CHAPTER TWO

THE CURRENT SITUATION

2.1 Introduction

Cameroon is usually referred to as Africa in miniature. The reason for this observation is that while the country covers only 1.6 % of the surface area of the African continent, it contains representations of the continent's major ecosystems as indicated in Table 1.1. Belonging to one of the world centres of biological diversity (Fig. 2), the country ranks 5th in biodiversity after the Democratic Republic of Congo (Zaire), Madagascar, Tanzania and South Africa. It contains at least 21 % of the African fish species, at least 48 % of the mammals, at least 54 % of the bird species, 50 % of the known continental amphibian species, 30 to 75 % of the reptile species, and 42 % of all recorded African butterfly species, (MINEF, 1996a; Lees and Spiers, 1989).

This chapter presents the state of the major components of Cameroon's biological diversity within each of the ecosystems (Table 1.1, Fig. 6). The trends of the components in space and time as well as the related impacting activities by the various stakeholders are also examined as management hot-spots. The major biodiversity components adopted in the ecosystems are plants, animals and micro-organisms while the stakeholders considered are Government, Local Communities, Economic Interest Groups, Non-Governmental Organisations, the International and the Scientific Communities.

Priority ecological zones identified for the NBSAP are treated in this section serially from south to north. This gradient also presents in a decreasing order, the richness and diversity of the nation's biological resources. Table 1.1 presents the NBSAP ecosystems whose geographical locations within the country are indicated in Fig. 6.

2.2 State of biodiversity

The critical treatment of biological diversity issues include agricultural, floral, faunal, aquatic as well as microbial considerations. Activities in these sectors can be examined as follows:

a) Agricultural biodiversity

This sector includes domesticated crops and animals. The production and variability in Cameroon's agricultural biodiversity can be seen as shown in the Fig. 3 and 4. The crop diversity shown is a function of ecological diversity.

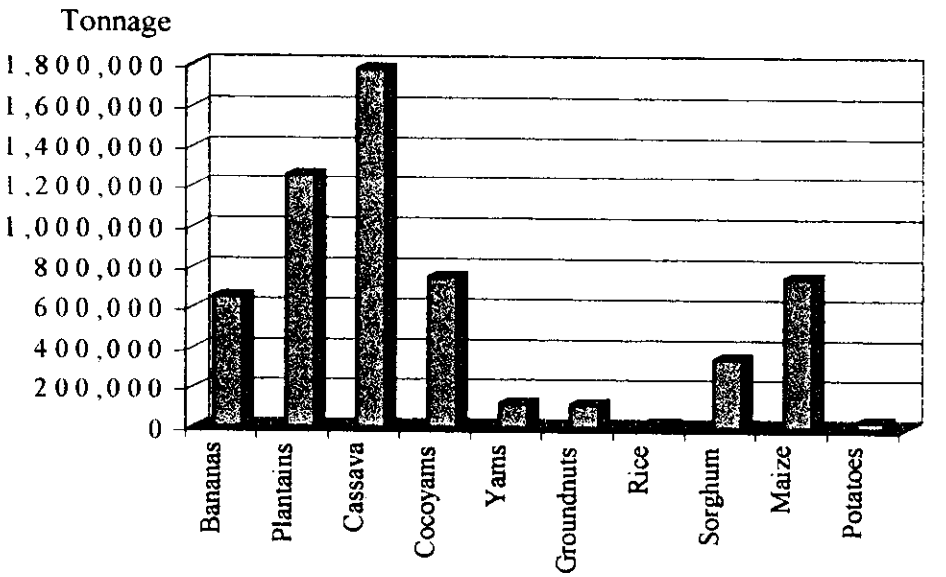


Fig. 3: Main foodstuff production (Mbah, 1997)

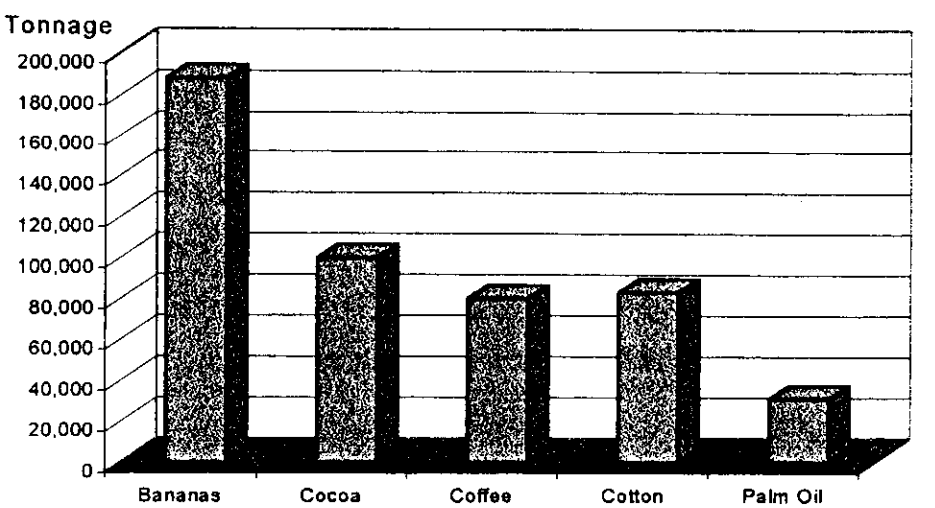


Fig. 4: Main export crops in 1994 (Mbah, 1997)

