 1970;
- \* Duration of radiance: a spatial variability (decreasing from north to south) of 15% and fairly high temporal average (47%);
- \* Air temperature:
  - An important fluctuation during the year marked by differences concerning maxima, which vary between 10.3°C (Gaoua) and 13.7°C (Dori), and minima between 12.3°C (Gaoua) and 18.9°C (Dori).
  - Equally, very high diurnal variations particularly in the northern half;
  - For all the country, a progressive increase of about +0.2°C in the sudanian zone, +1.0°C in the central part (sudano-sahelian) zone) and 1.35°C in the northern part of the country.



### Photo 1: Cloud of dust raised by harmattan winds

(Source : Secrétariat Technique Permanent du Cadre Institutionnel de la Gestion des Questions environnementales, Mali).



- \* Wind: we observe:
  - In the sudanian climatic zone, relative predominance of calm winds (50%) heading southwest, south and southeast;
  - In the sudano-sahelian climatic zone, relative predominance of harmattan and monsoon winds (respectively 42 and 45%);
  - In the sahelian climatic zone, relative predominance of calm winds (42%);

- \* Pluviometry:
  - Existence of two centres of action (the Azores anticyclone and Saint Helen anticyclone), which determine the settlement process and the raininess degree of the rainy season in Burkina Faso;
  - Concerning monthly rainfall, it is observed a substantial reduction of the humid period as one moves northwards;
  - It is also observed a sensible and regular regression of pluviometry in the period 1971-2000 as compared to years 1961-1990 and 1931-1960 to such an extent that (i) isohyets 600mm and 900mm moved southward from 100 to 150 km in comparison to the position they occupied between 1931 and 1960, (ii) isohyets 400mm appears in the northern part of the country between 1961-1990 and 1971, although it was almost inexistent during periods 1931-1960 and finally (iii) isohyets 1200mm disappeared in the last two periods from the sudanian zone;
  - An important variability of inter-annual pluviometry is observed for the three zones following a gradient which decreases from north to south (Dori 69%, Ouagadougou 66% and Gaoua 57%) with a diminution of 14% of the average annual rainfall between periods 1931-1960 and 1961-1990 on the whole territory but specially in the central and northern regions;
- \* The Potential Evapotranspiration (EPT):
  - A very strong variation gradient (400mm to 700mm) between the recorded values in the two extreme zones (sudanian and sahelian);
  - An important drop of ETP values between 1981 and 1990 on the entire territory.

From the analysis of the climate parameters evolution, we observe that Burkina Faso, considering its geographical position is submitted to a high density radiance, to an insulation varying between 6 and 11 hours per day, to high temperatures amplitudes and to a predominance of harmattan winds in the northern half of the territory. Such climatic situation though it includes advantages in terms of possibilities of renewable energies (solar Aeolian

energies), constitutes however a handicap related to climatic comfort for human beings, fauna and flora and for the conduct of socio economic activities (agriculture, animal husbandry, leisure, etc.). Besides, the following trends can be noted:

- A clear regression of annual pluviometry during period 1961-2000 as compared to period 1931-1960. For the last 20 years (1981-2000), some resumption seems to start particularly in sudanian and sudano-sahelian zones;
- A very high rate evapotranspiration in the whole country, especially from 1931 to 1981;
- A trend towards greater drying in the whole country particularly during the last 40 years (1961-2000).

### 1.2.1.2 GEOLOGY

Three main types of geological formations mark the geology of Burkina Faso:

- The D Precambrian or Achaean: they are the oldest formations. They cover the greatest part of the territory (54%) and are mainly constituted by granitoid, amphiboles, pyroxene basic rocks and gneiss. Soils are acid and contain clays of the kaolonitic type, low swelling and particularly poor in phosphor. Besides, they contain important ground water reserves.
- The Precambrian C or Birrimian: it is constituted by volcanic or volcano-sedimentary rocks, tuffs and various lavas on 26% of the territory. They are essentially composed of basic rocks including montmorillonitic type clays, which are swelling clays that are very rich in mineral elements; soils resulting from the alteration of these formations are very fertile. Besides, water drillings success rates are very high; these birrimian are generally known in West Africa as zones, which are favourable to mining research because important potentials and deposits were discovered there.
- The A Precambrian: it occupies about 20% of the territory and is essentially composed of sedimentary rocks deposited in a discordant way on the crystalline platform. Clayey and sandy soils essentially contain kaolinite in their clay fraction. These formations present enormous ground water potentials because of their rapid recharging and their high accumulating coefficient.

### 1.3.1.3. GEOMORPHOLOGY

A very important levelling marks the relief of Burkina Faso; however we distinguish the following sets:

- \* Plaines (90% of the country) located at about 250-300m of altitude including:
  - Some residual forms such as Appalachian crests constituted essentially by birrimian basic rocks (Kampti, Gaoua, Houndé, kaya, Kongoussi, Ouahigouya, Djibo, Dori et Boulsa), which form parallel alignments on

- tens of kilometres. They sometimes bear the remains of a bauxitic cuirass;
- Modest forms constituted by granitic inselbergs (Arbinda at 400m altitude);
- \* Sandstone covers from southwest and southeast, including:
    - The Banfora sandstones plateau (450 and 500m) in the south-western part of the country.
    - A series of ruin like and picturesque relief called “Sindou needles”.
    - The Permian doleritic sills located west of the Bobo-Katioula road axe until Mount Tenakourou (747m);
  - \* The Gobnangou pseudo-cuesta in the southeast, desiccated by the Pendjari tributaries;
  - \* Dune bars of Aeolian origin in the northern part of Burkina, corresponding to old ergs heading east west. Live dunes (barkhane) can be seen in the outskirts of the village of Oursi in the far north of the country.

#### 1.3.1.4. WATER RESOURCES

Water is a renewable natural resource. It is a fundamental element of durability for all ecosystems. It intervenes in all human activities and constitutes an important asset in the development of a country.

In Burkina Faso, rains generate the essential of water resources during the July-August period.

Permanent water streams however are rare, although the hydrographical network is quite important particularly in the southern part.

Water resources of Burkina are submitted to climatic and hydro-geological disparities, which are internal to the country.

Besides, the unequally spread water potentials are not always usable because of some economic, technical as well as quality constraints.

From the national territory, a total volume of 7.5 billion cubic metres of water flows toward neighbouring countries. 4.7 billion can be stored on the territory.

Ground water resources of Burkina are estimated at 113.5 billion cubic metres including only 9.5 billion cubic metres of usable renewable resources. Big water bearings are located in sedimentary zones in the west and south west of the country and the recharging of the layers also depend on annual raininess.

### **1.2.1.2.1 SURFACE WATER**

Burkina Faso water streams are tributary of three international rivers namely the Niger, the Volta and the Comoé rivers. We distinguish four main national hydrographical basins, which are the catchments basins of the Comoé, the Niger, the Nakambé and the Mouhoun rivers.

At a lower level, these four basins are subdivided into 17 national sub-basins. The Mouhoun and Comoé rivers are permanent water streams whereas the Nakambé and the tributaries the Niger (which hydrographical basins represent more than 2/3 of the total area of the country) are temporary.

The annual average surface water potential of the four catchments basins of the country is estimated at 8.6 billion cubic metres.

Annex 1 gives more detailed data on specificities, the interest and impact of the various catchments basins.

### **1.2.1.2.2 GROUND WATER**

There are two important hydro-geological domains conditioning the productivity of captures and exploitable resources.

- \* The crystalline domain: It covers 82% of the national territory and is mainly formed of crystalline crystallophillian rocks (granite, gneiss, magmatites, shale etc). They are safe and sterile formations and only phenomenon-based breakings and alterations locally create favourable conditions for the flow of ground water. Thus, water can be found in alterites upper reservoirs and the lower reservoirs of fissures, fractures and faults.

Superficial water bearings of alterites reservoirs are very influenced by climate changes and pollutions. They are susceptible to rapid discharges by evapotranspiration during the dry season. Crystalline water-bearings have a limited extension and form a discontinued chain set of layers. The recorded flow rate varies between 0.5 and 20 cubic metres / hour and static levels' depth in the drillings varies from 10 to 25m on almost all the crystalline area.

- \* The sedimentary domain: constituted by formations which form strips heading south-west to north and in the south-east region of the country, the rock is formed of sandstones, limestone, cherty beds and shale. Due to more intensive and regular fracturings, there is some continuity of layers that are multi-layers with great extension water-bearings, generally of high productivity. Therefore, drillings have a depth, which varies between 65 and 100m and can provide flows of 100 cubic metres / hour. These sedimentary water-bearings, particularly those of the west constitute important water reserves for the country.

In Burkina Faso, available resources are thus unequally distributed. The great water-bearings of the sedimentary domain are opposed to limited layers of the crystalline domain regions. Sometimes, we note the presence of perched superficial water-bearings in the laterites and alluviums, which may locally contain interesting layers. In most cases, these layers are temporary. The other data and features of ground water resources are:

- \* The overall ground water resources of the country are estimated at 9,500 m<sup>3</sup> of renewable resources and 113,240 millions m<sup>3</sup> of total reserve.
- \* Recharges rates vary between 0.1 and 10% of the annual rainfall and layers' recharges is done in a discontinued way through (i) infiltration of rains during the rainiest periods (July, August) and (ii) supply from neighbouring layers and water streams.
- \* Since 1970, there has been a decrease of river flows, causing a decrease of layers' level (more than 2 m for the period 1978 – 1999), following a long period of drought.

### 1.2.1.3 SOILS

Burkina Faso is marked by a pedological heterogeneity due to a long geomorphologic evolution and to the diversity of geological covers. Studies conducted by ORSTOM (now IRD), IRAT (now CIRAD), SOGREAH, SOGETHA and BUNASOLS reveal nine (9) categories of soils. Annex 2 presents a synthesis of the various classes of soils according to the classification of the CPCS (Pedological Commission on Mapping and Soils) in 1967.

Generally speaking, Burkina Faso has an agricultural land potential estimated at around 9,000,000 ha, included 39% of lands which are used annually. Most of these are marked by a deficiency in phosphor limiting their productivity. However, a certain number of soil types have interesting agricultural, forest, and pastoral potentials. They are:

- Vertisols, eutrophic tropical brown soils, sub-arid vertic brown soils. Indeed, their analytical and morphological features confer upon them a good water retention capacity and high mineral richness.
- Widely spread tropical ferruginous soils give average potentials for washed out or impoverished sub-groups with concretions and spots, washed out or impoverished without concretions and hydro-morph washed out. They overall present a massive structure with low-grade organic substance, nitrogen and exchangeable bases. The cationic exchange capacity is also low with a more or less acid pH.
- Ferralitic soils, because of their important depth, are appropriate for arboriculture but are chemically poor.
- Located at the lower parts of the landscape, hydro-morph soils have average content in organic substances and nitrogen. They are appropriate for rain fed and irrigated rice cultivation and market gardening.

### 1.2.2 Biological Diversity

In Burkina Faso there are two phytogeographical domains, which are subdivided in sectors and districts on the basis of the climate–flora–vegetation trilogy (Guinko, 1985): the sahelian and the sudanian domains which frontier is located around the 13<sup>th</sup> north parallel (map 8). Data about fauna (ADDA–21,1998) are included in the presentation of sectors.

