

BURKINA FASO
Unity - Progress - Justice

United Nations
Development Programme

Global Environment
Facility

COUNTRY STUDY ON BURKINA FASO BIODIVERSITY

**CONDUCTED BY THE PERMANENT SECRETARIAT OF THE NATIONAL COUNCIL FOR THE
MANAGEMENT OF THE ENVIRONMENT AND THE NATIONAL TECHNICAL COMMITTEE OF
THE CONVENTION ON BIOLOGICAL DIVERSITY UNDER THE AEGIS OF THE MINISTRY IN
CHARGE OF ENVIRONMENT AND WATER**

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FOREWORD

Biological diversity is the unique capital for the survival of humanity. It maintains life on land thanks to its ecological roles and as a supplier of subsistence products for living beings. Biological diversity also contributes to the regulation and harmonisation of national, regional and international social rapports, thanks to its scientific, technological, sociological, cultural and educational uses.

Unfortunately nowadays, the constituent elements of the main components of biological diversity, notably ecosystems, animal and plant species and genes, disappear at a rhythm that compromises the obligation made to all generations to bequeath this heritage in good state to future generations.

This first national monograph on the biological diversity of Burkina Faso globally aims at collecting and analysing ecological, biological, economic and social data that will permit to circumscribe the framework in which the development of the National Strategy and Plan of action concerning biological diversity must be undertaken.

In this view, the present document presents, first of all, a state of the art on the biological diversity in Burkina Faso, notably on the knowledge of its constituent elements, the scheduling of its management, the economic aspects that ensues and the threats that weigh on it, and next, draws up the important options able to encourage its conservation and sustainable use. This document draws up the existing potentialities and the major preoccupations of Burkina Faso in the matter of national biological diversity. It is the synthesis of nineteen (19) sectorial thematic studies on questions related to biological diversity and its support, which have been examined through broad discussions.

With its two (2) appendices, one on the systematic list of indexed species and the other on parameters pertaining to these species, the present national monograph is, in our sense, a strong instrument of information, education and orientation of actors and users of biological diversity, for the perpetuation, while doing the harmonious integration of actions related to natural resources, of the preliminary conditions to reach the objective of sustainable human development.

We count on the commitment and determination of all, to reverse the deteriorating tendency of the biological heritage of Burkina Faso.

OUAGADOUGOU, FEBRUARY 1999,

Salif DIALLO
MINISTER OF STATE
MINISTER OF ENVIRONMENT AND WATER

LIST OF ABBREVIATIONS

| | |
|------------|---|
| BDPA : | Agricultural Production Development Office |
| BF : | Burkina Faso |
| BUNASOL : | National Soils Office |
| CAP : | Certificate of Professional Aptitude |
| CES/AGF : | Conservation of Waters and Soils/Agro-Forestry |
| CES/DRS : | Conservation of Waters and Soils/Defence and Restoration of Soils |
| CFD : | French Development Fund |
| CIEH : | Inter - States Committee for Hydraulic Study |
| CILSS : | Inter - States Committee for Drought Control in the Sahel |
| CIRAD : | International Centre for Research in Agronomy for Development |
| CIRDES : | International Centre for Research Development of Animal Rearing in Humid Zones |
| CIRP : | International Council for Phytogenetic Resources |
| CNDA : | National Centre for Agricultural Documentation |
| CNRST : | National Centre for Scientific and Technological Research |
| CNSF : | National Centre for Forest Seeds |
| CONAGESE : | National Council for Environmental Management |
| CRPA : | Regional Centre for Agro - Pastoral Promotion |
| CRTO : | Regional Remote Sensing Centre of Ouagadougou |
| DNA : | Deoxyribonucleic acid |
| DOET : | Directorate of the Organisation of Traditional Animal Rearing |
| DPIA : | Directorate of Animal Production and Industries |
| DRARA : | Regional Directorates of Agriculture and Animal Resources |
| DSA : | Agricultural Services Directorate |
| EU : | European Union |
| FAO : | United Nations Food and Agriculture Organisation |
| F CFA : | Franc of the African Financial Community |
| FED : | European Development Fund |
| FEM : | Global Environment Fund (French Acronym) |
| GEF : | Global Environment Fund |
| GEPRENAF : | Participatory Management of Natural Resources and Fauna |
| ICRAF : | International Centre for Agro-Forestry Research |
| ICRISAT : | International Centre for Research on Crops of Semi-arid Tropical Zones |
| IDR : | Rural Development Institute |
| IEMVT : | Institute of Animal Rearing and Tropical Veterinary Medicine |
| IGN : | National Geographic Institute (in France) |
| INERA : | Environmental and Agricultural Research Institute (ex Survey and Agricultural Research Institute) |
| INSD : | National Statistical and Demography Institute |
| IITA : | International Institute for Tropical Agriculture |
| IPD/AOS : | Pan-African Institute for Development/ West Africa Sahel |
| IRAT : | Institute for Tropical Agronomic Research |
| IRBET : | Institute for Research in Tropical Biology and Ecology |
| MARA : | Ministry of Agriculture and Animal Resources |
| MAT : | Ministry of Territorial administration (Ministry of Interior) |
| MEE : | Ministry of Environment and Water |
| ORSTOM : | French Institute of Scientific Research for Development in Cooperation |

| | |
|------------|---|
| OCCGE : | Organisation for Cooperation and Fight Against Important Endemic Diseases |
| OCDE : | Organisation for Cooperation and Economic Development |
| ONAT : | National office of Soil Development |
| ONG : | Non-Governmental Organisation |
| ORANA : | Organisation for Research on African Food and Nutrition |
| ORD : | Regional Development Organisation |
| OXFAM : | Oxford Committee for Famine Relief (NGO for struggle against famine) |
| PANE : | National Environmental Action Plan |
| PDAV : | Village Agriculture Development Project |
| PDRI/HKM : | Integrated Rural Development Project /Houet-Kossi-Mouhoun |
| PNB : | Gross National Product |
| PNGT : | National Programme for Soil Management |
| PNUD : | United Nations Development Programme |
| PNUE : | United Nations Environmental Programme |
| RAF : | Agrarian and Land Reorganisation |
| SIG : | Geographic Information System |
| SOPAL : | Alcohols and Liqueurs Production Company |
| SOSUCO : | Sugar Company of Comoé |
| SPA : | Provincial Services of Agriculture |
| SATEC : | Technical Assistance and Cooperation Company |
| UICN : | International Union for Nature |
| UO : | University of Ouagadougou |
| USAID : | United States Agency for International Development |

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use of TERMS

| | |
|--------------------|--|
| Allogamy: | Pollination of a flower by a pollen from another flower coming or not from another plant. |
| Beetles: | Coleoptera that lays eggs in flower of peas and whose larvae eat the seeds of this plant. |
| Cryptogames: | Flowerless, fruitless and seedless multi-cell plants (as opposed to phanerogames). |
| Genotypic: | Overall genes contained in the chromosomic D.N.A. of a living cell. |
| Macrophytes: | Generic term used to designate any plant that can be seen with the naked eye (ant.: microphyte). |
| Phanerophyte: | Used for plants whose terminal buds and sprouts are situated on stems. |
| Riparian: | Vegetation that grows on the banks of rivers. |
| Spontaneous: | Used for a plant that grows naturally in a region without being introduced by man. |
| Therophytes: | Annual plants. |
| Tradipractitioner: | A person practising pharmacopoeia and / or traditional medicine. |
| Vertisols: | Very clayey soils. |

ABSTRACT

National monographs aim at collecting and analysing biological, economic and social data which will enable to determine the framework for the development of national strategies and plans of actions (PNUE, 1993).

Since the term “biological diversity” is relatively new, this report underlines the essential characteristics of biological diversity for sustainable development.

This document about the situation in Burkina Faso, in terms of biological diversity, reveals that praiseworthy actions have already been undertaken in the past but there is still a lot to do.

A total of nineteen (19) thematic studies dealt with the various issues related to the conservation and sustainable use of biological diversity. These studies are concerned with the overall information and results, which are presented in this report.

Burkina Faso is a landlocked Sudanese-Sahelian country, with a surface area of 274 200 Km², located in the heart of West Africa. Its population is about 9 190 000 inhabitants (INSD, 1991), with an annual population growth of 2.63%.

The present situation of the country’s biological diversity is characterised by the destructive pressure of man and animals which mainly results in bush fires, shifting cultivation, population pressure, overgrazing and excessive use of biological resources. In addition to these man-caused factors there is the effect of successive droughts which have been occurring since 1970. The conjunction of these two main factors lead to the accelerated deterioration of biological diversity.

In order to deal with this trend, the country has undertaken or is still undertaking actions in order to ensure the sustainable use of biological resources.

The results of the taxonomic inventories made in this national survey on biological diversity are as follows:

1. Species

Table (i) below shows the situation of the inventory of species according biological diversity elements.

Table (i): Situation of surveyed species

| | |
|-------------------|--------------|
| Fauna | |
| Insects | 1515 |
| Reptiles | 60 |
| Birds | 482 |
| Mammals | 139 |
| Fishes | 118 |
| Amphibians | 30 |
| Shellfish | 6 |
| Molluscs | 28 |
| Zooplankton | 16 |
| <i>Sub-total</i> | 2 394 |
| Flora | |
| Algae | 191 |
| Higher fungi | 28 |
| Herbaceous plants | 812 |
| Ligneous plants | 376 |
| <i>Sub-total</i> | 1 407 |
| TOTAL | 3 801 |

2. Ecosystems:

In Burkina Faso there are three main types of ecosystems:

- Terrestrial ecosystems: 25 140 000 ha, or 91.22% of the country;
- Aquatic ecosystems: 72 500 ha, or 0.26% of the country;
- Intermediate ecosystems: 371 000 ha, or 1.34% of the country.

The rest of the country includes other types of environment, particularly dunes, towns, rocks and roads.

3. Biological resources

The richest habitats of species (in terms of quantity and quality) amount to the various conservation areas of terrestrial fauna (national parks, synergetic areas, biosphere reserves), forest reserves, natural and artificial wetlands (ponds, lakes of dams, developed areas).

The overall data from the thematic studies conducted in response to the needs of this report show the following contributions of biological diversity to the national economy in 1996.

- wood: 177 394 million m³;
- big fauna: 35 species whose inventory has not been exhaustive;
- fisheries: 12 500 tons per year of which only 7 000 tons are utilised;
- forest and fruit seedlings produced in nurseries: 12 million of which only four million are planted;
- cereals: 2 963 300 tons including 129 700 tons of rice;
- peanut: 194 400 tons;
- tubers: 41 170 tons;
- fibre plants: 177 600 tons of cotton;
- livestock (bovine, ovine, caprine, pigs, asine, equine, camelidae): 18 million heads (animal breeding accounts for the equivalent of 12% of GDP and 16% of exports);
- rabbits: 67 000 heads;
- pets (dogs and cats): 900 000 heads;
- poultry: 22 million heads;
- non ligneous forest products (e.g. honey, shea kernels, neere seeds).

In addition, there is sight-seeing tourism which contributes to the national economy. In 1993 this contribution was 17 791 548 US dollars.

Some types and/or species of fauna and flora have an important economic value because of the high profitability of the products they provide. They are, for example:

- Cotton (fibre, seeds...)
- Rice (human feed);
- Tomato (human feed);
- Cowpeas (human feed);
- Sesame (oil, confectionery...);
- Corn (human and animal feed);
- Peanut (seeds, oil, drying of leaves for hay...);
- Shea-tree (kernels, wood...);
- Neere (pulps and seeds used for making soumbala...);
- Mango-tree (fruit);
- Citrus fruit (fruit);
- Cashew (nuts);
- Tamarind (tamarind);
- Soya (Soya milk, beans for making soumbala, Soya oil, cakes for animal feed...);
- Red sorghum (sorghum beer, human feed);
- Millet and white sorghum (human feed);
- Sorrel (drink, seeds, fibres, sauce);
- Medicinal plants;
- Exotic vegetable plants;
- Gum-bearing plants;
- Edible higher fungi;
- Livestock (proteins, foreign currency);
- Wild animals (proteins);
- Elephant (ivory);
- Fishes (proteins);
- Shea caterpillar (human feed).

Let us note that data figures have not been established yet for some products taken from biological diversity. This is the case, for example, of pharmacological products and a lot of non-ligneous forest products (e.g.: Most fruits picked up from spontaneous species, straw used for thatching roofs, etc.).

4. Endemism

In Burkina Faso the situation of endemism at the level of flora and fauna is not well known; Nevertheless, it was found that 23 vegetable species surveyed in Burkina Faso are endemic in West Africa.

5. Threats

As far as threats on species are concerned, few inventories have been made because of the relatively new situation of the attention paid to the various constituent components of the country's overall biological diversity.

However, it was found that losses in biological diversity are mainly due to the following threats and trends:

- bush fires and biotope destruction;
- population pressure leading to the decrease of fallow;
- Shifting cultivation and destruction of species and ecosystems;
- poverty and recourse to the satisfaction of immediate needs;
- climatic pejoration.

6. Endangered species

The number of endangered species is low, but this certainly does not correspond to reality, since research work on their identification is recent and very little. Endangered species have been numbered according to the following categories:

- mammals: 8;
- birds: 3;
- reptiles: 2;
- fishes: 1;
- trees: 15.

7. Measures in favour of the conservation of biological diversity

The measures, in force, aiming at reversing the trend hinge on regulation, Programming, planning and implementation of developmental action. The main items of these measures are:

- Structural Adjustment Programme and its sectorial components;
- National Plan of Action for the Environment (PANE);
- Strategic plan for scientific and technological research;
- Agrarian and Land Reform (RAF);
- Environmental Code;
- Forest Code;
- Water Code
- Mining Code;
- Integrated Rural Development Programme.

8. Spending on conservation of biological diversity

According to official data, the implementation of the overall measures by governmental structures during these five years (1992-1996) cost 230 579 million CFA francs (as far as annual budgets and projects within the framework of the Public Investment Programme) divided as follows: 11 433 million CFA F financed with the State's own resources, 11 181 million CFA F born by self-financing of activities and 205 966 million CFA F from external support (loans and subsidies). Besides these expenses, there is a substantial NGO financial support to the management of renewable natural resources.

The financial need of the Burkinabè State to complement its own efforts amounts to 27 056 million CFA F for all actions within the framework of PANE (1994).

9. Options of conservation of biological conservation

With regard to the present situation of biological diversity, the following general options have been put forward:

- inform and sensitise more decision-makers and actors about the need to safeguard biological diversity;
- make the whole population accountable for a good conservation and sustainable use of biological diversity;
- deepen knowledge, including local know-how about biological diversity;
- strengthen national capacities in sustainable management of biological diversity, particularly in the domain of training and appropriate infrastructures.

These options are part of State policy, which is based on decentralisation, and devolution of power from the State to decentralised territorial communities, particularly in the area of “Land Management”. Among the specific options which have been approved, the following may be listed:

- increasing the participation of the population in combating desertification;
- settling young people in their communities through the generation of employment in these environments;
- full participation of populations in decision making from bottom up (decentralisation process);
- strengthening family education;
- strengthening environmental education;
- intensification of agricultural productions;
- development of knowledge on the constituent components of biological diversity.

CHAPTER 1: INTRODUCTION

The national monograph on biological diversity represents the foundation for the development of national strategies and action plans concerning the conservation of biodiversity, the sustainable use of its constituent components and the promotion of the fair and equitable sharing of benefits arising out of the utilisation of genetic resources. Thus, the country study is a reference document, which enables to measure the actual capacities of effective management of biological resources in order to improve management approaches. Moreover, it is a didactic tool of reference. However, the country study will have to be updated as new important data on biological diversity is made available.

This study presents the natural environment of Burkina Faso, compiles the ecological, biological and economic data arising out of the country's biological resources, identifies the threats to renewable resources of the environment and, finally, puts forward the options required to reverse the negative trends on biological diversity. And to contribute to further the knowledge on biological diversity, it was necessary to deal, in the first place, with the notion of biological diversity in this study.

1.1 BIOLOGICAL DIVERSITY

The notion of biological diversity

The general public is very little familiar with the term "biological diversity". Indeed, there are many people who are wondering what biological diversity is. It was not until the end of the seventies that the notion of biological diversity began to become a concern in informed circles.

Yet, hardly time goes by without man benefiting from the good deeds of biological diversity. For example, the foods deriving from plants and animals, clothes made from cotton and silk, furniture made from wood, drugs manufactured from plant and animal extracts, etc., are good deeds from biological diversity.

The word "diversity" designates the number, the variety and variability of living organisms (OCDE, 1996. *Préserver la diversité biologique*).

The term "biology" deals with the manifestations of condition in the form of life, such as genes (from DNA to gametes), plants (from algae to baobab tree), animals (from the virus to the elephant or whale). Biology also deals with reactions to organisms, the ones with the others (eg. : heat breaks down organisms, which can lead to the birth of other lives).

Ecology deals with the living conditions of living organisms and with the relationships they establish between themselves. The result of these conditions and relationships constitutes a unique functional system known as ecosystem.

The notion of "**biological diversity**" designates the varieties and/or the variability of **genes, species and ecosystems**. Thus, the Convention on biological diversity defines "biological diversity" in Article 2 as the "*variability of living organisms of any origin, including, among others, terrestrial and marine ecosystems, and other aquatic ecosystems and the ecological complexes they belong to; this comprises the diversity within species and between species*".

Biological diversity is divided into three main components. They are :

- **Genetic diversity** : hereditary variability contained in genes (eg. : heredity related to form, size and colour of plants and animals); biotechnology, genetic improvement and the extraction of medicinal substances from plants and animals are made possible thanks to the genetic material the latter contains;
- **Diversity of species** : taxonomic differentiation of plants and animals, including micro-organisms, as well as the differentiations within species (varieties, breeds);
- **Diversity of ecosystems** : variety of ecological systems contributing to maintain forms of life (e.g. : ecosystems of forests, mountains, savannahs, marines and fresh water ecosystems).

The number of the constituent components of biological diversity known today is very little as compared with the diversity of what exists on our planet. According to scientists, only 1.7 million (OCDE , 1996 : Préserver la diversité biologique, p.20) of species are known in the world out of a total of 12 million estimated nowadays. Therefore, man totally ignores all the services that the rest of the unknown species may supply him, whereas, it has been established that man derives from biological diversity the essential part of products for his life.

1.2 BIOLOGICAL RESOURCES

The Convention distinguishes between biological diversity (see definition above) and “*biological resources*” which are *genetic resources, organisms or components of these organisms, populations, or any other biotic component of ecosystems with actual or potential use or value for humanity*. By way of illustration, the following examples can be given : millet, rice, potato, yam, shea kernel, nere seeds, crocodile, tilapia, antelope, hare, ox, hen, plant and animal varieties and breeds, forest, savannah, river, grasslands, fallows, etc. A constituent component of biological diversity (a species for example) which man ignores the use in his milieu may be a biological resource elsewhere, or become one later in the same place. This is the reason why it is necessary to safeguard all the components of biological diversity.

1.3 THE IMPORTANCE OF BIOLOGICAL DIVERSITY AND BIOLOGICAL RESOURCES

1.3.1 THE IMPORTANCE OF BIOLOGICAL DIVERSITY

Biological diversity is very important for humanity, because the survival of mankind depends on it. In general, the services supplied by biological diversity can be sub-divided into five categories :

- The production of consumer goods (food, clothes, furniture, shelter, etc.);
- The provision of medicinal products (plant and animal extracts);
- The maintenance of plant and animal life (oxygen, climate, etc.);

- Socio-cultural values (taboos, shrines, tales and folktales, customary symbols etc.);
- Other services (scientific, technological, educational, recreational and aesthetic uses, etc.).

As far as the three components of biological diversity are concerned, the following examples of services can be given :

- **genes** : their manipulation allows the development of new varieties, the increase in the quality and yield of species and the increase in the resistance of some plants and animals to diseases;
- **species** : cereals, fruits, vegetables, tubers, animal and plant proteins contribute to maintain life;
- **ecosystems** : they contribute to the regulation of the climate and the load capacity in the natural environment keep ecological balance, improve air and water quality, eliminate wastes, favour the production and reproduction of species.

In short, biological diversity is the foundation of sustainable development. The following development shows by way of illustration the importance of biological diversity for sustainable development by sector.

- Environment : regulation of water and the atmosphere, soil protection, soil enrichment;
- Agriculture :genetic material for the improvement of cultivated plants, biotechnology, keeping humidity, prevention of erosion;
- Forestry : genetic material, habitats for a great variety of species which can be exploited as forestry products;
- Livestock raising : genetic material;
- Harvesting : gathering, hunting, game ranching;
- Energy : water regulation, production of fuel wood;
- Water supply : water regulation, infiltration of rain water;
- Industry : source of genetic and biological raw materials for industrial products;
- Public health : medicinal products, climate regulation, living environment;
- Teaching and research : nature, flora, fauna, genetic material;
- Art : handicraft;
- Culture and religion : rites, cultural and religious values.

The main importance of biological diversity lies not only at the level of the supply of consumer goods, but also in terms of the varieties of these goods. Indeed, man's needs in food can be found in various products; for example starch is more concentrated in cereals, sugar is provided by sugar cane, fats are plenty in groundnuts, and vitamins are more concentrated in fruits. As a result, the diversity of food products is necessary in order to ensure a balanced diet.

Moreover, it must be underlined that biological diversity abounds with constituent components whose utility we ignore for the time being. As part of the implementation of the Convention on Biological Diversity, more efforts are being made to improve the knowledge of biological diversity, which will undoubtedly permit mankind to discover new services this invaluable capital may supply to it.

1.3.2 THE IMPORTANCE OF BIOLOGICAL RESOURCES

As defined earlier, biological resources are the products of biological diversity directly exploitable and/or profitable for man. Development depends on biological resources.

In effect, according to statistics, the economy of developing countries is based by more than 80% on biological resources, while that of developed countries is dependent on them by 45%. In order to illustrate this fact, the following examples of kinds of activities depending on biological diversity and which have obvious economic benefits may be cited : farming, market gardening, livestock raising, cash crops, gathering, timber exploitation, hunting, fishing, sight-seeing tourism, animal traction, biotechnology, the use of plant or animal substances in the pharmaceutical industry, pharmacopoeia, etc.

Moreover, biological resources are particularly important at local, national and sub-regional levels. It is an advantage when the biological resources at one's disposal permit to enjoy privileges as compared with the others. In this respect, the following examples may be retained:

- all soils, all zones or all regions are not good for the growing or raising of all species;
- most species are specific to well determined regions, zones or habitats;
- the presence of eatable plant or animal species but hardly used represents an alternative in time of famine or food shortage.

The presence and abundance of biological resources are therefore a main factor of development, particularly, for a country like Burkina Faso whose economy is based essentially on agriculture.

1.4 COUNTRY STUDIES ON BIOLOGICAL DIVERSITY

1.4.1 INTERNATIONAL CONTEXT

The Nairobi Conference of May 1992 on the adoption of measures agreed on concerning the Convention of Biological Diversity, took resolution 2, whereby it acknowledged the importance of country studies on biological diversity as part of determining priorities to develop strategies and action plans in view of the effective enforcement of the Convention. Therefore, article 6 of the Convention on Biological Diversity (CBD) makes it an obligation for each contracting Party to develop national strategies, plans or Programmes aimed at ensuring the conservation and sustainable use of biological diversity.

The object of country studies is to collect and analyse biological, economic and social data which will permit to define the framework the development of national strategies and action plans is part of (PNUE,1993).

More specifically, the country study compiles up-to-date data on the components of biological resources, and on ecosystems, assesses from rational bases the basic costs and requirements for the conservation of biological diversity and sustainable use of its constituent elements, and proposes actions in order to arrive at the effective enforcement of the terms of the Convention.

The indispensable activities for the preparation of the country study are data collection on:

- constituent components of biological diversity;
- importance of biological resources and their diversity;
- socio-economic issues;
- costs and current benefits related to biological resources;
- determination of weaknesses in terms of data;
- determination of main threats and required solutions.

At the level of existing institutions, the country study helps, therefore, to improve the definition and effective planning of actions, as well as the rational and sustainable management capacities of biological resources. It is a renewable tool, that is to say, it has to be improved periodically as the evaluation of undertaken measures are made and new data are made available.

1.4.2 NATIONAL CONTEXT

Since the big droughts of the 1970's, Burkina Faso developed strategies, action plans and Programmes destined to rehabilitate a socio-economic and ecological balance susceptible of contributing to food self-sufficiency and to permit to begin the sustainable development process.

In Burkina Faso, activities undertaken in terms of knowledge and management of biological diversity are usually isolated, so that the results deriving from them remain scattered and ignored, while the Convention on Biological Diversity stresses a reliable, concerted and global management of biological resources.

Among the main current political orientations concerning agricultural development on which the country's economy depends, there are two options directly applying to biological diversity. These are:

- the increase in productivity through the dissemination of intensive production technologies;
- the fight against the deterioration of natural resources by particularly taking required measures in land domain and by giving more responsibility to grassroots actors.

Burkina Faso ratified the Convention on Biological Diversity on September 2, 1993. This tool entered into force in December 1993. Since then, the country undertook the enforcement of the terms of this Convention, including the development of national strategies and action plans on biological diversity. Thus, the Permanent Secretariat of the National Council for the Management of the Environment (SP/CONAGESE) was established, with as main mission the promotion of the integration of the fundamental principles of the protection of the environment into the economic, social and cultural development process of Burkina Faso. Therefore, CONAGESE's permanent secretary co-ordinates and participates in the implementation of conventions and agreements related to the environment. For this purpose, a Technical Committee was set up under its aegis with the responsibility of co-ordinating actions for implementing the Convention on Biological Diversity.

With the support of the United Nations Programme for the Environment (UNPE), Burkina Faso obtained a financing from the Global Environment Facility (FEM) to undertake the

project "Élaboration de la monographie sur la diversité biologique du Burkina Faso" (Country Study of Burkina Faso's Biological Diversity). The object of this project is to collect and analyse biological, economic and social data to serve as the basis for the development of national strategies and actions, as well as sectoral plans on biological diversity.

1.4.3 DATA COLLECTION METHODOLOGY

The present report is a summary of the sectoral studies undertaken on the country study on Burkina Faso's biological diversity. It takes into account, on the one hand, UNDP's main guidelines concerning country studies on biological diversity and, on the other hand, the methodology recommended in the report of the international expert following the launching workshop of the development process of the aforesaid country study.

Information collection actually began in February 1996, the activities concerning the development of the drafting of this document started in January of the same year. Data were collected through :

- visits and discussions with officials and technicians of governmental institutions and international institutions working in the domain of the conservation and/or use of biological diversity;
- visits to Non-Governmental and private structures interested in biological diversity;
- interviews with private resource people;
- consultation of documents (books, publications, papers, activity reports, doctorate theses, study reports);
- consultation of national collections.

The collection of data was supported by studies on the following themes: socio-economy, policy and strategy concerning the environment, ethnobotanics, ligneous forestry plants, herbaceous plants, phytogenetic resources, agriculture and livestock raising, plant reproduction of domesticated species, environmental legislation, entomology, aquatic plants, wildlife, aquatic fauna, land use, ecology, microbiology, geographical information system. The list of authors, as well as the titles of reports issued, is presented in appendix 1.

This report is the summary of these studies and the related observations made by three (3) regional workshops, one (1) national workshop and resource people and competent technical services.

The data collected through the thematic studies are certainly not exhaustive because of the dispersal of information in different structures. Moreover, some data are not up-to-date (e. g.: the data about censuses are from 1991, those on migrations from 1992). However, other data collected are relatively recent; it is the case of the natural vegetation map and land use (1995).

CHApTer 2: a GENERAL SURVEY OF BURKINA FASO

2.1 HISTORY

According to the periodical edition of “ATLAS JEUNE AFRIQUE”, 1993, the country was structured and organised before the French occupation that lasted from 1896 to 1960: a supreme chief the “Mogho-Naba”, i.e. the Mossi king, ruled “The Mossi Empire of Ouagadougou”. Called Upper-Volta (because located upstream of the big river “the Volta”) after the arrival of the French, the country was divided between Mali, Niger and Côte d’Ivoire in 1932 and will not recover its autonomy and its borders until 1947. Upper-Volta became independent on August 5, 1960, and on August 4, 1984, the Republic of Upper-Volta was given the name “Burkina Faso”, which means “the Land of Honest People”.

2.2 GEOGRAPHIC SITUATION

Burkina Faso is a landlocked Sudanese and Sahelian country situated in the heart of West Africa. It is located between north of latitude $9^{\circ}20'$ and $15^{\circ}3'$, east of longitude $2^{\circ}20'$ and west of longitude $5^{\circ}3'$. With an area of 274 200 km², the country is limited in the east by Niger, in the north and north-west by Mali, in the south by Ghana, in the south-west by Côte-d’Ivoire, in the south-east by Benin and Togo (Map 1)

Map 1: Geographical situation of Burkina Faso

2.3 ADMINISTRATIVE DIVISIONS

In 1996, Burkina Faso was divided into 45 provinces, each under the leadership of one (1) Haut Commissaire (highest ranking political and administrative official of the province). The data of the present study were collected from the former administrative division, which included a total of 30 provinces. The provinces are divided into districts under the authority of prefects. Districts are sub-divided into villages led by Traditional Chiefs. The whole country has a total of 355 districts and 8 500 villages. Maps 2 and 3 respectively show the old and new division of the country into provinces.

Map 2 : Division of Burkina Faso into 30 provinces

Map 3 : Administrative division of Burkina Faso into 45 provinces

2.4 PHYSICAL ENVIRONMENT

2.4.1 CLIMATE

In general, Burkina Faso is characterised by a tropical climate of the Sudanese and Sahelian type, with two alternating seasons: a long dry season from October to April and a short rainy season from May to September. The majority of the country is situated in the climatic zone of Sudanese type, particularly the centre and the south, whereas the extreme south and the south-west are part of the Sudanese and Guinean zone. The northern part is under the influence of the Sahelian climate.

A study of climatological records covering the period from 1961-1990 (see Atlas Jeune Afrique, 1993, and Atlas Agro-climatologique des pays de la zone du CILSS) revealed that in Burkina Faso:

- temperatures are always higher than zero degree °C, no matter the time of the year;
- monthly average temperatures rarely go beyond 35 °C ;
- variations in thermal amplitude are more pronounced in the north than in the south of the country;
- the relative humidity of air is low with a high evaporative demand in the dry season which may be more than 10 mm of water a day;
- rainfall varies from 300 mm in the extreme north to 1100 mm in the extreme south and south-west;
- the rainy season begins sporadically as early as April in the south before covering all the country in June;
- the end of the rainy season occurs quickly by the end of September in the north and by the end of October in the south.

In comparison with the period from 1951 to 1960, one notices a clear decline in the average of rainwater quantities for the period 1961-1990, which falls from 400 mm to 300 mm in the north and from 1300 mm to 1100 mm in the south. Map 4 shows the present isohyets for all the country.

Map 4: Average rainfalls (period 1960-1986)**2.4.2 RELIEF**

The majority (about 75%) of the Burkinabè territory rests on Precambrian crystalline platform turning the overall relief flat. The average altitude is 400 m, while the highest altitudes range between 125 m in the south-east (Pama region) and 749 m in the south-west (Ténakourou Peak). Two main topographic domains cover the territory of the country: a large peneplain covering 3/4 of the country and a sandy massif in the south. Besides these two domains, one can notice a few specific forms of relief such as dunes, chains of hills and/or small mountains, crusted tables and a few cliffs.

2.4.3 SURFACE GEOLOGY

The main geological data collected in Burkina Faso are follows:

- the existence of a granito-gneissic platform dating from the Precambrian age which covers the majority of the country (particularly the centre and east);
- the existence of sandstone massif rich in aquifers in the west towards Mali;
- the presence of fossil sandy bars in the Sahelian region oriented from east to west;
- the presence in the Central Plateau of a Birrimian arch characterised by green rocks constituting a series of more or less pronounced reliefs breaking away from the overall monotony of the landscape.