Meanwhile agricultural losses at national level are significant and can be as high as 25% for bananas, yams, cocoyams and Irish potatoes (Fig.5). Figure 6 shows the diversity and relative contributions of livestock species. This is also a consequence of ecological diversity.

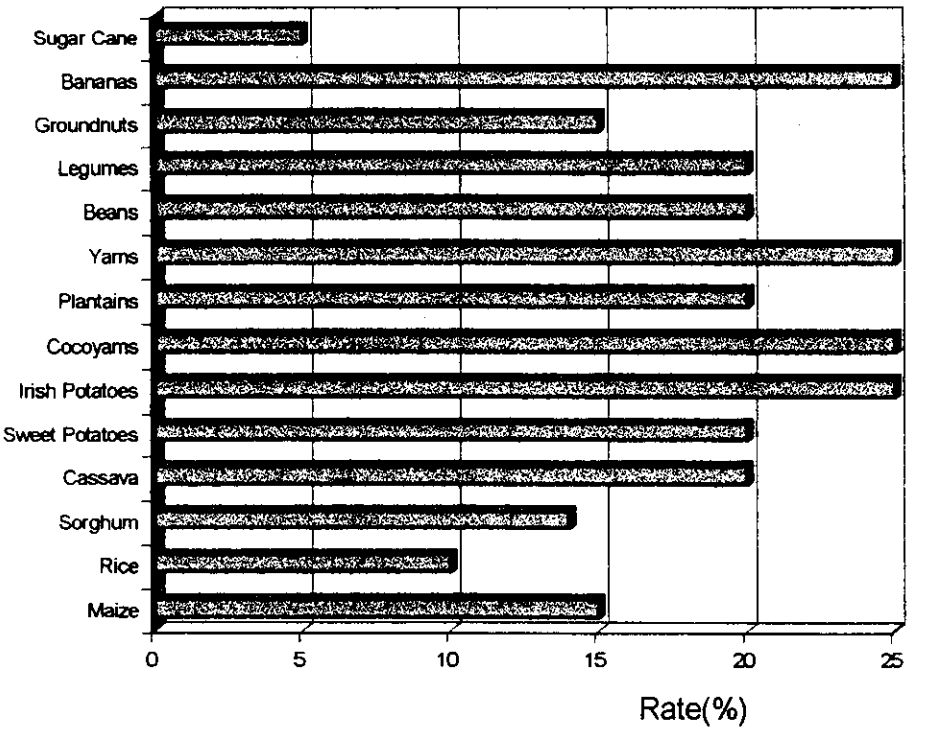


Fig. 5: Post-harvest losses (% annual production) of crop species (Nami, 1997)