### 1.2.2.1 Vegetation and fauna

#### 1.2.2.1.1 Vegetation and fauna of the Sahelian domain

The overall vegetation is dominated by steppes with several facieses (herbaceous, shrubby, arboreal) which monotony is interrupted here and there from north to south by growing shrub and forest galleries. Floristic physiognomy and composition of vegetation enable the differentiation between the two sectors:

- \* The **strict sahelian sector** located north of the 14<sup>th</sup> parallel is marked by herbaceous steppes, replaced in the south by a more or less thick arboreal steppe (spotted bush),
- \* The **sub-sahelian sector** located between the 13<sup>th</sup> and 14<sup>th</sup> parallels is marked by shrubby steppes evolving southwards in arboreal steppes.

#### 1.2.2.1.2 Vegetation and fauna of the Sudanian domain

The Sudanian domain constitutes savannah extension zone. The higher and thicker grassy carpet (above 80 cm) facilitates the annual passage of bush fires. The distribution of the gregarious species *isoberlinia doka* allows the distinction of two sectors:

- \* The **north Sudanian sector** located between the 13<sup>th</sup> and 12<sup>th</sup> parallels corresponds to the more intensively cultivated area of the country because of the high demographic pressure. Vegetation shows agricultural areas dominated by protected species.
- \* The **south Sudanian sector** located between the 5<sup>th</sup> and 11<sup>th</sup> parallels benefits from the most moderate climate of the country and the less disturbed forests formations because of the population poor density. The overall vegetation is formed of wooded savannah and clear forests interrupted by forest galleries. There are four (4) districts located on both sides of the Mouhoun River: the district located in the western part of the Volta river, the east Volta district, the Pendjari district and the Comoé district.

#### Photo 2: Anarchic clearings

Source: *Yacouba KONATE*



For two decades, the south Sudanian sector constituted the immigration area par excellence for breeders and farmers coming from the north of the country and looking for better living conditions. This entails an anarchic clearing of wide surfaces for farming, a progressive decrease of wooded areas and subsequently wood stocks.

The most widely spread or specific animal species are: elephant, hippopotamus, buffalo, hippopotrague, bubale, buffon cob, Defassa cobe, warthog, harnessed guib, ourébi, Grimm cephalop, red flank cephalop, Maxwell cephalop, lion, leopard, spotted hyena, baboon, callitriche, Magistrat colobe, patas, crocodiles, varanus, pythons, tortoises, and important populations of birds. Species whose names are underlined are endemic or endangered.

### 1.2.2.2 The Ligneous potential

Natural forest formations (galleries forests, clear forests, arboreal savannahs, shrubby savannahs, striped bushes) were estimated in the early 80s at 15,420,000 ha and are shared between protected domain (non classified) (75%) and forests reserves (25%).

Classified domains include national parks (390,000 ha), fauna reserves (2,545,500 ha) forests reserves (880,000 ha).

According to the results of the National Forest Inventory carried out in 1980, plant formations cover 254,100 km<sup>2</sup> that is 92% of the national territory. Their distribution according to origin and type of formation is detailed in annex 4.

This ligneous potential is highly damaged because of repetitive droughts and degrading factors (bush fires, over grazing, uncontrolled clearings and anarchic wood cuttings) which cause its advanced alteration.

The 1980 National Forest Inventory (FAO, 1983) estimated the ligneous potential at 502 millions m<sup>3</sup> including 349 millions m<sup>3</sup> for natural forests and 153 millions m<sup>3</sup> for fallow and cultivated fields. Ten years later, another nationwide forest inventory (fontès and Guinko, 1995) estimated the quantity of wood at over 177 million m<sup>3</sup>.

However, it is worth mentioning that diversity of methodological approaches used, combined to the dynamics of vegetation formation must have caused disparities and other errors in estimates. This poses the issues of effectively knowing available resources.

### 1.2.2.3 Taxonomies and species

The total number of recorded species is estimated at 3,992 for macro organisms. For micro organisms, little surveys were carried out. Current knowledge on families' taxonomy genres and species of biological diversity components gives the following synthesis.

#### 1.2.2.3.1 The animal reign

The animal reign consists of micro organisms, aquatic and terrestrial insects, terrestrial, aquatic, wild and domestic vertebrates, and invertebrates. Annex 5 shows the sample list of fauna species in Burkina.

- ✱ Micro organisms consist of viruses, mushrooms, moulds and bacteria: we only know 113 genres of mushrooms shared between 18 families, yeasts and moulds as well as 413 genres for 83 families of bacteria.
- ✱ Insects: out of the estimated 30;000 species, only 1515 were listed from known documents and reference collections.
- ✱ Aquatic fauna: overall, 54 families, 57 genres and 118 species of fish, batrachians, crustaceans, molluscs and zooplanktons.

- \* Wild terrestrial fauna: wild fauna is well known and figures on mammals, birds, reptiles give 665 species of 362 genres and 119 different families and belonging to 35 orders.
- \* Domestic fauna: 11 families, 14 genres and 16 species of mammals and birds.

#### 1.2.2.3.2 FLORA

Flora consists of aquatic and terrestrial flora.

- \* Aquatic flora:
  - Aquatic micro flora: 32 families, 88 genres and 191 species were listed in the dams of Ouagadougou, Loumbila, Kompienga and Bagré.
  - Aquatic and semi aquatic herbaceous macro flora: it consists of (i) floating aquatic macrophytes, (ii) semi aquatic macrophytes (iii) macrophytes from water saturated areas and hygrophilous macrophytes living in areas abandoned by water.
- \* Terrestrial flora comprises:
  - Higher mushrooms, which consist of 8 families, 13 genres and 28 species.
  - Herbaceous flora (herbaceous carpet and agricultural herbaceous flora), which comprises 87 families, 333 genres and 627 herbaceous species with a predominance of leguminous species (145 species) and graminiae (145 species).
  - Ligneous flora (forest, fruit, ornamental, medicinal) composed of trees, shrubs and local lianas; it also comprises 55 families, 214 genres and 376 species (including 95 exotic ones).

According to their uses, we have agricultural plants, medicinal plants, fodder plants, ornamental plants, tannin plants, etc. Some plants like sugar cane and cotton are produced for industrial purposes.

#### 1.2.2.4 Ecosystems

The ecosystem is a dynamic complex of plants, animals and micro organisms communities, and their nonliving environment which form a functional unit thanks to their interaction (art. 2 of the biological diversity Convention).

In Burkina there are three main types of forest ecosystems, distributed as follows: (Table 1).

**Table 1: Distribution of ecosystems.**

Content	Area (ha)	% Territory
Terrestrial Ecosystems	25,140,000	91.22
Aquatic Ecosystems	72,500	0.26
Intermediary Ecosystems	371,000	1.34
<b>Total</b>	<b>25,583,500</b>	<b>93.84</b>

**Source :Ouadba, J. M., 1997 in Monographic**



The rest of the territory is covered by other types of environments, mainly dunes, dwelling places, rocks, roads etc.

#### **1.2.2.5 Genetic Diversity**

In Burkina Faso, activities related to the genetic diversity include plant as well as animal reign, with a focus on the former, as depicted by the different collections presented below.

##### **1.2.2.5.1 Cereal collections**

They include:

- 1- Sorghum (bicolour sorghum) with (i) 247 ecotypes of medium cycle sorghum at Soria, (ii) 125 ecotypes of long cycle sorghum at Farako – Bâ, (first collections of ICRISAT, 1979), (iii) 389 ecotypes of sorghum in the northern, eastern and central regions of the country, (iv) 197 ecotypes of the southwest, (v) around 870 sorghum grown forms, (vi) around ten spontaneous forms throughout Burkina Faso (U.O / IDR / CIRP, 1984, 1985, 1986).
- 2- Millet (*pennisetum americanum*) with several hundred local millets collected by IRAT and U.O / IDR / CIRP between 1960 and 1986 all over the country.
- 3- Maize (*zea mays*) with a collection of 201 ecotypes at INERA
- 4- Rice (*Oryza sativa*, *Oryza glaberrima*) with the collection of 527 samples.

##### **1.2.2.5.2 Leguminous food plants**

1. Prospecting and collections of cowpea (*vigna sinensis* or *vigna unguiculata*) with the collection of about 40 local ecotypes.
2. Prospecting and collections of voandzou (*voandzeia subterranean*) with the collection of 59 local species and 67 introductions.
3. Groundnuts with a collection of 417 short-cycle groundnuts species (90 days) and 291 delayed species (140 days), 164 semi delayed species (105-120 days) and 123 fast species.
4. Sesame with 160 species from the centre of the country and 160 others from the southwest.
5. Rice-bean with a white-seed species and a brown-seed species.

##### **1.2.2.5.3 Tubers**

1. Yams (*dioscorea* spp.) with 50 cultivars belonging to four (4) species: *dioscorea cayenensis* (80%); *dioscorea alata*; *dioscorea bulbifera*; *dioscorea esculenta*. There are 3 groups of wild yams: *dioscorea togoyensis*, *D. dumeterum*, *D. abyssinica*;

2. Sweet potato (*Ipomaea batatas*) 6 clones with clear-white peel, 2 clones with clear-red peel, yellow and whitish yellow.
3. Manioc (*manihot esculenta*) with two red and white peels.
4. Taro (*Colocasia*) with one species
5. Macabo (*Xanthosoma esculentus*) with a pluvial and an aquatic species.
6. Galingale or sweet pea (*cyperus esculentus*) with 2 black and yellow peels species.

#### 1.2.2.5.4 Market gardening

- 1-. Prospecting with collections of wild and cultivated forms related to cultivated forms of onion (ROUAMBA and al. 1993) okra, local eggplant and tomato conducted by ORSTOM (Belem, personal presentation)
- 2- Collections with 40 locally grown onion ecotypes, 80 species of okra, 40 species of local eggplant and pepper.

#### 1.2.2.5.5 Other collections

- \* FODDER COLLECTIONS: 23 annual gramineae, 9 perennial gramineae, 3 annual papi-papilionaceae, 3 perennial papilionaceae and 2 perennial cyperaceae are known.
- \* LIGNEOUS COLLECTIONS: seeds of 160 species are gathered and disseminated (cf. national seed data 2001-2002) by CNSF as they are either endangered (*Acacia Senegal*, *Dalbergia melanoxylon*, *pterocarpus cucens*, ...) or vulnerable (*Adansonia digitata*, *Anogeissus leiocarpus*, *bombax costatum*, *Ceiba pentandra*, *khaya senegalensis*, *parkia biglobosa*, *prosopis africana*, *acacia nilotica*, *acacia raddiana*, *acacia seyel*, *acacia Senegal*, *acacia sieberiana*, *tamarindus indica*, *sclerocarya birrea* and *daniellia oliveri*)
- \* ENTOMOLOGICAL AND VERTEBRATE COLLECTIONS: 6.000 samples of snakes and an important collection of fish.

#### 1.2.2.6 Introduced species and varieties of fauna and flora.

In Burkina Faso, 201 out of 320 species of ligneous domestic flora are exotic.