2.4.4 HYDROGRAPHY

The country's surface water resources are estimated at 10 billion m³ per year, while ground water resources are evaluated at more than 6 billion m³ per year (OUEDRAOGO N. A., 1996).

The hydrographic network, which drains all the waters, includes three big international basins of uneven importance bearing the names of the main streams draining them (Map 5). These are :

- the Volta basin : it covers an area of 178 000 km², fed by the Mouhoun, Nakambé and Nazinon rivers, formerly called respectively Volta Noire, Volta Blanche and Volta Rouge, and covers the central part of the country;
- the Comoé basin : with an area of 1 700 km² is fed by the Comoé river and its affluents, the Léraba and Yanon and covers the south-west of the country;
- the Niger basin: with a total of 79 000 km² is fed by the affluents of River Niger in the east by the Bali, Garouol, Sirba, Gouroubi, Diamangou and the Tapoa, and in the west by the Banifing.

In general, most of the streams have a seasonal flow. There are only three perennial streams but non-navigable all year. They are: the Mouhoun, the Comoé, and the Pendjari. The following streams have a seasonal or intermittent flow: the Nazinon, the Nakambé and the Sirba. Perennial water bodies include natural lakes (Bam and Dem), the Hippopotamuses Pond, the Oursi Pond, and artificial lakes of which two, Kompienga and Bagré, are big water bodies with a marked hydroelectric vocation.

Map 5: International catchment areas**2.4.5 PHYTOGEOGRAPHY**

The phytogeographic domains take into account the vegetation and flora of the region concerned. In general, they correspond to the distribution areas of the main physiognomic types of vegetation (biomes or plant formations) recognised, as well as to the distribution areas of the main floral groups which characterise them in families or taxons (OUADBA J. M., 1997).

The main current phytogeographic features of Burkina Faso are:

- the Sahelian domain : it is arid and covers the northern part of the country with a rainfall < 600 mm;
- the Sudanese domain: it is less arid and covers the rest of the country and receives a rainfall >700 mm.

In detail, one distinguishes from north to south a sub-Saharan transition zone, a north-Sudanese zone and a south-Sudanese zone. The phytogeographic zones are divided into sectors and districts. (Map 6).

Map 6: Phytogeographic territories

2.4.6 VEGETATION

The natural vegetation of Burkina Faso has been the object of many studies. The studies by GUINKO S. (1984) "Végétation de Haute-Volta" represent a reliable reference. Recently, CNSF studies on the ecological units of the vegetation have provided further useful precisions. Finally, the most recent studies dealing with vegetation cartography and land use in Burkina Faso (FONTES J., DIALLO A., COMPAORE J. A., 1995) constitute an up-to-date source of information, which is useful for the development of the country study on biological diversity (GEOCONSEIL, 1996). Map 7 shows the natural vegetation.

2.4.6.1 Vegetation of the Sahelian domain

On the whole, it is a grassy, bushy, shrubby and thicket steppe usually quite sparse. Ligneous species may come together locally to form more or less penetrable bushes.

In the north of the fourteenth parallel, the north Sahelian sector stands out alone characterised by a batch of Saharan and Sahelian species which are found very rarely in the sectors further south. Among others, one can cite: *Acacia ehrenbergiana*, *Acacia nilotica* variety *tomentosa*, *Acacia raddiana*, *Grewia tenax*, *Leptadenia pyrotechnica*, *Maerua crassifolia*, *Salvadora persica*, for the ligneous species. This steppe includes thin riparian bars predominated by *Anogeissus leiocarpus*, *Mitragyna inermis*, *Acacia ataxacantha* and *Acacia seya* dominant.

The south Sahelian sector covers the thirteenth and fourteenth parallels. The Saharan and Sahelian based flora species enriches itself with Sudanese components. The vegetation physiognomy is always the steppe type, even if the thirteenth parallel clearly demarcates the extension limit of savannahs north. The most common ligneous species of this sector are: *Acacia laeta*, *Acacia nilotica adansonii* variety, *Acacia senegal*, *Boscia salicifolia*, *Commiphora africana*, *Dalbergia melanoxylon*, *Pterocarpus lucens* and *Grewia flavescens*. The following Sudanese and very ubiquitous species are quite well represented in this sector: *Acacia macrostachya*, *Combretum glutinosum*, *Combretum nigricans elliotii* variety. They particularly form the composition of the bushes or "spotted bushes" associated with *Pterocarpus lucens* and *Dalbergia melanoxylon*.

2.4.6.2 Vegetation of the Sudanese domain

It develops south of the thirteenth parallel. The Sudanese savannahs gradually take over the steppe formations. At the same time that the herbaceous ground cover fills out higher the ligneous species increase. From north to south, global improvement axis of hydric conditions, the physiognomy of the savannah can become in succession herbaceous, shrubby, bushy and thicket to tend eventually towards a clear forest in the extreme south-west. The densification of the herbaceous plant material favours the annual passage of fires considered as a powerful factor for the maintenance of such a formation.

Between the thirteenth and fourteenth parallels the Sudanese-north sector stands out alone. It is a very highly populated sector and the savannah shows a regular rustic landscape of park type, predominated by big trees belonging to the protected agro-forestry species such as: *Acacia albida*, *Adansonia digitata*, *Butyrospermum paradoxum* subsp. *parkii*, *Lannea microcarpa* and *Tamarindus indica*.

In the grassy stratum, the share of perennial species intensifies. In the ligneous stratum, one always notices a more important shrubby stratum where combretaceae are well represented. The most regular species are: *Acacia dudgeoni*, *Acacia gourmaensis*, *Acacia seyal*, *Bombax costatum*, *Combretum micranthum*, *Combretum glutinosum*, *Combretum nigricans*, *Grewia bicolor*, *Guiera senegalensis* and *Sterculia setigera*.

Despite their small extent, it is important to note the presence of dry pockets of dense forests constituting "sacred woods". These woods represent vestiges of ancient forest climates saved from clearing because they were protected by customary practices. They are predominated by *Anogeissus leiocarpus*, *Diospyros mespilifomis*, *Celtis integrifolia*, *Acacia pennata* and *Pterocarpus erinaceus*.

The Sudanese-south experiences the less xeric climates of Burkina Faso. It includes the densest forestry formations. GUINKO S (1984) subdivided this sector into (4) districts where a common Sudanese floral deposit is found and which are associated with Guinean riparian species such as *Cola laurifolia*, *Manilkara multinervis*, *Elaeis guineensis*, *Dialium guineense* and *Antiaris africana*. It is agreed to define this sector as that of *Isoberlinia doka*, a cesalpiniaceae characteristic of Sudanese and Guinean savannahs. A succession of ligneous, wooded or shrubby species can be associated with it. Let us cite: *Acacia polyacantha* subsp. *campylacantha*, *Acacia sieberiana*, *Anogeissus leiocarpus*, *Burkea africana*, *Daniellia oliveri*, *Khaya senegalensis*, *Parkia biglobosa*. To this non-exhaustive list must be added more Guinean species often associated with the hydrographic network.: *Carapa procera*, *Chlorophora excelsa*, *Monodora tenuifolia*, *Voacanga africana*. Map 7 shows all the types of vegetation of Burkina Faso.

Map 7: Types of vegetation (according to Fontes, Diallo et Compaoré, 1995)

2.4.7 SOILS

The soils of Burkina have been the object of many studies. But, ORSTOM and BUNASOL particularly conducted the greatest number. Thus, the entire territory of Burkina Faso was covered to 1/1500,000. These documents are important and they constitute the basis of most researches in pedology in the country today.

In a nutshell, it can be said that the national territory is covered by soils with a relatively poor level of fertility, particularly in phosphorous and nitrogen, and a limited water reserve. They suffer very acutely from the phenomenon of runoff and from hydric and wind erosion.

Pedological studies undertaken in Burkina Faso mention nine main types of soils which are as follows: raw mineral soils, hardly developed soils, vertisols, isohumic soils, brown soils, ferrallitic soils, soils with iron and manganese sesquioxide, hydromorphic soils and sodium soils or salsodium soils. The main types of soils encountered in Burkina Faso are presented in table 1.

Table 1 : Types and characteristics of soils

| Types of soils | % | Situation | Constraint | Potentialities |
|---|----|--|--|---|
| 1. Mineral Soils | 3 | Spread everywhere | Null to low agricultural interest | Grazing area |
| 2. Hardly developed soils | 26 | Spread everywhere, particularly the Poni , Sanguié and Mouhoun provinces | Coarse texture, low availability in water, poor in organic matter, N and P | Some parts are rich in Ca et Mg, terrace cultivation |
| 3. Vertisols | 6 | Provinces of Sourou, Oudalan, Sissili , Sanguié and Boulgou | Heavy in humid condition, hard in dry condition, deficit in N.P.K. | Good capacity of water retention, rich in minerals, suitable for the cultivation of maize, sorghum, millet, cotton and rice |
| 4. Isohumic soils | - | Sourou, and Oudalan provinces (in fixed ergs and depressions) | Mediocre physical property, low availability of water, low content in N.P.K. | Good capacity of water retention, high mineral resources, suitable for the cultivation of cotton, maize and rice |
| 5. Brown soils | 6 | west, south-west and centre of the country | Possible case of hygromorphy | Quite good mineral resources, food crops, cotton and sugar cane |
| 6. Soils with iron and manganese sesquioxides | 39 | Widely spread | Massive structure of induration, low content of nutrients | Cultivation of cereals, leguminous plants and arboriculture |
| 7. Ferrallitic Soils | 2 | Provinces of Houet, KénéDougou, Comoé and Mouhoun (Bondokuy) | Low water reserve, poor in Mo, N, P and exchangeable bases, contains exchangeable Al | Cultivation of millet and leguminous plants and arboriculture |
| 8. Sodium or Salsodium Soils | 5. | Centre-south, centre-north and east regions | Massive structure, tendency toward alkalisation | Cultivation of cereals and cash crops after improvement |
| 9. Hydromorphic Soils | 13 | Along rivers and streams | Hydromorphy | Cultivation of sorghum, (rainfed) and out of season crops |

Al: aluminium; N: nitrogen; P: Phosphorous; K: potassium; M: molybdenum, M: magnesium

2.4.8 ROAD INFRASTRUCTURES

Burkina Faso now owns a road network of 12 506 km of which 726 are tarred. Table 2 below presents the situation of road infrastructures classified according to category and region.

Table 2: Road infrastructures classified according to category and region

| Classified region | Category of roads in km | | | | |
|-------------------|-------------------------|--------------|----------------|--------------|---------------|
| | National | Regional | District | Unclassified | Total |
| Ouagadougou | 912.8 | 135 | 361.9 | 101.9 | 1 511.6 |
| Bobo-Dioulasso | 864 | 429 | 632 | 123 | 2 048 |
| Ouahigouya | 600.4 | 428.2 | 75.2 | 112 | 1 215.8 |
| Fada N’Gourma | 694.8 | 216 | 424 | 170 | 1 504.8 |
| Dédougou | 660.4 | 306 | 770.1 | None | 1 736.5 |
| Dori | 104.6 | 513.2 | 226 | None | 843.8 |
| Léo | 361.4 | 313.6 | 130.1 | 80.4 | 885.5 |
| Gaoua | 512 | 58 | 325 | 315 | 1 210 |
| Kaya | 418.2 | 292.6 | 42.5 | None | 753.3 |
| Tenkodogo | 481.5 | 290.1 | 25 | None | 796.6 |
| Total | 5 610.1 | 2 982 | 3 011.8 | 902.3 | 12 506 |

Map 8 Communications

2.5 HUMAN ENVIRONMENT

In Burkina Faso, the determining human factors can be summarised in the following terms: high population growth, irregular distribution of population density with high rates in some parts of the country; the highest rates are found in the provinces of Kadiogo, Houet, Kouritenga, Oubritenga, Yatenga, Comoé, etc. Burkina Faso is subject to important internal and external population migrations. The population is characterised by an important ethnic diversity (sixty in total) and an important inter-mixing.

2.5.1 POPULATION DISTRIBUTION

The population of Burkina Faso is 9 190 000 inhabitants according to the population census conducted in 1991 (OUEDRAOGO N. A., 1997), with an annual growth rate of 2.63%. The resident population in 1985 was 7 964 705 inhabitants. Compared with that of 1991, it increased by 15% in six (6) years. Considering the importance of the Burkinabè community living abroad (more than 2 million), we can infer that the country comprises more than 10 000 000 inhabitants.

According to the Atlas Jeune Afrique, the distribution of the Burkinabè population shows some disparities ranging from 11 inhabitants per km² (provinces of Oudalan, Gourma, Tapoa) to 122 inhabitants per km² (province of Kouritenga). The average density for all the country is 33 inhabitants per km². However, the centre of the country called the Mossi land experiences a high population concentration, which led to an overexploitation of natural resources resulting in the degradation of the environment and a loss of biological diversity. The main big urban centres are : Ouagadougou, Bobo-Dioulasso, Ouahigouya, Koudougou, Banfora. Map 9 below gives an idea about the distribution of the population. The State is trying to solve the population problem through a family education Programme.

Map 9: Population density according to district per km² (INSD, 1985. Census)

2.5.2 ETHNIC GROUPS

In Burkina Faso, there are about sixty coexisting ethnic groups predominated by the Mossi, Fulani and Bobo-Dioula ethnic groups. The main economic activity of the Fulani is livestock raising, while the majority of the rest of the peasant population constitutes farmers. But more and more we are experiencing a combination of both activities by the former as well as the latter because of the climatic variations. Table 3 shows the distribution of the main ethnic groups according to their importance in percentage of the total population. Three national languages are widely spoken in the country. They are in rank of order the More, Dilua and Fulfuldé (Fulani) languages

Table 32: Principal ethnic groups of Burkina Faso

| Ethnic groups | % |
|---------------|-----|
| Mossi | 48% |
| Fulani | 10% |
| Lobi | 7% |
| Samo | 7% |
| Bobo | 7% |
| Sénoufo | 6% |
| Gourounssi | 5% |
| Gourmantché | 5% |
| Bissa | 5% |

Source: J.J. Kessler et C. Geerling, 1994

2.5.3 MIGRATIONS

The population of Burkina Faso experiences an important migration at both internal and external levels. The average ratio between internal and external migrations is as follows: out 100 migrant people, 71.2 % migrate inside the country and 28.8% abroad.

External migrations occur towards those countries where labour demand is high. It is actually difficult to give precise figures of Burkinabès living abroad.

Internal migrations occur towards both urban centres (rural exodus) in search of employment and from some rural areas towards other areas that are relatively prosperous for agricultural activities (rural migrations).

Rural migrations occur as follows:

- individual or collective departures occurring from usually infertile and overpopulated regions (e. g. : the central plateau or Mossi land) towards more fertile and hardly exploited areas; the main host provinces are those of Houet, Mouhoun, Gourma, Tapoa, Kossi and Sissili;
- spontaneous departures towards places where there are real possibilities of earning more substantial incomes (e. g. : gold sites), noticed in the provinces of Sanmatenga, Passoré, Séno and Soum;
- State organised migrations towards areas developed for agricultural exploitation; they concern the developed plain of the Sourou province and the plain of the Kompienga and Bagré dam and the Kou valley.

The settlement of populations in these areas is anarchic. However, as far as organised migrations are concerned, the National Office in charge of Land Development (ONAT) is trying to organise the settlement of migrants.

The growth rates of migrations in host provinces between 1975 and 1985 were as follows : 88% for the Houet province, 44% for Mouhoun, 73% for the Tapoa, 64% for the Kossi and 106% for the Sissili (J.J. Kessler et C. Geerling, 1994).

2.5.4 LAND TENURE SYSTEM

According to OUEDRAOGO N., 1997, three land systems which coexisted in Burkina Faso can be distinguished. They are as follows: customary land system, colonial land system and post-colonial land system.

2.5.4.1 The customary land system

The customary land system is almost the same everywhere in Burkina Faso. It is based on the collective ownership of land. The collective ownership of land is exercised by the land custodian (known as Tengsoba for the Mossi, Tarfolo for the Sénoufo, Susunnbaso tinibaso for the Bwaba etc. (OUEDRAOGO S. 1993). In all customs the land custodian is the closest descendant of the first settler. In this capacity, he administers the land patrimony of the group in the interest of all the community. He distributes land or he authorises land use, following the indispensable rites, by households and individuals that require it and in accordance with

their needs. Thus, the applicant acquires a user right, which must not be mistaken for ownership right in the Western sense of the term. However, after the death of the applicant his heirs will settle and exploit the same land without the land custodian intervening anew. This land is available for the whole community for any possible use in case no heir claims it. Land is given provisionally to strangers (non-natives) even if this provision may be permanent. Therefore the right accorded to the stranger is precarious, hence the notion of land insecurity for migrants. In this case, land is simply lent, often following royalties in kind or performances of various services. Security imperatives require that the applicant be first socially integrated. However, except in rare cases, land cannot be refused to an applicant according customary law. Therefore the customary land system is complex in practice.

At the economic and social levels, it must be acknowledged that the customary land system, with all its utilisation nuances, opposes creative investments or dissuades them through the almost permanent insecurity as far as individual use is concerned. In this system, land is not given to those who have the necessary means to develop it, but to those who won the confidence of the owning social group, and what is more, on a provisional basis.

2.5.4.2 The colonial land system

This system is essentially based on private ownership while making provision for a public estate. Private estate is acquired through purchase, exchange, gifts or legacies, etc. Public estate is made up of natural properties such as hills, rivers, natural or artificial lakes (roads, artificial water bodies, etc.). This system was resisted to by the customary land system.

2.5.4.3 The post-colonial land system

The land system in force now is based on the agrarian and land reform (RAF), adopted in 1984, which grants user rights to individuals and moral entities.

It makes provision for a national land including all the lands within the borders of Burkina Faso, no matter their former status or legal systems. State property is inalienable, unseizable and imprescriptible. In addition to ownership right, the State assigned itself that of management. In this way, it defines rights for groups and individuals. It should be pointed out that the settlement and exploitation of rural lands by peasants for subsistence are free.

The RAF so designed shatters the mystic aura of land and takes away from peasants their references and customary value systems by leading them to practise new farming techniques (protection and restoration of soils, fertilisation, etc.). This law particularly aimed at making land available to those willing to develop it, and at organising the rational management of this resource which has become in the end scarce in Burkina Faso.

Therefore, this land system aims at favouring the development of productive agricultural forces. However, it does not encourage populations to make sustainable investments and a lot of resistance to its enforcement can be noticed.

2.6 AGRICULTURAL REGIONS AND PRODUCTION SYSTEMS

Many regional divisions of Burkina Faso were made by the technical services of ministerial departments (MARA, MEE, MAT...) following precise specific objectives. The agricultural zones described here are those determined by INERA.

2.6.1 THE NOTHERN REGION: THE SAHEL

It covers the majority of the Burkinabè Sahel and includes the Sahel provinces of Oudalan and Soum. It is the driest region of the country. The rainy season, which lasts approximately three months extends from June to September. Rains are erratic and the total rainfall in a year is hardly more than 600 mm. Evapotranspiration there is very high and is combined with high amplitudes of temperatures during the day and at night.

By tradition, it is a livestock zone. Millet is the main crop, while white sorghum comes second. There are almost no rotation crops. Fallowing decisions are dependent on the displacement of animal habitat or penning (KAFANDO P., 1995). Night penning of animals on plots after harvests constitutes the main form of soil fertilisation. The inputs of chemical fertiliser are negligible. Animal traction, which has been introduced by vulgarisation agents, is not yet generalised. However, in the Soum there are a few hitches with donkeys and camels. Usually agricultural work is manual in this region where the margin of manoeuvre of producers is narrow as far as the choice of cropping and production system is concerned.

2.6.2 THE CENTRAL REGION

It covers the following provinces: Sanmatenga, Namentenga, Oubritenga, Boulkiemdé, Sanguié, Kadiogo, Ganzourgou, Bazèga, Zoundwégo, Sissili and Nahouri. It extends to almost all the central plateau, with an annual rainfall ranging from 600 mm in the north to 900 mm in the south. Unequally distributed, rains spread over 4 to 6 months. Agriculture in this region is mainly rain fed.

Due to its high population density, this region experiences serious problems of environmental degradation resulting from the overexploitation of its meagre resources. The population pressure in the centre is such that there is practically almost no fallow anymore. Therefore, soil fertility is not restored, accelerating in this way its degradation and aggravating the adverse effects of wind and hydric erosion. The inputs of fertilisers to make up for and restore crop exploitations are weak. This system of land use gradually leads to soil depletion, hence the notion of land overexploitation

Farming systems in the regions are based on cereals like in the east. Sorghum and millet come first, i.e. about 80 % acreage, followed by groundnuts and quite far behind maize.

The introduction of animal traction dates back from the 1960's. In general, the use of traction equipment is limited to ploughing before planting, particularly for cash crops (groundnuts and cotton). It cannot be said that animal traction is a characteristic of this region as most farming activities are still done manually. Local varieties of sorghum and millet are still preponderant. Recourse to improved seeds concerns only groundnut and rice.

As a result of the many water bodies in the central regions, market gardening is developing. Since it is an out of season activity, producers have the opportunity to get to work and increase their incomes.

2.6.3 THE NORTH-WESTERN REGION

It includes the provinces of Bam, Passoré, Yatenga and Sourou. This region is characterised by a rainfall, which varies between 600 mm in the north to 800 mm in the south. The dominant economic activity is livestock raising, with, however, animal numbers less than those of the Sahel and the central regions. But the degradation of the climatic conditions obliged producers to adapt themselves. In this sense farming systems in this region are now based on the couple millet-sorghum (white). Groundnut comes in third position. Pedo-climatic conditions offer producers of this region little choice in terms of crop diversification. Croplands are lacking and they are continuously used under rotations: millet-sorghum-groundnut. However, it can be noticed that farmers are making efforts to overcome this hostility of nature. It is one of the regions, where the use of organic manure (animal manure and excreta), in association with the use of straw, is quite common. In provinces such Yatenga and Passoré, the Zaï (improved traditional technique) is used to restore deteriorated land. Although the introduction of animal traction goes as far as the beginning of independence (BDPA and SATEC intervention), this practice is also constrained for many reasons : soil fragility, high costs, maintenance of draught animals. As a result, farming activities still remain manual. In the north-western region, it is worth noticing the existence of the Sourou valley, which provides great opportunities for the cultivation of irrigated rice, maize and market gardening. With irrigation, producers undertake two campaigns of rice and earn substantial incomes. It must be noticed that in the irrigated areas, agricultural intensification techniques are used.

2.6.4 THE EASTERN REGION

It covers the provinces of Boulgou, Kouritenga, Gourma, Gnagna and Tapoa. Some provinces (Gourma, and Tapoa) in this region are the least populated and thus the least deteriorated in Burkina Faso. The annual rainfall varies between 600 mm and 900 mm. It shelters the country's big fauna reserves. It is considered as a cereal producing region. Farming systems there are characterised by the predominance of sorghum and millet in rotations. Groundnut comes next. In recent years, the penetration of cash crops such as cotton has been noticed thanks to political incentives.

2.6.5 THE WESTERN REGION

It covers the provinces of Kossi, Mouhoun, Houet, Kéné Dougou, Bougouriba, Comoé and Poni.

The rainfall is in the range of 900 mm and 1100 mm. It constitutes the region with the best agricultural potential. Maize is the main food crop. The growing of rain-fed rice is also developed. It is the chosen zone for the main industrial and cash crops (sugar cane and cotton).

The western region is also that of yams. Mainly cultivated in the Comoé and Poni provinces, the position of yam is relatively important in the farming system. Its cultivation demands rich

soils, hence the need to clear new plots as fields become poor. It is a destruction factor of biological diversity.

The western region, no matter what is said, is the region where the modernisation of agriculture is fast (use of improved seeds and grain drills, mechanical ploughing and weeding, treatment with insecticides). In addition to the large adoption of animal traction, favoured by the cultivation of cotton, an experiment of mechanisation occurred thanks to the financial facilities provided by cotton cultivation. This intensification of agriculture is limited in the short term by the fragility of soils whose fertility conservation is not guaranteed. The low rate of organic matter in the soil and the need to restore soil depletion constitutes challenges for most producers in the region despite their satisfactory technical level.

In this region, fallowing is a practice still in force, because of the relative availability of lands. But the land pressure, which is growing with the flow of migrants, tends to make it disappear.

2.7 INSTITUTIONS INVOLVED THE MANAGEMENT OF BIOLOGICAL RESOURCES

Many national and international institutions are stakeholders in the management of biological resources in Burkina Faso. First, there are, at the national level, ministerial departments and their decentralised agencies with technical, leadership and organisational roles in the field, but also many integrated rural development NGOs, Programmes and projects and, second, at the international level donors and research and development institutions.

2.7.1 STATE OWNED INSTITUTIONS

2.7.1.1 The two ministries in charge respectively of agriculture and animal resources

These two ministries undertake resources management activities through their 12 decentralised agencies constituted by the Regional Centres for the Promotion Agro-pastoral Activities (CRPA) involved in the field with Agricultural Provincial Services (SPA) or Provincial Services of Animal Resources (SPRA).

Similarly, many autonomous Programmes and projects are implemented through the above-mentioned ministries. As far as these Programmes are concerned, one can mention, National Land Management Programme (PNGT), Agricultural Sector Sectoral Adjustment Programme (PASA), etc. The main realised or on-going projects are: PDRI/HKM, the CES/AGF special Programme in the central plateau, the SOUM livestock project, NOUHAO, PATECORE, PDRI/TAPOA and PDRIZORGHO, the NAHOURI Local Development Project, etc.

2.7.1.2 Ministry in charge of Environment and Water

This ministry is the institutional guarantor for the conservation and sustainable use of renewable natural resources. It is particularly involved with environment, forestry and water domains.

As far as forests are concerned, intervention is mainly done by :

- central agencies, particularly the Permanent Secretariat of the National Council for the Management of the Environment, the Forestry Service and its central technical departments, the General Headquarters of the Protection of the Environment and the National Centre of Forestry Seeds;
- Regional Departments of the Environment and Forestry whose number is ten (10) with 45 Provincial Services for the Environment and Forestry (SPEEF).

Activities undertaken are part of plans, Programmes and projects such, as the National Action Plan for the Environment (PANE), or “National Action 21”, the National Action Plan for Desertification Control (PNLCD), the Burkinabè Sahel Programme, the Cartographic Tools Project for the Management of the Environment, the Participatory Management Project of Natural and Wildlife Resources, the Biological Diversity Integrated Project of Game Ranching Systems (GEF/Nazinga Project), etc.

In water domain, intervention is made through:

- General Headquarters of Hydraulics and its central technical services;
- ten (10) Regional Water Departments (DRE) whose teams work towards the mobilisation of water resources in order to meet consumption or irrigation needs.

In addition, there are autonomous projects and attached services such:

- the National Office of Wells and Boreholes (ONPF) and the National Office of Dams and Hydro-agricultural Development (ONBAH) undertaking the realisation of water points and the construction of dams in favour of hydraulics, support measures for natural resources management actions and irrigated agriculture;
- the Kompienga Contracting Authority and the Bagré Contracting authority which are responsible for the development and hydroelectric exploitation of the water bodies concerned;
- the Ziga Contracting Authority which has been working for the realisation of a water body which must supply the city of Ouagadougou;
- the Water and Rural Equipment Fund (FEER) financing CES/DRS actions;
- the Water and Sanitation National Office.

2.7.1.3 Ministry of Secondary, Higher Education and Scientific Research.

Actions undertaken by this ministerial department in the domain of natural resources management and production systems deal mainly with research. The institutions in charge of research Programmes are as follows :

- Rural Development Institute (IDR);
- Health Science Research Institute;
- The Faculty of Economics and Management of the University of Ouagadougou (FASEG);
- The Environmental and Agricultural Research Institute (IN.E.R.A.);
- Institute of Societal Sciences (I.S.S.);
- The Faculty of Sciences and Techniques (FAST);
- Research Institute of Applied and Technological Sciences (IRSAT).

Actions are undertaken through plans and Programmes such as the Research Strategic Plan, Programmes of Natural Resources Management Programmes and Production Systems Programmes, Animal Production, Annual Plant Production, Forestry Production, etc.

2.7.1.4 Ministry in charge of Infrastructures, Housing and Urbanisation

The agencies of this ministry involved with the management of natural resources and production system are three:

- the Department of town planning;
- the Department of Road infrastructures;
- the Geographical Institute of Burkina (IGB);

2.7.1.5 Ministry of transport and Tourism

The agencies involved in actions of natural resources management and production system are:

- the National Department of Meteorology (D.M.N.);
- the Department in charge of tourism.

2.7.1.6 Ministry of Health

The contribution of this ministry deals with the rational exploitation of medicinal products from flora and fauna. A technical agency, the Department of pharmaceutical services has been assigned this mission.

2.7.1.7 Ministry of Trade and Handicraft

At the level of this ministry, it is mainly the National Commission in charge of Prices which contributes in the domain of the use of biological diversity products. In addition, the Department of Industrial Development, and the Departments of Trade and Economic Affairs Inspection are the most involved in actions in the domain of natural resources and production system particularly concerning :

- the development and implementation of commercialisation strategies for agricultural commodities and animal export;
- the development and enforcement of regulations in terms of quality and standard;
- the main agencies involved with the management of renewable natural resources are :
 - the Mining Department;
 - the Burkina National Electricity company (SONABEL).

2.7.1.8 Ministry of finance.

One (1) institution from this ministerial department, particularly the customs service, is involved with the control of the export of biodiversity products.

2.7.1.9 Ministry in charge the administration of the territory

At this level, the provincial and departmental administrative services are involved.

2.7.2 NON-GOVERNMENTAL ORGANISATIONS AND ASSOCIATIONS

Many NGOs finance and/or undertake activities within the framework of the management of natural resources in Burkina Faso. In general, their approach is based on the full participation of communities and on techniques applicable by the latter. Among these NGOs, there are:

- OXFAM which finances and implements, in collaboration with CRPAs, the Agroforestry Project (PAF) in migrants' home zones ;
- Agro-Ecology Project (PAE) which in fact is financed by German NGOs working in collaboration with CRPAs from migrants' home zones;
- Paul II Foundation for the Sahel;
- Nature's Friends Foundation (NATURAMA);
- EURO-ACTION ACCORD, donor of the "soils protection and restoration" project in the north;
- Federation of National Unions of Naam Groups (F.U.N.G.N.);
- Associations of Burkina Hunters;
- Associations of Tradi-practitioners;

2.7.3 TRADITIONAL INSTITUTIONS

In Burkina Faso, there is practically a customary right over lands, represented by "Land Custodians" and consequently, over biological resources contained in these lands. Thus, land custodians are the traditional guarantors of the management of biological resources.

2.7.4 SUB-REGIOANAL AND INTERNATIONAL INSTITUTIONS CONCERNED WITH OR INTERESTED IN NATURAL RESOURCES MANAGEMENT PROGRAMMES AND PRODUCTION SYSTEMS

2.7.4.1 Donors

Among the donors, the following may be listed:

- The United Nations Development Programme (UNDP);
- The United Nations Environment Programme (UNEP);
- The United Nations Food and Agriculture Organisation (FAO);
- The United Nations Capital Development Fund (UNCDF);
- The World Food Programme (WFP)

- The European Union;
- The International Fund for Agricultural Development (IFAD);
- The United Nations Sudano-Sahelian Office (UNSO);
- The United States Agency for International Development (USAID);
- The World Bank (WB);
- The French Development Fund;
- The African Development Bank (ADB);
- The West African Development Bank (WADB);
- Bilateral co-operations (e.g. : Canadian Agency for International Development, Swiss Cooperation, Dutch Cooperation)
- etc.

2.7.4.2 Sub-regional and international Institutions and/or organisations

The sub-regional and international institutions involved in the management of biological resources and production system are :

ⁱCILSS, CIEH, ICRAF, ICRISAT, IITA, CRTO, IPD/AOS, OCCGE, Antenne Sahélienne, ORSTOM, CIRAD, UICN, etc.