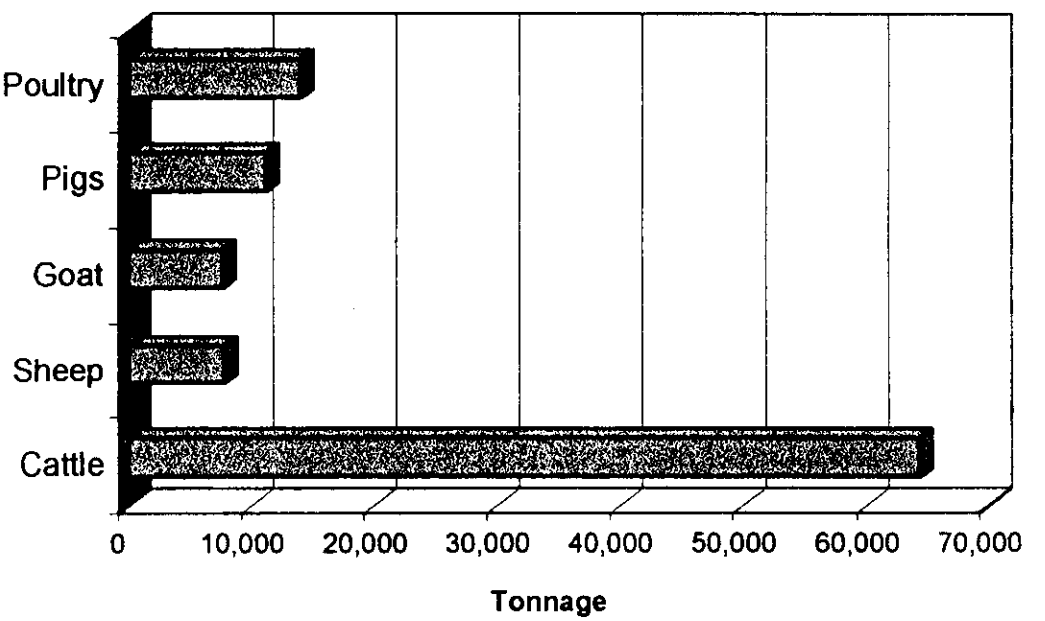


Fig. 6: Meat from major domesticated animals (Mbah, 1997)

b) Marine and Coastal biodiversity

Marine and coastal biodiversity is composed of weeds, invertebrates, fish, reptiles, birds and marine mammals. Cameroon fisheries production (paragraph

2.2.1.2.2) is mainly for national consumption (60%): invertebrates include lobsters, deep water shrims, prawns and inter-tidal molusces. Some marine mammals include Manantee and seals.

c) Floral biodiversity

So far, the general situation by group and published taxons in Cameroon is represented in Table 2.1.

Table 2.1: Floral diversity in Cameroon

Group	Taxons Published		
	Families	Genera	Species
Spermatophytes	83	552	1928
Pteridophytes	26	68	257
Total	109	620	2,185

Source: Satabie (1997)

d) Microbial diversity

The trend in the diversity in identified micro-organisms is shown in Table 2.2. A further study (Nwaga, 1997) makes a general listing of microbial diversity as encountered in agriculture, food processing, industry, environment and health.

Table 2.2: Microbial diversity in Cameroon

Mushrooms	N° of Species	Bacteria	N° of Species
Agaricaceae	6	Rhizobium	> 60
Amanitaceae	59	Pseudomonas	> 20
Polyparaceae	8	Endomycorrhiza	> 100
Ganodermatae	2	Ectomycrorrhiza	> 20

Source: Nwaga (1997)

2.2.1 Marine and Coastal Ecosystems

The marine and coastal ecosystem is made of the continental shelf and the coastal plain. The country's continental shelf starts from its limit on the high seas, to the water - land interface, while the plain is made of continental lowlands (Amou'ou *et al*, 1985), divided into four sectors:

- the Mamfe basin,
- the Ndian basin,
- the Douala basin, and
- the Kribi lowlands.