Ligneous, food-producing, market gardening and industrial plants are the main types to be introduced.

Concerning domestic fauna, the following species were introduced:

- Concerning bovine: the azawak and M'bororo (Niger) zebus, the Gouadalis (Nigeria), the N'dama bulls (Côte d'Ivoire).
- Concerning ovine: the bali-bali race (Macina)
- Concerning porcine: the pig of korogho (Côte d'Ivoire).
- Concerning poultry: the Gallor fowl, Rode-Island Red hens, the Plymouth, the Nera (Europe).
-

**1.2.2.7 Situation on ex-situ conservation establishment.**

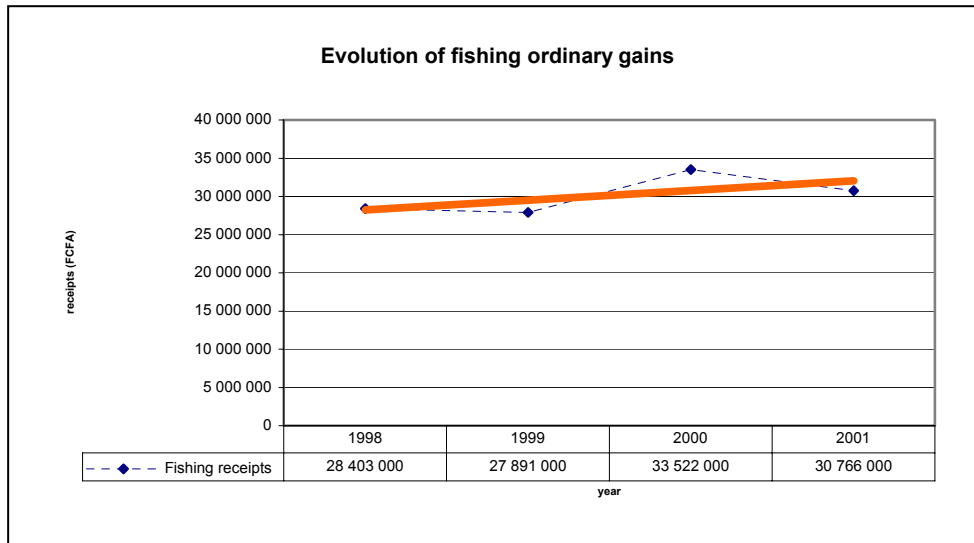
In Burkina Faso, Only a few units are in charge of collecting, handling, disseminating, medium and long term conservations and improvement of plant and animal genetic resources: INERA, the University of Ouagadougou, CNSF, Regional Directorates of Agriculture (DRA), Regional Directorates of Animal Resources (DRRA).

Besides, there is no consolidated registered basic data.

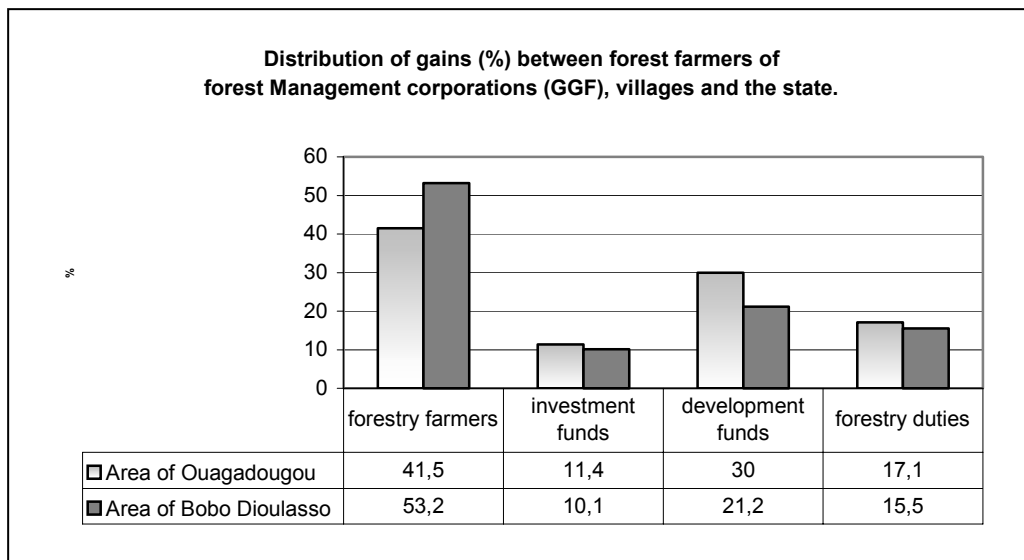
**1.2.2.8 Economic data on resources use**

Forest activities, fauna and fishing generate an increasingly important financial contribution to the state budget.

The evolution of this contribution is described in the following graphs:

**Graph 1: Evolution of fishing ordinary receipts.**

Source: STC / PDES, Ministry of finances and economy (MEF)

**Graph 2: Distribution of gains (%) between forest farmers of Forest Management Corporations (GGF), villages and the state.**

Source: Directorate of Finances and Administration of the Water and Environment Ministry (DAF/MEE)

#### **1.2.2.8.1 Data on forest management**

Forest developments generate substantial incomes for the forest farmers of Forest Management Groupings (GGF), villages and the state.

### **1.2.2.8.2 Data on fauna management**

Incomes generated by concessionaires of hunting areas and by the population in the framework of their hunting activities have constantly increasing from 1996 to 2000.

The income of local populations is generated by the rental of village hunting zones, the sale of wild game and the 30% representing the taxes to be paid for the issuing of the hunting licence. Besides, fauna management create jobs (75 and 100 full time and 300 part time).

## **2.3. Mineral resources**

Burkina Faso disposed of a varied and rich mining potential, which comprises inter-alia:

### **2.3.1.1. Ferrous metals**

- 1- Manganese (Mn): more than 20 million tons with 55% Mn.
- 2- Nickel (Ni): marks
- 3- Vanadium magnetite (V<sub>2</sub>O<sub>5</sub>): 298.400 tons

### **2.3.1.2. Non-ferrous metals**

- 1- Copper (Cu): over 100 million tons of various grades;
- 2- Antimony: (Sb<sub>2</sub>S<sub>3</sub>): 35.000 tons
- 3- Zinc (Zn): 6 million tons at 18% Zn
- 4- Aluminium (Al): over 5 million tons
- 5- Gold (Au): More than 20 million tons
- 6- Non metallic substances
- 7- Phosphates: over 34 million tons
- 8- Limestone (CaO): over 16 million tons
- 9- Siliceous sands: 370.000 tons
- 10- Clays.

### **2.3.1.3. Building materials**

In Burkina Faso, there are rocks likely to be used in the building industry. It is mainly: pink granite, syenite, gabbros and laterites.

### **2.3.1.4. Precious stones**

Diamond-bearing marks and micro-diamonds were evidenced in the catchments basins of the Comoé, Léraba, Mouhoun, and Sissili rivers, and in the region of Barsalhogo.

### **2.3.1.5. Energetic substances**

They concern peat (Sourou valley) and graphitic shale (Korsimoro, Datari, Sémanpoum).

### 3. ENVIRONMENTAL PRESSURES

This part of the document is the very gist of the tale telling on the situation of the environment because it aims at apprehending (i) causes of the problems, (ii) ways to prevent, settle them, or alleviate their impacts, (iii) consequences of our inactivity or inadequate reaction.

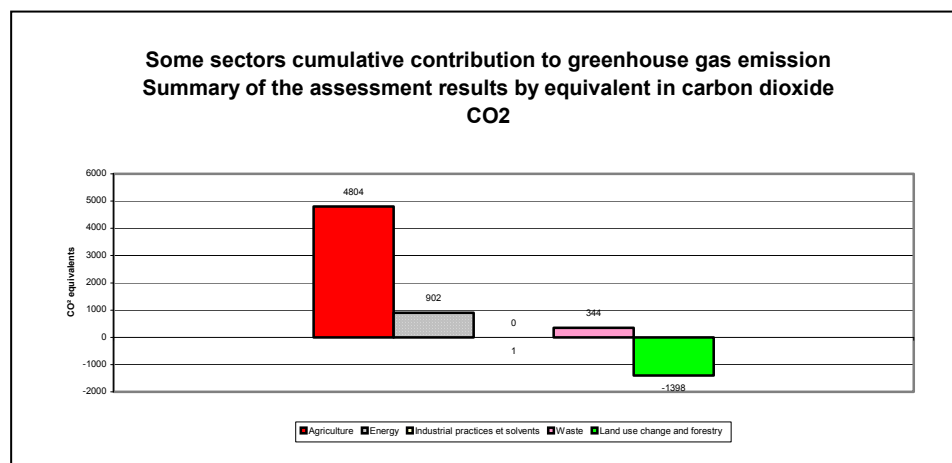
The problems dealt with in this part of the summary stem from:

- \* **Agricultural and cattle breeding activities;**
- \* **Industrial activity;**
- \* **Consumption styles;**
- \* **Energy production;**
- \* **Environments management issues (ground and surface water, air, soils);**
- \* **Loss in biodiversity (flora, wildlife, ecosystems);**
- \* **Pollution and nuisance (atmospheric, by industrial and household wastes, by Pesticides, and fertilizers);**
- \* **Climate changes;**
- \* **Natural hazards (drought, floods, pest invasion) and technological hazards (dangerous products and wastes storage, transportation).**

Environmental issues can be considered in two main lines. It includes, on the one hand, **issues related** to environments management, loss in biodiversity, and pollution and nuisance, and the other hand, natural or technological **hazards** stemming from the action, failures, and other defects in systems and mechanisms for controlling and regulating men action.

To facilitate the apprehension of the various problems and their settlement, they have been classified into the following six major issues: climate changes, high pressure on water resources, soils and mining resources issues, loss in biodiversity, issues linked to living styles and environment degradation, and natural and technological hazards issues.

#### 3.3. Climate changes



**Graph 3: some sectors cumulative contribution to greenhouse gas emission  
Summary of the assessment results by equivalent in carbon dioxide CO<sub>2</sub>.**

The global warming phenomenon is directly or indirectly caused by the anthropic action (pollution by household wastes, toxic, pesticides, fertilizers, industrial and biomedical wastes, atmospheric pollution, etc....) that are not often environment friendly.

The state of knowledge highlighted by studies carried out as part the implementation process of the blueprint Convention on climate changes presents the following trends:

- \* **Agriculture** is ranking first in greenhouse gas emission
- \* It is **followed** by the **energy sector** (*902 equivalents in CO<sup>2</sup>*) dominated above all by **carbon dioxide** emission caused by the transportation sub-sector (road, railway);
- \* Waste sector occupies the third position in gas **emission sources**.