2.8 LEGAL REGULATIONS FOR THE CONSERVATION AND SUSTAINABLE USE OF BIOLOGICAL DIVERSITY

The sustainable management of species and populations has always been a concern in Burkina Faso. In order to attain these objectives, legislative and regulatory measures have been taken in favour of both species and natural formations and the country's development. However, a lot of measures are now confronted with enforcement difficulties.

2.8.1 LEGAL ENVIRONMENTAL INSTRUMENTS IN FORCE

In this domain, two frameworks are concerned: the national framework and the international framework.

2.8.1.1 National framework

The instruments approved in this framework are constitutional, legislative and regulatory

2.8.1.1.1 The constitutional instruments

The Burkinabè Constitution of the fourth Republic approved on June 2, 1991 accords a special importance to the protection and management of the environment. It makes many provisions for this purpose.

First, the preamble, which is part and parcel of the constitution, asserts the increased consciousness of the population as far environmental issues are concerned. This awareness of the population of the need to protect the environment was the result of a collective start supported by an inflexible political will.

In addition to the preamble, the protection of the environment constitutes the object of two other provisions of the Constitution. First, there is Article 14 which confers the status of national patrimony upon national resources. In other words, it is the inalienability of these natural resources, at the detriment of the local populations, which is underscored.

As for Article 29, it establishes among human fundamental rights the right to a healthy environment. This measure specifies the State's duty towards citizens, but also towards future generations for which it is our responsibility to bequeath a natural patrimony in an acceptable condition, i.e., which does not jeopardise their chance of survival.

Article 101 of the constitution, concerned with the distribution of legislative and regulatory competencies, deals with the environment. It includes the protection of the environment in matters where the law fixes the fundamental principles.

This establishment of the constitutional value of the protection of the environment is all the more reinforced since it is the only Burkinabè constitutional measure which specifies that the protection of the environment is considered as a State obligation.

2.8.1.1.2 Legislative and regulatory instruments

Burkina Faso has at its disposal a legislation and regulations covering all the aspects of environmental protection and promotion. In a specific way, these legal provisions apply to land, forestry, wildlife, fishery, water, agricultural and livestock systems. For example, the following measures, which directly apply to biological diversity, may be quoted:

- Agrarian and Land Reform;
- Environment Code;
- Forestry Code;
- Mining Code;
- Water Code;
- Signature and ratification of many international treaties, conventions and agreements concerning the management of biological diversity resources;
- Traditional and customary regulations (traditional hunting and fishing, sacred woods, taboos).

The exhaustive list of legislative and regulatory instruments having an impact on biological diversity may be consulted in the document entitled “Élaboration d’une monographie nationale sur la diversité biologique : Étude juridique” (Development of a Country Study on Biological Diversity: Legal Study), a study conducted as part of this monograph. Table 4 shows the quantitative situation of regulatory laws and texts, while table 5 is a caption of legal instruments according to domain of competencies.

Table 4: List of legislative and regulatory texts on the environment

| Laws and texts | Quantitative situation |
|----------------|------------------------|
| Laws | 22 |
| Decrees | 92 |
| Orders | 226 |
| Circulars | 4 |

Table 3: Summary of legal instruments in force in Burkina Faso.

| Domain of competence | Number of instruments | Impact |
|---------------------------|-----------------------|----------|
| Environment | 74 | Direct |
| Forests | 78 | Direct |
| Wildlife | 31 | Direct |
| Fishery | 6 | Direct |
| Water | 10 | Direct |
| Agriculture and livestock | 106 | Direct |
| Land | 4 | Indirect |
| Health | 39 | Indirect |
| Wastes and pollution | 8 | Direct |
| Inflammable products | 15 | Indirect |

2.8.1.2 International Framework

Following the other countries of the international community, Burkina Faso subscribed to a number of intentional commitments of which the following impact on the domain of biological diversity:

- The Convention on wetland of international importance, particularly as Wildlife Habitat (Ramsar, 1971), intended to harness now and in the future the gradual encroachment upon wetlands by recognising their fundamental ecological functions and their economic, cultural, scientific and tourist values;
- The Convention concerning the protection of World Cultural and Natural Patrimony (Paris, 1972) which institutes a collective system for the protection of outstanding sites of cultural and natural heritage;
- The Convention on International Trade in Endangered Species of Wild Flora and Fauna [CITES (Washington, 1973)]. It protects endangered species by controlling trade in dead or live animals through a license system;

- The Convention on the Conservation of Migratory Species of Wild Animals (Bonn, 1979) which protects wildlife species migrating across international borders by facilitating international agreements;
- The Berne Convention on the Conservation of Wildlife and their Natural Habitats;
- The Convention on Biological Diversity aiming at the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the exploitation of genetic resources;
- The Convention Framework on Climatic Changes whose objective is to stabilise green house gas concentration in the atmosphere at a level which prevents any dangerous disruption of the climatic system by man;
- The United Nations Convention on desertification control in countries seriously affected by drought and/or desertification, particularly in Africa; its objective is to fight against desertification and to mitigate the effects of drought.

CHAPler 3 : current status of biological DIVERSITY in BURKINA FASO

In Burkina Faso, biological diversity has been the object of various human and climatic threats.

Man's destructive action on biological diversity is mainly translated into bush fires, shifting cultivation, population pressure, overgrazing and overexploitation of biological resources. To these man-made factors must be added the effect of successive droughts since 1970. The combination of these two main factors leads to the degradation of biological diversity. The immediate consequences of these facts are the loss of biological diversity and the erosion of ecosystems. In Burkina Faso, the degradation of biological diversity is more perceptible in the north-Sudanese and Sahelian zones.

3.1 TAXONOMIC INVENTORY

The biological diversity of Burkina Faso is not well known in spite of the inventories made since the colonial period until today, because very few systematic inventories were made. However, the studies undertaken as part of the present monograph constitute pertinent references and bring out an appreciable biological richness. The total number of recorded species is 3 992 as far as macro-organisms are concerned, apart from micro-organisms for which few researches have been conducted. The following development deals with the summary situation of the knowledge on the taxonomy of the families, genera and species of the components of biological diversity. The details of this taxonomy are part of the document entitled "**Annexe de la monographie nationale sur la diversité biologique du Burkina Faso**" [Appendix of the Country Study on Biological Diversity in Burkina Faso].

3.1.1 ANIMAL KINGDOM (FAUNA)

The animal kingdom includes micro-organisms, aquatic and terrestrial insects, terrestrial, aquatic, wild and domestic vertebrates, and invertebrates.

3.1.1.1 micro-organisms

Micro-organisms are ubiquitous, i.e. they are present in almost all milieux, contrary to higher organisms whose distribution in the biosphere is more dependent on climatic zones (TRAORE A., 1997).

Burkina Faso, as a result of its geographical situation meets the minimal conditions in order to shelter most of the micro-organisms recorded in the world up to now. Indeed, according to TRAORE A, 1997, many micro-organisms have been identified from samples of Burkina Faso soils or plants. Therefore, and for practical reasons, the documents under-describe the main groups of micro-organisms known today, even if their study has not been systematically undertaken in Burkina Faso. In the absence of their detailed description, the report lays emphasis on family and genera taxonomy.

3.1.1.1.1 Viruses

Viruses are parasites infecting insects, plants, vertebrates, invertebrates and bacteria. Often, their ultimate effect is the destruction of their host. Table 6 shows the inventory of viruses recorded in the world and which might be found in Burkina Faso.

Table 6: Family and genera number recorded according to virus categories.

| Virus Categories | Parasite viruses of vertebrates and others | Parasite viruses of plants | Parasite viruses of invertebrates | Parasite viruses of bacteria | Total |
|------------------|--|----------------------------|-----------------------------------|------------------------------|-------|
| Family number | 14 | 3 | 7 | 9 | 33 |
| Genera number | 31 | 22 | 19 | 12 | 84 |

Source : TRAORE A, 1997

3.1.1.1.2 Fungi and moulds

This group of micro-organisms includes fungi, yeasts and moulds. According to TRAORE A., 1997, there are 113 genera of fungi and moulds divided into 18 families.

3.1.1.1.3 Bacteria

Bacteria are metabolically very active despite their small size. They play a remarkable role in the bio-fertilisation, bio-energy and bio-protection reactions of the environment. For this reason, it is important to provide as detailed as possible taxonomic classification for them. On the basis of the structure of their wall or membrane, bacteria are classified into four main groups:

- gracilicutes or gram-negative bacteria;
- firmicutes or gram-positive bacteria;
- tenericutes or bacteria without wall;
- mendosicutes or bacteria with a very variable composition wall.

The summary of their taxonomic inventory is presented in the table below:

Table 7: Family and genera number according to recorded bacteria

| Group of bacteria | Gracilicutes or gram-negative bacteria | Firmicutes or gram-positive bacteria | Tenericutes or bacteria without wall | Mendosicutes or bacteria with a very variable composition wall | Total |
|-------------------|--|--------------------------------------|--------------------------------------|--|-------|
| Family number | 54 | 14 | 3 | 12 | 83 |
| Genera number | 289 | 87 | 7 | 30 | 413 |

Source: TRAORE A., 1997

3.1.1.2 Insects

Insects comprise the largest numbers of species in the animal kingdom. However, the situation of knowledge in Burkina Faso of insect diversity is relatively weak as compared with their population. The entomological fauna of Burkina Faso is still not well known. For out of an estimate of 30 000 species, only 1515 species have been recorded in known documents of reference collections. Species of insects from some orders such as Hemenopterans have not yet been the object of an inventory (e.g.; bees, wasps). In addition, the geographical distribution of the various species has not yet been made.

The following taxonomic caption of Table 8 shows the quantitative situation of the knowledge of recognised entomological fauna in Burkina Faso.

Table 8: Quantitative situation of recognised entomological fauna in Burkina Faso

| Identification | Orders | Families | Genera | Species |
|----------------|--------|----------|--------|---------|
| Quantity | 22 | 151 | 250 | 1515 |

Source: OUEDRAOGO P, 1996, TRAORE C. A. et ZIGANI S. N., 1996.

3.1.1.3 Fauna

This sub-chapter deals purely with aquatic animals (except insects), those dependent on aquatic milieu (batrachians, reptiles, birds), terrestrial wild fauna and domestic fauna.

3.1.1.3.1 Aquatic fauna

The taxonomic inventories made on aquatic fauna results in the figures shown in table 9.

Table 9: Summary of the taxonomic situation of aquatic fauna

| Taxons | Families | Genera | Species |
|--------------|-----------|------------|------------|
| Fishes | 24 | 57 | 118 |
| Batrachians | 5 | 16 | 30 |
| Molluscs | 10 | 13 | 28 |
| Crustaceans | 5 | 7 | 6 |
| Zooplanktons | 10 | 13 | 16 |
| Total | 54 | 106 | 198 |

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

3.1.1.3.2 Terrestrial wild fauna

Vertebrate classes dealt with in this chapter are those of mammals, birds and reptiles. The situation of wild fauna is relatively well known, even if there is still much to do as far as field prospection is concerned. Table 10 shows the situation of the taxonomic knowledge of this fauna.

Table 10 : Summary of the taxonomic inventory of terrestrial wild fauna

| Classes | Orders | Families | Genera | Species |
|--------------|-----------|------------|------------|------------|
| Mammals | 11 | 33 | 77 | 128 |
| Birds | 20 | 76 | 246 | 477 |
| Reptiles | 4 | 10 | 39 | 60 |
| Total | 35 | 119 | 362 | 665 |

Source: OUEDRAOGO L. et KAFANDO P., 1996

3.1.1.3.3 Domestic fauna

Domestic fauna is not abundant species because producers are seeking an important qualitative and quantitative yield of this fauna rather than variability. The taxonomic study of domestic fauna is summarised in the following table:

Table 11 : Summary of the taxonomic study on domestic fauna

| Identification | Families | Genera | Species |
|----------------|-----------|-----------|-----------|
| Mammals | 7 | 9 | 11 |
| Birds | 4 | 5 | 5 |
| Total | 11 | 14 | 16 |

Source : SANA O., 1997

3.1.2 PLANT KINGDOM (FLORA)

The flora is constituted of forestry, agricultural, food garden, industrial, medicinal, fodder, ornamental plants, etc. The study of the plant kingdom dealt with aquatic flora and terrestrial flora.

3.1.2.1 Aquatic flora

Very few inventories of Burkina Faso aquatic plants have been made. Indeed, of the country's 1 300 water bodies, only 5 have benefited from a micro-flora taxonomic inventory, and hardly fifty have been studied from the viewpoint of herbaceous flora of aquatic milieux (OUEDRAOGO R. L., 1996).

3.1.2.1.1 Aquatic micro-flora

Taxonomic inventories of the aquatic flora at the level of n°2 and n°3 dams of Ouagadougou and Loumbila, Kompienga and Bagré dams gave the taxonomic results shown in table 12. In addition, the inventories undertaken show that, of this recorded micro-flora 22 have not been determined.

Table 12: Summary of the taxonomic study on aquatic micro-flora

| Identification | Families | Genera | Species |
|----------------|----------|--------|---------|
| Number | 32 | 88 | 191 |

Source: OUEDRAOGO R. L., 1997.

3.1.2.1.2 Herbaceous aquatic macro-flora

Aquatic herbaceous flora is made up of herbaceous plants and includes four sub-groups:

- aquatic macrophytes which are floating herbaceous plants
- semi-aquatic macrophytes fixed at the bottom of water and whose upper part rests on the surface of the water;
- macrophytes of water saturated zones;
- hygrophile macrophytes living in dried out zones.

Table 13: Caption of the taxonomic inventory of aquatic herbaceous flora

| Taxons-flora sub- groups | Families | Genera | Species |
|-----------------------------------|-----------|------------|------------|
| Aquatic macrophytes | 23 | 28 | 46 |
| Semi-aquatic macrophytes | 20 | 36 | 69 |
| Water zones saturated macrophytes | 10 | 17 | 24 |
| Hygrophile macrophytes | 23 | 37 | 46 |
| Total | 76 | 118 | 185 |

Source : OUEDRAOGO R. L., 1996

3.1.2.2 Terrestrial flora

The taxonomic data collected on terrestrial flora concerned higher fungi, herbaceous flora, (herbaceous flora and agricultural herbaceous flora), ligneous flora (forestry, fruit, ornamental and medicinal).

3.1.2.2.1 Higher fungi

The taxonomic inventories of higher fungi in Burkina Faso are not as advanced as the ones of higher plants. According to SANOU and BA, 1996, 8 families, 13 genera and 28 species of higher fungi are now known in Burkina Faso.

3.1.2.2.2 Herbaceous plants

Although the floral inventories dealt with the whole country, knowledge on herbaceous plant taxonomy is not very important.

The taxonomic inventories made in all the areas of the country on terrestrial herbaceous plants made it possible to record 87 families, 333 genera and 627 species.

The data collected reveal the predominance of species from some families such as: leguminous plants (145 species) and gramineae (145 species). Moreover, other families are considered as frequent in the field, particularly the Acanthaceae (26 species), Amaranthaceae (21 species), Asclepiadaceae (27 species), Convolvulaceae (27 species), Euphorbiaceae (12 species) and Solanaceae (12 species).

3.1.2.2.3 Ligneous forestry flora

Within the ligneous flora, the monogeneric families are more numerous than the multigeneric families which include the Caesalpiniaceae, Apocynaceae, Euphorbiaceae, Papilionaceae, Rubiaceae, Anacardiaceae, Ampelidaceae, Mimosaceae, Asclepiadaceae, Meliaceae, Palmae, Sapindaceae, Cappariaceae, Combretaceae and Sapotaceae. The local ligneous forestry flora (trees, small shrubs and creepers) includes 55 families, 214 genera and 376 species (with 95 exotic species).

3.1.3 TAXONOMIC SUMMARY OF THE INVENTORY OF SPECIES

Data shown in chapter 3.1 are summarised in table 14.

Table 14: Summary of biodiversity taxonomic inventories

| Kingdom | Components | Number of families | Number of genera | Number of species |
|-----------------------|---|--------------------|------------------|-------------------|
| Animalia (Animals) | Insects | 151 | 250 | 1515 |
| | Aquatic fauna | 54 | 106 | 198 |
| | Wild fauna | 119 | 362 | 665 |
| | Domestic fauna | 11 | 14 | 16 |
| <i>Sub- total</i> | | 335 | 732 | 2394 |
| Plantae (Plants) | Higher fungi | 8 | 13 | 28 |
| | Algae | 32 | 88 | 191 |
| | Aquatic herbaceous flora dependent on wetlands | 76 | 118 | 185 |
| | Terrestrial herbaceous flora | 87 | 333 | 627 |
| | Ligneous flora | 55 | 214 | 376 |
| <i>Sub- total</i> | | 258 | 766 | 1407 |
| Grand total | | 593 | 1498 | 3801 |

Appendix 2 compares the situation of the taxonomic inventory to the main phylum of biological diversity according to the five kingdoms of Margulius, L. et K. Schwart (1988).

3.2 DIVERSITY OF HABITATS AND ECOSYSTEMS

The essence of the diversity of habitats and ecosystems comes from the geographical situation and the physical milieu described in chapter 1.4.

3.2.1 PHYSICAL CHARACTERISTICS OF THE HABITAT

More than 80% of the Burkinabè territory rests on a large peneplain with an altitude of 250 to 300 m hardly affected by the hydrographic network. A few small chains of steep hills emerge from distances apart (GUILOBEZ S., 1985).

3.2.1.1 vegetation

Because of its flora and vegetation, Burkina Faso is part of the vast Sudano-Zambian region. The flora is divided into two main sub-sets. One belongs to the Saharan and Sahelian dry flora, and the other to the Sudanese. In the extreme southwest, flora components of the Guinean wetland appear along the main rivers.

3.2.1.2 Classification of habitats in humid milieu

In Burkina Faso, wetland water can be classified into three (3) categories, which are: Oligotrophic water bodies (often deep with a narrow bank, poor in coastal plants), eutrophic water bodies (they are often flat and surrounded by concentric belts of aquatic plants) and dystrophic water bodies (with water rich in humid matter and poor in mineral salts).

3.2.2 ECOSYSTEMS

As mentioned in chapter 1.4.5, the present phytogeographical division shows two main domains: the Sahelian domain and the Sudanese domain, which correspond respectively to two main phytogeographical domains of the country. These two can be distinguished by their respective floral set: the Saharan and Sahelian dry flora zone (25% of the country), and the mesophile Sudanese flora zone. In the details, there are transition zones constituted by north-Sahelian, south-Sahelian, north-Sudanese and south-Sudanese sectors.

There is not yet a consensus on national nomenclature for the classification of plant formations. For the moment, plant units are classified by drawing inspiration from Yangambi's classification of vegetation types. The following nomenclature of groups of plant formation / ecosystem/ habitat has been chosen:

- terrestrial ecosystems (natural or artificial) : sparse forest, savannah, steppes, fallows and agroforestry parks, plantation;
- intermediary ecosystems : formations along streams and lake banks, swamps, irrigated systems;
- hydrospheres (natural or artificial, intermittent or perennial) : vegetation of lakes, dams and ponds, phytoplankton;
- Specialised ecosystems: terrestrial (vegetation of sandy structures), aquatic (vegetation of springs and waterfalls).

According to the Tropical Forestry Action Plan in BOGNOUNOU O., 1993, the three main types of forestry ecosystems found in Burkina Faso are distributed as follows:

Table 15: Distribution of ecosystems

| Identification | Area (ha) | % Territory |
|-------------------------|-------------------|--------------|
| Terrestrial ecosystems | 25 140 000 | 91.22 |
| Aquatic ecosystems | 72 500 | 0.26 |
| Intermediary ecosystems | 371.000 | 1.34 |
| Total | 25 583 500 | 93.84 |

Source: OUADBA J. M., 1997

The rest of the country is covered with other types of environment, particularly dunes, towns, rocks, roads, etc. Some of these ecosystems or habitats have been the object of specific studies by technical services. They are:

- The designated and State protected forests;
- Some forest galleries along the Mouhoun River ;
- The agroforestry parks of the Central Plateau;
- Wetlands.

3.2.2.1 Ecosystem functions

Ecosystems maintain the lives of the other categories of biological diversity, including man. The richness of a country in biological diversity depends on the importance in quantity and quality of its ecosystems. The economy of Burkina Faso, as any agricultural country, depends on the functions of the ecosystems it shelters. Table 16 shows us a few examples of these functions, which benefit the development of Burkina Faso.

Table 16: List of a few functions of ecosystems.

| Function | Role played by ecosystems | Types of ecosystems or habitats |
|------------------------------------|--|--|
| Production | Maintenance of fertility | Forestries, clogged wetlands |
| | Maintenance of humidity | idem |
| | Diversification of production | Agricultural zones, pastoral zones, pastures, zones which can be irrigated |
| Prevention of erosion / Protection | Slowing down of runoff water speed and winds | Ligneous and herbaceous forestry formations |
| Mildness of climate | Shade, increase in air humidity | Forestries, wetlands |
| Education | Availability of varied complexes | Terrestrial, aquatic. |
| Scientific | Variation of ecological systems | idem |
| Aesthetic and recreational | Diversification of species | National parks |

3.2.2.2 Terrestrial ecosystems

Natural forestry formations are divided into protected areas (25%) and non-protected areas (75%). The domain of forest reserve covers a total area of 2,721,857 ha, i.e. 14% of the national territory.

Among the terrestrial ecosystems, forests account for an important position. The exploitation of the documentation produced under the aegis of the ministry in charge of environment reveal the following data concerning terrestrial plant formations. Plant formations (herbaceous and ligneous) cover 93% of the national territory distributed as follows: 60% of natural formation (forests, savannahs, steppes, spotted bushes), 32% of man-made formation (fallows and agroforestry parks, plantations). The detailed distribution of plant formations is shown in table 17, following the documents produced under the aegis of the ministry in charge of environment.

Table 17: Distribution of types of plant formations.

| Origins of formation | Types of formation | Area (ha) | % Territory |
|----------------------|--------------------------------|-------------------|-------------|
| Natural | Gallery forests | 270 000 | 1 |
| | Sparse forests | 287 000 | 1 |
| | Bushy savannahs | 4 291 000 | 16 |
| | Shrubby savannahs | 10 185 000 | 37 |
| | Spotted tigers | 387 000 | 1 |
| | Steppes | 1 200 000 | 4 |
| Man-made | Fallows and agroforestry parks | 8 770 000 | 32 |
| | Plantations | 20 000 | - |
| Total | | 25 410 000 | 92 |

Source: OUADBA J. M., 1997.

The herbaceous cover presents characteristics related to the phytogeographical zone in which it is found. In general, the most representative families are in the decreasing order: gramineae (monocotyledones with hollow stem), leguminous plants (dicotyledones with pod), and cyperaceae (apetalous monocotyledones with full stem).

A recent study conducted by FONTES J. and GUINKO S., 1995, on plant formations in Burkina Faso, provides the distribution of plant formations according to domains and the country's phytogeographical sub-sector, as shown in table 18.

Table 18: Distribution of terrestrial plant formations according to phytogeographical zone

| Phytogeographical zones / Plant formations | Area (Km ²) | % Territory |
|--|-------------------------|-------------|
| SAHELIAN DOMAIN | | |
| North-Sahelian sector | | |
| Grassy steppe | 862 | 0.32 |
| Grassy and bushy Steppe | 8.619 | 3.18 |
| Shrubby steppe | 18.842 | 6.95 |
| Shrubby and bushy steppe | 3.304 | 1.22 |
| Aquatic grassland | 165 | 0.06 |
| South-Sahelian sector | | |
| Shrubby steppe | 33.352 | 12.31 |
| Shrubby to bushy steppe | 7.237 | 2.67 |
| Steppe and valley bush savannah | 6.765 | 2.50 |
| Bushy savannah | 287 | 0.11 |
| SUDANESE DOMAIN | | |
| North-Sudanese sector | | |
| Bushy to wooded savannah | 3.868 | 1.43 |
| Bushy to shrubby savannah | 75.965 | 28.05 |
| Agroforestry parks/Savannahs-Parks | 11.835 | 4.37 |
| Bushy savannah and Sourou grasslands-prone to floods | 869 | 0.32 |
| South-Sudanese sector | | |
| Shrubby and bushy savannah | 33.412 | 12.34 |
| Bushy to shrubby and wooded savannah | 43.891 | 16.21 |
| Bushy to wooded savannah and sparse forest | 20.518 | 7.58 |
| Forest-gallery and associated aquatic grassland | 434 | 0.16 |
| TOTAL | 270 225 | 97 |

Source: OUADBA J. M., 1997

3.2.2.3 Ecosystems of wetlands

According to the Ramsar Convention, “Wetlands are areas of swamps, marshy waste lands (peaty swamps), peat bogs or water (natural or artificial, perennial or intermittent) where the water is stagnant or running, fresh, briny (salty taste) or salted, including marine areas whose depth is not more than 6 metres deep during low tide”.

Cowardin et al., in 1979, gave the following more globalising definition: “Wetlands are transition zones between terrestrial systems and aquatic systems where the water table is close to, or reaches soil surface, or where this surface is covered with shallow water.”

In the Burkinabè context (a continental country), wetlands are formed by all the natural or artificial zones where water is running or stagnant, perennial or intermittent; they cover about 225 000 ha. Those are water reservoirs (dam lakes, depression lakes, and ponds), springs and flood basins. **Appendix 3** shows the outstanding wetlands of Burkina Faso.

In the typology of Burkina Faso wetlands, there two categories : submerged wetlands and clogged wetlands.

a) Submerged wetlands

They include two categories:

- zones submerged by running water;
- zones submerged by bog water.

In the category of zones submerged by running water, the size of streams depends on the catchment area. Thus, when the former is not more than a few hectares, we have brooks, ditches or torrents; for a catchment area of a few km² to thousands of km², we have a backwater; for rivers, the size of the catchment area is hardly more than 100 000 km².

At the level of running water, there are five main streams: Mouhoun, Nakambé, Nazinon, Comoé and Pendjari. Nakambé and its main affluents flow for an average of six months a year, Nazinon for six months; only Comoé and its affluent Léraba, Mouhoun and its affluent Kou and Pendjari have an perennial flow.

Bog water concerns lakes, ponds, water reservoirs and dams. The updated inventory of surface water resources estimates the number of water reservoirs to 1300 (OUEDRAOGO R. L., 1996). The perennity of natural and artificial water bodies highly depends on their respective depth and the climatic and physiographical zone of the country.

Zones submerged by bog water are those covered by perennial water. Among them, there are two big artificial water bodies, Kompienga (216 km² with 2 billion m³ maximum) and Bagré (250 km² with 1.7 billion m³), have a marked hydroelectric vocation. The ponds, including the Oursi Pond (Ramsar site), which used to be big and perennial are now subject to drainage; only the Hippopotamuses Pond (which is a biosphere reserve) is saved from this situation. Map n°10 shows the hydrographic network and the water reservoirs.

b) Clogged wetlands

Clogged wetlands are those with soils that are saturated by water. This saturation may be superficial and translated into a partial submersion hardly more than a few centimetres. It may be deep and translated into the existence of some hydrophile plant species or cultivated plants on the surface, requiring an hydric supply higher than can be provided by the regional climate.

Clogged wetlands are of two types: natural superficial clogging (related to the presence of streams, lakes and water reservoirs) and artificial clogging (irrigated areas).

The type of clogged wetland we are interested in here is natural superficial clogging. Depending on clogging, there are mouillere, bogs, marshes and swamps.

The mouilleres are temporarily clogged small areas, characterised by superficial drippings affecting locally the outcrop of an aquifer groundwater. Usually, mouilleres are found on the low sides at the margin of lowland central zones. They appear in mid-August and at the end of November in south and southwest zones of Burkina Faso.

Bogs are larger than mouilleres, and they are found in the central part of lowlands or at the margin of ponds and flood basins in the south-Sudanese zone.

In Burkina Faso, natural clogging of soils is intermittent because of the character of the climate.

3.2.3 STATE OF THE CONSERVATION OF SPECIES AND POPULATIONS

The measures and actions undertaken until now made it possible to preserve some of the habitats which are the most favourable to the conservation of biological diversity, such as parks, natural reserves (protected forests, protected zones and silvi-pastoral reserves). Map 11 gives a view of the distribution of protected natural formations.

Map 10: Hydrographic network and water reservoirs

Map 11: Protected natural formations

3.2.3.1 Presentation of the richest habitats in fauna and flora diversity

In Burkina Faso, like everywhere in the world, biological diversity is distributed through all the country's ecosystems according to the biology and ecology of each species. Today, these ecosystems are victims of many natural and man-made factors, particularly, persistent droughts and population pressure, which make their equilibrium precarious. The consequence of this is the reduction of species ecosystems and habitats, the scarcity of some species, which have now become fragile, the change in attitude of some species, etc.

Today, the richest (qualitatively and quantitatively) habitats in species amount to the various conservation areas of terrestrial fauna (national parks, synergetic zones, biosphere reserves, etc.), protected forests, natural and artificial wetlands (ponds, dam lakes, developed areas, etc.). In these agricultural zones, there is an increasing development of a vertebrate fauna dependent on these types of habitats (eg. : crop destructive insects).

3.2.3.1.1 National parks, natural reserves and other protected zones

In the report, presented by Burkina Faso at the United Nations Conference, on the Environment and Development held in Rio de Janeiro, Brazil, in 1992, the country's natural forestry formations are divided into two domains: the non-protected domain (11 604 000 ha, i.e. 75% of formations) and the protected domain (3 816 000 ha, i.e. 25% of formations). The protected formations (protected forests and the silvi-pastoral and partial fauna reserve) are 65 and cover a total area of 2 678 747 ha (source : GUINKO S., 1996). The development below presents the components of the protected domain.

a) National parks.

They include the total protection zones of wildlife and its habitat where the only samples allowed are those of improvements by technical services, (by involving resident populations). There are two (2) in the country, particularly the "W" National Park, established by decree on August 14 1954 with an area of 350 000 ha, situated in the Tapoa province, half-way between Niger, Benin and Burkina Faso, and the Kaboré Tambi National Park in Pô, Nahouri province, established by order 76-02/PRES-ET of 02/09/1976. The total area of national parks is 390 500 ha, i.e. 10% of protected formations.

b) Wildlife reserves.

Wildlife reserves are protected natural zones or wildlife exploitation (sampling, hunting, and tourism of vision, etc.) is regulated.

Burkinabè wildlife, which used to be very rich has now become much poorer today. The existing big wildlife is mainly concentrated in the extreme south of the protected zones of the southwest zones (Comoé province), Centre-south and southeast (provinces of Sissili, Nahouri, Gourma and Tapoa). The Arly wildlife reserve and the Nazinga game ranch are high observation points of big wildlife (source: Notice de la Carte de végétation du Burkina Faso, GUINKO S. et FONTES J., 1995).

Wildlife reserves cover 2 545 500 ha. There are nine (9) most important ones in terms of area and they are subdivided into two categories according to the management approach applied to

them. Thus, four total reserves and five partial reserves can be distinguished; the list of the 9 wildlife reserves is shown in table 19.

Table 19: List of wildlife reserves

| Name | Classification | Area (ha) | Year of establishment | Situation |
|-----------------------------|----------------|----------------|-----------------------|---------------------|
| Arly Wildlife Reserve | Total | 76 000 | 1954 | Tapoa province |
| Madjoari Wildlife Reserve | Total | 17 000 | 1970 | Tapoa province |
| Singou Wildlife Reserve | Total | 192 000 | 1955 | Gourma province |
| Bontioli Wildlife Reserve | Total | 12 700 | 1957 | Bougouriba province |
| Arly Wildlife Reserve | Partial | 96 000 | 1954 | Gourma province |
| Kourtiagou Wildlife Reserve | Partial | 51 000 | 1957 | Tapoa province |
| Pama Wildlife Reserve | Partial | 223 700 | 1955 | Gourma province |
| Nabéré Wildlife Reserve | Partial | 36 000 | 1957 | Bougouriba province |
| Bontioli Wildlife Reserve | Partial | 29 500 | 1957 | Bougouriba province |
| TOTAL | | 733 900 | | |

Source: OUEDRAOGO N. A., 1997.