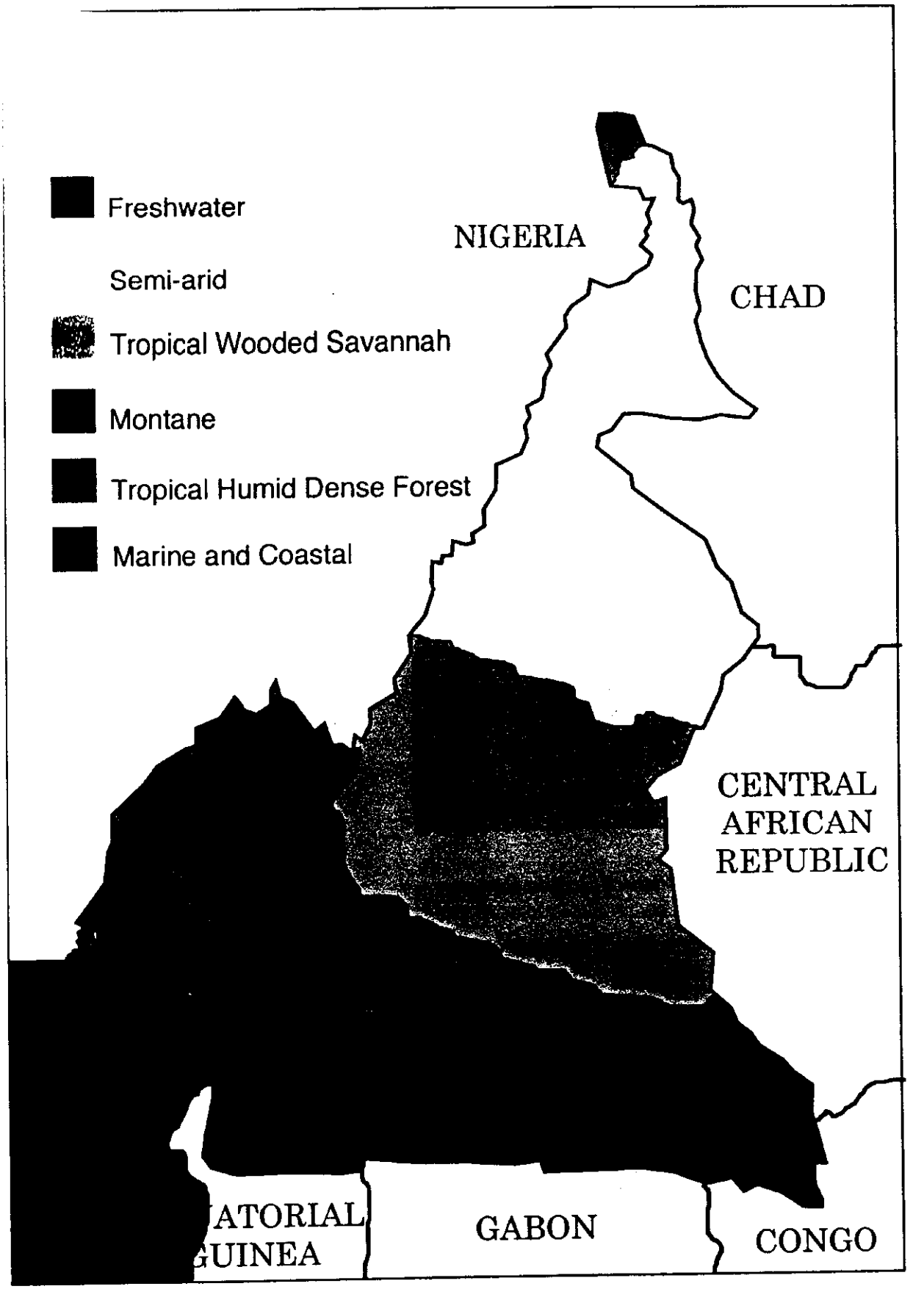
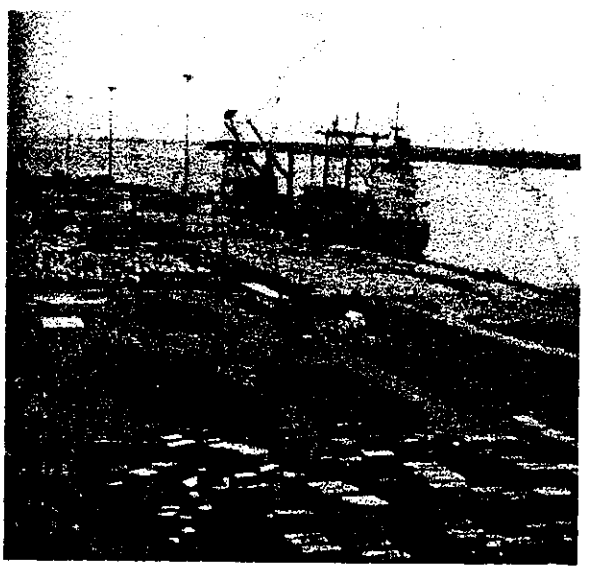


Figure 7 : Major Ecosystems of Cameroon

The Mamfe basin borders the western highland plateau to the north, and the Rumpi Hills (4°50' N and 11°27'E) to the south. It slopes to the Nigerian coast from east to west, and is drained mainly by the Cross River or the Manyu. The Ndian basin meanwhile, leans on the Rumpi Hills and Mount Cameroon (4°13'N and 9°11'E) to the west and opens into the Atlantic Ocean through the Rio del Rey marshes on the south west. The Douala basin is the largest in the coastal plain. It is characterised by large estuaries (Plate 2.1, Fig. 10): the Wouri, the Sanaga and the Nyong. The Kribi basin meanwhile is relatively higher. It is drainded by shorter and less alluvium containing streams: the Kienké, the Lobé, the Lokoundje, and a section of the Ntem.



The Douala Estuary habours the sea port which serves as Cameroon's main outlet for agricultural, timber and wildlife products.

Plate 2.1 View of Douala Estuary

Despite their still roots, the mangrove vegetation is intensely exploited by fishermen for smoking fish.

Plate 2.2 Mangrove vegetation in the Limbe Coastal region

2.2.1.1 Status of Biodiversity Components

2.2.1.1.1 Plants

According to phytogeographic studies by Letouzey (1985) and botanical inventories by Cheek (1992) and Satabie (1997), the following number of plant species have been identified for the Marine and Coastal ecosystems:

a) Woody species (excluding Mangroves)

A total of 600 tree species and 750 shrub species have been identified in the Marine and Coastal ecosystem. Of these, *Afrothismia pachyantha* (Cheek, 1992), is strictly endemic to the Mabeta-Moliwe area. Other endemic species of the ecosystem are included in Table 2.4, due to the similarity in the continental woody species of the tropical humid dense forest and the marine and coastal ecosystem. The threatened species are also similar and are presented in Table 2.4.