Activities considered as being **sources of emission** in the sectors of **agriculture, energy and wastes** include:

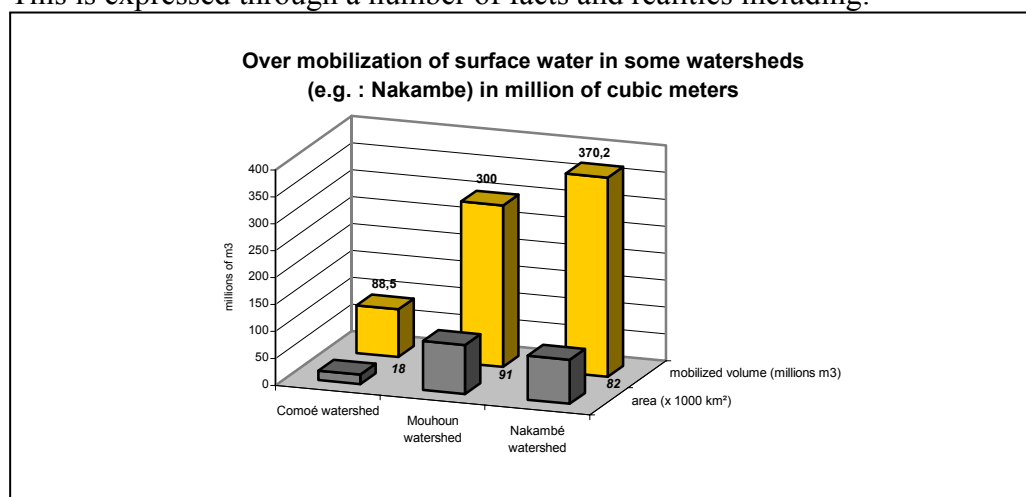
- \* Forest and savannah conversion,
- \* Irrational management of cattle,
- \* Intense use of hydrocarbon in transportation,
- \* Solid and liquid wastes decay.

Climate changes **consequences** include:

- \* Recurrent water shortage;
- \* Uncertain agricultural yields;
- \* Development of pathogenic germs;
- \* Recurrent drought in some areas and floods;
- \* Etc. (GIEC, 1990)

### 3.4. High Pressure on Water Resources

This is expressed through a number of facts and realities including:



**Graph 4 :**  
**Over mobilization of surface water in some catchments basins (e.g. : Nakambe) in million of cubic meters**

1. "Surface water over mobilisation " expressed through:

- \* The **setting up of works, upstream from each other** without any hydraulic plan, has negative impact **hydraulic schemes** and **ground water assessment** since there is drop in the production as a whole, compared to overall productivity expected for each investment taken separately;
- \* The **clearing and/or flooding** of large areas of woodlands or not, for big dams construction purpose leading to loss in **cultivable, forest, pastoral lands**.

In addition, it is noticed that, although we have still **bit data** due to the inter-annual variations in rain, about 60% of water **captured** by small dams is considered **lost** because of evaporation.

Dams are the main means of collecting surface water for drinking, irrigation breeding, and energy, industrial, etc. purposes. In this regard, a stock list of **2.000** dams including 300 permanent and 8 big has been drawn up.

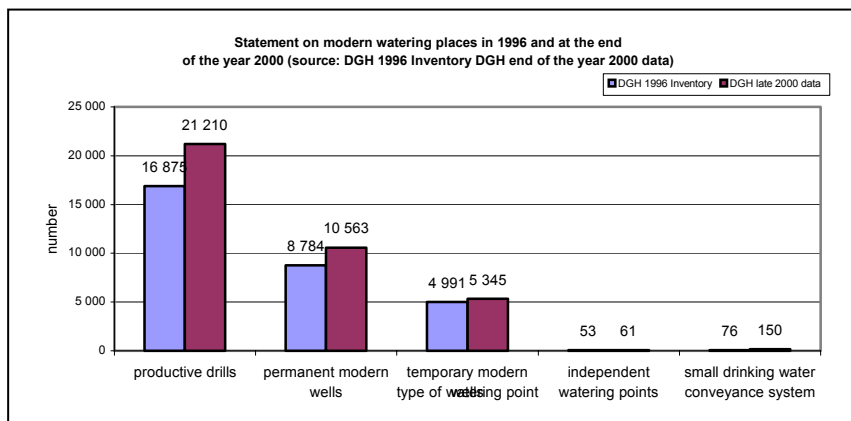
**Ground water collection** is done by means of **drilling**, wide-diameter nozzle modern wells, and traditional wells.

**3.4.1. Worrying Situation of this Resource Collection Works**

Generally speaking, small and big dams management and maintenance record considerable difficulties including the main following ones:

- Frequent desertion of small dams after their construction;
- Under-exploitation of these dams that are often use for supplying water to cattle and which are threatened by evapotranspiration;
- Lack of sound regulatory framework for controlling big works management and maintenance, which undoubtedly poses public security problems;
- Low productivity of modern wells with one well out of three providing water throughout the year;
- Unprotected drillings and modern wells immediate surroundings;
- Etc.

**3.4.2. The all out ground water collection**



**Graph 5: Statement on modern watering places in 1996 and at the end of the year 2000 (source: DGH 1996 Inventory DGH end of the year 2000 data)**

While **enough researches have not been carried out to improve knowledge on this resource** so as to

ensure its sustainable management, the number of ground water collection works still increases. Therefore, water layers are at risk. The following figure shows trends in this area.



Furthermore, hydraulic and exhaure equipment maintenance and monitoring schemes failures remain a recurrent problem. It should also be noted that ground water collection relies greatly (89%, from 1996 to 2000) on foreign funding.

### 3.4.3. Increasing worrying and poor quality of surface and ground water

This situation is marked by:

- \* The **great number of substances in suspension (MES)** in all basins, and especially in the Nakanbe;
- \* The **worrying content in iron and phosphate** in all dams of the basin;
- \* **Natural phenomena** affecting drinking water quality: **54% P<sup>H</sup> acidity in the South-Western part, high salinity in the South-East** and **extreme arsenic content** in Mogtedo area;
- \* Cases of dams' **bacteriological contaminations** often **arising** from animal husbandry and **houses** located near watering places, which involves high risks in water-born diseases;
- \* **Outspread of water-born and infectious diseases** such as onchocerciasis, malaria, bilharziasis, dracontiasis, etc. **from dams**;
- \* Cases of dams **eutrophisation** caused by enriched nitrogenous and phosphatic compounds resulting from the leaching of lands by fertilizers and households liquid wastes discharge;
- \* Actual risks of ground water layers contamination by:
  - Industrial and households liquid wastes discharge,

**Photo 3: multiple uses water plans**  
(source: KESSLERJ.J. et GERLING C.)



Unauthorized wastes disposal,

- Spreading of fertilizers and pesticides in cotton areas
- \* Disputing uses leading sometimes to conflicts (satisfying SN-SUCO great needs at the expense of other downstream farming areas, anarchic farming, fraudulent deduction, and conflicts arising from land usage in irrigated zones, more than 400 multipurpose dams, ....

- \* **Risks of conflicts at sub-regional level** in case **consultations are not conducted before**, and even when agreements have not been signed between countries sharing the same resources.

### 3.5. Land and mining resources Problems

#### 3.5.1. Desertification

Environment degradation factors are linked with

- \* Climatic **quirks**;
- \* **Inadequate** natural resources development **methods and techniques**;
- \* Negative impact of **poverty** on populations, coupled with the need to meet their increasing needs.

In this regard, problems can be grouped into two categories:

##### 3.5.1.3. Biophysical problems

- \* **Soils impoverishment** **chemical elements** and **fertility loss** due to **drop in soils organic matters rate** and leaching of components that are not used by plants due, inter-alia to:



- **Deforestation**;
- **Bush fires**;
- **Wind and water erosion**: Great quantities of soils are washed away every year by rain in most

of the country areas, and especially in the central part of the country.

**Photo 4: Bushfires in the savannah**  
(source: KESSLERJ.J. et GERLING C.)

- **Threats on biological diversity**, especially plant cover: in 1996, **about 105,000 ha of plant cover was lost every year**.

##### 3.5.1.4. Social and Economic Problems

\* **Populations' poverty is major factor in natural resources degradation** because:

- Persistent use of traditional farming methods;
  - Mechanization and input utilization poor rate;
  - Rural low incomes lead to an irrational use environment.
- \* **Drop in usable water and especially non-wood products' availability** (fruits, medical plants, raw materials for handicraft...):
- **Loss of income for some deprived fractions** of the population, namely women;
  - **Drop in nutritional supplies**.

### 2.3.1.3. Social consequences

The impacts of desertification include, inter-alia,

- \* **Increase** in firewood and drinking water supply **duties** because, respectively, of the great distance with production centres;
- \* **Early drying up** of some streams and other sources.

**Photo 5: water supply duty in rural area**

(Source: Yacouba KONATE)



**Photo 6: firewood supply duty**

(Source: Yacouba KONATE)



### 2.3.2. Soils pollution

In **rural area** pollution appears through **lands degradation due to irrational use of fertilizers and pesticides** in order to increase cotton crops yield and the productivity of big irrigated areas of the country.

In **urban area**, pollution appears through:

- \* **Discharging of liquid wastes loaded with industrial heavy metals and toxic matters;**
- \* **Discharging of household and industrial solid wastes dumped** in an anarchical way;
- \* **Use of fertilizers** in market gardening.

### 2.3.3. Problems arising from Mining and Quarries Development

Problems arising from mining and quarries resources development depend on development methods and techniques:

Photo 7: Disharmony in the landscape and risks of accidents and pollution by substances and products used for minerals processing, stored in the open and from the mining activity.



\* Problems arising from **semi-industrial and industrial development of the two gold mines** (Poura and Essakane) include:

- **Failure to rehabilitate deserted galleries** (over 60m sometimes in Poura) and their flooding later on;
- Desertion of open sky "**artificial hills**" containing cyanide in Essakane.

This situation can partly be explained by the fact that **impact studies were not carried out and no environmental monitoring of the impact of mining activity on the environment was provided.**

\* **Environmental damages** arising from **gold washing sites** include, inter-alia,

- **Arable lands degradation, landscape changes, and especially deforestation** resulting from trees cutting for various uses (building of huts and warehouses for minerals' processing, stay in exploitation galleries, manufacturing of ladder for getting down wells, firewood, etc.) in the surroundings;
- **Pollution of ground water layers** (use of mercury) and surface water (dust, human wastes....);
- **Wildlife extinction** resulting from poaching and men crowding;
- **Depravation of morals and appearance** of respiratory and sexually transmitted diseases;
- **Lands and security problems** including:

- ◇ High pressures on agricultural and pastoral lands;
- ◇ Conflicts between natives and gold washers, diminution of lands;
- ◇ Movement of populations and outspread of criminality.

#### **2.4. Loss in Biological diversity**

**Ecosystems and houses are affected by dynamics** arising from **climatic variations** (climate changes, persistent droughts), on the one hand and **anthropic action** (bush fires, excessive takings of biological resources, itinerant farming, and overgrazing).

Biological diversity loss phenomenon main components include:

##### **2.4.1. Reduction in "natural" forest formations**

- \* In 1980, the **number of dead foot trees reached**:
- **4.20%** average in the **north Sudanian part**;

- And **more than 10% in the sahel** where many stands (*Acacia raddiana*, *Pterocarpus lucens*, *Dalbergia melannoxylon*, *Balanites Aegyptiaca* and *Adansonia digitata*) are desperately perishing.