The areas mentioned for the various reserve categories are the ones existing in official records. However, the actual areas are less than these figures because of the various pressures mentioned earlier. In addition to these reserves, there is the Nazinga Game Ranch, which contains an important diversity of vertebrates.

c) The silvi-pastoral and partial wildlife reserve

In Burkina Faso, there is a silvi-pastoral and partial wildlife reserve known as of the Sahel, which covers an area of 1 600 000 ha, corresponding to the Soum, Séno and Oudalan provinces. It is a zone where pastoral activities are undertaken in natural pastures and where there is a wildlife reserve open to pastoral activities. The main part of this reserve is now subject to exploitation systems which do not conform with the status of a reserve; this explains why the prospecting undertaken as part of the UPV-82/008 project retained a zone of 1 220 km² comprising the west of Forage Christine, the Oursi and Béli ponds for the conservation of the representative ecosystems of Burkinabè Sahel (source : OUEDRAOGO N. A., 1997).

d) Synergetic reserves

They concern the wildlife-protected areas where hunting is controlled and wildlife habitat partially protected. Depending on their management systems, they are either real synergetic zones, controlled by the State agencies in charge of environment, or zones hired by the State to individuals who ensure their management themselves following laid down specifications.

e) Reserves of international importance

Three protected domains in Burkina Faso have an international importance, i.e. belonging to world patrimony. These are : The Hippopotamuses Pond (biosphere reserve of an area of 19 200 ha) situated in the Houet province, the Oursi Pond (Ramsar site with an area of 45 000

ha) in the Oudalan province , and the “W” Park (Ramsar site with 235 000 ha), half-way between Burkina Faso, Benin and Niger.

f) Protected forests

According to METRO A., 1975 protected forests are the forestry zones defined and demarcated as such according to a legislative and regulatory measure, in such a way as to give it the required legal protection. The protected forests of Burkina Faso cover a total area of 1 112 747 ha, without the Sahel silvi-pastoral and partial wildlife reserve (see. Table 20). However, this total area is theoretical, because of the illegal settlements forests are subjected to.

Table 20: Situation of protected formations in Burkina Faso

| Province | Name of the formation | Situation (district, village) | Date Of designation classification | N° of order - decree- of designation | Area (ha) |
|------------|--------------------------|-------------------------------|------------------------------------|--------------------------------------|-----------|
| Comoé | FC Bérégadougou | Banfora | 4 Nov. 1953 | 8107 /SE / F | 5 000 |
| Comoé | FC Bounouna | Sidéradougou | 31 May 1955 | 4088 /SE / F | 1 300 |
| Comoé | FC Boulon | Sidéradougou | 31 May 1955 | 4087 /SE / F | 12 000 |
| Comoé | FC Kongoko | Sidéradougou | 31 May 1955 | 4089 /SE / F | 27 000 |
| Comoé | FC Kaflandé | Banfora | 4 Nov. 1953 | 8106 /SE / F | 30 000 |
| Comoé | FC Diéfoula | Niangoloko | 29 Nov. 1937 | 3499 /SE / F | 85 000 |
| Comoé | FC Logoniégué | Mangodara | 4 August 1955 | 689 / FOR | 29 000 |
| Comoé | FC Babolo | Niangoloko | 22 Sept. 1943 | 3413 /SE / F | 550 |
| Comoé | FC Gouandougou | Sidéradougou | 31 May 1955 | 4086 /SE / F | 9 500 |
| Comoé | FC Dida | Mangodara | 4 August 1955 | 688 / FOR | 75 000 |
| Comoé | FC Toumousséni | Banfora | 12 April 1954 | 2875 /SE / F | 2 500 |
| Comoé | FC Yendéré | Niangoloko | 5 April 1934 | 1312 /SE / F | 700 |
| Comoé | FC Source du Mouhoun | Moussodougou | 31 May 1955 | 4084 /SE / F | 100 |
| Comoé | FC Niangoloko | Niangoloko | 27 Feb. 1936 | 420 /SE / G | 6 654 |
| Boulgou | FC Ouilingoré | Zabré | 23 Oct. 1936 | 2500 / SE | 6 850 |
| Boulgou | FC Yakala | Tenkodogo | 23 Oct. 1936 | 2500 / SE | 1 600 |
| Bougouriba | FC Dibon | Diébougou | 24 June 1954 | 4637 / SE/F | 20 000 |
| Bougouriba | FC Bougouriba | Diébougou | 4 August 1955 | 690 / FOR | 8 500 |
| Bougouriba | FC Bontioli | Diébougou | 23 March 1957 | 3147 / SE/F | 29 500 |
| Bougouriba | FC Nabéré | Diébougou | 3 August 1953 | 5768/ SE/ EF | 36 500 |
| Houet | FCMaro | Houndé | 28 Jan. 1940 | 116 / SE | 50 000 |
| Houet | FC Bahon | Houndé | 26 March 1937 | 836 / SE | 1 600 |
| Houet | FC Tui | Houndé | 17 Jan. 1940 | 115 / SE | 50 000 |
| Houet | FC Dindéresso | Bobo-Dsso | 27 Feb. 1936 26 August 1941 | 422 / SE ou 3006 / SE / E | 8 500 |
| Houet | FC Mare aux Hippopotames | Satiri | 26 March 1937 | 836 / SE | 19 200 |
| Houet | FC Koulima | Bobo-Dsso | 27 Feb. 1936 | 421 / SE or 1486 / SE | 2 150 |
| Houet | FC Bansié | Bobo-Dsso | 26 March 1937 | 836 / SE | 300 |
| Houet | FC Mou | Bobo-Dsso | 20 Oct. 1938 | 3406 / SE | 34 000 |
| Houet | FC Dan | Bobo-Dsso | 3 August 1953 | 5765 / SE | 4 300 |
| Houet | FC Téré | Kouka | 23 Nov. 1951 | 8314 / SE/ F | 10 700 |
| Houet | FC Kou | Bobo-Dsso | 13 Jan. 1951 | 190 IGF | 117 |
| Houet | FC Péni | Bobo-Dsso | 24 Sept. 1942 | 3389 / SE/ F | 1 200 |
| Houet | FC Koa | Bobo-Dsso | 27 April 1936 | 891 / SE | 350 |
| Houet | FC Bambou | Bobo-Dsso | 26 March 1937 | 836 / SE | 1 800 |
| Houet | FC Kapo | Houndé | 26 March 1937 | 836 / SE | 9 900 |
| Ganzourgou | FC Wayen | Wayen | 26 August 1941 | 3009/SEor3005 | 12 000 |
| Kadiogo | FC Barrage | Ouagadougou | 9 Oct. 1936 26 August 1941 | 2376 / SE 3004 / SE | 260 |

Table 20 (continued)

| Province | Name of the formation | Situation (district, village) | Year of designation | N° of order / decree / of designation | Area(ha) |
|--------------------------|--|-------------------------------|--------------------------------|---------------------------------------|------------------|
| Kouritenga | FC Sitenga | Koupéla | 23 Oct. 1936 | 2500 / SE | 840 |
| Mouhoun | FC Pâ | Boromo | 19 June 1937 | 1639/SE/S | 15 625 |
| Mouhoun | FC Bonou | Boromo | 19 June 1937 | 1639/SE/S | 1 700 |
| Mouhoun | FC Tuy | Bondokuy | 17 Jan. 1940 | 115/SF/5 | 50 000 |
| Mouhoun | FC Nasébou | Boromo | 19 June 1937 | 117/SE | 14 000 |
| Mouhoun | FC Sâ | Dédougou | 17 Jan. 1940 | 3320/SE | 5 400 |
| Mouhoun | FC Kari | Dédougou | 13 Oct. 1938 | 3320/SE | 13 000 |
| Mouhoun | FC Ouoro | Dédougou | 13 Oct. 1938 | 3320/SE | 14 000 |
| Mouhoun | FC Toroba | Dédougou | 13 Oct. 1938 | 3320/SE | 2 700 |
| Mouhoun | FC Tissé | Dédougou | 13 Oct. 1938 | 3320/SE | 21 500 |
| Mouhoun | FC Sorobouty | Boromo | 13 Oct. 1938 17 Jan. 1940 | 113/SF/S | 5 800 |
| Mouhoun | FC 2 Ballé | Boromo | 19 June 1937 | 1639/SE/S | 115 000 |
| Nahouri | FC Pic de Nahouri | Pô | 13 Oct. 1938 | 3320/SE/S | 836 |
| Nahouri | FC de Nazinga | Pô | 4 Decem. 1953 | 8827/SE/F | 38 300 |
| Namentenga | FC Tougouri | | 9 Oct. 1936 | 2376/SE | 40 |
| Oubritenga | FC Nakambé | Ziniaré, Manga, Kombissiri | 3 August 1953 | 5767/SE/EF | 98 000 |
| Oubritenga | FC Ziga | Ziniaré | 3 August 1953 | 5769/SE/EF | 9 000 |
| Oubritenga | FC Gonsé | Saaba | 28 Feb. 1953 | 1550/SE | 6 000 |
| Oubritenga | FC Bissiga | Zitenga | 23 Oct. 1936 26 August 1941 | 2500/SE 3003/SE | 4 100 |
| Passoré | FC Niouma | Yako | 12 April 1954 | 2878/EF | 735 |
| Passoré | FC Twéssé | Yako | 24 June 1954 | 4638/SE/F | 490 |
| Poni | FC Koulibi | Batié | 4 August 1955 | 387/FOR | 40 000 |
| Sanmatenga | FC Yabo | Kaya | 9 Oct. 1936 | 2376/SE/S | 1 000 |
| Sanmatenga | FC Dem | Kaya | 19 June 1937 | 1639/SE/S | 350 |
| Sanmatenga | FC Nakambé | | 9 Oct. 1936 | 2376/SE | 2 000 |
| Sanguié | FC Kalio | Pouni | 17 Janv. 1940 May 1 1936 | 111/SE/S 961/SE | 12 000 |
| Sissili | FC Sissili | Léo | 31 Decem. 1955 | 1093/FOR | 32 700 |
| Soum-Séno-Oudalan | Réserve sylvo-pastorale et partielle de faune du Sahel | Séno-Oudalan-Soum | 9 Decem. 1970 | Ordonnance n° 70/302/PRES/AGRI-EL | 1 600 000 |
| Sourou | FC Sourou | Yaba | 27 March 1937 | 1092 | 14 000 |
| TOTAUX | 66 | | | | 2 712 747 |

Source: GUINKO S., 1996

3.2.3.1.2 The situation of protected areas

In addition to the late initiation of the measures in order to protect them (1936-1957), the protected zones are increasingly faced with an accelerated degradation which constitutes a serious threat. The main damages protected formations are subjected are:

- degazetting, modifications of demarcations and changes in the status of some forests;
- every 1/3 of the country's area undergoes bush fires;
- clearing of almost 100 000 ha/year of forestry lands;
- fragilisation of ecosystems by their inappropriate exploitation;
- resurgence of the degradation of formations because of population and livestock, as well as the successive droughts which cause a plant and animal massive death.

Inside protected areas all the components of biological diversity do not benefit from practical appropriate conservation measures. This is particularly the case of entomological fauna and aquatic flora, which represent hardly explored domains. In addition, efforts made as part of conservation and sustainable use of biological diversity are characterised by constraints coming mainly from the poverty of the populations often struggling for their survival.

3.2.3.2 Richness in species of ecosystems

In general, the diversity of species in the Burkina Faso ecosystems is not well known. The presentation, in chapter 3.1, as well as the summary in table 14 illustrate this situation. Indeed, the various thematic reports developed for the present report underscored this weakness, and this is why the data has not been established for all the taxonomic groups.

3.2.3.3 Endangered species

Endangered species in Burkina Faso are determined through legislative texts specifying the condition of their protection. The list of extinguished, threatened and vulnerable species is not well stocked because of the recent character of the particular attention paid to the various constituent components of the country's global biodiversity. Table 21 below gives the list of such species.

Table 21: Situation of extinguished, dying, threatened and vulnerable species at the national level.

| Category | Extinct | About extinction | Threatened | Vulnerable | Total |
|-----------------------|---------|---|--|---|-------|
| Mammals | Oryx | | Panther Cheetah Elephant | Damaliscs Gazella Rufifron Gazella Dorcas Wild dog | 8 |
| Birds | | Ostrich | Abyssian hornbill | West African crowned crane | 3 |
| Reptiles | | | Crocodile Python | | 2 |
| Fishes | | | | Protopterian (eel) | 1 |
| Ligneous flora | | <i>Celtis integrifolia</i> <i>Adenium obesum</i> | <i>Acacia senegal</i> <i>Dalbergia melanoxyton</i> <i>Pterocarpus lucens</i> <i>Vitex doniana</i> <i>Ximenia americana</i> | <i>Adansonia digitata</i> <i>Bombax costatum</i> <i>Ceiba pentandra</i> <i>Anogeissus leiocarpus</i> <i>Khaya senegalensis</i> <i>Prosopis africana</i> <i>Parkia biglobosa</i> <i>Butyrospermum paradoxum</i> | 15 |

Table 22: Endangered plant species in the north and centre-north of Burkina Faso.

| Overexploited species now scarce around urban centres | Scarce species about extinction | Vulnerable food species |
|---|--|---|
| <i>Daniella oliveri</i> | <i>Acacia erythrocalix</i> | <i>Adansonia digitata</i> |
| <i>Diospyros mespiliformis</i> | <i>Annona senegalensis</i> | <i>Bombax costatum</i> |
| <i>Entada africana</i> | <i>Brachystelma simplex</i> subsp. <i>banforae</i> | <i>Butyrospermum paradoxum</i> subsp. <i>parkii</i> |
| <i>Fagara xanthoxyloides</i> | <i>Gossypium anomalium</i> | <i>Detarium microcarpum</i> |
| <i>Nauclea latifolia</i> | <i>Guibourtia copallifera</i> | <i>Lannea microcarpa</i> |
| <i>Rauvolfia vomitoria</i> | <i>Hibiscus gourmassia</i> | <i>Sclerocarya birrea</i> . |
| <i>Securidaca longepedunculata</i> | <i>Landolphia heudolotti</i> | <i>Spondias mombin</i> |
| <i>Trichilia roka</i> (= <i>T. emetica</i>) | | <i>Saba senegalensis</i> variété <i>glabriflora</i> |
| <i>Vitex doniana</i> | | <i>Parkia biglobosa</i> |
| <i>Ximenia americana</i> | | <i>Tamarindus indica</i> |

Source: BÉLEM B., 1996, et BOGNOUNOU O., 1997.

3.2.3.4 Endemism

The situation of endemism is very little known in Burkina Faso. However, there is a timid knowledge concerning flora for which it has been established that, at least, 23 existing species in Burkina Faso are endemic in West Africa. Table 23 lists these species and their respective families.

Table 23: West African scarce/or endemic species

| | Family | Genus and species |
|----|------------------|--------------------------------------|
| 1 | Mimosaceae | Acacia erythrocalyx |
| 2 | Scrophuliaceae | Craterostigma plantagium |
| 3 | Fabaceae | Aeschynomene mbacoundensis |
| 4 | Limnocharitaceae | Lagarosiphon muscoides |
| 5 | Malvaceae | Gossypium anomalum |
| 6 | Rubiaceae | Botopedima tenius * |
| 7 | Cyperaceae | Afrotrilepis pilosa |
| 8 | Cyperaceae | Bulboschoenus maritimus |
| 9 | Cyperaceae | Eleocharis decoriglumis |
| 10 | Cyperaceae | Schoenoplectus articulatus |
| 11 | Cyperaceae | Cyperus articulatus * |
| 12 | Fabaceae | Sesbania rostrata |
| 13 | Alismataceae | Sagittaria oblusifilium |
| 14 | Caryophyllaceae | Polycarpaea dillei |
| 15 | Poaceae | Eragrostris lingulata |
| 16 | Malvaceae | Hibiscus gourmania |
| 17 | Hamarylliaceae | Crinum mulicum |
| 18 | Oleaceae | Jasminum kerstingii (very localised) |
| 19 | Poaceae | Rytachne furtira |
| 20 | Poaceae | Elionurus euchaetus |
| 21 | Aslepiadaceae | Gongronema obscurum |
| 22 | Asclepiadaceae | Brachystelma simplex, subsp. anforae |
| 23 | Caesalpinaceae | Guibourtia copallifera** |

According to *LEBRUN, 1991 et OUEDRAOGO, 1994.*

Key : *= present in the Sindou Peaks

**= present in Tourny (Kankalaba)

3.2.3.5 Introduced Fauna and Flora species and varieties

The introduction of species in a country constitutes a means to mitigate a loss at the economic, sociocultural and scientific level. In Burkina Faso where the increase in production and the fight against the consequences of drought represent priorities, the recourse to exotic species is a common practice. The activity sub-sectors which introduce species and varieties are particularly agriculture and forestry. Thus, for example, of 320 species of domesticated ligneous flora, 201 are exotic (BELEM B., 1996). In addition, the livestock sub-sector has recourse to the introduction of varieties of animal species.

The main types of plants being introduced are ligneous plants, food crops, market garden crops, industrial crops, cash crops and decorative plants.

As far as domestic wildlife is concerned, the following breeds have been introduced:

- at the level of cattle the Azawak zebus and M'Bororo zebus (Niger), the Gouadalis (Nigeria), and the N'Dama Taurus (Côte d'Ivoire);
- at the level of sheep, the bali-bali breed (Macina);

- at the level of pigs, breeds such as the Korogho pig (Côte d'Ivoire);
- at the level of poultry, the Gallor guinea-fowl, Rode-Island Red hens, the Plymouth, the Nera (Europe).

3.2.3.6 Domestic animals and cultivated plants

Domestic animals and cultivated species rank high in the uses of the constituent components of biological diversity in Burkina Faso, because the country has an agro-pastoral vocation.

3.2.3.6.1 Domestic animals

Domestic fauna experienced more and more a phenomenon of crossbreeding, because of the search for bigger sizes and yield. The few traditional farmsteads of the country are more and more abandoned in favour of the raising of species that have bigger sizes.

3.2.3.6.2 Cultivated plants

Since the colonial period, concrete actions have been undertaken as part of the conservation of cultivated plants. They are:

- improvement of domesticated species through botanical research, provenance trials;
- use of at least 40 local species in plantation operations;
- multiplication and regeneration techniques;
- improvement of natural formations;
- research in further knowledge of the biology of species;
- seeds conservation.

As far as agricultural plants are concerned, the level of species conservation is mediocre because there is no (or almost none) important actions of *in-situ* conservation of resources. However, the protected forest domains contribute to the conservation of wild species. The fundamental reason behind this situation lies in the country's difficult socio-economic conditions, which oblige the local populations to seek to satisfy their immediate needs at the detriment of sustainable development. This results in the adoption of new species and varieties having yield and quality higher than those of local species. However, there are a few *ex-situ* conservation and conservatory installations of phytogenetic resources.

For cereals (sorghum, millet, maize, rice and fonio), local varieties (when they exist), wild forms have been prospected, sampled and preserved in international centres of genetic resources. The duplicates of some of these samples are preserved at the national level in Farakoba. Today, 237 samples of sorghum, 112 of millet, 41 of fonio and rice are preserved there. Oil seeds (groundnuts, sesame and soybean) are preserved in very small quantities in refrigerators and regenerated every two years. Oil seeds such as Cowpeas and Bambara groundnuts are preserved in cold-storage room.

3.2.3.7 Traditional conservation knowledge and practices

Traditional knowledge and practices have sometimes integrated the desired conservation methods of species, biotic communities and consequently genetic resources. These practices

are more marked in Africa where there are between man and nature beliefs, messages, correspondences and knowledge. These practices are related to ethnic groups (of which there are more than 60 in Burkina Faso), clans and age group.

Traditional conservation practices of biological diversity in Burkina Faso, like in many African countries are:

- conservation village forestry relics, called "sacred woods", with cultural or religious goal, constituted of specific species such as *Anogeissus leiocarpus* (African birch), *Combretum micranthum* (Kinkéliba), etc., whose sites are chosen by traditional chiefs and elderly people (the wise);
- the establishment of agroforestry park systems for the preservation of soil fertility and the supply of forestry products to man; the most used species in this framework often have multiple uses; they are, for example, *Acacia albida* (whitish Acacia, Mimosa), *Parkia biglobosa* (Nere), *Butyrospermum paradoxum* (shea-tree *Sclerocarya birrea* (Sclerocarya, Plum-tree), *Lannea microcarpa* (Grapefruit tree), *Bombax costatum* (red kapok tree), *Diospyros mespiliformis* (Ebony tree *Adansonia digitata* (Baobab), and *Acacia nilotica* (Acacia from the Nile);
- the prohibition by religion or tradition from exploiting some animal species [ex: *Canis familiaris* (the dog), *Equus asinus* (the donkey) and *Sus cristatus* (the pig) by the Muslim religion],
- useful species such as *Tamarindus indica* (Tamarind) and *Stereospermum kunthianum* by the Mossi and Bissa, *Parkia biglobosa* (Nere) used by some Bissa clans for fetishes in the domain of thunder;
- the traditional regulation of the exploitation of some animal or plant resources (e. g. : organisation of village hunting and fishing), gathering, cereal harvesting;
- customary practices with an indirect protection of species (customary bush fires) .

Table 24 shows the non-exhaustive list of species being the object of traditional conservation according to the values ascribed to them.

Table 24: List of traditionally preserved species

| Ascribed value | Species |
|-------------------------------------|--|
| Economic | <i>Acacia albida</i> , <i>Adansonia digitata</i> , <i>Borassus aethiopicum</i> , <i>Bombax costatum</i> , <i>Butyrospermum paradoxum</i> , <i>Diospyros mespiliformis</i> , <i>Lannea acida</i> , <i>Lannea microcarpa</i> , <i>Parkia biglobosa</i> , <i>Sclerocarya birrea</i> , <i>Tamarindus indica</i> |
| Sacred (sacred woods) | <i>Adansonia digitata</i> , <i>Albizia chevalieri</i> , <i>Anthiaris africana</i> , <i>Bligia sapida</i> , <i>Borassus aethiopicum</i> , <i>Ceiba pentandra</i> , <i>Combretum micranthum</i> , <i>Cyrtosperma senegalensis</i> , <i>Dioscorea dumetorum</i> , <i>Elaeis guineensis</i> , <i>Khaya senegalensis</i> , <i>Pachystela argentea</i> , <i>Pterocarpus erinaceus</i> |
| Clanic (protection) | <i>Clarias anguillaris</i> , <i>Crocodilus niloticus</i> , <i>Crocodilus cataphractus</i> , <i>Hippopotamus amphibius</i> , <i>Python sebae</i> , <i>Python regius</i> , <i>Tamarindus indica</i> , <i>Varanus niloticus</i> , <i>Varanus exanthematicus</i> , <i>Gazella dama</i> , <i>Gazella dorcas</i> , <i>Gazella rufifrons</i> , <i>Epomopharus gambianus</i> , <i>Eidolon helvum</i> , <i>Orycteropus afer</i> , <i>Parkia biglobosa</i> |
| Religious and/or ritual | <i>Equus asinus</i> , <i>Canis familiaris</i> , <i>Sus cristatus</i> |
| Socio-cultural | <i>Adansonia digitata</i> , <i>Ficus sp.</i> , <i>Tamarindus indica</i> , <i>Khaya senegalensis</i> , <i>Sclerocarya birrea</i> |
| Handicraft and/or customary (masks) | <i>Azelia africana</i> , <i>Lannea microcarpa</i> , <i>Cassytha filiformis</i> , <i>Canarium schweinfurthii</i> , <i>Tamarindus indica</i> , <i>Adansonia digitata</i> , <i>Gardenia erubescens</i> , <i>Ficus sp.</i> , <i>Khaya senegalensis</i> |

3.2.3.8 Land use

The available data on land use in Burkina Faso comes from the interpretation of aerial photographs of IGN- France missions taken during the period between 1950 and 1956. The resulting map (Map REMY G.) reflects the various extents of intensity of land use during the period concerned. One notices a parallel between the data from this map and those from population densities published by SAVONNET in 1965.

The map of land use by RÉMY G. supplies the following data in table 25 for 1956 :

Table 25: Extent of land use

| Extent of land use | Area (km ²) | % |
|--------------------|--------------------------|------------|
| Null | 39 800 | 14.6 |
| Insignificant | 49 000 | 18.0 |
| Less than 6% | 86 990 | 31.9 |
| Form 6 to 25% | 74 900 | 27.0 |
| from 25 to 50% | 19 000 | 7.0 |
| More than 50% | 2 000 | 0.7 |
| Uncovered zone | 900 | 0.3 |
| TOTAL | 272 500 | 100 |

Source: OUADBA J M., 1997

One can notice that only little more than the third of the territory can be considered as populated on average (use > 6-25%) or highly populated (use > 25%)", the level of settlement translating the extent of land use.

An attempt to evaluate the evolution of land use was made in 1991 by GUINKO S., BANDRÉ E. and OUADBA J. M., at the request of the cartographic project Atlas of Burkina, hosted by the ministry of planning. The information available now can be taken from the "Carte de la végétation et de l'occupation du sol au Burkina Faso" by FONTES J. et GUINKO S. (1995). Land use, synonymous with "agricultural domination ", is expressed in three (3) classes according to the percentage of farms and young fallows against the background of natural or spontaneous vegetation. The result of the data is presented in table 26.

Table 26: Area of land use according to class

| Class | Area (km ²) | % |
|------------------|-------------------------|--------------|
| Low (<10%) | 136,329 | 50.33 |
| Average (10-30%) | 73,574 | 27.16 |
| High (>30%) | 60,938 | 22.50 |
| TOTAL | 270,841 | 99.99 |

Source :OUADBA J. M., 1997

Map 12 below gives the extent of croplands use.

Map 12 extent of croplands use

It can be noticed here that half of the country belongs to the class of low land use (136.329 km²). Milieux with higher use account for about 20% of the national territory and correspond mainly to zones including big urban centres (Ouagadougou, Koupéla, Koudougou) where the majority of the country's population is concentrated.

These authors made it clear that a “rate of less than 10% equals low densities of population and long enough crop rotations-fallows to ensure a good regeneration of soils. On the other, more than 30% of use, the population density is very important and leads to a systematic shortening of the cycle of fallow, lower yields and impoverishes soils”.

By analysing the results from FONTES J. et GUINKO S., it can be estimated that since 1956, and particularly in recent years, the intensity of land use has increased by 17% for all the country. However, this increase does not have the same meaning everywhere, because of the diversity of agricultural practices and the disparity in population densities.

3.2.3.9 Changes noticed at the level of ecosystems and habitats these last 20 years.

Ecosystems and habitats are influenced by dynamics related to climatic variations or changes and to various human activities, including the following: persistent droughts, bush fires, excessive exploitations of biological resources, shifting cultivation and overgrazing. For example, it is mentioned in “Précis de télédétection”, Presse Universitaire du Québec, volume

2, (1996), that the plant landscape of Burkina Faso underwent from 1972 to 1990 a sudden transformation resulting in two spatial dynamics:

- in the north, in the Sahelian region, it is a continuous line of degradation which expanded to the south;
- in the centre as in the south of the country, the evolution occurred in degradation areas which expanded and joined together.

3.2.3.9.1 Terrestrial ecosystems

Savannah and steppe ecosystems have dynamics related to climatic variations, rate of fires, which go through them, and the various human activities affecting them.

According to GUINKO S., 1996, the evolution of plant formations in Burkina has been very high these last twenty years. They suffered from two important drought phases, which are responsible for significant mortality phenomena of ligneous species. These very droughts brought many constraints to the farming and raising populations. Significant displacements of migrants from the north to the south led to pressures on the Sudanese savannahs that are often high.

Today, the north-Sudanese savannahs and the Sahelian steppes all constitute secondary formations resulting from man's destructive action on the original vegetation through bush fires, clearing, overgrazing and excessive logging for energy and handicraft needs. To these man-made factors, must be added also the effect of climatic drought which has been manifesting itself since 1971 through persistent low rainfall. This persistent climatic drought resulted in the south, in the shift of Sahelian and Sudanese zones. Thus according to DIALLO A. (1990), as compared with the period from 1960-1970, the 500 mm isohyet shifted towards the south by about one degree latitude during the period from 1970-1980.

The degradation of the ligneous vegetation is clearly perceptible in the north-Sudanese zones. The national forestry inventory made in 1980 by FAO (DIALLO A., 1990) estimated that the percentage of dead standing trees reached 4.20% in the north-Sudanese zone and more than 10% in the Sahel. In the Sahelian zone, many populations of *Acacia raddiana*, *Pterocarpus lucens*, *Dalbergia melanoxylon*, *Balanites aegyptiaca* and *de Adansonia digitata* are suffering from a worrying decay. OUADBA J.M, 1983 asserts that in the Nakambé basin, 72% of forest formations have declined between 1958 and 1979.

The map of natural vegetation and land use constitutes a source of information on the current status of ecosystems and habitats, which underwent changes in these last 20 years. This map reveals the following forms of vegetation:

- a few Guinean and humid flora formations in replacement of the Guinean forests along the main streams in the extreme south-west;
- a few gallery forests which took over from the quite homogenous formations in the Sudanese part;
- thicket, shrubby and edaphic savannahs;
- agroforestry parks where the fallowing cycle has been drastically reduced;
- herbaceous steppes comprising thickets, shrubs and bushes;
- formations of flood basin zones, marshes and swamps.

Agricultural clearing contributed a lot to the degradation of soils. According to BONKOUNGOU E., 1985 “although all cultivated lands account only for about one third of the 9 million hectares of the country’s cropland, extension possibilities of cultivated lands are actually very limited in some regions because of the mediocre qualities of soils, the low availability of water, or an already high land use leading to even clearing very fragile marginal zones”.

Indeed, it can be noticed that in some regions of Burkina, Yatenga for example, the maximal density threshold (50 inhabitants/km²), considered as compatible with the maintenance of soil fertility has been largely exceeded in the present context of traditional production systems, technical conditions, and natural and human conditions of agricultural and pastoral activity (BOGNOUNOU O., 1996).

This aspects of degradations related to clearing, human and pastoral toll, the deterioration of living environment is well shown in the world map of desertification (UNEP/FAO/UNESCO) where the majority of Burkina is classified in the high risk desertification zones.

Concerning the particular case of specific ecosystems, it is worth mentioning the overall degradation of forest galleries in the agro-ecological zone further south of the country (Comoé, Léraba, Mouhoun). As a result of their protective role of banks and springs, sensitive habitats of the hydrographic network, uncontrolled clearing of forest galleries constitutes a major ecological risk with incalculable consequences (BOGNOUNOU O., 1996).

In the west of Burkina, rural migrations increased in recent years. In the absence of lands, migrants consciously or unconsciously settled illegally in many protected forests. Drawing inspiration from a few displacement actions, the forestry administration is looking for a global and adapted strategy to make illegal settlers leave these forests.

3.2.3.9.2 Freshwater ecosystems

Chronic rainfall shortages recorded for more than two decades have resulted in the non-filling of water points and in the decline in the flow of streams. Ponds, lakes and other water bodies have since then been undergoing various pressures, which led to their silting. This resulted in the quantitative and qualitative modification of aquatic fauna. In addition, the use of chemical fertilisers in irrigated cash crop farms contributed through the weathering phenomenon to pollute water bodies, making ecosystems unbearable for fauna, hence the loss of many specimen and the decline in the number of fauna and herbaceous species.

Animal action at the level of ponds also contributed to their modification. Indeed, the plant biomass produced by ponds, containing many fodder species (47.3 %) of flora (in Sahelian zone), is invaded by many herds. Animal grazing and trampling lead to a rapid degradation of the vegetation and to few modifications, translated into the appearance of new faeces (*Nymphaea lotus* and *Utricularia stellaris*).

3.2.3.9.3 The main changes occurred in the last 20 years in the populations of some plant species.

Biological diversity in Burkina Faso was once very rich in flora and fauna. Today, populations of some important species suffer from pressures due often to uncontrolled exploitations, clearing and bush fires.