b) Mangrove species

Mangroves cover a total area of 2,434 km^2 (Sayer *et al*, 1992) with 14 mangrove and associate mangrove species (Saenger, 1995), namely: *Rhizophora racemosa, R. harrisonii, R. mangle, Avicennia germinans, A. nitida, Languncularia racemosa, Nypa fruticans, Hibiscus tiliaceus, Thespesia pupulnea, Acrostichum aureum, Conocarpus erectus, Drepanacarpus lanatus, Chrysobalanus icaco,* and *Pandanus candelabrum.* Mangroves serve numerous environmental and economic functions including:

- provision of appropriate breeding and spawning sites for marine fauna including fish and crayfish,
- provision of a convenient milieu for mariculture,
- buffering of strong sea storms otherwise devastative to coastal installations,
- employment in sea shore-land reclamation ventures,
- provision of interesting sites for tourism and for film producing.
- source of energy and for domestic uses and smoking of artisanal fish products.

The most commonly used species is *Rhizophora racemosa.*

c) Herbaceous species

As reported by the above studies, 350 species of lianas and climbers have so far been identified in the Marine and Coastal ecosystems. The most valuable of these are "Okok" or "Eru" (*Gnetum africanum*), a vegetable, heavily exported from Cameroon to Nigeria; the sponge, and water vines both of which belong to the genus *Ficus*; the potential anti-HIV vine *Ancistrocladus korupensis*. Eight (8) species of ferns, and 15 species of mosses have also

been identified in the area (Letouzey, 1985). Although lichens and orchids are mentioned, the total number of species so far identified for the ecosystems has not been indicated. More studies are needed to determine the number of endemic and threatened herbaceous species of the ecosystems.

d) Agricultural species

The food and cash crop species found in the Marine and Coastal ecosystem are common to other ecosystems. However, due to the low altitude, heat and humidity, the Oil Palm (*Elaeis guineensis*), the Coconut palm (*Cocos nucifera*) and the Banana (*Musa spp.*) are particularly favoured and thrive excellently in these ecosystems.

Box 2.1

Class "A" Animals.
Animals Protected in Cameroon by Order N° 2513 of 28/06/1998 and Order N° 013/MINEPIA of 31/05/1995

MAMMALS		BIRDS
1. Lion	11. Calabar Potto"Arctocebus"	1. Ostrich
2. Leopard	12. Bossman's Potto	2. Bateleur
3. Cheetah	13. Allen's Galago	3. Harrier Hawk
4. Caracal	14.Abyssinian B § W Colobus	4. Secretary Bird
5. Aadvark	15. Chimpanzee	5. Black Stork
6. Red-fronted Gazelle	16. Gorilla	6. White Stork
7.Mountain Reedbuck	17. Elephant "tusks less 5kg"	7. Shoe Bill
8. Giraffe	18. "Pygmy Elephant"	
9. Water Chevrotain	19. Manatee	
10. Black Rhinoceros	20. Gudalis (Ngaoundere)	

Source : Decoux *et al* (1997), Mbah (1997)

2.2.1.1.2 Animals

a) Wild mammalian species

According to various fauna surveys, Gadsby and Jenkins (1992), Njoh (1997), Folack *et al* (1997), and Njock (1997), approximately 175 mammalian species have been identified in the Marine and Coastal ecosystem. The level of endemicity is not known but the Water Chrevrotain (*Hyemoschus aquaticus*) is reported to be exceptionally rare. It has consequently been declared *endangered* by the Department of Wildlife and Protected Areas. Folack *et al* (1997) also mentioned the following species as *endemic* to the Onge River reserve:

- *Potomogale velox*
- *Lutra macullicollis*
- *Hyemoschus aquaticus*
- *Cephalophus syviculor*
- *Aonyx capensis*
- *Potomochoerus porcus*
- *Tragelaphus spekei*
- *Osteolaemus tetraspis*

Particular mention has also been made (Folack *et al*, 1997) of the existence of a herbivorous aquatic mammal (*Trichechus senegalensis*) having the physionomy of a seal, weighing up to 400 kg and inhabiting the estuary of the Sanaga river. Other mammals reported in the area include the forest elephant (*Loxodanta africana cyclotis*), nocturnal Lemurians such as *Peridicticus potto* and *P. calabarensis*, 20 species of monkeys all belonging to the families Cercopithecidae and Colobidae. Meanwhile according to Fedden *et al* (1986), the bat species *Hypsignatus zenkeri* is found only within the coastal fringe of the country. This is possibly the species roosting on trees located around the presidential palace of the Kribi shore-line.

b) Domestic mammalian species

The domestic animals surviving in the Marine and Coastal Ecosystems also survive elsewhere in the country and are considered common. However, a dwarf breed of cattle known as the Muturu, *Bos taurus*, suspected to be resistant to *Typanosomiasis* transmitted by the Tse-tse fly, is known to be *endemic* to the area. Two varieties currently exist in the zone notably the 'Bakossi' and the 'Bakweri'. These breeds are currently represented by only about 1,300 heads each, a cause for alarm (Mbah, 1997)!