This situation is at the basis of various, sometimes considerable, pressures on sudanian savannah: important movement of farmers and breeders from the North towards the South, **illegal** voluntary or involuntary **occupation of** numerous forest reserves in the Western part of the country arising from migrants in quest of lands.

- \* **Modification of plant original aspect (cleared forests) into secondary formations (north sudanian savannah and sahelian steppe)** arising from:
  - **Man action** (bush fires, **clearing**, overgrazing and cutting of wood) ;
  - Climatic drought.

#### 2.4.2. Reduction and risks of extinction of some plant species

- \* In the **sahelian zone**, biological diversity loss is highlighted by:
  - "**Xerophilisation**" of species, **mostly therophytes** (annual grasses > **60%**)
  - "**Vulnerability**" of some *Acacias* species used in fodder production due to the increased level of pruning and regeneration difficulties arising from the deficit of rain, on the one hand, grazing and trampling of young plants by cattle, on the other hand.

Thus, **27 plant species** are considered **endangered** in the Northern and Central-Northern part of Burkina Faso.

- \* In the **sudanian zone**, we notice
  - **Extinction of entire "non-utilitarian" species** resulting from clearings;
  - **Systematic and irrational use of some species** for firewood and construction timber such "**Lingué**" or *Azelia africana* for the manufacturing of "djembe"(instrument of music).
  - Scarcity of species and populations of *Parkia biglobsa*, *Vitellaria paradoxa*, *Tamarindus Indic*, *Lannea microcarpa*, *Sclerocarya birrea*, in agro-forest parks, etc. due to the fact that fallow time has been reduced.

#### 2.4.3. Problems arising from aquatic species evolution

**Selective fishing, ignorance of fishing biological potentialities** and inadequacy of **water schemes development plans** resulted in:

- \* Quantitative and qualitative transformation of aquatic fauna due to:
  - Chronic rain deficits recorded for more than two decades;
  - Degradation and silting of ponds, lakes and other water plans;
- \* **Loss in many specimen and reduction in the number of wildlife and herbaceous species** due to pollution arising from the use of fertilizers.

## 2.5. Problems arising from life styles and living environment degradation

### 2.5.1. Pollution by pesticides, fertilizers, and toxic substances.

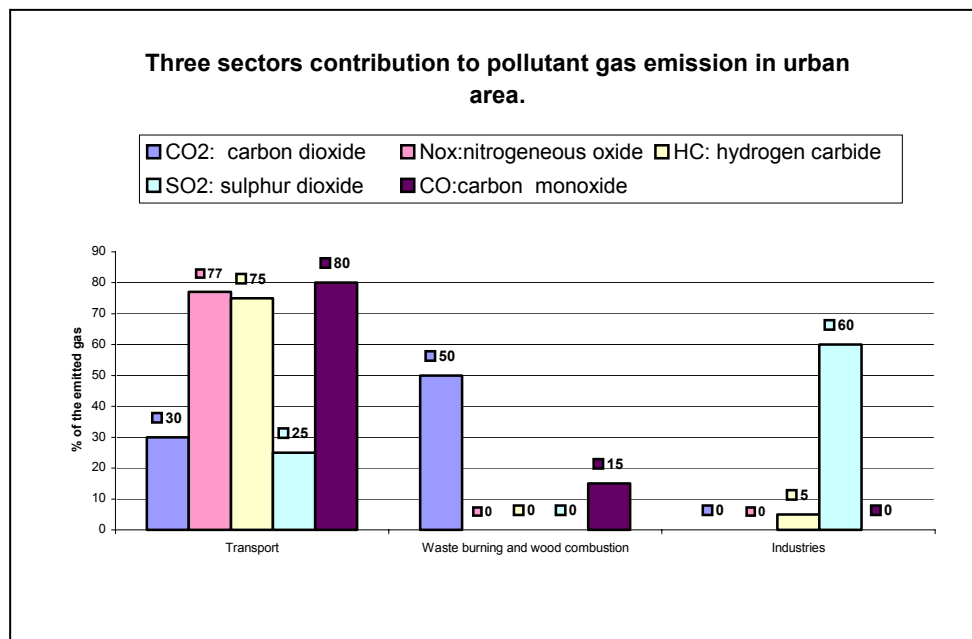
This is shown through:

- \* **Water pollution**
- \* **Nuisance for man** given the fact that these products are harmful to skin, eyes, and respiratory system.

### 2.5.2. Spoiling of air quality

It is observed that:

- \* **In urban area, air pollution** is caused by
  - Transportation means which produce:



**Graph 6: Three sectors contribution to pollutants gas emission in urban area.**

◇ Leaded exhaust gas resulting from bad choice and sometimes bad dosage of fuel used, long duration and poor

maintenance of vehicles;

- ◇ Dust clouds raised by motorcycles' exhaust pipes which are turned downwards the ground and those raised by roads that are not tarred;

- \* Air pollution in **rural are is caused** mainly by **bush fires**:
- \* Air pollution **impacts** include:
  - **Contamination of working places by dust** involving drop in workers' productivity as well as additional costs and efforts in working tools maintenance or replacement of equipments;
  - **Infections of men and animals** including:

- ◇ **Respiratory diseases** caused by particles, gaseous discharges (SO<sub>2</sub>), dust clouds and soot arising from industrial and handicraft activities and roads that are not tarred;
  - ◇ **Intoxications** caused by smoke generated by some industrial facilities (brick fields) containing hydrofluoric gas;
  - ◇ **Troubles** (itching, eyes watering...) resulting from chemical industries emissions;
  - ◇ **Diseases caused by carcinogenic substances** (HC/CV) contained in smoke raised heavy transportation vehicles and kidney diseases as well as mental affections caused by lead.
- **Environmental damages: sediments and other acid rainfall** that are harmful for vegetation due to the presence of sulphur monoxide (SO<sub>2</sub>) resulting from some industrial activities;

### 2.5.3. Pollution by household wastes

This type pollution is highlighted by:

- **Soils' acidification as well as surface and ground water contamination** resulting directly from inadequate management of households solid wastes, especially in towns;
- **Waterproofing and pollution of farms**, animal health risks and negative visual impact caused by non-biodegradable plastic wastes;
- **Anarchic draining of households liquid wastes and pits** into public property and in the environment causing the spreading of numerous diseases carriers, surroundings and environment pollution and nuisances;
- **Pollution of water layers** resulting the **transformation** of a number of **traditional wells into pits and waste dumps**.

### 2.5.4. Pollution by industrial wastes

This type of pollution results from **industrial facilities liquid wastes** discharged in the environment without prior processing; their organic and chemical substances content bring about:

- \* **Loss in fishing potentialities** caused by liquid wastes containing basic organic substances produced by soap factories and nitrogen products generated by SOSUCO water tanks rinsing out;
- \* **Surface and ground water, and soils pollution and damages on vegetation** caused by liquid wastes containing chromium and alkaline yielded by chemical industries, as well as organic matters produced by slaughterhouses;
- \* **High risks of contamination of market gardening products** that are irrigated with industrial and hospital liquid wastes;
- \* Eutrophisation of water plans due to organic pollution.

### 2.5.5. Oil wastes

They are produced mainly by **garages, public transport, two-wheeled motorised vehicles workshops, petrol pumps with pits, thermal power stations, industries, railway and air transportation** and have considerable impacts on environment involving:

- \* Risks of contamination of soils, surface and ground water;
- \* Atmospheric pollution resulting from emission of dioxins, which are very harmful for man.

### 2.5.6. Biomedical wastes

**These wastes can infect soils and water resources** when:

- \* There is no specialised body of collection and disposal of these wastes, as they are processed like household wastes;
- \* Increasingly important quantities are produced (310 tons in Bobo-Dioulasso and 1.267 tons in Ouagadougou, for the year 2000)

## 2.6. *Natural and technological hazards*

- \* A risk can be defined as the **probability of occurrence of an event and the damages caused by this event**;
- \* A major risk is marked by the scope of a phenomenon, the nature of the impacts undergone with probability low rate of occurrence. A major risk can provoke a disaster, that is to say, a high number of victims;
- \* Technological hazard can be defined as **risks arising from human activities** (risks related to factories, power stations and transportation means).

### 2.6.1. Hazardous substances transportation and storage

The following table and graph show the various means of transportation and the great quantities of hazardous products transported.



Graph 7: Quantities of hazardous products transported in tons

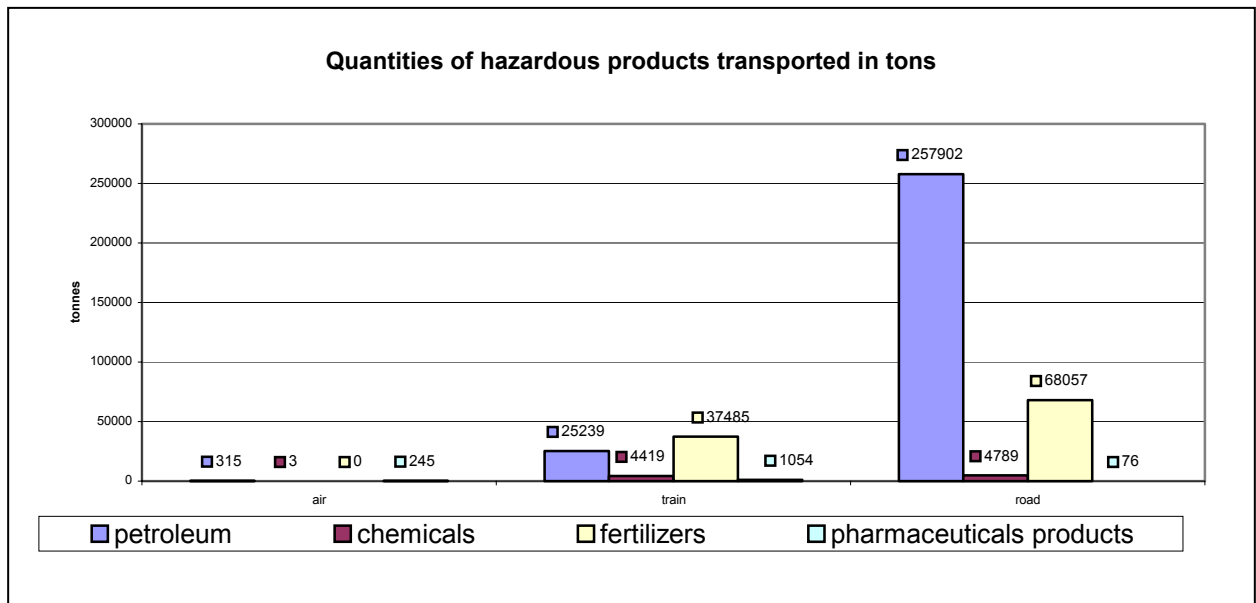


Table 2: Problems due to dangerous products importation, exportation and use

Areas	Products	Type of problems	Involved companies
<b>Big towns and rural areas</b>	<ul style="list-style-type: none"> <li>Oily products</li> <li>Nitrogenous fertilizer</li> <li>Pesticides</li> <li>Chemicals</li> <li>Heavy metals</li> <li>Pharmaceutical</li> </ul>	<ul style="list-style-type: none"> <li>air pollution</li> <li>water pollution</li> <li>hazard due to ingestion of obsolete and dangerous products</li> <li>Intoxication</li> <li>poisoning / suicide</li> </ul>	SOFITEX SOFAPIL SAPHYTO SONABHY TAN ALIZ/SBCP CAMEG MEDIFA, PROCHIMIE COPHADIS
<b>Rural areas</b>	<ul style="list-style-type: none"> <li>fertilizer</li> <li>Pesticides</li> <li>Chemicals</li> </ul>	<ul style="list-style-type: none"> <li>soil pollution</li> <li>persistence in food</li> <li>Intoxication of animals</li> </ul>	SOFITEX SAPHYTO

### 2.6.2. Big dams



Populations living downstream of most of the 8 big dams (except Bagre, Kompienga, and Ziga dams) face actual risks of flood since there are no early warning and cost lines watching systems.