The Sahelian domain is now predominated by Phanerophytes (1.37%), which are ligneous species (mainly Acacia), and Therophytes (61%), i.e. annual gramineae. The populations of some Acacia of fodder utility have been vulnerable because of the extent of pruning and regeneration difficulties related, on the one hand, to the rainfall situation which is more and more difficult, and on the other hand, to the grazing and trampling of seedlings, when they exist, by cattle.

In the Sudanese domain where agricultural activities predominate, clearing leads to the extinction of entire populations of species; only useful species are saved during clearing.

Logging concerns all the ligneous species traditionally used as timber. The targeted species are numerous. In the absence of statistics concerning the proportions of the most sold species or prized, it can be noticed that:

- *Detarium microcarpum* (Detah with small fruits) is always very much exploited in its distribution area. This species does not seem to be in danger because of the strength of stump sprouts;
- *Prosopis africana* (Prosopis from Africa) has sparse populations and its regeneration is endangered by logging (it has a high calorific power). *Burkea africana* (Kurkea from Africa) is in the same situation;
- *Butyrospermum paradoxum* subsp *parkii* (Shea nut tree), although protected, is fraudulently and excessively exploited.

Today, since the demand is very high because of the population increase in the urban milieu, and rural migrations in the west is important, we are experiencing an important logging of fresh wood for fuel. In Bobo-Dioulasso, it can be noticed that since the devaluation of the CFA Franc in 1994, the number of wood traders has increased a lot.

For example, it has been pointed out that the Kou massif is very deteriorated particularly because of fraudulent logging and the negative impact of visitors. In the Mangodara region, clearing for the cultivation of yam has degraded the soils and the vegetation up to the north of Côte d'Ivoire. These human disruptions caused the scarcity of some species of fauna in Dindéréso and Folenzo.

Around big urban centres, some protected species such *Butyrospermum paradoxum* (Shea nut tree) suffer from excessive fraudulent logging, which results in the decline of the populations of such species. In addition, the reduction of fallow period contributed to the scarcity of species and populations in the agroforestry parks of neere (*Parkia biglobosa*), shea nut tree (*Butyrospermum paradoxum*), Tamarind (*Tamarindus indica*), grapefruit tree (*Lannea microcarpa*), plum-tree (*Sclerocarya birrea*), etc. Actions undertaken as part of the "three struggles" (struggle against bush fires, struggle against excessive logging and struggle against animal ranging) have now been reinforced by a policy aiming at associating local communities to the rational exploitation and sustainable management of forests, for example, the protected forest of Nazinon, the protected forest of Gonsé, the GEPRENAF project, the project GEF/Nazinga project, the protected areas project and the conservation of biological diversity in the east of Burkina Faso, etc.

3.3 NON-BIOLOGICAL RESOURCES

The management or exploitation of the following categories of non-biological resources often has an impact on biological diversity.

3.3.1 TOURIST SITES

The following tourist sites are clustered together and attached to urban centres in the country.

Bobo-Dioulasso and its neighbourhoods :

- city of Bobo-Dioulasso : Big Market, museum, Dioulassoba mosque, tomb of Guimbi OUATTARA, Dioulassoba district
- village of Koro;
- Hippopotamuses pond of Bala;
- village of Borodougou;
- Dafra sacred pond;
- Guinguette (Spring of the river Kou).

Banfora and its neighbourhoods :

- city of Banfora ;
- sugar zone: SOSUCO, SOPAL;
- Fabledougou Domes;
- Sindou Peaks;
- Cascade of Karfiguela;
- Waterfalls of Tourni ;
- Fruit zone Orodara;
- village of Tengrela.

Gaoua and its neighbourhoods:

- ruins of Loropeni;
- city of Gaoua;
- ruins of Kampti.

Ouagadougou and its neighbourhoods:

- city of Ouaga : Rood Woko market, museum, handicraft centre, MORO NABA Palace ;
- Museum of Manéga;
- Crocodiles pond of Bazoulé;
- Fruit Project of Bazèga;
- Artists' village of Laongo;
- Monastery of Koubri;
- city of Saponé.

Koudougou and its neighbourhoods:

- city of Koudougou;
- Project of Goundi;
- Pond of sacred crocodiles in Sabou;
- city of Réo;
- village of Sambisgo and its "Red Riders".

Ouahigouya and its neighbourhoods:

- city of Ouahigouya;
- village of Ramatoulaye;
- city of Yako : hills of Pilimpikou;
- city of Gourcy;
- city of Titao.

Dori and its neighbourhoods:

- city of Dori;
- Oasis of Djomga;
- village of Gorgadji.

Pô and its neighbourhoods:

- village of Tiakané : Binger's hut;
- village of Tiébéle : Kasséna habitat;
- Nazinga Ranch;
- Kaboré Tambi Park.

Gorom-Gorom and its neighbourhoods:

- Pond and Dunes of Oursi;
- Pond of Darkoy;
- Markoye Ranch;
- Sanctuary of the Birds of Oursi Pond.

Fada N'Gourma and its neighbourhoods:

- city of Fada;
- Lake of Tapoa;
- village of Namouno;
- waterfalls of Koudou;
- cliffs Gobnangou;
- W National Park;
- Kompienga Dam;
- fauna reserve of Arly;
- Bagré Dam;
- Hippopotamuses Pond of Lenga, called "Woozi" (this site has now been swallowed up by the water of the Kompienga Dam).

Many other sites besides those above-listed exist, but they have not been valorised yet.

3.3.2 MINERAL RESOURCES

At the level of mining, many studies or prospecting have revealed that the country owns a wide range of mineral indices such as gold, phosphorous, zinc, silver, lead, nickel, bauxite, limestones and cement stones, magnetites, manganese, bituminous schists and diamond. For the time being only gold has been the object of industrial exploitation, semi-industrial exploitation, handicraft or gold washing. The existence of functional small china tiles units can also be mentioned. The exploitation of the manganese of Tambao whose volume reaches 17 million tonnes with a content of 54 %, as well as that of the huge sulphides of Perkoa whose deposit is estimated at five million tonnes have started. All these mineral activities have a negative impact on the environment and it is worth compensating each time these activities are undertaken.

It must be pointed out that the exploitation of mining resources is confronted with physical problems or obstacles, mainly the absence of water, isolation and the high cost of energy.

3.4 THREATS

The threats concerned in this chapter are constraints and trends, which impede the objective of conservation and rational or sustainable use of biological diversity. Those endangering biological diversity in Burkina Faso are in general of climatic and human origins. On this specific level, there are many threats, which also impede efforts of conservation and sustainable use of biological diversity.

Because of the objet of the impact of such and such a threat, this may be considered as a general threat applying to all the biological diversity, or as specific harming one or a few species.

3.4.1 GENERAL THREATS

Biological diversity in Burkina has been subjected since the 70°s to major threats, which disturb ecosystems and cause loss of species.

3.4.1.1 Drought and desiccation

Drought is defined as a period of one or two years whose rainfall is less than the average (TOULMIN C, 1993). Scientists think droughts have always been a tragic and concomitant phenomenon of life in the Sahel. Thus, drought periods have marked the history of Sahelian countries. Their resulting duration, scope and damages have constantly increased in the recent 100 years (LEISINGER K. M./SCHMITT K., 1992).

Droughts have disrupted the equilibrium of many ecosystems and led to devastating effects on croplands and cattle. Today, the consequences felt express themselves through both economic impoverishment of populations and the impoverishment of biological diversity.

The droughts from 1968 to 1973, with a volume of rains of 15 to 40% less than the average, resulted in losses of harvests and cattle, aggravating at the same time the competition for land

use. Plant and animal production systems have had to undergo modifications in order to adapt to the situation. Farmers abandoned their traditional varieties with often a long cycle to adopt new varieties with shorter cycle. Therefore, an impoverishment of the genetic patrimony was being done unwillingly. Thus, many cultivated varieties of plant species were abandoned or lost. The droughts have often led to the consumption of seeds following famines they cause.

The transformation of natural spaces (habitats of forestry or aquatic fauna) leads *ipso facto* to the decline, even the extinction of some species of fauna dependent of these milieux. The disruption in land use leads to the displacement of populations towards zones, which are relatively favourable to agricultural and pastoral activities.

As to desiccation phenomena they are translated into the decrease in the groundwater table, the drying up of streams and the death of the vegetation, particularly of ligneous species. CAMILLA TOULMIN defines desiccation as an aridity process resulting from a dry period whose duration is termed in decades. It leads inevitably to the loss of ligneous and herbaceous vegetation, the drying up of some water bodies, the decrease in the level of the groundwater table, etc.

The droughts of the 70's and the persistent irregularity of rainwater in recent years have clearly uncovered the need to have production systems adapted to climatic variations and capable of producing the minimum required. In these conditions, it is imperative to have a wide range of species, which are more productive and more resistant to drought.

3.4.1.2 Demographic growth and population movements

In 1960 the population of Burkina was 4 300 000 inhabitants, while in 1991 it was estimated at 9 190 000 inhabitants. The significant consequences resulting from this important demographic growth are, for example, the increase in land pressure and the rise in the demand for food, clothes, housing, health care, education and employment. In Burkina Faso, the satisfaction of the economic needs of the populations mainly comes from the exploitation of biological resources.

3.4.1.3 Bush fires

In Burkina Faso, bush fires constitute one of the main threats to the conservation and sustainable use of biological diversity. These fires are customary (as part of customary ceremonies), criminal (intentional) or accidental. Every year, tens of thousands of hectares of forests are destroyed by fire. If the phenomenon is not quickly controlled, all the expected objectives from the protection and the development of natural formations in favour of sustainable development will be compromised.

3.4.1.4 Degradation of soils

Soil degradation is a notion that can be related to the extent of soil exploitation. In effect, it is caused by the inappropriate methods of land use in careless delicate or fragile ecological conditions. Like any production means, soil deteriorates and needs to be recapitalised. Yet, in the case of Burkina Faso, usually when soil deteriorates, it does not benefit from inputs to enable its restoration, hence the aggravation of the process. Besides, the phenomenon of desertification and overpopulation, which result in the scarcity of croplands leads to the

reduction or abandonment of the fallow period. All these realities no longer permit the biological diversity to renew itself as it should.

3.4.1.5 Policies of natural resources management

Policies of natural resources management aim at attaining expected results in order to ensure the well-being of populations. However, some development policies do not comply with the concern of sustainable development so much sought today.

In effect, in a country with limited resources like Burkina Faso, there are often tendencies to meet immediate objectives at the detriment of biological diversity:

- the cultivation of yam and cotton which always need rich soils, explaining in this way the massive and shifting clearing, which does not save plant species, disrupt ecosystems, render vulnerable the fauna the latter shelter;
- the abandonment of local varieties and breeds of cereals and domestic species in favour of the more productive and exotic ones.

At the institutional and legal levels, there are also the following situations which do not facilitate the conservation and sustainable use of biological diversity:

- since land belongs to the State and not to the person using it, the latter does not carry out sustainable investments, such as plantations, fearing to be disapproved one day;
- traditional land system, based on land concession, particularly temporary loans, constitutes a system of land insecurity for the beneficiary.

At the strategic level, there are two main threats on biological diversity. They are:

- the lack of a true environmental education Programme which effectively mobilises all the population for the protection of the environment;
- the lack of knowledge concerning the endemism of flora and fauna species, which does not permit to consider specific actions in favour of those that would be threatened.

3.4.2 SPECIFIC THREATS

As underlined earlier, specific threats in our case are those whose impact concerns only one or a few components of biological diversity.

3.4.2.1 Specific threats to flora

The following non-exhaustive list gives the specific threats to flora:

- overexploitation of raw materials of plant origin;
- overgrazing resulting from excessive grazing of fodder and trampling of the herbaceous stratum by cattle;
- uncontrolled agro-pastoral practices;

- the introduction of invading species which in the long run prevent the development of other species (case of water hyacinths and attacks from parasites);
- shifting cultivation which calls for new clearing as the farm becomes less productive;
- pollution of water due to the use of pesticides, which leads to the mortality of some aquatic plant species;
- excessive logging;
- genetic erosion following the abandonment of local varieties;
- silting of water bodies.

3.4.2.2 Specific threats to fauna

The specific threats to fauna are as follows :

- poaching, with as adverse effect the insecurity of officers in charge of the protection of fauna;
- overexploitation of synergetic and halieutic resources;
- genetic erosion through the abandonment of local breeds;
- practices susceptible, in the medium or long term, of leading to a significant loss in the diversity of domestic animals; it is the adoption of new breeds of big size (e.g.: sheep, goats, hens) at the detriment of local breeds which are naturally more adapted to local conditions, and the preference of males as compared to females for practical reasons or conveniences (e.g. : donkeys, horses, dogs, etc.);
- lack of gene banks of domestic animals;
- decline or extinction of species of aquatic fauna resulting from the decrease in water quantity;
- destruction of or attacks on habitats;
- silting of water bodies;
- pollution of water due to the use of pesticides, which leads to the mortality of some aquatic species.

3.5 SITUATION ON STTINGUP *EX-SITU* CONSERVATION

Burkina Faso has neither centres of genetic resources, nor a central gene bank. However, it owns a few agencies in charge of the collection, handling, distribution, medium and long term conservation and improvement of plant and animal genetic resources. They are: INERA (in charge conducting and co-ordinating research activities in the domain of environment and agriculture), the University of Ouagadougou (conventional institution in charge, among others, of issues related to nature sciences and rural development), CNSF (National Centre of Forestry Seeds) in charge of providing to research and development good quality forestry seeds, CRPAs (whose main object is the promotion of agriculture and pastoralism in the country's regions).

These structures do not have human and material resources in quality and quantity to fulfil their mission. For example, the station of Farakoba now has only one freezer for the conservation of cereal samples. Another difficulty of these conservation institutions is that almost all of them function on the basis of projects, which does not ensure their sustainability. At the level of documentation, there is no solid and catalogued basic data. The data are found in the archives of researchers, and today, the data on vulnerable, threatened or endangered

species have not been collected with precision for some categories of resources, such as agricultural plants. For this category of plant resources, the status of collections undertaken is limited to what is presented below.

3.5.1 COLLECTIONS

In this report, mention has been made of the collections of cereal, leguminous and tuber plants and of a few ligneous species and fodder plants undertaken in Burkina Faso since 1960. Concerning the *ex-situ* conservation of agricultural plants, INERA has two air-conditioned rooms (now out of use), one at the station of Kamboinsé and another one at the Station of Farako-Bâ. Temperatures vary between 17 and 18°C, and seeds (all species taken together) are preserved there. As far as ligneous plants are concerned, they are preserved by CNSF in three different milieux : ambient temperature, one air-conditioned room and two cold-storage rooms. But in reality, there is no gene bank with a national vocation, having a well structured team. Each Programme of INERA manages its own work germplasm according to improvement objectives, whereas the material preserved at CNSF is particularly in accordance with demand priorities of species. There is no clearly defined national Programme.

3.5.1.1 Cereal collections

3.5.1.1.1 Sorghum (*Sorghum bicolor*)

A first gathering of local forms of the "Guinensia" type of Sorghum was undertaken by IRAT since 1959 at Saria and later enlarged with other samples kept at Farako-Bâ and 37 non "Guinensia" forms collected in 1967 (Le Conte J., 1967). From the prospecting undertaken by IRAT/CIRAD, INERA now has its disposal :

- 247 ecotypes of medium cycle sorghum at Saria (BALMA D., 1985) ;
- 127 ecotypes of long cycle sorghum at Farako-Bâ, from the first collections of ICRISAT of 1979. At that time 800 local varieties were gathered from Burkina Faso, Niger and Senegal (ICRISAT, 1980). During this period, ICRISAT's Phytogenetic Resources division received at Hyderabad (India) a collection of 210 ecotypes of sorghum from Burkina Faso (Mengesha M.M. and Prasada Rao K. E. 1981) ;
- 389 ecotypes of Sorghum were gathered from the regions of the north, east, and centre of the country by CIRP in 1981 ; this collection was continued in 1982 with DSA by the gathering of 197 ecotypes from the south-west. In 1984, 1985, 1986, U.O./IDR/CIRP gathered about 870 forms of cultivated sorghum and about ten spontaneous forms throughout Burkina Faso.

Evaluation tests were conducted in the field with this material. Thus, taking into account the ecological conditions of the origins of samples, most experiments were carried out on sites close to these conditions. The objectives aimed at by these evaluations usually have a morphological characterisation based on a certain number of criteria and the taking into account of some diseases and parasites. Because of the sparse actions of collection, it cannot

be concluded that these samples are representative of natural diversity, and consequently could not satisfy the needs of research. In the same way, as conservation conditions are deplorable, many genetic resources have already been lost for good.

3.5.1.1.2 Millet (*Pennisetum americanum*)

About 200 local ecotypes of millet have been collected by IRAT between 1960 and 1986 throughout the country.

ICRISAT gathered a certain number of traditional cultivars between 1977 and 1981 :

- 551 numbers from an ORSTOM/FAO/ICRISAT collection in Burkina Faso and Niger, were evaluated in 1977;
- 1 112 sampled ears in 108 farms from the Mossi plateau in 1980 and 1981;
- collection of early material (Iniadi) in the south-east of the country in 1981.

A coverage of the regions of the north, east, centre in 1981 and south-west in 1982, permitted to gather respectively 211 ecotypes (with three spontaneous forms) and 76 ecotypes.

New prospecting series throughout the country, have allowed U.O./IDR/CIRP to gather some 333 ecotypes.

The various results show that Burkina Faso ecotypes display a great genotypic variability (cycle, length, width and ear shape, seed colour...), characteristic of the climatic zones roughly corresponding to the latitude. Therefore, one can distinguish :

- in the north (Sahelian zone), early varieties (cycle of 90 to 100 days), with usually long and thin ears having a cylinder shape, a roux yellow seed colour (Gaouri Baleri) or light yellow (Gaouri Daneri). These seeds would be close to the forms of "Haïni" millet from the west of Niger;
- in the south (south-Sudanese zone), varieties with late cycle (120-150 days) having short to medium ears (20 to 80 cm). In the southern and eastern part of this zone (Pô, Diapaga), very early forms of 90 days (Iniadi Millet), with shorts ears (30 to 30 cm) having usually conic form and grey seeds are found;
- in the centre (north- Sudanese zone), semi-late varieties (100 to 120 days), with short and thin, spindle-shaped, conic or cylinder shaped ears (30 to 40 cm). These ears become longer and longer in the north of the Mossi plateau. The colour of the seed may be yellow (Kapelga) or grey (Kassabelga). In the western part of this zone (Nouna), later varieties close to "Sanio" millets (130 to 150 days) are found.

The size of the ecotypes observed at Gampéla (Centre), presents a variation of 124 to 386 cm (ZONGO J. D. et al. 1988). In general, in the south-west the biggest ecotypes are found in the south-west.

The exploitation of the variability of the local ecotypes from the various prospecting made it possible to provide vulgarisation with high performance material in population varieties.

As a result of millet allogamy, the conservation of collections proves to be difficult and is undertaken in lines (live collections), and medium conservation is released in the same conditions as sorghum. Some institutes such as IRAT thought about a permanent collection with farmers in order to preserve variability.

3.5.1.1.3 Maize (*Zea mays*)

As early as 1962 IRAT gathered a certain number of mainly early local ecotypes from the west and a population from the centre. It remains from this prospecting improved varieties including some which have gone into vulgarisation and others preserved as live collections (BALMA D., 1985).

The 1981 prospecting (CIRP- DSA), also permitted to gather 8 ecotypes from the north, centre and east of Burkina Faso and 153 ecotypes from the southwest.

All this collection, i.e. 201 ecotypes, was handed over to INERA. The results from the evaluation of these collections show that :

- Burkina varieties differ in seed colour (yellow, white, reddish-brown) and the length of their cycle;
- In the centre and east, there is a predominance of ecotypes with more early yellow seeds;
- In the south-west, there is a mixture of white and yellow varieties with a good frequency of the dentate white type;
- there is no marked gradient between cycle length and latitude.

The problem of medium and long term conservation on the spot occurs in the same way as for other cereals because of the limited capacities of freezers.

3.5.1.1.4 Rice (*Oryza sativa*, *Oryza glaberrima*)

A total of 527 samples were collected with a predominance of *O. sativa* (90 %) over *O. glaberrima* (10 %).

The abandonment of *glaberrima* is general throughout the country and seems to come from many factors, particularly the length of the cycle, ginning and the presence of more high performance varieties of *sativa*.

This prospecting also revealed an uneven distribution of rice-growing as well as samples (60 % were collected in the southwest) due undoubtedly to the present distribution of rains in Burkina Faso.

The most popular variety remains the sintane Diofor (cultivated everywhere). One notices a clear predominance of improved varieties in the CRPA of Hauts-Bassins and the persistence of the Konsourou and the series of alkam in the CRPAs of the centre and centre-south.

The prospecting did not permit to collect wild species of the type *Oryza barthii* and *O. longistaminata* because of the drying up of their site and also the period (from November 1983 to February 1984) was not favourable for all the regions. A second prospecting would be

necessary. The results from the evaluations, taking into account the agronomic and morphological characters and the enzymatic polymorphism, are expected.

3.5.1.2.1 Prospecting and collections of Cowpeas (*Vigna sinensis* or *Vigna unguiculata*)

Cowpeas prospecting began in 1977 in Burkina Faso with the collection of about 40 local ecotypes (BALMA, 1985).

In 1981 and 1982, in addition to the prospecting of cereals, respectively 40 ecotypes in the north and about 90 ecotypes in the west, were gathered. At the time the Programme had a collection of 161 local ecotypes called KVu (Kamboinsé *Vigna unguiculata*).

Evaluations and results: 109 entries of this collection were evaluated in Kamboinsé in 1982 for a few agronomic characteristics at 2 planting dates.

Ecotypes presented the following characteristics:

- 18 usually late and photosensitive entries with big, white and rough seeds (15-63 g/100 seeds) having a lying growth ;
- 45 non- photosensitive entries with creeping growth, early and 4 small ones (10-11 g/100 seeds);
- a leguminous other than *Vigna*, from the *Kerstingiella geocarpa* species, with a full cycle of 110 days;
- 45 without flowers.

All the material was tested for resistance to aphids, beetles, Striga, drought and for the production of good quality seeds. A few varieties having displayed good characteristics are used in crossing Programmes:

- Ouahigouya local variety resistant to drought crossed with KN-1 (Kamboinsé Niébé-1);
- Kaya local variety with a good quality seed crossed with Gorom-local for resistance to Striga;
- Kaya local variety with a good quality seed crossed with TVu 2027 for resistance to bruchas;
- Kamboinsé local variety resistant to Maruca, crossed with TVu 2027 for resistance to beetles.

KVu-2 and KVu 20-2 entries seem to be the best, the local Gorom variety has gone into vulgarisation for a long time. The varieties considered to be interesting are kept in live collections and regenerated every 2 years.

3.5.1.2.2. Bambara groundnuts Prospecting and Collections (*Voandzeia subterranea*)

The first prospecting of Bambara groundnuts were undertaken, in addition to the prospecting of cereals in 1982 and 59 local varieties were collected (southwest). In order to start the Programme, 67 introductions from Mali (22), Nigeria (33), Senegal (2) and IITA/Ibadan (10) were also carried out. A total of 45 entries including a local and exotic material was evaluated for a few agronomic characters.

Diseases attacked most of the entries. After evaluations, the selection Programme conducted a certain number of yield tests, which are still going on now.

Bambara groundnut collection (KVs = Kamboinsé *Voandzou subterranea*) is kept in live collections and renewed every two years.

3.5.1.3 Tubers

Five crops: yam, sweet potato, cassava, araceae (Taro and Macabo) and Souchet (seasoning plant) have been prospected. The evaluations dealt with an important number of morphological characters taking into account the vegetative apparatus and the tuber.

3.5.1.3.1. Yams (*Dioscorea* spp.)

In each prospected region 10 samples have been collected per cultivar, i.e. about 300 samples of cultivated yam. Local names were given to these cultivars, wild yams were only numbered. Because of the overlap of some samples, the number of cultivars has been reduced to about 50.

Recorded cultivated varieties come from 4 species: *Dioscorea cayenensis* (80 %); *Dioscorea alata*; *Dioscorea bulbifera*; *Dioscorea esculenta*;

There are 3 groups at the level of wild yams: *Diocorea togoyensis*, *D. dumenterum* , *D. Abyssinica*.

3.5.1.3.2. Sweet potato (*Ipomaea batatas*)

Collected samples produced 6 clones distributed as follows: 2 clones with white-light white skin, 2 clones with red-light white skin, 1 clone with yellow skin and 1 clone with white-light yellow skin.

3.5.1.3.3. Cassava (*Manihot esculenta*)

Two clones have been identified, one with a red skin and another with a white skin.

3.5.1.3.4 Taro (*Colocasia esculentus*)

Only one variety of taro was prospected.

3.5.1.3.5. Macabo (*Xanthosoma sagittifolium*)

Samples resulted in a rain-fed variety and an aquatic variety.

3.5.1.3.6. Souchet or sugered peas (*Cyperus esculentus*)

Two varieties were recorded, one with a black skin and another with a yellow skin.

3.5.1.4 Fodder collections

A prospecting was undertaken in 1984 in the north of Burkina (ABOU F. et FOURNIER A., 1984) and permitted to collect 40 taxons including : 23 annual Gramineae, 9 perennial Gramineae, 3 annual Papilionaceae, 3 perennial Papilionaceae and 2 perennial Cyperaceae.

The samplings concerned 148 seeds (grains) and 106 vegetative samples.

An initial evaluation of the production potential of the collected ecotypes was made in 1986. The following results of 24 ecotypes were recorded:

- the local green matter varies from 0.130 T.M.S./ha (for *Chloris pilosa*) to 18.7250 T.M.S./ha (for *Pennisetum pedicellatum*);
- the total dry matter varies from 0.047 (same species) to 5.805 (same species) T.M.S./ha ;
- *Panicum laetum* and *Echinochloa sp.* Bearing up to 4 mowings.

3.5.1.5 Ligneous collections

Vulnerable, threatened, endangered or particularly economically important species now benefit from sustained attention. Thus, the seeds of 67 species have been collected by CNSF. Among them the following local species categorised below are concerned by this option:

- **threatened species:** *Acacia senegal*, *Dalbergia melanoxylon*, *Pterocarpus lucens*;
- **vulnerable species:** *Adansonia digitata*, *Anogeissus leiocarpus*, *Bombax costatum*, *Ceiba pentandra*, *Khaya senegalensis*, *Parkia biglobosa*, *Prosopis africana*, *Acacia nilotica*, *Acacia raddiana*, *Acacia seyal*, *Acacia senegal*, *Acacia sieberiana*, *Tamarindus indica*, *Sclerocarya birrea* and *Daniellia oliveri*.

Efforts are also being made in order to be able to have seed collections of endangered species, such as *Celtis integrifolia* and *nium obesum* (jackal baobab). An *ex-situ* conservation policy in favour of other important or endangered species is making its way through.

In this way, CNSF, the agency in charge of the supply of good quality seeds to producers and researchers undertook a study aiming at determining the conservation capacity of utilitarian species, in order to make them available as much as possible. The species concerned are: *Acacia albida*, *A. gourmaensis*, *A. nilotica* variety *adansonii*., *A. nilotica* variety *tomentosa*., *A. senegal*, *Balanites aegyptiaca*, *Bauhinia rufescens*, *Ceiba pentandra*, *Gmelina arborea*, *Jatropha curcas*, *Khaya senegalensis*, *Parkia biglobosa*, *Parkinsonia aculeata*, *Prosopis juliflora*, *Pterocarpus erinaceus*, *Pterocarpus lucens*, *Tamarindus indica* and *Ziziphus mauritiana*.

As far as *Parkia biglobosa* is concerned, a collection from 96 sources including each 25 to 30 separate descents was undertaken in the distribution area of the species in West Africa. In addition, INERA, through the former IRBET owns herbarium collections of which the first are from the fifties, as well as an arboretum. Other collections of the same kind of herbariums were undertaken by specialised institutions for specific needs; this is the case of the Institut du Développement Rural of UO and CNSF.

3.5.1.6 Entomological collections

With regard to the important position of insects in the life of humans, they also benefited from a certain attention. In effect, many species of insects are useful whereas others are harmful. Thus, many institutions whose activities deal with insects realised specific collections. The main structures of this kind are found in the cities of Bobo-Dioulasso and Ouagadougou and listed below.

a) In Bobo-Dioulasso:

- MURAZ Centre, Bobo-Dioulasso;
- INERA research centre of Farakoba and its attached services :
 - Cotton Programme,
 - Plant Protection Service,
 - Plant Protection Laboratory;
 - C.I.R.D.E.S.

b) In Ouagadougou:

- the ONCHOCERCOSIS PROGRAMME;
- IRBET now INERA Forestry Production Department;
- The French Institute for Scientific Research and Cooperation Development commonly know as “ORSTOM”;
- C.I.R.A.D.;
- C.N S.F.;
- the Laboratory of Applied Entomology of the University of Ouagadougou;
- the Laboratory of Natural History of CNRST;
- the entomological collection of the INERA Station of Saria.

3.5.1.7 Collections of vertebrates

As far as vertebrates are concerned, few collections have been undertaken. Only the Laboratory of Natural History of CNRST has a collection of domestic and wild fauna containing some 6 000 samples of snakes, and an important collection of fishes.

CHAPTER 4: COMPLEXITY OF NATURAL RESOURCES AND BIOLOGICAL DIVERSITY MANAGEMENT.

4.1 INSTITUTIONAL AND LEGAL ASPECTS.

It is estimated at the present time that the regulation be it customary or modern, does not sufficiently take in account the conservation of the biological diversity even though, on the whole it already contributes to its conservation. Thus, in the traditional society, the use of natural resource is submitted to a customary regulation under the control of a customary chief.

4.1.1 TRADITIONAL ORGANISATION OF NATURAL RESOURCES MANAGEMENT.

Nowadays, land problem constitutes one of the thorny elements in the issues of soil management. In spite of the different reforms, customary practices are part of the daily life of villagers. The natural resources are placed under the sovereignty of a land custodian or village chief. In the traditional society land law is imperative at the level of the customary exploitation and conflict resolution.

a) Access to land in the rural environment

Land is considered a property whose access is reserved to all, including strangers. However, there are rules of land tenure. The different types of uses are: permanent use right that is acquired by inheritance, or after clearing or yet by lineage (or segment of lineage) and temporary use right that is a loan granted by a permanent use holder.

In the traditional environment, land is an inalienable property and by this fact it cannot be the object of an exchange, of mortgage, of sale or even less definitive gift. The advantage of the traditional system is that land is a sacred property and it escapes despoilment. Its major inconvenience resides in the nature of the system of land concessions notably the temporary loan, source of permanent insecurity for the recipient.

b) Traditional right of use of forest and other resources

The traditional African society in general and Burkinabè in particular distinguishes two types of forests:

- the sacred forests that represent places of cult and are therefore shielded from all forms of exploitation. They are rarely more than ten hectares each;
- the bush that represents the non-sacred forest areas whose exploitation is subject to rules and customs generally under the authority of land owners or bush chief. It is there that rural and other various activities take place.

Traditional rights of use include nuances according to the produce to which they apply.

- **Right over trees**

The Right to exploit trees is exercised by the land custodian village chief, or the land lineage chief or by the recipient owner of loaned land. Generally, the land owner sets the rules for the exploitation of so-called sacred trees (or useful ones) such as the *néré*, the shea nut, the baobab, the fig-tree, the kapok tree, etc.

- **Hunting Right**

In general, traditional hunting in Burkina Faso is yearly and collective (beat). In addition, it exists the individual hunt that is the regular hunter fact.

- **Fishing Right**

The management of lakes is also the responsibility of customary authorities. Permission to fish is given by the customary chief in the Mosi area, water chief in the Bissa area and no one can fish without their authorisation. In the Gurunsi area, every village can have a backwater that it exploits as it pleases the villagers. Traditionally, there are some accredited fishermen.

- **Grazing Right**

The lands traditionally reserved for agricultural activities raise the issue of breeders' access to pastures, and their uses are regulated on a consensual and control basis.