This species of the *Polypteridae* family found in the lower course of coastal rivers is unique because of its snakelike appearance, can attain a length of 90 cm.

Plate 2.3 Calamoichthys calabaricus (Snake-fish)

c) *Fish, Crustacea and Molusc species*

Four hundred and fifty one species of fish have so far been identified in the Marine waters of Cameroon (Republic of Cameroon, 1997). Of these, 381 are marine and 70 are brackish; 5 are employed in aquaculture and 13 exported live. Eight (8) Crustacea species have so far been identified in the country's marine waters, 4 of which are of economic importance, namely: *Nematopalaemon hastatus* locally called "Njanga", *Panaeus kerathurus*, *Parapenaeopsis atlantica*, and *Penaeus notialis* (Njock, 1997; Folack and Galega, 1997). Table 2.3 shows *threatened* fish species in Cameroon while the following species have been introduced (Njock and Bokwe, 1999): *Astatoreochromis alluadi, Clarias gariepinus, Cyprinus carpio and Oreochromis marcrochir machrochir.* Of the 57 endemic fish species (Njock and Bokwe, 1999) of Cameroon, 19 are shown in Table 2.3.

Table 2.3 Threatened fishes (35 species, scientific names and status) of Cameroon *

Carcharhinu limbatus	N	*Pristis pectinata*	N	*Tilapia bemini*	E
Carcharhinu plumbeus	N	*Pristis pristis*	N	*Tilapia bythobates*	E
Carcharhias taurus	N	*Pungu maclareni*	E	*Tilapia deckerti*	N
Carcharodon	N	*Sarotherodon caroli*	N	*Tilapia flava*	E
carcharias	N	*Saratherodon galilaeus galilaeus*	N	*Tilapia gutturosa*	E
Clarias maclareni	N	*Sarotherodon linnellii*	E	*Tilapia imbriferna*	E
Dalatias licha	N	*Sarotherodon lohbergeri*	E	*Tilapia kottae*	N
Epinephelus itajara	N	*Sarotherodon steinbachi*	E	*Tilapia snyderae*	E
Hippocampus	N	*Stomatepia mariae*	E	*Tilapia spongotroktis*	E
hippocampus	E	*Stomatepia mongo*	E	*Tilapia thysi*	E
Konia dikume	E	*Stomatepia pindu*	E		
Konia eisentrauti	E	*Thunnus obesus*	N		
Myaka myaka	N	*Tilapia bakossiorum*	E		
Pristis microdon					

* *N = native, E = endemic*

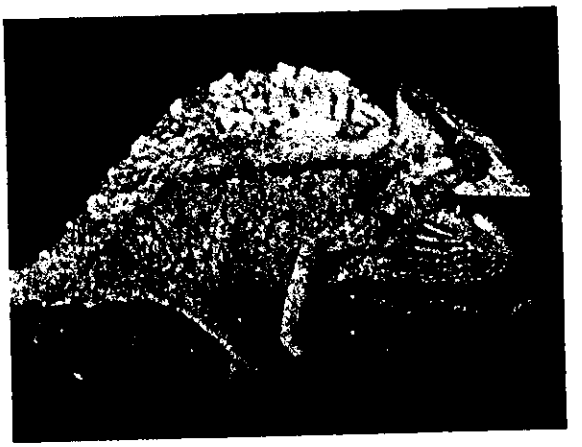
Source: Njock and Bokwe, 1999

The studies cited above also indicate that 25 species of Molluscs have so far been identified in the area. The shells of some of the Mollusc species serve for ornamental purposes while other species serve for local consumption. The species include: *Sphonaria mouret, Purpura collifera, Purpura yetus, Sepia officinalis, Mytilus tenuistratus, Crassostrea gasar* and *C. rufa.* The total number of Mollusc species mentioned above includes identified snails.

d) *Amphibian species*

Folack *et al* (1997) mentioned that the coastal ecosystem contains 200 species of identified Amphibians. An interesting species which indicates the presence of mangroves is the mud-skipper (*Periopthalmus papilio*). Also mentioned is the existence of a giant (Goliath) frog in the Edea region, measuring 30 cm long and weighing 2.4 kg. The Goliath frog is

hunted for international commerce and is currently *threatened* with extinction (Folack *et al*, 1997).



This species is found in the Korup National Park. The Giant Chameleon is reported to be sixty million years old.