**Photo 8: breaking of a dike causing flood and damages to the environment and infrastructures located downstream, Jonquière, Canada.**

(Source: CGC, Canada)

### Problems related to exports, imports and use of hazardous substances.

Towns or regions	Products	Nature of problems	Companies involved
<b>Big towns and farming areas</b>	<ul style="list-style-type: none"> <li>●Oil</li> <li>●Nitrogen fertilizers</li> <li>●Pesticides</li> <li>●Chemical products</li> <li>●Heavy metals</li> <li>●Pharmaceuticals</li> </ul>	<ul style="list-style-type: none"> <li>-Air pollution</li> <li>-Water pollution</li> <li>-Inability to adequately eliminate expired or faulty products</li> <li>-Intoxication</li> <li>-Poisoning / suicide</li> </ul>	SOFITEX SOFAPIL SAPHYTO SONABHY TAN ALIZ/SBMC CAMEG MEDIFA PROCHIMIE COPHADIS
<b>Farming areas</b>	<ul style="list-style-type: none"> <li>●Fertilizers</li> <li>●Pesticides</li> <li>●Chemical products</li> </ul>	<ul style="list-style-type: none"> <li>-Soil pollution</li> <li>-Residues in food of animals</li> <li>-Intoxication of animals</li> </ul>	SOFITEX SAPHYTO

#### 2.6.3. Other hazards

There are other probabilities for the occurrence of disasters and these risks actually exist. They include, inter-alia:

\* Increasingly threatening pollution by **purification and hazardous sludge wastes**;

*In 1988, quantities produced reached 1,000 tons + 2,1324 cubic meters and 831 tons + 831 cubic meters, respectively for Ouagadougou and Bobo-Dioulasso.*

\* Risks of contamination by **batteries** caused by the lead and the acid they contain;

*Batteries menders and fishermen (in ballasting their net) handled lead without special care.*

\* High risk of accidents due to **inadequate protection of level crossings** in big towns;

\* Risks arising from **mining activities** due to cyanide solutions discharge in environment, uncontrolled use of mercury and nitric acid and risks of landslides after exploitation;

\* Risks of **severe drought** with disastrous impacts resulting from inter-annual great rainfall variability and recurrent droughts;

\* Potential natural risk of **flooding** due to rain uncertainties and occurrence of heavy rains involving overflowing of buck-water, ponds, and rivers, as well breaking of dams dykes;

\* Risks of **massive and sudden locust and other migratory locust invasion** likely to be out of control of structures in charge of controlling and eradicating such scourges;

\* **Ill-considered risks for citizen health** due to the weakness of quality control mechanisms, liberalisation of trade and lack of professional code of ethics of economic operators. Thus, it is reported that:

- **Formalin** is be used for fish conservation;
- **Bromate** is used in bakeries in bread;
- **Carbideis** used for fruits ripening and cooking;
- **Expired pharmaceutical products** are sold.

### 3. Responses

This part of the summary focuses on: (i) stakeholders, (ii) institutional, legal, and regulatory measures as well as (iii) some practical actions undertaken to address more or less efficiently and successfully problems listed in the previous chapter.

Stakeholders have been divided into four groups including: (i) populations and their organisations, (ii) civil society (local communities, associations, and NGOs, private sector), (iii) Government, and (iv) cooperation partners.

Institutional, legal, and regulatory responses or measures are structured in laws, decrees, regulatory tests and conventions signed or ratified by the Government of Burkina Faso.

The practical actions listed here are above all, those initiated by the Government of Burkina Faso under sector-based policies, programmes and projects implementation or not which data are available and can be used in the framework of this work.

Thus, data provided are not exhaustive and even need to be completed and improved by carrying out further investigations or more detailed studies

#### 3.3. Responses to climate changes

Although urban and rural populations of Burkina Faso are daily experiencing this scourge, problems arising from climate changes were not granted special attention until the early 90's, thanks to UNCED.

##### 3.3.1. Stakeholders

The Ministry in charge of Environment initiated since 1995 through a joint Decree of the Ministries in charge of Environment, Transports, and Scientific Research, the creation of an **Inter-ministerial committee in charge of implementing the action for the Framework Convention on Climate changes (CIMAC)** involving (among many others), representatives of ministries in charge of co-ordinating climate changes related activities. It is under the SP/CONAGESE administrative and technical supervision.

##### 3.3.2. Institutional, legal, and regulatory responses

By ratifying the **United Nations Framework Convention on Climate changes**, (signed in New York on May 9<sup>th</sup> 1992) by Law n° 22-93/ADP/ dated May 24<sup>th</sup> 1993, Burkina Faso has acquired an important instrument in order to contribute in the stabilization of emissions and greenhouse gas concentration in the atmosphere at a reasonable level which does not cause climatic disturbances harmful to ecosystems, life, human activities, and, in short, the pursuit of sustainable economic development.

### 3.3.3. Practical Actions

The following practical initiatives have been undertaken and constitute Burkina Faso contribution to international community efforts to implement the **United Nations Framework Convention on climate changes**:

- \* Conducting **sector-based surveys** on vulnerability to climate changes and capacities to cope with climate changes, which enable to better apprehend the context and level of contribution to emissions and efforts, aimed at addressing some of the issues related to climate changes.
- \* Possibilities and practical initiatives for greenhouse gas **sequestration**, namely working out techniques enabling **plant cover regeneration**;
- \* Adoption of a **National Strategy** for implementing the Convention on Climate Changes.

### 3.4. Some responses to high pressures on water resources

The “Water” sector involve various stakeholders including (i) the State and development partners in charge of defining and monitoring mechanisms for a quantitative and qualitative resources mobilisation and, (ii) organised populations, (iii) local governments and (iv) the private sector, for the management of actions and implementation of maintenance works, respectively.

In addition, the orientation law governing water management provides for the creation of National Water Council, an advisory body.

It is provided that water management bodies will be created in each of the four catchments basins.

#### 3.4.1. Institutional, Legal and Regulatory Responses

The ratification by Decree n°68-277 dated November 23<sup>rd</sup> 1968 of the **African Convention for Environment Natural Resources Conservation** signed in Algiers on 15<sup>th</sup> September 1968, asserts the political willingness of Burkina Faso to contribute to finding common and sustainable solutions to problems arising from natural resources management in general, and especially those arising from conservation, utilization, and development of ground and surface water as well as adequate and continuous supply of quality water to populations.

This willingness was renewed recently through the adoption of law n°002-2001 dated April 3<sup>rd</sup> 2001 related to the “**orientation law governing water management**” and aiming inter-alia at:

- (i) Providing drinking water to populations;
- (ii) Coping with or adjusting the requirements in agriculture, animal husbandry, fishing farming, extraction of minerals, industry, energy production, transportation, tourism, leisure, as well as any other human activity conducted legally, to preserve and improve water quality, protect aquatic ecosystem,

- (iii) Facing health, public sanitation, civil security requirements and problems posed by floods and droughts.

### 3.4.2. Practical actions

The **National Water Policy** aims inter-alia at :*(i)* Meeting human consumption and households utilisation needs, *(ii)* developing agricultural and pastoral hydraulics and *(iii)* providing water to the other sectors of the economy (energy, fisheries, industry etc.). It defined and contributed to the implementation of sector-based programmes such as the Village and Pastoral Hydraulics Programmes, Urban Hydraulics Programmes, the Saaga Programme and the signing of international agreements for a better management of transboundary basins.

The working out of an action plan and water resources development and management plans are also provided for where necessary (one or many catchments basins, one or many catchments sub-basins).

### 3.5. Some solutions related to soils and mining problems

#### 3.5.1. Stakeholders

Farmers are more affected than the other stakeholders by land degradation. In addition, except the Ministry of agriculture and the Ministry in charge of Scientific Research which have bodies or specific programmes on land fertility management, the compound problems related to lands, mining resources, management are handled separately and individually in the various ministries.

The Ministry in charge of Environment initiated and set up over the last few years, operations and a body in charge the restoration of deteriorated lands at village level and between villages, in close collaboration with populations.

Mining sector stakeholders mainly include the State and development partners in the area of regulations and research and development concessions control on the one hand, and the private sector on the other hand, that focuses on research and development. Its action has contributed, over the years to promote the Project for National Capacity Building in Mining and Environment Management (PRECAGEME).

#### 3.5.2. Institutional, legal and regulatory Responses

Among the relevant legal and regulatory responses initiated by Burkina in the area of lands problems, we can mention the ratification by law n°33-95 /ADP/ dated December 9<sup>th</sup> 1995 of the **17<sup>th</sup> June 1994 Paris Convention of on Desertification Control** in countries severely affected by drought and/or desertification in Africa especially. A process leading to the practical actions listed below immediately followed this important measure.

All mining resources development issues are covered by the National Mining Policy structured around the *(i)* **mining code**, *(ii)* mining investment back-up **institutions**, and *(iii)* back-up measures (**tax and customs duties** to increase mining budget receipts, **small-scale**

**mining promotion**, protection and management of environment by defining adequate standards, **training** to foster mining tradition).

### 3.5.3. Practical actions

Among actions undertaken to face lands degradation problems we can list those undertaken in the framework of:

- \* The National Desertification Control Programme of Action (PAN/LCD) which defines sector-based and global priorities, while providing coherence and synergy within projects and programmes and taking into account specific constraints faced by previous planning framework;
- \* Soil fertility management Project;
- \* Research for improving farming systems with a view of reducing farming areas by developing improved varieties, economical formula of fertilizing, soils fertility sustainable management technologies, soils and agro-forestry protection and rehabilitation;

PRECAGEME actions provide relevant responses to mining development problems through the setting up of an attractive regulatory and tax system, reinforcement of mining and environmental resources management institutions, promotion of small scale mining and improving traditional mining performance as well as reinforcement of human capital through training.

## 3.6. *Some responses related to the loss in biological diversity*

### 3.6.1. Stakeholders:

The scope and the complex nature of biological diversity loss require not only government and cooperation partners attention for guidance, definition and supervision of regulations, principles, and standards application in the area resources exploitation, but also a continuous action by populations, the civil society, and local communities to ensure responses fitting with their respective territories or areas scope.

Traditional rulers and landlords hold important positions for concerted and sustainable management of biodiversity resources at village level given their influence and the persistence of traditional techniques in lands management.