4.1.2 STATE LEGISLATION ON NATURAL RESOURCES MANAGEMENT

The Constitution of Burkina Faso states that all citizens have a right to a healthy environment, but they also have a duty to protect resources of the environment (article 101 of the constitution). Thus, the management of natural resources and the environment in general falls within the competence of the law that determines the practical measures on the subject.

The legislation in force on the management of resources concerns several aspects of its management, from land to irrigated perimeters, and is complex enough. Indeed, most of the present laws concerning the environment are still characterised by their partial colonial nature. As all the old French colonies of the subregion, Burkina Faso inherited the colonial legislation as regards land, forestry, fauna and fishing in French West Africa. Although many texts were subsequently adopted, the colonial legislation still subsists in many domains. The fact is that all this set of colonial texts organises a protection with little efficiency of the environment. Elaborated at a time when conceptions about natural resources protection were still recent, they are limited in general to a utilitarian approach. Nowadays, this conception has evolved a lot to consider the environment as a property that deserves a particular protection, no more in an immediate perspective but for present and future generations.

Other evils that characterise the environmental legislation up to a recent date are: multiplicity, inefficiency and often confusion.

- *The multiplicity* of texts results from the fact that elaborated in the colonial and post colonial contexts, their conception was not perceived in a globalised approach of promotion and protection of the environment. It was an ad hoc legislation, destined to manage punctual

situations. This punctual approach, consisting in legislating just as the circumstances arose, inevitably entailed some consequences that hindered the pursuit of coherent and effective actions;

- *Confusion*: to the multiplicity of texts is added the multiplicity of actors on the ground; all things that create confusion in the sharing of roles and responsibilities linked to the application of texts;
- *The ineffectiveness* of this legislation results from the fact that most of these enforcement texts were disseminated in the administration, without hold over the realities on the ground. These texts imprinted with the colonial spirit resolutely opted for excessive repression of the populations that did not understand why on their own land they were excluded from the exploitation of the natural resources (e.g.: case of forest reserves).

To mitigate the perverse effects of these situations the authorities often proceed to the adoption and/or rereading of some measures. For example, we can mention: the Agrarian and Land Reorganisation, Forestry Code, Environmental Code, Water Code, Draft Orientation Texts on Decentralisation, etc.

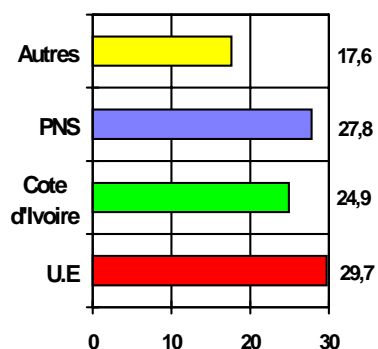
CHAPTER 5: ECONOMIC ASPECTS OF BIOLOGICAL DIVERSITY

The economy of Burkina Faso rests mainly on biological diversity. Indeed, the key sectors for the development of the country (notably, agriculture, breeding, forestry, fisheries, wild fauna, tourism, pharmacopoeia, trade) call on biological diversity. Many other needs of the populations come from biological resources. For example, agro-pastoral production represents a bit more than 38% of the Gross Domestic Product of the country, employs 85% of the population and ensures 40% of export returns (OUEDRAOGO N. A., 1997).

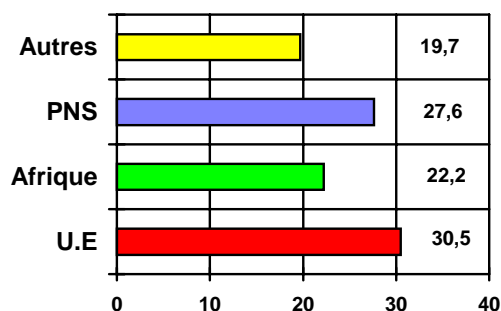
| MAIN IMPORTS | MAIN EXPORTS |
|---|--|
| Machines, vehicles, electric products, manufactured products, chemicals, oil products, cereals, dairy products, raw materials, lubricants, textiles | Cotton, manufactured products, machines, livestock, vegetables, leather and hides, groundnuts, shea nuts |

| VALUE IN MILLIONS | VALUE IN MILLIONS |
|---|-------------------|
| US \$: 552 US \$ | US \$: 321 US \$ |
| BALANCE OF TRADE IN MILLIONS US \$: - 231 | |

% of main suppliers



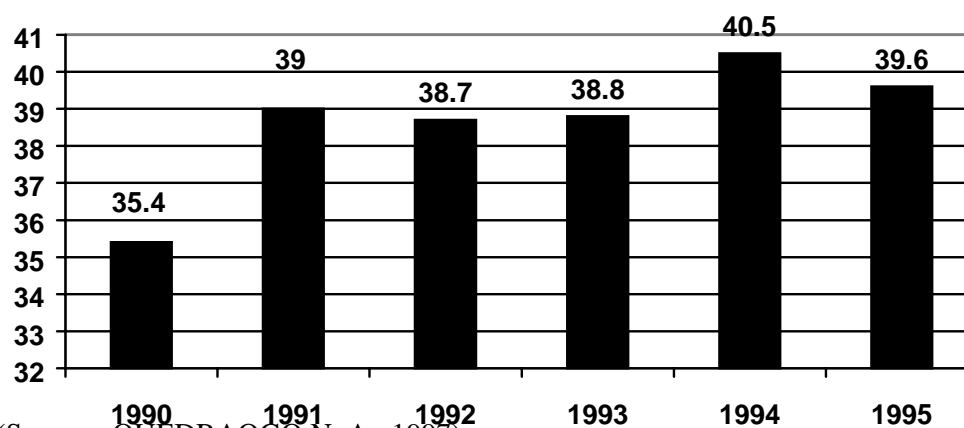
% of main clients



5.1 GENERAL SURVEY OF HUMAN DEVELOPMENT

The development of Burkina Faso essentially rests on biological diversity, in the sense that the primary sector is the main supplier of the gross domestic product (GDP). However, it must be admitted that data established concerning the degree of contribution of biological diversity to the economy of the country are below the realities and potentialities, because the biological resources remain very little evaluated and under-exploited. Table 27 presents the evolution of the contribution of this sector to the GDP from 1990 to 1995.

Table 27: Evolution of the primary sector's contribution to the GDP in % from 1990 to 1995

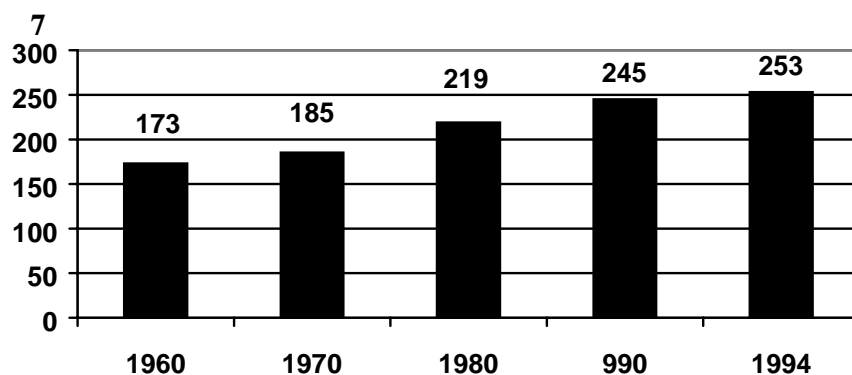


(Source : OUEDRAOGO N. A., 1997)

(Source : OUEDRAOGO N. A., 1997)

As indicated in this Table, the contribution of the primary sector to the GDP of Burkina Faso evolved during the concerned period. From 1960 to 1994 the GDP of the country evolved on an annual average of 1.1% (UNDP, 1997), what induced an appreciable rise of the per capita income. Table 28 presents the evolution of the per capita income by decade from 1960 to 1994.

In spite of this evolution, Burkina Faso is among the poorest countries of the world. According to the world report on human development (UNDP, 1997), poverty is understood as : insufficiency of income, bad conditions of health or education, lack of access to knowledge and possibilities of communication, impossibility to exercise some political rights and to assert human rights, absence of dignity, confidence and self respect, deterioration of the environment and impoverishment of the country. In the above cited report, detailed facts and figures on the level of development of Burkina Faso are provided. Table 29 presents some of these data by existing socio-economic development sectors. Appendix 4 gives the indicators used by the UNDP to determine the level of sustainable human development of countries.

Table 28: The evolution of the GDP in US \$ per capita by decade of 1960 to 1994

(Source : UNDP, 1997, World Report on the Lasting Human Development, p. 180.)

Table 29 : Level of development indicators by sector

| Development sector | | Indicators of development | | | |
|---|---|---|--|--|--|
| | 1960/173 \$ | 1970/185 \$ | 1980/219 \$ | 1990/245 \$ | 1994/253 \$ |
| Decennial evolution of the GDP (in US \$) per inhabitant (year/GDP) | | | | | |
| Access to goods and services | Population with access to health services 1990-1995 : 90% | Population with access to drinking water 1990-1996 : 78% | Population with access to sewerage | Rate of adult literacy in 1994 : 18.7% | Gross rate of schooling 1992-1994 : 25% |
| Health | Population to physician ratio 1988-1991 : 33,333 : 1 | Population by nurse 1988 | Children vaccinated against TB 1992-1995 : 78% | Children vaccinated against measles 1992-1995 : 55% | Public health expenditure : 7% of GDP |
| Flow of resources | Total external debt in % of the GDP in 1994 : 61% | Public aid for development received, 1995 : 483 million US \$ | Public aid for development received, 1995 : 16.6% of GNP | Public aid for development received, 1995 : 48 \$ per inhabitant | % of imports compared to exports, 1994 : 37% |

5.2 SOCIO-ECONOMIC VALUE OF BIOLOGICAL DIVERSITY

The uses that the Burkinabè population make of the constituent elements or products of the biological diversity are numerous, but the main ones are: human feeding, energy, health, domestic needs, handicraft, industry, trade, animal feed, culture, tradition, religion, rituals, etc.

The socio-economic value of biological diversity resides not only in the direct use that one makes of biological resources, but also in the indirect uses, such as the ecological services (eg. : improvement of the quality of water and air, the fixing of nitrogen, the formation of soils), socio-cultural uses (eg. : religious and cultural functions), recreational and aesthetic

uses (eg. : tourism of vision), etc. These uses end up at the level of feeding and the different sectors of activity that are interested in biological diversity.

Thus, some thematic studies made in the context of the present monograph permitted to determine the following supplies of biological diversity to the national economy in 1996:

- Standing wood : 177, 394 million m³;
- big fauna: 35 species whose inventory is not yet exhaustive;
- fisheries: 12, 500 tons per year, of which only 7 000 tons are exploited;
- forest and fruit seedlings produced in nurseries: 12 million of which only a maximum of 4 million is transplanted;
- cereals: 2,963,300 tons of which 129,700 tons of rice;
- proteaginous: 665,000 tons of which 177,600 tons for cotton, 194,400 tons for groundnuts and 41,170 tons for tubers;
- livestock (bovines, ovine, caprines, porcines, asines, equines, camelins): 18 million heads (breeding contributes 12% to the GDP and 16% to exports);
- rabbits: 67,000 heads;
- pets (dog and cats): 900,000 heads;
- poultry: 22 million heads.

In addition to these elements, there is also the contribution of tourism of vision to the national economy; for example, this contribution was 17,791, 548 US dollars in 1993.

Due to the socio-economic and sociocultural importance of the national biological diversity, measures and policies of natural resources management have been developed since the colonial period.

5.2.1 BENEFITS OF BIOLOGICAL RESOURCES

The economy of Burkina Faso essentially depends on agro-pastoral produce, therefore on biological diversity. Indeed, it is this diversity that constitutes the source of subsistence of the populations and that provides the essential of export produce and products among which we can cite cotton, green beans, livestock, leathers and skins, sheanuts, etc.

Benefits derived from biological resources in Burkina Faso depend on the virtues that the different ethnic groups of the country give to the species. Indeed, it must be noticed that the importance of a plant or animal species, through its products, is relative and evolutionary: relative when we consider the diversity of uses within ethnic groups, evolutionary because with time a product can be the object of great interest or of no interest on the part of the populations. For example, the use made of *Acacia macrostachya* seeds (*Acacia* with thick ears) for feeding in the Moosé and Samo areas is completely unknown to a lot of other ethnic groups in Burkina Faso. Also, the benefits that will be mentioned below are those that are the most commonly known.

5.2.1.1 Plants (flora)

The main types of products derived from plants in Burkina Faso are shown in table 30

Table 30: Plant products

| Plants | Types of products |
|--|------------------------------------|
| Ligneous | Timber |
| | Timber |
| | Firewood |
| | Lumber |
| | Charcoal |
| | Oilseeds |
| | Kapok |
| | Gum and resin |
| | Copal |
| | Tannins |
| | Rubber |
| | Bamboo |
| | Fruits |
| | Food (grains, leaves) |
| | Medicines |
| | Fodder |
| Others (Ornament, rope, mats and secos, chairs and beds, shade, poison, chewing stick, utensils ...) | |
| Herbaceous | Food (cereals, leguminous, tubers) |
| | Market garden produce |
| | Cotton |
| | Sugar cane |
| | Medicines |
| | Fodder |
| | Building materials (straw, fibres) |
| Others (weaving) | |

These benefits are derived from the flora, either in the wild or tamed state. It is important to underline that the number of species established by type of product is not even determined with accurateness. Nevertheless, this document presents the existing data below, particularly, with regard to the importance of the socio-economic and socio-cultural ligneous species that are relatively more studied in this respect, a few data on the agricultural herbaceous species of marked economic interest.

5.2.1.1.1 Inventory of ligneous species of socio-economic importance

In the main document of the Strategic Plan of Scientific Research (agricultural research section), and for the improvement of forest resources, fifty six (56) species among the most utilised in Burkina Faso were indexed (Table 31)

On the basis of a listing according to nine types of uses: human food, energy, health, domestic needs, handicraft, industry, agriculture, animal feed and ecological interest, sixteen species were retained for the programme of forest resource improvement according to their degree of use. These species, by their wood and various non-ligneous productions that they offer, are of marked socio-economic importance.

They are:

Acacia albida, *Acacia senegal*, *Adansonia digitata*, *Anogeissus leiocarpus*, *Azadirachta indica*, *Balanites aegyptiaca*, *Borassus aethiopum*, *Butyrospermum paradoxum*, *Detarium microcarpum*, *Khaya senegalensis*, *Maerua crassifolia*, *Parkia biglobosa*, *Prosopis africana*, *Sclerocarya birrea*, *Tamarindus indica* and *Ziziphus mauritiana*.

On the basis of the nomenclature of AUBREVILLE A., 1949, for woods, and various studies on species of various interest (BOGNOUNOU O., 1987; GUINKO S., 1985; PERROT E., 1925 ; etc.), an open list can be drawn concerning species of marked socio-economic interest in Burkina Faso.

This list is global, and does not take into account the parameter of diversity of uses according to the ethnic groups and ecological zones. Indeed, it must be admitted that the importance of a plant species, through its productions is relative and evolutionary: relative if we consider the diversity of use among the different ethnic groups, relative and evolutionary through history and dependent on the economic demand of the moment, especially in market economy.

Thus, the seed of *Acacia macrostachya* is at the basis of the highly appreciated culinary specialty in the Mossi, Samo, and Léla areas. This use is totally unknown in the Bwaba areas, pending its discovery in the context of exchanges by contact between migrating populations and the native ones. The edible leaves of *Pterocarpus lucens* are not eaten among the Bobo and Bwaba populations, whereas they are the basis of a highly appreciated sauce in the Samo and Yadga areas.

Table 31: Most commonly used ligneous species in Burkina Faso

| Species | Degree | Species | Degree |
|---|--------|-----------------------------------|--------|
| 1. <i>Acacia albida</i> | 8 | 29. <i>Fagara xanthoxyloide</i> | 8 |
| 2. <i>Acacia macrostachya</i> | 2 | 30. <i>Gmelina arborea</i> | 4 |
| 3. <i>Acacia nilotica</i> var. <i>adansanii</i> | 6 | 31. <i>Guibourtia copallifera</i> | 4 |
| 4. <i>Acacia nilotica</i> var. <i>tomentosa</i> | 6 | 32. <i>Guiera senegalensis</i> | 6 |
| 5. <i>Acacia nilotica</i> <i>senegal</i> | 7 | 33. <i>Hyphaene thebaica</i> | 6 |
| 6. <i>Adansonia digitata</i> | 7 | 34. <i>Holarrhena floribunda</i> | 8 |
| 7. <i>Afzelia africana</i> | 6 | 35. <i>Isobertia doka</i> | 2 |
| 8. <i>Anogeissus leiocarpus</i> | 7 | 36. <i>Khaya senegalensis</i> | 10 |
| 9. <i>Azadirachta indica</i> | 7 | 37. <i>Landolphia heudelotii</i> | 2 |
| 10. <i>Balanites aegyptiaca</i> | 7 | 38. <i>Lanea microcarpa</i> | 5 |
| 11. <i>Blighia sapida</i> | 8 | 39. <i>Maerua crassifolia</i> | 8 |
| 12. <i>Bmbax costatum</i> | 6 | 40. <i>Mitragyna inermis</i> | 2 |
| 13. <i>Borassus aethiopum</i> | 7 | 41. <i>Nauclea latifolia</i> | 2 |
| 14. <i>Boscia senegalensis</i> | 2 | 42. <i>Parinari curatelifolia</i> | 2 |
| 15. <i>Boswellia dalzielli</i> | 1 | 43. <i>Parkia biglobosa</i> | 8 |
| 16. <i>Butyrospermum paradoxum</i> | 10 | 44. <i>Prosopis africana</i> | 7 |
| 17. <i>Canarium schweinfurthii</i> | 1 | 45. <i>Pterocarpus erinaceus</i> | 5 |
| 18. <i>Ceiba pentandra</i> | 5 | 46. <i>Pterocarpus lucens</i> | 5 |
| 19. <i>Celtis integrifolia</i> | 4 | 47. <i>Rauvolfia vomitoria</i> | 8 |
| 20. <i>Combretum micranthum</i> | 5 | 48. <i>Saba senegalensis</i> | 2 |
| 21. <i>Commiphora africana</i> | 2 | 49. <i>Salvadora persica</i> | 1 |
| 22. <i>Crateva religiosa</i> | 1 | 50. <i>Sclerocarya birrea</i> | 8 |
| 23. <i>Daniellia oliveri</i> | 6 | 51. <i>Sterculia setigera</i> | 8 |
| 24. <i>Dalbergia melanoxylan</i> | 4 | 52. <i>Tamarindus indica</i> | 9 |
| 25. <i>Detarium microcarpum</i> | 7 | 53. <i>Vitex doniana</i> | 2 |
| 26. <i>Diospyros mespiliformis</i> | 8 | 54. <i>Voacanga africana</i> | 8 |
| 27. <i>Entada africana</i> | 5 | 55. <i>Ximenia americana</i> | 5 |
| 28. <i>Eucalyptus camaldulensis</i> | 6 | 56. <i>Ziziphus mauritiana</i> | 5 |

Degree of use (1 = least utilised species; 10 = most utilised species)

Source: Scientific Research Strategic Plan.

After this qualitative presentation of the main species of socio-economic interest, some data on their products that follow permit to situate their importance in the Burkinabè economy.

Historically the region of Bobo-Dioulasso was at the beginning of the century an important producer of natural rubber. From the natural planting of *Landolphia heudelotii*, the region provided in a year (KNIGHT A., 1905) seventy (70) tons of rubber. The introduction of hevea unfortunately ruined this economic hope. However, during World War II, Burkina and the different States of the ex-AOF (French West Africa), provided 3,446 tons of *Landolphia heudelotii* rubber as their contribution to the war effort against Hitlerien fascism (AUBREVILLE A., 1949). The latex of the liana still continues to be exploited but it is used solely as “dissolution” for the retreading of tyres.

If *Carapa procera* was exploited at the beginning of the century for its oilseeds (the demand was high from Marseille), the tree is only quite important locally. The seed continues to provide oil used in cosmetics and soap factory; ground, it is used in pharmacopoeia as anti-diarrhoeal and to attenuate the effect of palm wine from *Borassus aethiopum*.

As for *Canarium schweinfurthii*, Emile PERROT (1925) signalled the sale of balls of resin gums of this essence on the Orodara market. The incense of the country continues to be used and commercialised, but it remains of local importance as well as the resin gums of other Burseraceae (*Commiphora africana*, *Boswellia dalzielii*).

We can signal as a source of vegetable fat *Pentadesma butyracea* giving Lami butter. Forgotten by AUBREVILLE A. in his excellent work that is his Sudano-Guinean Flora; this relict tree forms some small populations in Tagara and the region of Sokouraba in the province of the KénéDougou.

The enumeration could be long. We are therefore going to limit the list voluntarily. In placing ourselves from the point of view of the centre of interest of the foresters, it appears to us interesting to deliver the economic appreciation of Aubréville on the plant productions of the forest species of the dry regions of West Africa, productions that did not benefit from enough interest like those of the dense forest regions.

a) The main types of ligneous production

The local species (AUBREVILLE A., 1949) will be enumerated by main type of production by taking up the author's nomenclature. The scientific partners are actualised in taking up those in force in the last edition of Flora of West Tropical Africa of Hutchinson L.J. & Dalziel J.M. revised by Hepper F.N.

- Ebony tree

The main species that provide wood for woodwork are :

- Mahogany of Senegal, Caïlcédrat (*Khaya senegalensis*): dense, colourful Mahogany, used for artisan manufacture of most furnishings;
- Vène (*Pterocarpus erinaceus*): this essence gives a light yellowish, brown veined violaceae wood with polished beauty;

- Ebony of Senegal (*Dalbergia melanoxylon*) : veined wood, classified as ebony.
- Timber

The list of species that provides wood for building is composed of :

- *Khaya senegalensis*;
 - *Pterocarpus erinaceus*;
 - *Dalbergia melanoxylon*;
 - *Azelia africana*, of the best dry woods,;
 - *Isoberlinia doka*;
 - *Acacia nilotica* variety *adansonii* / *tomentosa* variety, gives to tannifer pods;
 - *Erythrophleum guineense*;
 - *Afromosia laxiflora*;
 - *Anogeissus leiocarpus*;
 - *Prosopis africana*, wood very hard;
 - *Celtis integrifolia*;
 - *Diospyros mespiliformis*;
 - *Daniellia oliveri*, wood of caisserie,;
 - *Acacia sieberiana*;
 - *Borassus aethiopum*, the trunk used whole or split, constitutes a precious construction material for building bridges;
 - *Hyphaene thebaica*, important construction material in Sahelian zones where construction materials are relatively rare.
- Firewood and charcoal

Wood constitutes the main source of energy in Burkina Faso. Also, we can easily understand the importance given to firewood by the populations of the country. Except for some essence and tree specimen that are the object of socio-cultural value and *Stereospermum kunthianum* of which the inhalation of the smoke makes man feel dizzy, all the other species are used as firewood. Species with hard wood are used for charcoal (e.g. : *Butyrospermum paradoxum*, *Pterocarpus erinaceus* (vene), *Pterocarpus lucens*, *Tamarindus indica*, *Diospyros mespiliformis*, etc.)

- Oilseeds

Sheanut tree (*Butyrospermum paradoxum*) : its seed gives consistent fat (shea butter) with multiple uses (food, cosmetics, pharmacopoeia, etc.).

- Kapok trees

These are the productive kapok species, such *Bombax costatum*s and *Ceiba pentandra*s.

- Gum trees

Gum is an exudation that is produced in the dry season on the trunk of some plant species, essentially of the *Acacia* kind. The gum produced by *Acacia senegal* is one of the best, both by its adhesive properties and water solubility. The very dense species (more than

100 trees per hectare), dense (30 to 100 trees per hectare), less dense (5 to 30 trees per hectare) are especially important in zones of Sahelian climate.

Besides *Acacia senegal*, other species produce gum. These are : *Acacia seyal*, *Combretum nigricans*, *Anogeissus leiocarpus*, *Sterculia setigera*, *Acacia nilotica*.

- Copaliereses

Guibourtia copallifera, species exuding a hard copal called copal of Guinea.

- Tannins species

- *Acacia nilotica* variety *adansonii*, *Acacia nilotica* variety *tomentosa*, *Acacia nilotica* variety *nilotica*, *Burkea africana*, *Hymenocardia acida*, *Bridelia ferruginea*.

- Latex

- *Landolphia heudelotii*
- *Manihot glaziovii*
- *Butyrospermum paradoxum*

- Bamboos

There is only one species of bamboo that grows naturally in Burkina Faso ; it is about *Oxytenanthera abyssinica*, that provides hollow bamboo.

A particular mention must be made of the different wood species used in handicraft, construction and for different services, species for which the demand remains permanent. GUINKO S., 1984, gives many examples of them.

If the availability of some species (*Lannea microcarpa*, *Sclerocarya birrea*, that are used for making wooden bowls) are relatively important, others are becoming rarer and rarer because of some overexploitation and difficulties of natural and assisted regeneration. We will mention species such as *Pseudocedrela kotschyii*, *Prosopis exelsa*, as well as the particular case of relict forest gallery species (*Chlorophora africana*, *Antiaris africana*), exploited by modern sawmills in the province of Comoé.

b) Ligneous species of other interests

We will mention some groups of species which deserve a particular attention. These are : improvable fruit species by selection or grafting, improvable ornamental plants by selection or stuffing, trees with food organs (leaves, fruits, seeds), medicinal plants, local ligneous species of fodder interest.

- Improvable fruit species by selection or grafting

This list is inspired by Roberty,1950, but it has been improved.

Annona senegalensis

Cordia myxa

Diospyros mespiliformis

Lannea spp.

Parinari curatelifolia

Blighia sapida

Detarium microcarpum

Gardenia erubescens

Nauclea latifolia

Saba senegalensis

Sclerocarya birrea
Strychnos spinosa
Tamarindus indica
Ximenia americana

Spondias mombin
S. innocua
Vitex doniana
Ziziphus mauritiana

- Ornamental plants

Various *acacia* in quickset hedges
Cassia sieberiana
Heeria insignis
Stereospermum kunthianum
Bauhinia rufescens

Erythrina senegalensis
Feretia apodanthera
Securidaca longepedunculata
Strophanthus sarmentosus
Darlings nucifera

We can add to this list the different shade trees or trees with landscaped function (*Ficus sp.*, *Cola cordifolia*, *Khaya senegalensis*, etc.) and the various species of ritual value.

- Food organ (leaves, fruits, seeds) trees

Acacia macrostachya (seeds)
Adansonia digitata (leaves, fruits)
Azelia africana (leaves)
Annona senegalensis (flowers, fruits)
Balanites aegyptiaca (leaves, fruits, seeds)
Bombax costatum (flowers, calice, in the Moosi area, Bissa, Lela...)
Boscia senegalensis (fruits)
Capparis corymbosa (fruits)
Crateva religiosa (leaves)
Detarium microcarpum (fruits)
Diospiros mespiliformis (fruits)
Lannea microcarpa (fruits)
Lannea acida (fruits)
Ficus gnaphalocarpa (leaves, fruits)
Maerua angolensis (leaves)
Piliostigma reticulatum and *P. thonningii* (leaves) acidification of water for the cooking of “tô”
Pterocarpus lucens (leaves)
Securidaca longepedunculata (leaves)
Tamaridus indica (leaves, fruits)
Vitex doniana (leaves, fruits)
Ziziphus mauritiana (fruits)

- Remarkable medicinal plants

Acacia albida
Agave sisala
Allium sativum
Arachis hypogaea
Azadirachta indica
Balanites aegyptiaca
Cajanus cajan

Mentha piperita
Mentha viridis
Moringa oleifera
Parkia biglobosa
Pisum sativum
Punica granatum
Rauwolfia vomitoria

| | |
|------------------------------------|------------------------------------|
| <i>Capsicum annum</i> | <i>Ricinus communis</i> |
| <i>Capsicum frutescens</i> | <i>Saccharum officinarum</i> |
| <i>Carapa procera</i> | <i>Securidaca longepedunculata</i> |
| <i>Carica papaya</i> | <i>Sesamum indicum</i> |
| <i>Cassia italica</i> | <i>Solanum nigrum</i> |
| <i>Cassia occidentalis</i> | <i>Sterculia setigera</i> |
| <i>Cassia sieberiana</i> | <i>Strophantus hispidus</i> |
| <i>Catharanthus roseus</i> | <i>Tamarindus indica</i> |
| <i>Citrus limonum</i> | <i>Thevetia nerifolia</i> |
| <i>Darlings nucifera</i> | <i>Tinospora bakis</i> |
| <i>Combretum micranthum</i> | <i>Trichilia roka</i> |
| <i>Cymbopogon citratus</i> | <i>Voacanga africana</i> |
| <i>Datura stramonium</i> | <i>Xanthoxylum xanthoxyloides</i> |
| <i>Danillia oliveri</i> | <i>Zea mays</i> |
| <i>Elaeis guineensis medicinal</i> | <i>Zingiber officinale</i> |
| <i>Elaeis guineensis</i> | |
| <i>Glicine soy</i> | |
| <i>Holarrhena floribunda</i> | |
| <i>Lawsonia alba</i> | |
| <i>Lawsonia inermis</i> | |

- Perfume plants

| | |
|----------------------------|-----------------------------|
| <i>Ocimum spp.</i> | <i>Mentha spp.</i> |
| <i>Cymbopogon citratus</i> | <i>Cymbopogon giganteus</i> |

- Local ligneous species of fodder interest

All zootechnicians (GILLET, H., 1980) now agree to set to about 20% the minimum ligneous fodder part in the food ration of bovines in the dry season, in Sahelian and North-Sudanese zones.

Because of their richness in proteins, mineral salts, phosphorus and oligo elements, these species contribute in a non-negligible manner to the food and physiological balance of the livestock. In addition, their availability (leaves, flowers, fruits) in full dry season, when there is no grass, contributes to the survival of livestock during the critical periods. The ligneous species presented in Table 32 have an aerial foliage that contains a high nutritious value: As far as fruits are concerned, in spite of the limited knowledge on their nutritious value, they are of a non-negligible contribution. Here are two examples for illustrative purposes:

| | Proteins (%) | Phosphorus (%) |
|-----------------------------|--------------|----------------|
| <i>Acacia albida</i> | 11.7 | 0.12 |
| <i>Balanites aegyptiaca</i> | 11.2 | 0.12 |

- Food complement of plant origin (sources: BOGNOUNOU O., 1978; SAVONNET G., 1973; SCHNELL R., 1957; PROST A. and WEDRAOGO J., 1951).

These foods are provided by the simple picking of organs (leaves, fruits, seeds, tubers, rhizomes, roots etc.) of spontaneous plants not being part of an agricultural network, or at the stage of protoculture (case of *Gynandropsis gynandra*). From food point of view, their importance is not to be underestimated, because these plants contribute, in a direct or indirect way, to food balance, notably in the period of scarcity.

Food complements available in Burkina Faso and analysed by ORANA, Dakar, are:

- Starchy food : *Tacca involucrata*; Walnut and grains : *Adansonia digitata*, *Balanites aegyptiaca*, *Boscia senegalensis*, *Parkia biglobosa*;
- Vegetables and leaves: *Adansonia digitata*, *Amaranthus viridis*, *Cassia tora*, *Corchoru olitorius*, *Ficus gnaphalocarpa*, *Hibiscus sabdariffa*, *Moringa pterygospenna* (Mr. *Oleifera*) *Amaranthus spinosus*, *Piliostigma reticulatum*, *Ceratotherca sesamoides*, *Crateva religiosa*, *Gymnandropsis pentaphylla* (*G. Gynandra*), *Leptadenia lancifolia* (*L. hastata*);
- Fruits : *Adansonia digitata*, *Cola cordifolia*, *Diospyros mespiliformis*, *Landolphia heudelotii*, *Parkia biglobosa* *Borrassus aethiopicum* *Detarium microcarpum*, *Ficus gnaphalocarpa*, *Landolphia senegalensis*, (*Saba senegalensis*), *Spondias mombin*.

Plants that give food complements in period of scarcity are: *Dactyloctenium aegyptium*, *Setaria pallidifusca*, *Slylochiton hypogaeus*.