Plate 2.4 Giant Chameleon

e) ***Ophidian and reptilian species***

Folack *et al* (1997) reported that Ophidians are represented in the Marine and Coastal ecosystem by 150 species of snakes among which are the African Python, *Pithon sebae*, and other common species such as *Bitis gabonica, Boulangerina annulata, Dendroaspis viridis.* Reptiles, meanwhile, are represented by 85 species and include Crocodiles, Turtles and Tortoises while Saurians are represented by *Rampholeum spectrum, Chameleo quadricornis, C. montium.*

2.2.1.1.3 Micro-organisms and insects

Little information is available on the number of species available in the ecosystems. However, Lees and Spiers (1989) who made a species count around the Korup area reported a total of 1050 insect species, including hoppers. This number of species can be considered to be "representative" of the ecosystems. Lees and Spiers also mention that Cameroon has a total of about 1550 species of butterflies and hoppers accounting for 42 % of continental Africa's 3300 species.

Box 2.2

Types of degradation in the Marine and Coastal Ecosystem

- **Loss of original vegetative cover and potential economic plant species to crop monoculture practised by agro-industrial companies, and to artisanal agriculture,**
- **Pollution of Marine waters by petroleum companies, and fertilisers from agro-industrial activities,**
- **Coastal erosion and**
- **Deforestation particularly around the "Bouche du Cameroun."**

2.2.1.2 Principal Activities Affecting Biodiversity and Stakeholder Roles

2.2.1.2.1 Loss of original vegetative cover and of potentially economic plant and animal species due to crop monoculture and subsistence agriculture

The Marine and Coastal ecosystem are a zone of remarkable agricultural potential. The area hosts numerous agro-industrial companies (representing economic interest groups) which include the Cameroon Development Corporation (CDC), PAMOL, HEVECAM, Bananeraies de Njombe, SOCAPALM, and DELMONTE, all employing large land estates in crop mono-culture. In fact, these companies occupy almost half of the continental area of the coastal ecosystem and contribute significantly to degradation (Box 2.2). Studies carried out by API - Dimako (1994), revealed that agro-industrial plantations are responsible for 30% of the original vegetation cover loss, while artisanal agriculture, practised by the "local population" as uncontrolled slash and burn, accounts for another 60 % of original plant biodiversity degradation each year (MINEF, 1996b).

Considering the high concentration of agro-industries in these ecosystems, it is evident that together with artisanal agriculture these account for nearly all the annual deforestation in the zone. Studies by FAO (1980) revealed that the annual rate of deforestation of the tropical dense forest (of which the continental section of the Marine and Coastal ecosystems constitute a part) was about 100,000 ha (Foteu, 1997). Deforestation, due in part to agro-industrial companies operating in these ecosystems, is known to have contributed to the disappearance of priced tree species such as the Ebony (*Diospyros sp.*) and Zebra wood (*Zingana*) initially abundant in the region and which constituted important elements of foreign trade in the 19th and 20th centuries (Sayer *et al,* 1992). Animal species such as the Chimpanzee (*Pan troglodytes*) and surely many others not assessed, known to inhabit only virgin forests, have become exceptionally rare in the area. The agro-industries fail to respect rules governing cultivation activities by planting their crops right to the river banks and marshy areas.

The agro-industrial companies cited above are, however, known to enhance agricultural biodiversity through research, multiplication, and planting. The species involved are: Tea (*Camellia sp.*), Oil Palm (*Elaeis guineensis*), the Rubber plant (*Hevea braziliensis*), the Coco-nut Palm (*Cocos nocifera*), the Banana plant (*Musa sp.*), the "bush Pepper" (*Piper nigrum*) and *Prunus africana*.

Box 2.3

Pollution of marine waters by industrial companies, and fertilisers from agro- industrial activities

The Marine and Coastal ecosystems host about 70 % of the country's industries. They are categorised as:

- ***Chemical industries*** **(paint, cement, soap, textile, paper pulp, etc; manufacture or treatment) Examples include SAFCAM and CEP which produce paint and CCC which produces soaps and detergents. Detergents are associated with the decrease in productivity of fauna and flora.**
- ***Automobile industries*** **(engine oil, batteries, etc): These products enhance accumulation of lead in the food chain.**
- ***Petroleum industries*** **(refineries, fuel distribution companies, etc.) examples: SONARA, PECTIN, and shore-line fuel distributors such as ELF Serepca. Hydrocarbons have been proven, (Saenger, 1995) to cause the death of flora and fauna species.**
- ***Agricultural industries*** **(fertilisers, pesticides, insecticides, herbicides): These products lead to eutrophication.**

Pollution (Box 2.3)in the Marine and Coastal ecosystem is inadequately monitored. This is because available legislation is not enforced due to the shortage and lack of logistics needed to ensure control.

The establishment of plantations is based mostly on the economic importance of a given crop. There are similar plantations of different crops.