### 3.6.2. Institutional, Legal and regulatory Responses

Responses provided by Burkina Faso are in the framework of:

- \* The February 2<sup>nd</sup> 1971 **Ramsar Convention** related to humid zones with international importance especially as habitats for water birds, ratified by Burkina Faso through Kiti (decree) AN VIII-3 bis/FP/REX dated August 23<sup>rd</sup> 1989);

- \* The **June 5<sup>th</sup> 1992 Rio de Janeiro Convention on biological diversity**, ratified by Burkina Faso in reinforcement of law n°17-93/ADP dated May 24<sup>th</sup> **1993**;
- \* The orientation law related to water management (Law n°002-2001 dated April 3rd 2001) aiming inter-alia at protecting aquatic ecosystems.

### **3.6.3. Practical actions**

Following the ratification as part of **Ramsar convention** implementation and on biological diversity, Burkina Faso has designed a national strategy on biodiversity structured around: (i) biological diversity conservation, (ii) sustainable use of biological diversity elements and (iii) fair distribution of profits generated by biological resources development.

In addition National Forest policy has been up-dated and is now on structured around:

- \* Forestry sector: National Forest Development Programme, National Village Forestry Programme;
- \* Wildlife sector: the national wildlife resources management strategy including biodiversity management projects in the Nazinga ranch, Natural and wildlife resources Participatory Management Project (GEPRENAF), Support-project to wildlife conservation Units (PAUCOF) National Natural Ecosystems Management Programme (PRONAGEN), the W. Park Project;
- \* Fishery resources sector: The National aquatic resources management strategy including fishing management Projects in south-western regions (GEPSE) in southwest and west regions, the Bagré Dam Fishing component (MOB)

## **3.7. Responses to problems related to life styles and living environment degradation**

### **3.7.1. Stakeholders**

Up till recently, responses to problems arising from life styles and environment degradation were exclusively handled by the Government (ONEA, former DESA, DPPA, CREPA, NGO ...concerning sanitation aspects);

However, ongoing changes initiated since 1995, enable the involvement of local authorities (communes, grass-root organisations,...) and especially a spreading of management duties among the various stakeholders (administration, NGO, local communities, private sector).

### **3.7.2. Institutional, Legal and regulatory Responses**

Institutional, Legal, and regulatory Responses to Life styles and environment degradation problems are based on:

- \* The Constitution of Burkina Faso: "the right to a healthy environment is recognised. Protection and promotion of the environment are common obligations" (Article 29).
- \* Environment code (law n° 005/97/ADP of 30<sup>th</sup> January 1997). Adoption of sanitation and environment protection measures (on risky, unclean and



- inconvenient housing, on urban and rural wastes, industrial wastes produced on the national territory, foreign hazardous wastes etc.) and on improvement of urban and rural populations living environment;
- \* Environment code enforcement texts by decree N0 2001-185/PRES/ PM/MEE of 7<sup>th</sup> May 2001 setting the standards of pollutant discharge in air, water and soil and Decree N0 2001/342/PRES/PM/MEE defining the scope, content and procedure of the study and impact on environment;
  - \* Investment code stating clearly the taking into account of investment impact on environment;
  - \* Law governing pesticide control (Law N0 41/96/AADP/of 8<sup>th</sup> November 1996 amended by Law NO 006/98/An of 26 March 1998) prohibiting the sale, marketing and free distribution of pesticides without prior authorisation by the Ministry of Agriculture;
  - \* Health code (Law N0 23/94/ADP of 19<sup>th</sup> May 1994) authorising certain public services to taken measures to prevent drinking water pollution and prevent reduce harmful nuisance effects;
  - \* Law governing water management (Law N0 002-2001 of 3<sup>rd</sup> April 2001 aiming at: (i) meeting or adapting requirements of agriculture, breeding, fishing, of minerals extraction, of industry, of energy production, of transports, of tourism of leisure as well as of all other human activity conducted legally, (ii) protecting and restoring water quality, (iii) of meeting health, public health requirements..." ,

### 3.7.3. Practical actions:

Complexity of issues related to life styles and the degrading of life environment require practical responses which are at several levels:

- \* National policy on population (1991) which aim is to “contribute to the populations well-being through the quest of a balance between populations and resources“ by developing the territory and mastering the inter relations population/gender/development, the improvement of reproductive health (AIDS control and fund for infected people’s care);
- \* National strategy for the sanitation sub-sector (1996) which aims at (i) closely involving local authorities in actions planning and durability, (ii) promoting capacity building and appropriation of initiatives by stakeholders, (iii) reorganising the institutional mechanism on the basis of a balanced sharing of management responsibilities between the various stakeholders (administration, NGOs, local communities, private sector) and (iv) making sanitation, a fundamental element in development policies and programmes on community-based initiatives.

### **3.8. Preventive provisions for natural and technological risks**

#### **3.8.1. Stakeholders**

The stakeholders are constituted by the state for the definition, enforcement and monitoring of legal and regulatory instruments, but also economic and industrial operators of the private and the semi public sectors (road, air and railway transportation, import of dangerous or banned substances, civil engineering, energy, food industry, leather and skins, hospitals, mining and the informal sector) for the compliance with legal and regulatory provisions. However, the civil society through associations and NGOs are increasingly active in the provision of some services, sensitisation actions and lobbying.

#### **3.8.2. Institutional, legal and regulatory responses**

The **Constitution** of Burkina and the **environmental code** guarantee to each Burkinabè, the right to a safe environment, preserved from hazards, pollutions (by various wastes and gas) and various nuisances.

Besides these fundamental principles, we have other legal and regulatory instruments including the orientation law related to water management (Law n° 002-2001 of 3<sup>rd</sup> April 2001), which aims, among many other things to face issues posed by floods and droughts.

#### **3.8.3. Practical actions:**

The government adopted in 1996 the national strategy of the sanitation sub-sector. It aims at:

- \* Closely involving local authorities in the planning process;
- \* Reorganising institutional provisions on the basis of management responsibilities sharing between the various stakeholders (administration, NGOs, local communities and the private sector)
- \* Making sanitation, a fundamental element in development policies and programmes.

Priority activities are:

- \* Assessment of industrial pollution
- \* Mastery of rain water in secondary towns
- \* Reduction of dangerous substances
- \* Support to the implementation of the strategy.

#### **4. CONCLUSION**

The publication of this first report of the state of environment is in line with the commitment taken by Burkina Faso with the international community to break the cycles of incoherent and incomplete programmatic approaches. This first report on the state of environment present an overall and synthetic inventory of features of environment in Burkina Faso. It results from the collection and compilation of scattered data on environment.

Some information and some parts of the report may look abstract and even irrelevant or erroneous because of problems encountered in the access and processing of reliable data. That is why this first REEB does not allow a precise quantification of the country natural resources or a hierarchy of identified environmental issues, or the assessment of the effectiveness of measures taken by environment stakeholders. However, the collected data highlight the main environmental issues of Burkina Faso and offer some relevant solutions.

This survey was as close as possible to the most recent information sources.

In forthcoming editions, the REEB will emphasize more the analysis of the manifestation and occurrences of environmental issues thanks to data specially collected and processed to this end, with the cooperation of competent technicians and scientists in the various areas of environment.

The document also makes a short inventory of information systems, provisions and research programmes on Burkina Faso. These systems are inadequate and the government, first institutional guarantor of environment should reinforce current provisions. That is why this first edition of the REEB should also serve as the starting point for the creation of an informational base on environment, complying with international standards.

Such technical and administrative provisions will enable the report on the state of environment to become a truly innovative instrument of diagnosis on environmental issues and to assist decision making for a sustainable management of environment or to put it in a nutshell, sustainable development of Burkina Faso.

## 5. Annexes

**Annex 1:****Table 3: main features of national catchments basin of Burkina**

	<b>National catchments basin of the Comoé</b>	<b>National catchments basin of the Mouhoun</b>	<b>National catchments basin of the Nakanbé</b>	<b>National catchments basin of the Niger</b>
<b>Area (km<sup>2</sup>)</b>	17.590	<b>91.036</b>	<b>81.000</b>	<b>83.442</b>
<b>Subdivision and nature</b>		Main tributary of the Volta river, three sub-basins: Upper Mouhoun, Sourou and lower Mouhoun.	Second tributary of the Volta river Nakanbé, Nazinon, Sissili and Pendjari	Banifing catchments basin, Niger right bank basin tributaries
<b>Permanent (p) and temporary (t) tributaries</b>	Léraba (p) Comoé (p)	Poni, Bougouriba, Grand-Balé, Vranso, Sourou, Voun Hou (t) and Kou (p)	Nakanbé, Nazinon, Sissili (t) and Pendjari (p)	Beli, Gorouol, Goudébo, Dargol, Faga, Sirba, Bonsoaga, Diamangou and Tapoa (t)
<b>Flooding flows (m<sup>3</sup>)</b>	500			
<b>Storage capacity</b>	115 million of cubic metres. Average annual filling rate=71%	Above 438 million cubic metres. Average annual filling rate=65%	Above 4.23 billion cubic metres. Filling rate=53%	239 million of cubic metres, filling rate=41%
<b>Ecologic specificities</b>	Tengrela lake, Karfiguela waterfalls, bates' pond of Léra. Comoé, Sinlo and East Léraba flood plain in Douna, Diéfoula and Logoniégue forest reserves	Hippopotamus' pond, Guinguette (spring of the Kou), Sabou crocodiles' pond.	Bam and Dem lakes and more than 400 dams, including the Bagré, Kompienga, Ziga and Toecé dams.	
<b>Other features</b>	27 dams, 20 lakes	The Samandeni dam in project	High evaporation (40% on big dams and 60 to 70% on small dams)	

## Annex 2:

**Table 4: classes of soils, their main features and location in Burkina Faso.**

Classes of soils	Main features	Provinces or part of the country covered	Number of sub classes	%
<b>Iron and manganese sesquioxides soils</b>	<ul style="list-style-type: none"> <li>- Rapid mineralization of organic substance;</li> <li>- Individualisation of iron and manganese sesquioxides;</li> <li>- Massive structures of A B horizons</li> <li>- Poor in mineral elements</li> </ul>	North, east, centre-south, south west, north west,	5	38
<b>Hardly evolved soils</b>	AC type hardly differentiated profile	Centre-north, centre-south, east	3	26
<b>hydromorph soils</b>	Temporary or permanent water excess affecting part or all the profile	Zoudwéogo, Yatenga, Tapoa, Sourou, Soum, Sissili, Séno, Sanmatenga, Sanguié, Passoré, Oudalan, Oubritenga, Namentenga, Nahouri, Mouhoun, Kouritenga, Kossi, KénéDougou, Houet, Gourma, Gnagna, Ganzourgou, Comoé, Bulkiendé, Boulgou, Bougouriba, Bam	3	13
<b>Vertisoils</b>	<ul style="list-style-type: none"> <li>- High content in swelling clay of <i>montmorillonite</i> type;</li> <li>- Large desiccation breakings;</li> <li>- Sliding faces in the profile;</li> <li>- Superficial presence of a gilgai micro relief.</li> </ul>	Centre-south, west-north, Oudalan, Soum, Namentenga, Yatenga, Mouhoun, Sanguié, Nahouri, Sourou, Boulgou	3	6
<b>Brown soils (%)</b>	<ul style="list-style-type: none"> <li>- Mull type humus with high biological activity</li> <li>- Mineral richness</li> </ul>	Sourou, Gourma, Gnagna, Séno, Bam, Passoré, Gnagna, Yatenga, Namentenga, Gourma, Mouhoun, Kossi, Sanguié, Bulkiendé, Nahouri, Zoundwéogo, Ganzourgou, Kouritenga, Boulgou, Bougouriba, Tapoa, Sissili	3	6
<b>Sodic soils</b>	<ul style="list-style-type: none"> <li>- Presence of soluble salts (chlorides, carbonate, potassium or magnesium sodium)</li> <li>- Or presence of</li> </ul>	Centre-south, centre-north, north, east		5