Table 32: Nutritional Values of some ligneous fodder species
(according to LE HOUEROU H.N., 1980)

| Species | Raw proteins (%) | Phosphorus (%) | Non-silicate minerals (%) | Degree of appetite (scale: 1 to 5) |
|-------------------------|------------------|----------------|---------------------------|------------------------------------|
| Acacia radiane | 16 | 0.20 | 7.50 | 5 |
| Acacia senegal | 22 | 0.20 | 8.00 | 5 |
| Acacia seyal | 18 | 0.27 | 0.20 | 5 |
| Balanites aegyptia | 25 | 0.11 | 10.00 | 5 |
| Cadaba farinosa | 25 | 0.20 | 30.00 | 4 |
| Celtis integrifolia | 11 | 0.20 | 12.50 | 5 |
| Commiphora africana | 11 | 0.17 | 9.40 | 5 |
| Acacia albida | 17 | 0.25 | 6.30 | 5 |
| Khaya senegalensis | 15 | 0.16 | 6.40 | 5 |
| Maerua crassifolia | 20 | 0.12 | 14.50 | 4 |
| Lonchocarpus laxiflorus | 18 | 0.13 | ? | 4 |
| Pterocarpus erinaceus | 15 | 0.15 | 7.60 | 5 |

Degree of appetite: (1 = little appetite; 5 = very appetite)

5.2.1.1.2 Main plant production inventory (herbaceous farm) of marked economic interest (KELLERMANN J., 1967).

Among the herbaceous farm crops some have produce that are of great economic interest. These are :

- cereals: Sorghum, Rice, Corn, Barley,;
- vegetable plants: Green cabbage, Cauliflower, Turnip, Radish, Cucumber, Melon, Green beans, Tomato, Onion, Garlic, Okro;
- fruit crops: * Irrigated : Citrus fruits, Avocado tree, Banana tree, Date palm;
* Non-irrigated : Cashew, Mango tree, Strawberry plant ;
- sugar plants: Sugar cane;
- oleiferous plants: Groundnut, Sesame, Soy, Sunflower, Castor oil plant;
- stimulating plants: Tobacco;
- textile plants: Sisal, Cotton;
- tubers: Cassava, Yam, Sweet potato.

5.2.1.1.3 Species of socio-cultural importance

a) Generalities

Correspondences, messages and beliefs exist between the African and his plant environment. This is translated notably by the conservation and protection of sacred woods, even the veneration of a certain number of species.

In a country like Burkina Faso that has about sixty ethnic groups with a socio-cultural diversity, where each nationality has its own culture bound to species of its environment and the ecological conditions where it lives, the identification of socio-cultural species is not easy, and requires detailed research, notably ethnobotanic, anthropological, cultural etc.

A certain number of species can however be indexed and grouped in 4 main categories:

- 1 . those of groves or sacred woods (generally located in villages)
- 2 . those used to make sacred masks (woods, leaves and fibres)
- 3 . those with totemic and sacred value
- 4 . those struck with various prohibitions (prohibition to cut, prohibition to eat, etc.)

b) Species of socio-cultural importance

Referring to works of CHEVALIER A. , OUEDRAOGO J., 1968, RETELL - LAURENTIN, O. KABORE and field notes of BOGNOUNOU O, species shown in Table 33 are used in making masks.

Table 33 : List of main species used for the making masks.

| Botanical name | Mossi name |
|--------------------------------|------------|
| <i>Afzelia african</i> | |
| <i>Lannea microcarpa</i> | Sanbga |
| <i>Cassytha filiformis</i> | |
| <i>Canarium schweinfurthii</i> | |
| <i>Tamarindus indica</i> | Pusga |
| <i>Adansonia digitata</i> | Twèga |
| <i>Gardenia erubescens</i> | Garzungo |
| <i>Ficus sp</i> | Wuomsièga |
| <i>Khaya senegalensis</i> | Kuka |
| <i>Sclerocarya birrea</i> | Noabga |
| <i>Parkia biglobosa</i> | Rouaga |
| <i>Butyrospermum paradoxum</i> | Taanga |

c) Ligneous species of sacred woods

Sacred woods are areas protected on the customary plan for sacred rituals, often constituting "real sanctuaries of nature". In the analysis of these particular formations CHEVALIER A, 1950, had identified the main species of it in French Sudan (present Mali) and in regions where ethnic groups such as the Sénoufo found in Burkina Faso live.

Table 34 : Ligneous species of sacred woods

| Scientific name | Mossi name | English name |
|--------------------------------|---------------|--------------------------|
| <i>Adansonia digitata</i> | Toèga | Baobab |
| <i>Albizia chevalieri</i> | Donsendouaga | Albizia of Chevalier |
| <i>Anogeissus leiocarpus</i> | Siiga | Birch of Africa |
| <i>Anitaris africana</i> | Bligia sapida | Delicious Blizia, Finzan |
| <i>Borassus aethiopum</i> | Koanga | Rônier |
| <i>Ceiba pentandra</i> | Gounga | Kapok tree |
| <i>Combretum micranthum</i> | Randga | Kinkéliba |
| <i>Diospiros mespiliformis</i> | Goanka | Ebony tree |
| <i>Elaeis guineensis</i> | | Palm tree |
| <i>Khaya senegalensis</i> | Kuka | Mahogany |
| <i>Pachystela argentea</i> | | |
| <i>Pterocarpus erinaceus</i> | Noèga | Vène |

For the case of Burkina Faso, GUINKO S., 1985, by a phytosociological and phytogeographic analysis of wooded relicts, identified three main groupings:

- grouping under *Antiaris africana* and *Chlorophora excelsa* (in the phytogeographic districts of the western Black Volta and Comoé);
- grouping under *Anogeissus leiocarpus* and *Pterocarpus erinaceus* (most widespread, and situated in the northern soudanese phytogeographic domain);
- grouping under *Anogeissus leiocarpus* and *Combretum nigricans elliotii* variety.

Out of the total ligneous and herbaceous species recorded in these different groupings 77.6% are elements of the Sudanese-Zambeziian flora and 3.5% of the Guineo-Congolese flora, plus other phytogeographic elements.

5.2.1.2 Wild vertebrates

The contribution of products from mammals, birds, fishes, reptiles and amphibians to the national economy is very substantial, because it is around 29%.

Principal benefits from animal resources are enumerated in Table 35.

Table 35: Products and services from animal resources

| | |
|----------|---|
| Animals | Products and services |
| Domestic | Food (meat, milk, eggs) |
| | Exportation of livestock |
| | Production of leather and hides |
| | Tourism of vision |
| | Transport |
| | Animal traction |
| | Guarding |
| Wild | Food (meat) |
| | (Mammals, birds, reptiles and amphibians) |
| | Trophies |
| | Tourism of vision (safaris) |
| | Pharmacopoeia |
| | Hunting sport |
| Fishes | Food (meat) |
| | Fishing sport |

5.2.1.2.1 Domestic animals

Among the products from fauna, those of domestic animals occupy a place of choice, notably at the food and commercial level. Data on the economic values of these products can be appreciated as shown below.

According to data collected in SANA O., 1997, the contribution of breeding to the GDP increased with the passing of years, from 7.5% in 1985 to 11.5% in 1995. Table 36 presents data by year of the period considered.

Table 36: Contribution of breeding to GDP from 1985 to 1995

| Year | National GDP (in thousands of F CFA) | Contribution of breeding to the national GDP) | |
|------|--------------------------------------|---|------------|
| | | Valued added (in thousands of F CFA) | Proportion |
| 1985 | 664 093 | 49 507 | 7.5% |
| 1986 | 668 964 | 56 193 | 8.4% |
| 1987 | 670 059 | 56 285 | 8.4% |
| 1988 | 727 175 | 58 174 | 8.4% |
| 1989 | 776 429 | 59 785 | 7.7% |
| 1990 | 772 852 | 62 601 | 8.1% |
| 1991 | 780 964 | 65 601 | 8.4% |
| 1992 | 775 159 | 68 214 | 8.8% |
| 1993 | 850 683 | 69 080 | 8.1% |
| 1994 | 1 115 636 | 114 998 | 10.3% |
| 1995 | 1 236 801 | 141 751 | 11.5% |

SOURCE : NATIONAL INSTITUTE OF STATISTICS AND DEMOGRAPHY

In addition to this global contribution of breeding to the GDP, there are the following different uses of domestic animals by kind that it is advisable to enumerate.

- **Bovines (ox or *Bos indicus*).**

Oxen are used more and more like animals of traction for ploughing farms. Bulls are used for the customary (funerals, rituals, etc.) and religious ceremonies (Ramadan and Tabaski) in most of the regions of Burkina Faso. In some regions of the country, like the provinces of Bougouriba and Poni, oxen are used in dowry in the context of marriages. Cow milk constitutes a substantial contribution in the food of populations.

- **Ovines (sheep or *Ovis aries*)**

Sheep are used for sacrifices in the context of ancestral and Moslem religions. Hence, for example, AID EL KEBIR or feast of Tabaski, is nicknamed “feast of sheep”, because of the nearly indispensable character of the sacrifice of ram on this occasion by faithful Moslem.

- **Caprines (goat or *Capra hircus*)**

Caprines or domestic goats, are equally used for feasts and sacrifices. The he goat is sometimes considered a sacred animal in the traditional beliefs of some regions (e.g. : some localities of the Bissa area and of the province of Kéné Dougou), and from this fact it can only be killed with the will of the ancestors whose agreement is only obtained by sacrificial rituals.

- **Porcines (pig or *Sus cristatus*)**

The pig is only used for the production of meat, but its consumption is proscribed by the Moslem religion. The relative easiness of its breeding and the high degree of its productivity make of it an important means of contribution of currency for people who raise it.

- **Asines (donkey or *Equus asinus*)**

The donkey constitutes a powerful means of transportation in Burkina Faso and in other countries of the sub-region: The Burkinabè film-maker, Ismael OUEDRAOGO, rightly nicknamed it “the docker of the Sahel”, because it is the animal that transports everything in this zone (traction of ploughs and carts, transportation of wood, blocks and millet stalks, transportation of man and water etc.).

- **Equines (horse or *Equus cabali*)**

The horse is used by the Burkinabè people as means of transportation and for traction. It is an animal of prestige which is often used for parades during customary ceremonies of village chiefs.

- **Camelines (dromedary or *Camelus dromaderus*)**

The dromedary is an efficient means of transporting possessions and materials. It also serves to pull water from deep wells. Dromedary milk is of good quality and is used in the preparation of cheese.

- **Dogs (*Canis familiaris*)**

The dog is an animal of company that is especially used for taking care of dwellings and for hunting. Some traditionalists sometimes use it for sacrifices.

- **Cats (*Fellis catus*)**

The cat is equally an animal of company that essentially serves those who raise it to get rid of some harmful animals (mice, rats) and dangerous animals (such as the snake) for man.

- **Hens (*Gallus gallus*) and guinea-fowl (*Numida meleacus*)**

The hen and the guinea-fowl present a lot of interests in the Burkinabè society. Thus, they are used to make ritual sacrifices and for gifts to strangers. They are equally sources of proteins and currency.

5.2.1.2.2 Wild animals

With regard to the wild vertebrates, we can affirm that they play an important role in the life of Burkinabè communities. Their socio-economic values are very important. Thus, all vertebrates that exist in Burkina Faso participate in one way or the other in the satisfaction of fundamental needs of the rural and urban communities, and of tourists in the domain of food, traditional medicine, education, culture, scientific research and leisures.

On the economic plan the wild vertebrates bring their share of contribution through hunting, tourism of vision and synergetic tourism.

Through the organisation of hunting in Burkina, vertebrates such as mammals, birds and in a least measure reptiles, allow public finance, economic operators and rural populations to get yearly incomes of over two billion CFA Francs, and to produce more than 50 tons of game meat per year, of a monetary value of more than 600 million CFA francs. The most exploited species are, by order of importance of the number of species killed : francolines (*Francolinus coqui*, *F.*, *Albogularis*, *F.*, *Bicalcaratus*), falsely called partridge, the African hare (*Lepus capensis*), the warthog (*Phacochoerus africanus*), cobe redunca (*Redunca redunca*), the ourebi (*Ourebia ourebi*), the cobe of buffon (*Kobus kob*), the bubale (*Alcelaphus buselaphus*), the hippotrague (*Hippotragus equinus*), the buffalo (*Syncerus caffer*), guib harnacea (*Tragelaphus scriptus*) and cob defassa (*Kobus ellipsiprymnus*). Burkina Faso records at least 1500 hunters annually and half of them are foreign, especially French. Ecological tourism, for its part, records more than 5000 tourists per year, and it is essentially Fauna Reserves that are visited (National Park of Arly, Nazinga Game Ranch).

A summary investigation and a visit to a market specialised in the sale of medicinal products (BOINSE YAR market in Ouagadougou), permit to realise the importance of vertebrates in

the domain of pharmacopoeia. Sheds of the aforementioned market, located in full centre of Ouagadougou, are packed with an important quantity of skins, bones and various parts of vertebrates.

A tradipractician even asserted that any animal possesses some remedy in it, but that it is necessary to know the useful part of its body and its association to other complementary products.

On the cultural plan, a lot of vertebrates and especially the wild mammals still constitute an inexhaustible source of inspiration. Several cultural events in Burkina Faso use various parts of the vertebrate body as masks and motives. Besides, almost all the carved masks represent the totality or some of wild animals. Vertebrates also intervene in education through tales and stories. For example, they often embody power (the lion), intelligence (the hare), wisdom (the elephant), silliness (the hyena), and are therefore used in oral expression to moralise society.

Aquatic fauna also has important economic and social uses. It is especially the fish that occupies a place of choice in this domain. In general, all species of fish present in Burkina Faso are consumed by the populations. However, some of them are sacred: This is the case in Bobo-Dioulasso where the mudfish is sacred for natives of this city. Species most exploited are those that are found in most of the lakes, notably Tilapia (carps, *Tilapia nilotica*, for example), Clariases (Mudfish, *Clarias anguillaris*, for example), Lateses (Captains, *Lates niloticus*, for example), and occasionally *Synodontises*, *Bagrus* and *Chrysichtys*, and *Labeo* kinds.

The food value of fish, appreciated by the level of consumption, is 60Kg per fisherman/year, 5 Kg per inhabitant/year for the city of Ouagadougou, and only 1.5 Kg per burkinabe/year.

The socio-economic importance of fishing for the rural populations results from the fact that piscicultural exploitation takes place in the counter agricultural season in the small dams that represent 80% of the total number. From this fact, this activity perfectly conciliates with the farmers' daily tasks and allows him to get new sources of income and to enrich his food. The increase in incomes is even better felt in the lake areas that benefited from the training of the ministry in charge of fishing.

The other aquatic fauna species or those subservient to water, such as turtles, bacrachians and snakes, intervene to a certain extent in food, leatherwork and especially pharmacopoeia. That is the case with toads, frogs, turtles and pythons. The traditional breeding of frog is done in certain ricefields and swamps in the western part of the country where rudimentary developments are undertaken to ensure the grouping of these bacrachians. This practice is due to the fact that the big restaurants of Bobo-Dioulasso consume frog thighs.

The aquatic bacrachians sometimes serve as baits for the fishing of carnivorous fishes. There is no study capable of giving an indication with figures on the socio-economic value of this aquatic fauna category.

5.2.1.3 Insects

Numerous insect species are useful to man. Thus, hymenopteran species intervene in the pollination of plants. A large number of other species are used for nutritional support for man in Burkina Faso. It is the case of caterpillar from shea trees, *Cirina butyrospermii* (caterpillar of shea tree, consumed in the western part of Burkina Faso), winged termites of the *Macrotermes* kind, locusts, grasshoppers and praying mantises. Some insects produce substances that man feeds on. This has been the case, for a long time, of honey produced by bees. A lot of insects play an important role in the natural equilibrium, and some are used for biological fight. In this case we can mention the example of the *Coccinellidae*s, many Hymenopterans in industrialised countries and of beetles of the Neochetina kind (*Neochetina bruchi* and *N. eichhorniae* in the context of the fight against water hyacinth (*Eichhornia crassipes*). Insects also achieve the recycling of organic matter such as *Scarabeidae*s, that are never destroyed by farmers. Termites favour the infiltration of water into the soil ; they thus play a great role in a country with an arid and semi-arid climate like Burkina Faso.

5.2.1.4 Microorganisms

Benefits derived from microorganisms are located on several plans. But in Burkina Faso few measures are taken for the meantime for the optimal valorisation of this part of the constituent elements of biological diversity. However, the country derives profit from microorganisms even though it is not posted. The table that follows enumerates the beneficial actions of perceptible microorganisms for the improvement of the standard of living of our populations.

Table 37: Beneficial Actions of microorganisms

| Importance | Indicator of action | Type of action |
|-------------------------------|------------------------|---|
| Food production | Fertilisation of soils | Fixing of nitrogen |
| | | Formation of compost |
| Protection of the environment | Protection of soils | Fertilisation of soils Deterioration of pollutants |
| Nutrition | Production of proteins | Production of yeasts |
| Energy | Production of biogas | Mineralisation of organic matters |

SOURCE : TRAORE A., 1997

CHAPTER 6: CONSTRAINTS RELATED TO A BETTER CONSERVATION OF BIOLOGICAL DIVERSITY

Constraints related to the implementation of conservation measures are mainly due to two factors: the poverty of populations that often work for their survival and the successive droughts that entail the massive death of plants and animals.

6.1 CONFLICTS DUE TO NATURAL RESOURCES MANAGEMENT

In a context where the basis of the subsistence of the majority of the population depends on the exploitation of natural resources, conservation of biological diversity is at the same time not only a condition to the survival and development of these populations, but also a challenge.

Droughts of the seventies clearly revealed the necessity to have systems of production adapted to the climatic variations, capable of permitting the production of the minimum necessary, in spite of the unfavourable climatic conditions that would prevail. In these conditions it is imperious to have a large range of technologies, including phylogenetic, animal, forest resources.

But, many factors hinder the conservation of biological diversity. The most important ones are:

- natural climatic variations: the big droughts provoked a mass mortality of animal and plant species, and a slip of areas of distribution of certain spontaneous species of the Sahel toward Sudanese climatic zones;
- systems of slash-and-burn technique and extensive agricultural production.

The exact impact (positive or negative) of these two factors on biological diversity is not well established, due to lack of detailed studies.

Other not less important factors contribute to the bad conservation of resources. These are mainly:

- poaching that constitutes the real enemy of fauna nowadays. With regard to this activity its impact deserves to be valued;
- urbanisation : it inexorably leads to the disappearance of plant and animal species in the most affected zones (e.g. : the Central Plateau);
- opposition between the modern legislation and customary (traditional) regulation; this is how traditional appropriation right, of collective type, opposes modern right based on private property;
- introduction of a preliminary authorisation and the payment of taxes for any exploitation of resources for commercial purposes are often badly understood, which creates fraudulent exploitation, susceptible to compromise the conservation of biological diversity;

- conflicts between objectives of use and socio-professional groups (in a context of demographic expansion and natural resource rarefaction):
- agriculture/breeding - the extension of agriculture was being done at the detriment of pastoral space;
- natives / natives (related to problems of inheritance and power);
- natives/migrants (land problems)
- insecticide treatments: some insecticide products proscribed by legislation are still sold on the markets. These substances destroy without discernment harmful and natural auxiliary insects, and break the food chains. The consequence of all this is the disappearance of numerous species.

6.2 OTHER DIFFICULTIES

Besides the above mentioned constraints, there are other difficulties of which the main ones are enumerated below.

- The unsuitability of certain systems of agricultural popularisation; they incite the peasant to plant some productive varieties through technological packets prepared in advance, rather than to incite him to use several varieties, notably local ones. On this topic, a joint project by the Ministry of Environment / Ministry of Higher Education and Scientific Research is under formulation. This project aims at laying strong foundations for *in-situ* conservation, in getting producers more involved.
- The vast number of contributors in the management of natural resources and biological diversity. Indeed, the Burkinabè institutional landscape concerning natural resources management and conservation of biological diversity is marked by a scattering of decision centres.
- The insufficiency and sometimes the lack of a scheduling of actions by priority.
- The not taking into account the cost of natural resources regeneration, notably the fixing of quotas of exploitation as well as actions and/or taxes intended for the restoration of products taken, which creates a situation of imbalance between supply and demand and tends to lead eventually to the extinction of species and the imbalance of ecosystems.

The devaluation of the franc CFA, could have as other consequence an aggravation of the deterioration of biological diversity because of the increase in prices of imported products, notably agricultural inputs (fertiliser in particular) and medicines, which constrains the populations to fall back more on natural resources.

CHAPTER 7: DEVELOPED PROGRAMMES AND PROSPECTS

7.1 PROGRAMMES AND RELATED COSTS

The policy of agricultural and pastoral development of Burkina Faso is recorded in the Letter of Sustainable Agricultural Development Policy (LPDA), addressed to World Bank in the framework of the Structural Adjustment Programme (SAP) and of the Adjustment Programme of the Agricultural Sector (PASA) - (BF/PASA/LPDA/2 May 1992).

- The three (3) objectives that were defined in it are:
 - modernisation and diversification of production;
 - reinforcement of food security;
 - improvement of natural resources management.

Five orientations were brought out among which two have a direct effect on the conservation of biological diversity. It is about the increase in productivity by the dissemination of technologies of intensive production and of the slowing down of the deterioration of natural resources in taking some necessary measures in the domain of land-ownership.

These fundamental orientations fall within the policy of progressive disengagement of the State that will delegate more actions than it currently does. The determining role of actors at the grassroots level is thus defined.

This role has clearly been specified by the Head of State of Burkina Faso in his speech pronounced during the rally of June 2, 1994 on production in these terms: "Each of us (the Burkinabès) in their domain of expertise and sphere of activities can and must fully contribute to the realisation of sectorial objectives identified as vectors of well-being for the nation." During this rally the Head of State made six (6) commitments that are of interest to the entire domain of biological diversity. These are:

- protection of the environment and the fight against desertification;
- increase in agro-pastoral production;
- organisation of and support for the informal sector;
- development of the network of small and medium enterprises;
- support to income generating activities of women;
- elevation of the general level of knowledge at the grassroots level and the development of sports and cultural activities.

Concerning PASA of which mention is made above, a first phase ended in 1995 and should be followed by PASA II for the consolidation and furthering of the main orientations.

The policy of agro-pastoral development is implemented through several Programmes and projects. The planning from 1994 to 1996 was the following:

- Integrated Rural Development Projects: 7 billion;
- National Programme for Soil Management: 9 billion;
- Specific projects (breeding sector, etc.) : 9 billion;
- Institutional support: 14 billion;

Total funding acquired: 12,670 billion.

Thus, 16 projects out of a total of 39 have a direct tie with natural resources management and conservation of biological diversity.

The paragraphs that follow give details of economic development Programmes by the main sectors of activity that touch directly on biological diversity.

7.1.1 AGRICULTURE SUB-SECTOR.

The development of the agricultural sub-sector rests on the following five specific axes:

- the development of cereal crops (sorghum, millet, corn and rice notably);
- the development of cotton;
- the development of sugar cane for the production of sugar;
- the development of other industrial crops such as groundnuts, sheanut and sesame;
- the development of fruits and vegetables.

These axes are translated by specific Programmes and projects. The development of cereals is co-ordinated by a Permanent Secretariat for Cereal Policy and is implemented notably through Projects of Integrated Rural Development and irrigation Projects.

The challenge that faces the success of such an ambitious Programme rests precisely on the observation of a sustainable balance between natural resources conservation and balanced development without which biological diversity would not be preserved.

The most meaningful results concerning the conciliation between conservation and sustainable use of biological diversity are mitigated enough. Indeed, if in a general manner agricultural production has effectively had an appreciable increase, it remained attributable for the essential to the extension of cultivated surfaces to the detriment of forest formations that are the main sites of biological diversity and, unfortunately, at the cost of a great destruction of the constituent elements of biological diversity.

On the other hand, integrated rural development projects were able to create the dynamics of encouraging the populations to assume more responsibility at the grassroots level concerning

natural resources management. Structures like Village Committees for Soil Management, which are developing and strengthening from day to day, play more and more a positive role in the conservation of natural resources and biological diversity. But this still remains insufficient.

7.1.2 ANIMAL BREEDING SUB-SECTOR.

The evolution of breeding policy has been marked by the following important stages:

- before the nineteen seventies (1970s), breeding policy was centred on animal health with the objective of fighting against endemic diseases; CIRDES (ex-CRTA), was the kingpin of this policy, co-ordinated by the Economic Community of Livestock and Meat.
- from the nineteen seventies (1970s), projects of breeding, centred on the production of meat and milk appeared progressively. Let us mention as an example: the breeding project of West Volta, that was especially interested in the selection of resistant race to diseases; the Markoye Ranch in the North that introduced the AZAWAK zebu (resistant) as well as the redhead goat of Maradi. The FED-Yatenga Small Ruminant project whose centre of interest was the selection of meat and milk productive races (Macina sheep); PDAV, ODAT and the Rabbit Project were interested in poultry and rabbits. The Rabbit project, based in Bobo-Dioulasso, created a new race: the Bobo race, currently widely popularised in the country.

The development of breeding pursues the following specific objectives:

- institutional consolidation;
- support for the pastoral laying out (Pastoral Laying out Support Programme: PAAP)
- dairy development (National Dairy Development Pilot Project);
- Research - Development;
- collection and treatment of animal statistics;
- development of village animal breeding (animal development Project at the village level);
- pastoral zones follow-up (Pastoral Zones Follow-up Unit).

According to breeding services, information on the diversity of species and local domestic races or introduced into our country exist but is not useful because of its scattering and non-availability.

The main activities undertaken for a better knowledge of pastoral resources are about ecological follow-up and improvement of races of these resources.

With regard to ecological follow-up, interesting data on the biological diversity of pastures are regularly gathered. Their judicious exploitation should permit to draw a list of present species and to follow their evolution.

With regard to the improvement of races, the situation is the same for what concerns the availability and the reliability of information. Indeed, since the first descriptions done by IEMVT, no official publication updating the lists of local species and races as well as their description has been made.

The available information is often related to the execution of projects and dissertations and theses of end of studies. At present, the Directorate of Animal Health and CNDA can be considered as centres of excellence of archives concerning breeding in Burkina Faso. Indeed, at certain time, all information on breeding was kept at CNDA. The following institutions also detain some precious information on breeding, they are: IDR (for reports, dissertations and theses); CIRDES in Bobo-Dioulasso, that was interested lately in the inventory of domestic local animal races and species in Burkina Faso; CAPE of Matroukou; ORSTOM; Banankélé-Daga Centre (that had for mandate the improvement of bovines and the introduction of sheep races); Markoye Ranch (that was charged with the introduction of AZAWAK zebus and Maradi goats).

Concerning poultry (hens and guineafowls), rabbits, donkeys, horses and pigs, dissertations were recently published (see catalogue of dissertations and theses of IDR).

DPIA also deplores that with regard to the new races resulting from anarchical crossbreedings (provoked or spontaneous), no inventory has been done. The lack of control and regulation on crossbreedings favours certain risks of the disappearance of local races. This is so true that there is currently no on site or *ex situ* conservation Programme. The situation should complicate further with the total privatisation of breeding in the framework of SAP.

7.1.3 ENVIRONMENT - FOREST - FAUNA - FISHING SUB-SECTOR

The development objectives of these four subsectors are part of the more global National Action Plan for the Environment (PANE) framework, adopted in 1991 and reviewed in 1994 to take into account the conclusions of the Rio Conference. The main objectives of PANE are:

- to master the pressures on the natural habitat;
- to encourage natural resources regeneration and to protect biological diversity;
- to improve the living environment;
- to contribute to the process of a sustainable development;

More specifically, the objectives of the three subsectors (forests, fauna and fishing) are expressed in the national forest policy. They are essentially:

- forest resources valorisation by rational planning and exploitation methods;
- generation of employments and incomes in rural environments;

- conservation of biological diversity, in particular safeguarding animal and plant species threatened of disappearance;
- continuous improvement of knowledge and information on natural resources.

To achieve these objectives specific activities of the three subsectors have been identified and fall within the scope of the five programmes of PANE. They are:

- Framework Programme for National Heritage Management;
- Framework Programme for Soil Management;
- Framework Programme for the improvement of the Living Environment;
- National Programme for the Management of Information on the Environment;
- Programme for Expertise Development in Environment.

Thus, the global objective of the Master Programme for National Heritage Management (PCGPN) is to ensure efficient management of natural resources and the national space. For its implementation, this programme needs a funding of 19.791.308.250 F CFA (before the devaluation 1 United States dollar was equal to 250 F CFA).

The global objective of the Master Programme for Soil Management (PCGT) is to encourage the rural populations to take responsibility in natural resources management through integration of development policies, property security, maintenance and improvement of production base. This programme has a funding need of 1.554.032.250 F CFA (before the devaluation).

The general objective of the Master Programme for the Improvement of Living Conditions (PCACV) is to intensify the involvement of the rural and urban populations to the healthy management of their environment, to reinforce the essential infrastructures and to contribute to endow them with sustainable means of existence.

The National Programme for the Management of Information on the Environment (PNGIM) aims among others at improving the relevance, the quality, the availability of information on the environment and reinforcing the national mechanisms for information processing and diffusion. Funding to secure for this programme is valued at 1.051.088.500 F CFA (before the devaluation).

The Programme of Expertise Development in Environment (PDCE) aims at reinforcing human expertise and national technical capacities necessary to implement PANE and sustainable development. Funding search for this programme is valued at 1.875.310.000 F CFA (before the devaluation).

Among the financed projects are those included under the Public Investment Programme (PIP). The global cost of these fundings amounts to 14.648 million CFA francs, distributed among the following subsector activities:

- forestry in land use (village forestry) with 5 projects and 37.02% of the global amount;

- firewood and energy with 6 projects and 27.7% of the global amount;
- conservation of ecosystems with 7 projects and 14.3% of the global amount;
- valorisation of forest products with 1 project and 17.4% of the global amount;
- support to forestry institutions with 11 projects and 21.6% of the global amount.

7.1.4 SUMMARY OF ACTIONS FOR PRESERVING BENEFITS

The main actions undertaken in Burkina Faso to benefit from advantages offered by biological diversity are summarised in the Table 38, with indication of sites or zones concerned.

Table 38: Mode of managing biological diversity

| |
|--|
| <p>Agricultural production: all the national territory; Agroforestry: agroforestry parks Pastoral production: Sudano-Sahelian and Sahelian zones; Development of hydrographic basins: Sourou, the Kou Valley, Kompienga,; Management of wild fauna: protected forests, national parks, total reserves, partial reserves; Management of game: Nazinga ranch; Biosphere reserve: hippo pond; Ornithological sanctuary: Oursi pond; Forest resources management: protected forests, national parks, reserves of fauna, protected forests, sacred woods; Organisation of forest exploitation: adjoining forests of big urban centres (eg.: Gonsé, Nazinon); Halieutic resources management: perennial rivers, natural lakes, dams; Fight against soil erosion: Central Plateau of the country; Aesthetic and recreational activities: tourism of vision in parks and reserves, parklands; Habitat of birds: ponds of the Sahel, reserves of fauna; Readaptation of the legislation: management of the environment; Environmental education: classified forests, national parks, reserves, botanical garden, reform of the education system; Genetic resources conservation: <i>in - situ</i> and <i>ex - situ</i> conservatory; Domains of scientific research: research sites on natural resources management.</p> |
|--|

7.1.5 EXPENDITURES RELATED TO CONSERVATION AND SUSTAINABLE USE

Activities relating to conservation and sustainable use of biological diversity are various (e.g. : development of natural formations, protection of species, sensitisation, studies about natural resources, research, integrated management of resources, etc.), and are carried out at different levels of active life. The actions carried out are part of the framework of the National Action Plan for the Environment. The principal actors in the matter are state-controlled structures, NGOs, Peasants' Associations and individuals. Thus, the real costs of all these activities are difficult to evaluate because of the absence of a centralised database. However, a certain assessment of these expenses can be made from existing official documents.

7.1.5.1 Summary of expenditure

Expenses presented here concern actions undertaken by State structures. Financing is ensured by State funds, self-financing of activities and subsidies and loans from bilateral and multilateral co-operation. The Table below presents the balance sheet of these expenses from 1992 to 1996. As can be seen from Table 39, efforts dedicated to the management of environmental resources globally increased during the period considered.

Table 39: Summary of expenditures (in millions of F CFA)

| Source/ Year | 1992 | 1993 | 1994 | 1995 | 1996 | Total |
|-----------------|----------|----------|----------|----------|----------|---------|
| State | 1,765 | 3,012 | 2,787 | 1,694 | 2,175 | 11,433 |
| Self-financing | 1,573.97 | 1,966.95 | 3,700.02 | 3,436.22 | 2,502.98 | 13,180 |
| Cooperation | 32,302 | 41,233 | 33,440 | 45,061 | 53,930 | 205,966 |
| Total | 35,641 | 46,212 | 39,927 | 50,191 | 58,608 | 230,579 |

Source: Budget of the State and Directorate for Coordination and assessment of investments (Ministry in charge of finance)

7.1.5.2 Non-satisfied financial needs

The non-satisfied financial needs are those sought-after through projects to come and complement efforts deployed by the State to derive a better profit and better manage national biological diversity for a long time. Summaries of needs are presented in Table 40.

Table 40: Summary of financial needs to be searched for by PANE's framework programme for the management of biological diversity

| Framework programmes/programme | Amount (before the devaluation of the F CFA) in millions F CFA |
|--|--|
| Management of National Patrimony | 19,791 |
| Soil Management | 1,554 |
| Improvement of Living Conditions | 2,785 |
| Management of Information on the Natural Environment | 1,051 |
| Development of Capacities in Environment | 1,875 |
| TOTAL | 27,056 |

Source : Investment Programme PANE, 1994.

It necessary to note that there are serious difficulties to mobilise the necessary financial resources for the implementation of these programmes. The consequences of this is that, relatively, few projects have effectively received funding. This is testified in table 41

according to projects recorded at the level of the ministry in charge of planning and cooperation for search funding.

Table 41: Summary of the financial needs of projects in search of funding as at December 31, 1996 provided by the main ministries in charge of biological diversity

| Ministry in Charge of | In millions of F CFA |
|---|----------------------|
| Territorial Administration (Ministry of Interior) | 32,700 |
| Social Action and Family | 273,970 |
| Environment and Water | 4,578,923 |
| Secondary, Higher Education and Scientific Research | 3,794,140 |
| Agriculture and Animal Resources | 784,799 |
| Basic Education and Mass Literacy | 315,000 |
| TOTAL | 9,780,000 |

Source: Directorate for Coordination and assessment of Investments (Ministry in charge of finance)

8.1 GENERAL CONCLUSIONS

The conservation and sustainable use of biological diversity have been implicitly taken into account in policies of planning, management and research concerning natural resources in Burkina Faso since the colonial period. But the efforts put in are variable according to the different domains. Besides, the collected information is far from being exhaustive because of the scattering of the documentation with regard to structures implied in the management of biological diversity.

It is concerning management of forests, fauna and fishing that the efforts were most remarkable. Indeed, we have *in-situ* conservation programmes for these domains, even though difficulties of management persist. There is a herbarium of flora and inventories made concerning fauna and halieutic resources that give a partial situation of the reality.

As regards agriculture, several collections of species, subspecies, varieties and ecotypes were realised and preserved *ex-situ* either on the spot or with appointed agencies (ICRISAT). They are, essentially, research organisations that hold collections, each institute maintaining the material for the purpose of its own activities.

Concerning breeding, since the first descriptions made notably by French researchers of IEMVT before independence, no updating inventory has been made. It is urgent to proceed with such an inventory and an assessment of the existing patrimony following the provoked or spontaneous crossbreeding. As indicated, some rich information already exists, but remains dispersed. Consequently, it is necessary to proceed with a real campaign of collection, storage and assessment of present local and exotic resources in the country.

For all these domains, the legislation should be adapted in order to favour a real conservation of biological diversity that gives the local populations responsibility.

As indicated all along the present document, a real political will as well as some strategic plans exist. However, it is urgent to adapt all the approaches to the objectives of the Convention on Biological Diversity to which Burkina Faso subscribed.

Prevention and resolution of conflicts between the different groups lusting after renewable natural resources are therefore a vital necessity and must be an integral part of the management strategies of these natural resources and biological diversity. In this sense, the effective taking into account of customary regulation (as far as it constitutes a plus), constitutes one of the appropriate options that deserves to be strongly supported in the future.

In addition, it must be mentioned that a consequent regulation concerning the introduction of animal and plant species on the one hand, and putting in quarantine on the other hand, would protect the national patrimony from illnesses and the introduction of invading species. The control of the importation of modified living organism is also imperative. In fact, the absence of a consequent regulation leads to the non protection of national patrimony resources.

8.2 PROPOSED OPTIONS

From the preceding collected data, conclusions and priority options are summarised as follows by sector whose elements compose the biological diversity.

8.2.1 ECOLOGY

On the deterioration of ecosystems and habitats, there is an important documentation describing causes and consequences, and evaluating the extent of the phenomenon. However, there are few recent data - even old ones - on the dynamics of ecosystems and habitats under the impact of ecological change, or threats weighing on biological diversity. An effort should be made:

- to adopt a nomenclature and a classification of milieux that are consensual for Burkinabè technicians (this process is currently under way) ;
- to make an inventory and an assessment of the knowledge and local know-how concerning conservation and sustainable use of biological diversity by the different sociocultural and ethnic groups of Burkina Faso. In this context sacred-woods and concrete actions of traditional conservation will have to be listed and evaluated on the ecological plan;
- to put in place, at the national and regional levels, an effective system of continuous surveillance of the environment, notably the follow-up of the qualitative and quantitative dynamics of environment and the animal and plant biological diversity;
- to establish at the national and regional levels reliable maps of the evolution of the ecosystems and habitats;
- to proceed with the economic assessment of the biological diversity and biological resources.

8.2.2 HERBACEOUS AND LIGNEOUS FOREST SPECIES

In spite of their status, the protected forests, parks and other reserves of Burkina Faso have been deteriorating at a frightening rate because of two main factors: drought and human activities.

Also, a national strategy of conservation of biological diversity must be oriented towards the objectives and actions below:

- improved knowledge of the state of flora and vegetation of protected forests;
- control of bush fires;
- best forest resource valorisation;
- promotion of local species;
- control of pastures;
- reinforcement of agroforestry activities;
- reinforcement of environmental education;
- knowledge of the past (from historical and research data collected from neighbouring populations) of plant formations at the time of their classification;
- inventory of the flora and the ligneous and herbaceous potential of the protected forests;
- knowledge of the physical environment and the socioeconomic context of protected forests: relationship between forests and neighbouring populations;

- appreciation of modifications undergone by the flora and vegetation of protected forests and analysis of factors that govern this dynamics;
- identification, outside of the classified perimeters, of zones of floral interest that can be the object of classification in compensation of very damaged forests that could be given up to the neighbouring populations in view of regeneration by the CES / DRS techniques;
- improvement of knowledge on the phenomenon of drought and desertification;
- reinforcement of the national herbarium;
- setting up of a data bank on the protected forests and the development of a forest flora and a national nomenclature of the forest essences of Burkina Faso.

Considering what precedes, it appears indispensable to establish a major programme of activities based on the knowledge, rational exploitation and conservation of flora and the vegetation of protected forests for a sustainable development. This programme would integrate the following activities:

- promotion of non-ligneous forest products in order to better contribute to the safeguard ligneous species by forestry actions.
- valorisation of local forest species in reforestations while deepening research on germination and conservation of seeds, silviculture and adaptation of species to local conditions;
- training of peasants in modern techniques of defence and restoration of soils, conservation of soil, water (CES/DRS) and agroforestry.

The know-how of peasants concerning CES/DRS and of agroforestry deserves to be better popularised. Indeed, results from this know-how are perceptible in some provinces, like those of Passoré and Sanmatenga for example. Indeed, we see magnificent perimeters here and there, where small barriers have been erected either with soil or blocks of laterite, from which emerge perennial bushes and gramineae (*Andropogon gayanus*, for example), whereas spaces next to these perimeters are nearly naked. The practice of the Zaï in some provinces (that of Yatenga for example) permits to increase outputs in a substantial way and deserves to be extended to many more regions and arid and semi-arid zones of Burkina Faso.

These activities could be planned over periods of 20 to 30 years, in order to permit to better appreciate their impacts and to make a realistic assessment of such a scheduling of actions concerning conservation and sustainable use of resources.

8.2.3 AQUATIC PLANTS

The compilation made on the state of knowledge concerning the aquatic microflora and aquatic herbaceous flora permitted to establish that there are 191 algae and 185 species of aquatic flora composed in majority of angiosperms and cryptogams of large size. These figures established from a reduced number of explored lakes incite to believe that Burkina Faso can be a big field with a great responsibility that it is necessary to discover. This compilation also reveals the lack of information on traditional knowledge and practice of conservation and sustainable use of resources in aquatic flora, and this commands the realisation of investigations to discover them. On the other hand, numerous human activities have a negative impact on the conservation of this type of biological diversity, and it is convenient to count them by impact studies in order to define specific measures and actions that are imperative.

However, the following urgent actions should also be envisaged:

- to prospect the totality of lakes or in default, representative samples;
- to free the biomass of accumulated species with regard to some lakes, water hyacinth notably, to avoid their propagation and permit the resumption of socioeconomic activities where they exist; the neighbouring populations of affected lakes should be sensitised;
- to create piscicultural units and use the phytoplankton for feeding phytophage fish species, because of examples of this kind have given convincing results in the Koubri dam and in Bazèga ;
- to fix the banks of lakes, in particular those of the Sahel, in order to minimise the erosion of their edges and sandbanks.

8.2.4 CULTIVATED FOREST PLANTS

The number of forest species cultivated in Burkina Faso represents 26% of the of the species that make up the flora. The native species represent 37% of cultivated species against 63% of exotic species. This clearly shows that the local species did not benefit sufficiently from a particular attention with regard to their use. Also, an effort should be made for the promotion of local species. This promotion should be made through planting of local species and *in-situ* and *ex-situ* conservations.

For that matter, the following actions would deserve to be undertaken:

- to update and enrich the knowledge on cultivated species;
- to sensitise decision-makers, economic operators and the public on benefits derived from local species;
- to adapt forest activities to the needs of populations in order to guarantee a healthy management of biological diversity;
- to involve and give responsibilities to women and children in natural resources management;
- to master the financial contribution of cultivated local species to the national economy;
- to enhance national capacities for a better knowledge of the value of cultivated and wild local species.

8.2.5 AGRICULTURE

The problems that lead to the loss of agricultural biological diversity in Burkina Faso call for measures by way of solutions. These are for example:

- increase in the exploring and collection of varieties of agricultural species and their *ex-situ* conservation, in order to save endangered species;
- adoption of policies and elaboration of programmes and projects of *in-situ* conservation, to compensate for *ex-situ* conservation;
- increase in the policies for settling farmers in their lands, in order to avoid displacements that accompany the abandonment of local cultivars on site;
- strengthening the practice of techniques of defence and restoration of soils;

- adoption of incentive measures in view of a better conservation of species and local varieties.

8.2.6 PHYTOGENETIC RESOURCES

Burkina Faso has already elaborated a certain number of strategies for a sustainable management of its phyto-genetic resources and that is still current. They are about:

- making the inventory of already available material;
- defining priorities in the matter of genetic resources;
- identifying ecological zones where genetic diversity is threatened of extinction;
- defining programmes for prospecting and collection;
- promoting the creation of a national gene bank (*ex-situ* and *in-situ*) with a multidisciplinary vocation;
- encouraging and harmonising some technical and scientific exchanges with regional, inter-regional and international gene banks;
- arousing and valorising the interventions of scientific and financial partners;
- encouraging the development of the use of local genetic patrimony within the local scientific communities;
- evaluating the genetic diversity in order to put at the disposal of the selector material whose useful characteristics are immediately exploitable;
- managing in the global setting of the conservation of the environment, natural reserves where wild communities and cultivated species vegetate;
- sensitising urban and village populations on highly deplorable risks of genetic erosion that any excessive and uncontrolled activities of man, animal and nature itself can provoke;
- studying the legislative measures to be taken in order to ensure a healthy development of the diffusion of germplasm between the national users and international partners to ensure equitable sharing of benefits;
- elaborating a general policy of genetic resources management by the diffusion, importation and exploitation of forms of genetic material;
- working for the training of researchers, technicians and peasants wanting to work in the domain of conservation and use of phyto-genetic resources.

In addition to these options, it seems urgent to:

- encourage, at the national level, the creation of a national programme of research on phyto-genetic resources that would lead in the shortest delay to the creation of a real gene bank. This problem must be solved without delay or the set of materials already collected will disappear, for it would be therefore disastrous that all the work already done be lost, for lack of means of conservation, regeneration and assessment, or by ending prospecting;
- proceed with the creation of *in-situ* conservation units, insofar as a good number of cultivars are better preserved in their areas of origin;
- undertake the repatriation of collections of Burkina Faso preserved in foreign gene banks;
- study the question of the right of the obtainer, in order to get peasants interested in issues of phyto-genetic resources.

8.2.7 PHARMACOPEIA RESOURCES AND TRADITIONAL MEDICINE

On the national plan, actions in matters of ethnobotanic research in general, of medicinal plants in particular, remain relatively timid, and strictly speaking there is no elaborated strategy, even if we detect some promising indications on the subject. It appears therefore urgent:

- to update the list of species already indexed as medicinal plants;
- to make an inventory and a list of all plant and animal species used in medicine and traditional pharmacopoeia;
- to proceed with *in-situ* and *ex-situ* conservation of medicinal plants;
- to promote the growing of medicinal plants;
- to adapt the legislation to the objectives of conservation and sustainable use of biological diversity;
- to preserve the know-how of tradipracticians and ancestral knowledge;
- to evaluate the contribution of medicinal plants to domestic and national economy.

8.2.8 DOMESTIC FAUNA

The major objective that prevails in the matter of domestic fauna resides in the increase in productivity and conservation of species and races. To arrive at this, the following measures deserve to be taken:

- conservation of species and local races;
- genetic improvement of species and local races;
- optimisation of breeding;
- promotion of traditional breeding.

8.2.9 WILD FAUNA

The fauna of the wild vertebrates of Burkina Faso is relatively rich in species, in spite of the insufficient state of our knowledge of them.

In Burkina Faso, wild fauna constitutes an important link of protein contribution to populations and is the object of an important poaching. To valorise this fauna patrimony better, the country has undertaken:

- to rationalise the exploitation and management of hunting zones in promoting some private initiatives;
- to reinforce synergetic tourism and ecotourism;
- to strengthen the protection of synergetic resources;
- to promote “ranching” and small private breeding.

Considering the insufficient level of our knowledge of the wild fauna it is also imperative:

- to proceed with its advanced taxonomic study;
- to proceed with a periodic national counting of individual species;
- to enhance national human capacities in fauna taxonomy;

- to involve neighbouring populations more in actions of fauna conservation in making them benefit to the best from repercussions of this management;
- to create domains classified buffer zones in order to avoid or to limit aggressions of fauna habitats by populations;
- to adapt the legislation to the approach adopted for the conservation and use of this fauna.

8.2.10 AQUATIC FAUNA

Income generating and ecological and cultural value preserver, biological diversity of aquatic fauna in Burkina Faso contributes to the growth of the standard of living of rural populations.

Unfortunately, only vertebrates (fish, birds, reptiles and bacrachians) are known well enough; and there again it is the fishes that have benefited from a relatively greater attention. Fishes alone contribute close to 3.7 billion F CFA to the value added in the national economy, in spite of the under exploitation of this resource. Indeed, only 7,000 tons of fish out of a potential of 12,500 tons are exploited annually, but this is far from covering the national needs.

The present protective measures of the humid zones and halieutic resources are recorded at many levels (R.A.F., Environmental Code, Forest Code...). In other respects, the policies and national strategy of fishing development and some lakes and development programmes in general are about humid zones protection, without granting them a place of choice for all that.

To fill these gaps, the following options were adopted:

- to master the halieutic potentialities;
- to better organise fishermen;
- to work for the optimisation of catches;
- to bring logistic and financial supports to associations of fishermen.

Having seen the diagnosis presented in this document and the main conclusions drawn, the following complementary options could come to reinforce those enumerated above:

- to elaborate a legislation and/or a specific regulation on these zones that take into account all the aspects related to their conservation (protect, make viable and valorise), considering the fragility of humid zones, their ecological, socioeconomic and cultural importance;
- to undertake some studies on the knowledge of macro, meso and micro invertebrates (crustaceans, molluscs, insects, zooplanktons), considering the ignorance of invertebrate communities that populate humid zones;
- to undertake some complementary studies in order to fill the gaps concerning aquatic and semi-aquatic vertebrate knowledge.

8.2.11 INSECTS

Data collected in this document on entomological fauna are not complete enough, given the scattering of data at the national level and the level of foreign institutes, such as the Museum of Natural history in Paris.

It appears of highest interest for the knowledge of the entomological fauna of Burkina Faso and for a better management of resources, that a project of national entomological Collection finally sees the day. Considering the insufficiency of inventories of insects in Burkina Faso and considering the fundamental role played by these invertebrates in several domains of which pollination of plants, food chains, natural biological balances, decomposition of organic matter and its incorporation in soils, transmission of serious illness to man, animals and plants and destruction of crops, this project appears to be of great interest.

8.2.12 MICRO-ORGANISMS

In Burkina Faso, microbiology is nascent but it could have a great impact on the socioeconomic life in influencing: medicine, agriculture, food sciences, energy sector, ecology, and many other domains, because the use of micro-organisms in utilitarian goal is becoming an important stake for the well being of man. However, knowledge of these microscopic beings is very limited in our country.

Also, the essential orientation to take in the first place is to permit a better knowledge of these elements of biological diversity by researchers and producers. Actions to be undertaken in this direction would hinge mainly on:

- information and education on micro-organisms;
- development of research in microbiology;
- strengthening collections of conservation of micro-organisms: according to TRAORE A., 1997, it is only some stumps of micro-organisms that have been isolated in Burkina Faso these days.

Besides, microbiologists of Burkina Faso should look into:

- medical questions linked to micro-organisms: biotechnology, hygiene, mastery of genetic engineering to amplify potentialities of micro-organisms in various domains (production of enzymes among others to replace genetic defaulting), etc.;
- protection of environment by strengthening research in microbiology: researchers and students can constitute pole of expertise in biotechnology notably oriented towards questions of environment and valorisation of industrial waste, because the necessity of urban centre depollution has become imperative nowadays;
- production and conservation of food: increase in food production thanks to the intervention of micro-organisms (fixing of nitrogen, carbon, minerals, etc.), industrial production of compounds useful to man (proteins, solvents, organic acids, antibiotics, etc.);

- institutional development: for this it will be necessary to set up structures and an institutional organisation to specialise in different questions concerning micro-organisms.

8.2.13 THEMATIC MAPS

The essential of options that are offered can be summed up as follows:

- necessity to structure data to be collected according to a model which is compatible with Geographic Information System (GIS) and satisfying the necessary requirements;
- show that maps to identify for collecting data on biological diversity does not rest on the number of “maps” to produce but rather on the following points:
 - clearly define goal of the information to search for;
 - define without ambiguity the objectives and attributes;
 - indicate the complexity of integrating data into GIS .

8.2.14 GEOGRAPHIC INFORMATION SYSTEM

There are a great number of maps and other georeferenced information scattered in public organisations and elsewhere. It is important that a well structured inventory of these documents be realised to localise in an accurate way sources of information in view of using some of this information directly without needing to partially or completely reproduce them.

8.2.15 SOCIO-ECONOMIC FACTORS

From the point of view of some major insufficiencies that hinder the objective of sustainable socioeconomic development, the recommended options below could contribute to reduce problems:

- to undertake on the national plan information and sensitisation actions all out (populations, technicians, decision-makers, local elected officials, traditional chiefs, land custodians) on the issues of biological diversity in order to succeed in making participate effectively all the actors in the management of this diversity;
- to promote environmental education at the different levels of education right from the primary cycle;
- to capitalise and spread experiences of integrated management of natural resources;
- to undertake qualitative, quantitative and economic assessment of biological resources and inherent real costs in their management.

8.2.16 PLANNING POLICIES AND STRATEGIES

It is in domain of forest, fauna and fishing management that efforts were most remarkable. Indeed, we have *in-situ* conservation programmes for these domains, even if difficulties of management persist. There is a national herbarium, a structure working in the matter of forest

seeds, while inventories carried out on wild fauna and halieutic resources give a certain situation of the reality.

Concerning agriculture, several collections of species, subspecies, varieties and ecotypes have been realised and preserved *ex-situ* either on the spot or by appointed organisations (notably ICRISAT). It is essentially research that detains collections, each institute maintaining materials necessary for its own activities. It is therefore necessary to elaborate a systematic census programme of local and introduced phytogenetic resources and to envisage a programme of conservation. The choice being made for *in-situ* conservation.

Concerning breeding, since the first descriptions made notably by researchers of IEMVT before independence, no updating inventory has been made. It is imperative to proceed on such an inventory and assessment of the existing patrimony following provoked or spontaneous crossbreedings.

APPENDICES

Appendix 1 : List of authors of initial reports

Adama DIALLO, 1996 : Elaboration d'une monographie nationale sur la diversité biologique des plantes herbacées au Burkina Faso

Alamoussa Cheik TRAORE et Norbert Salama ZIGANI, 1996 : Monographie sur la diversité biologique de la faune aquatique du Burkina Faso

Albert COMPAORE, 1996 : Politiques et stratégies de planification et de gestion de la diversité biologique au Burkina Faso

Albert N. OUEDRAOGO, 1997 : Socio-économie et diversité biologique au Burkina Faso

Albert Patoin OUEDRAOGO, 1996 : Collecte des informations relatives à la faune entomologique connue du Burkina Faso

Alphred S. TRAORE, 1997 : Elaboration d'une monographie nationale sur la diversité biologique du Burkina Faso : Volet microbiologie.

Bassirou BELEM, 1996 : Ladomestication des plantes forestières, fruitières et ornementales du Burkina Faso

Didier BALMA, 1997 : Ressources phytogénétiques du Burkina Faso

GEOCONSEIL, 1997 : Études sur la collecte des données et l'identification des cartes pour la mise en place d'un Système d'Information Géographique

Jean Marie OUADBA, 1997 : Elaboration d'une monographie nationale sur la diversité biologique : Collecte de données biologique, considération écologiques

Lassané OUEDRAOGO et Pierre KAFANDO, 1996 : Monographie sur la diversité biologique nationale du Burkina Faso , faune sauvage, 1996: Mammifères, Oiseaux, Reptiles.

Louis R. OUEDRAOGO, 1996 : Monographie nationale sur la diversité biologique : Point sur la microflore et la macroflore aquatiques et semi-aquatiques du Burkina Faso

Jean Lauriault, 1996 : Monographie nationale sur la diversité biologique du Burkina Faso - Rapport de mission, Musée Canadien de la Nature

Nabyouré I. OUEDRAOGO, 1997 : Agriculture et diversité biologique au Burkina Faso

Ouétian BOGNOUNOU, 1996 : La diversité biologique végétales du Burkina Faso : Aspects ethnobotaniques

Oumarou SANA, 1997 : Diversité biologique des animaux domestiques au Burkina Faso

Samuel YEYE et Frank S. COMPAORE, 1996 : Elaboration d'une monographie nationale sur la diversité biologique : Études juridique

Sélé SORI, 1996 : Elaboration d'une monographie nationale sur la diversité biologique du Burkina Faso : Utilisation des sols au Burkina Faso

Sita GUINKO, 1996 : Données sur la diversité biologique forestière ligneuse du Burkina Faso

Zowindé KOUDOUGOU, 1997 : Études sur la collecte des données numériques à référence spatiale et l'élaboration des cartes thématiques

Appendix 2. Taxonomic inventory of principal phyla of biological diversity according to the five KINGDOMS of Margulius, L. and K. Schwart (1988)

| VIRUS (NOT A KINGDOM) 150 000 | | | |
|---|-----------------|---------------|----------------|
| | Families | Genera | Species |
| | 33 | 84 | |
| PROCARYOTAE KINGDOM (Bacteria and moners) | | | |
| Taxons | Families | Genera | Species |
| BACTÉRIA (Bacteria) | 83 | 413 | |
| CYANOBACTÉRIA (blue green Algae) | ? | ? | ? |
| MYCOPLASMS | ? | ? | ? |
| RICKESTTIES | ? | ? | ? |
| PROTOCTISTA KINGDOM (Algae et protozoa) | | | |
| Taxons | Families | Genera | Species |
| (Algae) | 32 | 88 | 191 |
| BACILLARIOPHYTA (Diatomes) | ? | ? | ? |
| PROTOZOA (Protozoa) | ? | ? | ? |
| KINGDOM : EUMYCOTA (Mushrooms et al.) (1 500 000 Estab. total non described species) | | | |
| Taxons | Families | Genera | Species |
| ASCOMYCOTA (Morelles et al.) | 8 ? | 24 ? | 28 |
| BASIDIOMYCOTA (Bolets, russules, al.) | ? | ? | ? |
| LICHENOPHYTA (Lichens) | ? | ? | ? |
| KINGDOM : PLANTAE (Plants) | | | |
| Taxons | Families | Genera | Species |
| BRYOPHYTA (Mousses et al.) | ? | ? | ? |
| LYCOPODIOPHYTA (Lycopodes) | ? | ? | ? |
| EQUISETOPHYTA (Preles) | ? | ? | ? |
| PTERIDOPHYTA (Ferns) | ? | ? | ? |
| CONIFEROPHYTA (Conifers et al.) | ? | ? | ? |
| MAGNOLIOPHYTA (dico+mono) | 349 | 838 | 1188 |
| KINGDOM : ANIMALIA (Animals) | | | |
| Taxons | Families | Genera | Species |
| CNIDARIA (Hydra et al.) | ? | ? | ? |
| PLATELMELMENTHES (Flat worms) | ? | ? | ? |
| NEMERTEA (Ribbon worms) | ? | ? | ? |
| ROTIFERA (Rotifers) | ? | ? | ? |
| NEMATA (Round worms) | ? | ? | ? |
| MOLLUSCA (Molluscs) | 10 | 13 | 28 |
| ANNELIDA (Earthworms, leeches, al.) | ? | ? | ? |
| ARACHNIDA (Spiders) | ? | ? | ? |
| COLLEMBOLA (Collemboles) | ? | ? | ? |
| CRUSTACEA (Crustaceans) | 5 | 6 | 6 |
| INSECTA (Insects) | 151 | 250 | 1515 |
| CHILOPOLDA (Centipedes) | ? | ? | ? |
| DIPLOPODA (Millipedes) | ? | ? | ? |
| Osteithyes (Bony fishes) | 24 | 57 | 118 |
| Amphibia (Frogs, salamanders) | 5 | 16 | 30 |
| Reptilia (Turtles, snakes) | 16 | 52 | 60 |
| Aves (Birds) | 100 | 292 | 482 |
| Mammalia (Mammals) | 33 | 77 | 128 |
| Total | 849 | 2210 | 3774 |

Appendix 3 : Characteristics of noticeable humid zones of Burkina Faso

| Sites | Description | Commentaries | Criteria |
|--------------------------------|--|---|----------|
| 1. Béli | Rivers and natural ponds | Sensitive site but with low biological diversity | S |
| 2. Oursi et Yemboli | Natural ponds | Rich ornithology, sites with fragile ecology due to pasture pressure | B, E, S, |
| 3. Banh | Flooding and manure spreading zone | Threatened by the dam and pressure of migrants | B, E, S, |
| 4. Sourou | Dam with irrigation-farming development | Natural habitat in course of change by irrigation-farming developments (rice-farming and others) – to be supervised | E, S, |
| 5. Ziga | Rivers with a dam project | Risk of changing a habitat of ecological value | S |
| 6. Ouagadougou | Urban dams; site being part of the drainage network of the town | Risk of urban/industrial pollution of these dams and classified forest | S |
| 7. Grand Balé | Rivers in a national park | Site rich biological diversity (big mammals) | B |
| 8. Bagré | Dam with hydro-electric and irrigation farming | Risk changing the habitat | E |
| 9. Arly (Pendjari) | Rivers in the national park | Site with rich biological diversity (hippopotamuses, birds) | B |
| 10. Parc W | Rivers in the national park (Pendjari and Mekrou) | Site with rich biological diversity not yet catalogued | B |
| 11. Bala | Hippopotamus ponds and flooding zone in a reserve of the Biosphere | Site with rich biological diversity (hippopotamuses) | B, T |
| 12. Nazinga | Rivers with many dams in the ranch | Site with rich biological diversity (mammals, birds, flora) | B, T |
| 13. Guinguette | Zone of Artois sources | Forest gallery (lignous), site rich in biological diversity (fishes), tourist overexploitation, damage of the banks | B, S, T |
| 14. Tengréla | Natural lakes near the cascades | Forest gallery (lignous), site rich in biological diversity (fishes) | B, T |
| 15. N'Dionkélé-Foulasso | Flooding zone | Site with rich biological diversity Rice-growing, risk of changing the habitat | B, E |
| 16. Sabou | Developed ponds | Site with rich biological diversity (crocodiles) | T |
| 17. Lenga | Rivers and flooding zone | Site with rich biological diversity (hippopotamuses), destabilized by the Bagré dam | T |
| 18. Bam | Natural lake | Diverse crops | E |

Source : UICN - BURKINA, 1994, in OUADBA, 1997.

Key:

- B = Site with rich biological diversity
- E = Economic site (development of irrigation-farming, etc.)
- S = Sensitive site
- T = Tourist site

Appendix 4: Indicators for determining human development level (HDI)

The state of the world proposes here and in the statistical Tables of the geopolitical entities an "Indicator of human development" (IDH). This composite indicator is calculated every year, since 1990, by the United Nations Development Programme (UNDP).

Such an initiative came about because the indicator of development most commonly used, the gross domestic product (GDP) per capita, calculated at market exchange rate, is, in many cases, a very bad measure of the level of well-being attained. For example, Saudi Arabia, with 9,338 dollars per capita in 1994, had not less 38.2% of illiterates in its adult population and had an infant mortality rate of 28 ‰. Costa Rica, whose GDP per capita is 62% of Saudi Arabia's, seems nevertheless to have a higher human "development"; it only has 5% of illiterates and the infant mortality is three times less (13 ‰).

In the ideal, an indicator of "human development" should be able to take into account many factors.

UNDP preferred to retain only three elements to construct its index: life expectancy at birth; level of instruction, represented by the level of adult literacy and raw rate of schooling irrespective of levels (with a weighting of two thirds for the first and one third for second); and at last the income represented by per capita GDP after a double transformation taking into account the relative difference in prices from one country to the other and because the income does not increase development human in a linear manner (when we go from 1,000 to 2,000 dollars per capita income yearly, the diversity of new choices that opens up increases more than when we go from 14,000 to 15,000 dollars).

Minimum and maximum values are set for each of these elements:

- life expectancy at birth: 25 to 85 years;
- adult literacy : 0% to 100% the value;
- rate of schooling: 0% to 100%;
- Real GDP per capita: 100 dollars PPA to 40,000 dollars PPA.

Each of these indicators is first expressed on a scale of 0 to 1. Thus, life expectancy at birth in Costa Rica (76,6 years) is given the value:

$$0.86 = 76.6 - 25 : (85 - 25)$$

To the life expectancy in Saudi Arabia (70.3 years) is given the value:

$$0.755 = 70.3 - 25 : (85 - 25)$$

The same calculation is done for the indicator of level of instruction and for the indicator of income level. In second stage, we work out the average of the three figures thus obtained. We thus get the composite index of human development. We end up with an HDI of 0.889 for Costa Rica and 0.774 for Saudi Arabia. By this means, it is possible to operate ranking of all the countries.

Francisco Vergara
1996–1997 Statistics

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