<b>Classes of soils</b>	<b>Main features</b>	<b>Provinces or part of the country covered</b>	<b>Number of sub classes</b>	<b>%</b>
	exchangeable sodium			
<b>Raw mineral soils</b>	<ul style="list-style-type: none"> <li>- Quasi-absence of pedologic evolution</li> <li>- Cuirassed and rocky buttes</li> </ul>	Kossi, Mouhoun, Houet, Kéné Dougou, Tapoa, Bam, Sanmatenga, Boulgou, Nahouri, Kouritenga, Zoundwéogo, Balé, Tuy, sud-est	4	3
<b>Ferrallitic soils</b>	<ul style="list-style-type: none"> <li>- ABC profil</li> <li>- Advanced alteration of primary minerals,</li> <li>- Elimination of alkaline bases and part of out of profile silica</li> <li>- kaolinite et de sesquioxides neoformation</li> </ul>	Houet, Kéné Dougou, Comoé, Mouhoun	3	2
<b>Isohumic soils</b>	Differentiated texture	North	2	1

## Annex 3:

Table 5 : Sahelian and sudanian domains flora and fauna.

Description	Sahelian domain		Sudanian domain	
	Strict sahelian sector	Sub-sahelian sector	North sudanian sector	South sudanian sector
Geographic location	North of 14 <sup>th</sup> parallel	Between 13 <sup>th</sup> and 14 <sup>th</sup> parallels	Between 12 <sup>th</sup> and 13 <sup>th</sup> parallels.	Between 5 <sup>th</sup> and 11 <sup>th</sup> parallels
Physionomy (structure) of plant cover	Herbaceous steppes, woody steppe bushes ("spotted bush") with typical sahelian and saharan species	Herbaceous steppes, woody steppe with ubiquitous sahelian and saharan species	Protected species farming landscapes with "sacred woods" in some places, which look like clear forests.	Wooded savannas and clear forests interrupted by forest galleries with guinean and sudanian species
Floristic composition	<i>Acacia ehrenbergiana</i> , <i>A. raddiana</i> , <i>Grewia tenax</i> , <i>Maerua crassifolia</i> , <i>Andropogon gayanus</i> var., <i>Tridentatus</i> , <i>Aristida stipoides</i> , <i>Hyphaene thebaica</i> (palmier doum) et <i>Cenchrus</i> sp., etc.	<i>Acacia laeta</i> , <i>Bauhinia rufescens</i> , <i>Commiphora africana</i> , <i>Dalbergia melanoxylon</i> , <i>Pterocarpus lucens</i> , <i>Combretum glutinosum</i> , <i>C. micranthum</i> , <i>C. nigricans</i> var. <i>elliottii</i> , <i>Acacia macrostachya</i> , <i>Acacia senegal</i> , <i>Euphorbia balsamifera</i>	<i>Vitellaria paradoxa</i> (shea), <i>Parkia biglobosa</i> (néré), <i>Tamarindus indica</i> (tamarin tree), <i>Adansonia digitata</i> (baobab), etc	<i>Antiaris africana</i> , <i>Chlorophora excelsa</i> , <i>Dialium guineense</i> , <i>Cola laurifolia</i> , <i>Elaeis guineensis</i> , <i>Manilkara multinervis</i> et <i>Pterocarpus santalinoides</i> , <i>Acacia polyacantha</i> subsp. <i>campylacantha</i> , <i>A. sieberiana</i> , <i>Anogeissus leiocarpus</i> , <i>Daniella oliveri</i> , <i>Diospyros mespiliformis</i> , <i>Khaya senegalensis</i> , <i>Isoberlinia doka</i> , <i>soberlinia dalzielii</i> , <i>Burkea africana</i> , <i>Vitellaria paradoxa</i> subsp. <i>parkii</i> , <i>Lophira lanceolata</i> ,

Description	Sahelian domain		Sudanian domain	
	Strict sahelian sector	Sub-sahelian sector	North sudanian sector	South sudanian sector
				<i>Monotes kerstingii</i> , <i>Parkia biglobosa</i> , etc.
Wild animals species	Ostrich, <u>red flank gazelle</u> <sup>1</sup> , <u>dama gazelle</u> , <u>cheetah</u> , striped hyena, spotted hyena, common jackal, pale fox, cat of Libya, ratel zorilla, wart hog, elephant (periodically), patas, orycterope, Senegal galapo, rocky daman, chive, common genet, Ichneumon mongoose, red mongoose, important resident and migratory avifauna.	<u>Red front gazelle</u> , elephant, hippopotamus, buffalo, hippotrague, <u>damalisc</u> bubale, buffon cob, Defassa cob, redunca, wart hog, Grimm ourebi and cephaloph de, <u>leopard</u> , <u>cheetah</u> , sevral, caracal, spotted hyena, cat of Libya, baboon, patas, Senegal galapo, striped flank fox, ratel zorilla, chive, common genet, pardine, mongooses, oryctérope, rocky daman, a very important game avifauna, crocodiles, varanus, pythons, tortoises ( <i>species whose names are underlined are endemic or endangered</i> ).	Hippotrague, bubale, buffon cobe, unctuous cobe, elephant, buffalo, hippopotamus, sylvicapre, wart hog, ourébi, cobe redunca, harnessed guib, red flanks cephaloph, baboon doguera, patas, callitriche, spotted hyena, orycterope, lion, <u>leopard</u> , crocodiles, varanus, pythons and an important avifauna.	Elephant, hippopotamus, buffalo, hippotrague, bubale, buffon cob, Defassa cobe, wart hog, harnessed guib, ourebi, Grimm cephaloph, red flank cephaloph, <u>Maxwell cephaloph</u> , lion, <u>leopard</u> , spotted hyena, baboon, callitriche, <u>Magistrate colobe</u> , patas, crocodiles, varanus, pythons, tortoises and important birds populations.

<sup>1</sup> Species whose names are underlined are endemic or endangered



## Annex 4:

**Table 6: distribution of plant formations types and average volume of standing wood.**

Origin of formations	Types of formations	Area (ha)	% of national territory	Average volume. (/ha/m <sup>3</sup> )
Natural	Forest galleries	270 000	1	155
	Clear Forest	287 000	1	31
	Wooded Savannas	4 291 000	16	31
	arbustive Savannas	10 185 000	37	12
	Dotted bush	387 000	1	18
	<b>Sub-total</b>	<b>16 620 000</b>	<b>60</b>	-
Anthropic	Fallows and agro-forestry parks	8 770 000	32	17
	Trees plantations	20 000	-	-
	<b>Sub-total</b>	<b>8 790 000</b>	<b>32</b>	-
	<b>General Total</b>	<b>25 410 000</b>	<b>92</b>	-

Source: FAO 1983

## Annex 5:

**Table 7: some wild animals species**

Scientific names of wild animals species			
Ostrich	<i>Struthio camelus</i>	Ichneumon mongoose	<i>Herpestes ichneumon</i>
Red flank gazelle	<i>Gazella rufifrons</i>	Red mongoose	<i>Herpestes sanguineus</i>
Dama gazelle	<i>Gazella damah</i>	Leopard	<i>Panthera pardus</i>
Cheetah	<i>Acinonyx jubatus</i>	Savanna Varanus	<i>Varanus exanthematicus</i>
Stripped Hyena	<i>Hyaena hyaena</i>	Python	<i>Python (sebac, regius)</i>
Spotted Hyena	<i>Crocota crocuta</i>	Ponds crocodile	<i>Crocodylus tetrapis</i>
Common fox	<i>Canis aureus</i>	Ourebi	<i>Ourebia ourebia</i>
Cat of Lybia	<i>Felis libyca</i>	Callitriche, green monkey	<i>Cercopithecus acthiops sabaues</i>
Ratel	<i>Mellivora capensis</i>	Amphibious Hippopotamus	<i>Hippotamus amphibius</i>
Zorilla	<i>Ichtonyx striatus</i>	Caracal	<i>Felis caracal</i>
Wart hog	<i>Phacochoerus acthiopicus</i>	Redunca	<i>Redunca redunca</i>
Elephant	<i>Loxodonta africana</i>	Buffalo	<i>Synarus caffer</i>
Patas, Red monkey	<i>Erythrocebus patas</i>	Lycan	<i>Lycan pictus</i>
Orycterope	<i>Orycteropus afer</i>	Oryx	<i>Oryx dammah</i>
Senegal galapo	<i>Galago senegalensis</i>	Dorcas gazelle	<i>Gazella dorcas</i>
Rocky dama	<i>Procavias ruficeps</i>	Abyssinie Calao	<i>Bucorvus abyssinicus</i>
Chive	<i>Viverra civetta</i>	Damalisc	<i>Damaliscus lunatus</i>
Common Genet	<i>Genre Genetta et Pseudogenetta</i>	Long necked crane	<i>Balearica pavonica</i>

## Annex 6:

**Table 8: Synthesis of the taxonomic state of aquatic fauna**

Taxonomy	Families	Genres	Species
Fishes	24	57	118
Batrachians	5	16	30
Molluscs	10	13	23
Crustaceans	5	7	6
Zooplanktons	10	13	16
<b>Total</b>	<b>54</b>	<b>106</b>	<b>193</b>

Source: TRAORE, C.A. et ZIGANI, S.N., 1996 in Monographie

## Annex 7:

**Table 9: Synthesis of the taxonomic inventory of wild terrestrial fauna**

Class	Order	Family	Genres	Species
Mammals	11	33	77	128
Birds	20	76	246	477
Reptiles	4	10	39	60
<b>Total</b>	<b>35</b>	<b>119</b>	<b>362</b>	<b>665</b>

*Source: Ouédraogo, L. et Kafando, P., 1996 in Monographie*

## Annex 8:

**Table 10: Recapitulative of the taxonomic inventory of aquatic herbaceous flora**

Flora sub-group taxonomy	Families	Genres	Species
Aquatic macrophytes	23	28	46
Semi-aquatic Macrophytes	20	36	69
Macrophytes from water saturated zones	10	17	24
Hygrophilous Macrophytes	23	37	46
<b>Total</b>	<b>76</b>	<b>118</b>	<b>185</b>

Source: OUEDRAOGO, R.L., 1996 in Monographie