Plate 2.5 Plantation Agriculture in the Marine and Coastal Ecosystem

2.2.1.2.2 Trends in fish production

Njock and Bokwe (1999) report that commercial fishery is close to 120,000 mt. Per year. This yield is nevertheless decreasing. This negative trend has been attributed to *overexploitation*, accompanied by the use of *small meshed nets* which take small and immature fish (Njock and Bokwe, 1999). There are 32 commercial species one of which, *Epinephelus spp.*, is threatened (Njock and Bokwe, 1999). There are 35 and 57 threatened (Table 2.3) and endemic species, respectively (Njock and Bokwe, 1999). It is also obvious (MINEF-C/UNIDO/UNDP-GEF, 1999) that *pollution* from chemicals released by coastal industries (Box 2.3) affect the prolific and reproduction levels of marine fish species. There is no detailed information on major fish species under commercial exploitation.

2.2.1.2.3 Coastal erosion and deforestation particularly around the "Bouche du Cameroun"

A major concern in the coastal area, especially around the Wouri basin, is the increasing mangrove deforestation by the local population. The process follows a different trend from that of continental deforestation. The species are currently cut by residents of fishing camps, coastal villages and towns for fish smoking, firewood, home construction, tannin extraction and traditional medicine. The alarming rate of mangrove cutting, especially at the "Bouche du Cameroun" is partially due to the absence of specific legislation to protect the species from uncontrolled felling. One reason for this limited control probably stems from co-ordination difficulties: swamp tree species, mangroves are under the supervision of the Ministry in charge of the Environment and Forestry, but by virtue of their location in marine waters, they fall in the domain of the Ministry of Livestock, Fisheries and Animal Industries which has no mandate to implement the relevant legislation and consequently does not act.

2.2.1.2.4 Forestry

Although the coastal area (Limbe, Tiko, Douala, Kribi) contains most of the timber parks of the country, meagre legal timber exploitation actually takes place in the area.

With the exception of the Ocean Division, the region contributed only 220,877 m^3 of timber against 2,802,949 m^3 for the country in 1995/96 (MINEF/DF, 1996b). Illegal felling of timber, using motorised manually operated engine saws, is rife in the ecosystem. Timber poachers supply numerous township timber markets. It should be indicated that people are increasingly involved in *illegal timber exploitation* in reaction to the financial crisis facing the nation. Tree species mostly sought by illegal exploiters include: *Poga oleosa*, the

Entandophragmas sp. (Mahogany), *Chlorophora excelsa* (Iroko), and *Kantou guineensis* (Mbele). Species employed in local carpentry works are usually preferred.

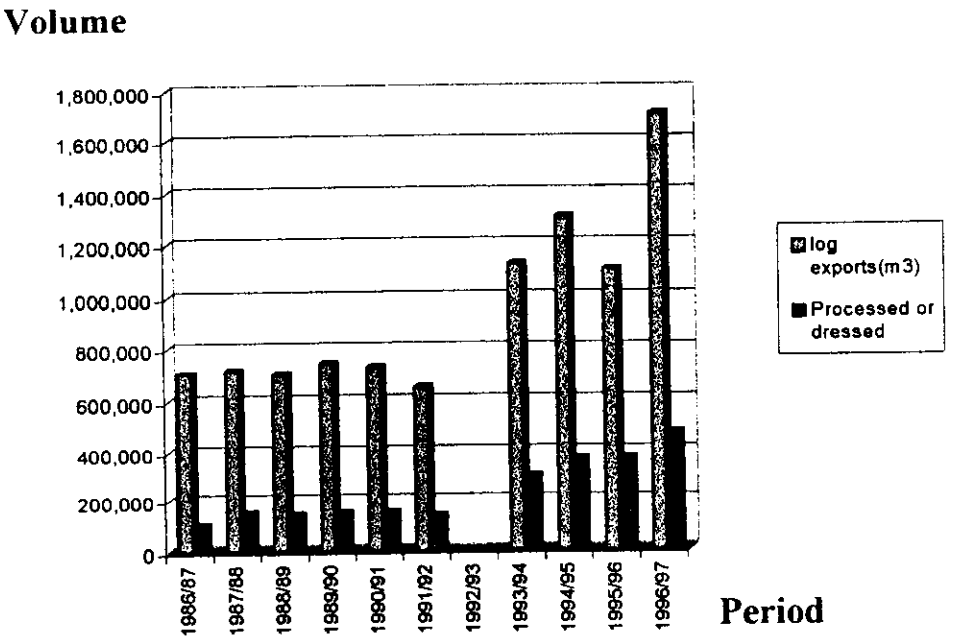


Fig. 8: Timber export trends through sea ports of Cameroon (1986-97)

N.B. A small proportion of the exports includes exits through the rivers and roads of the South Eastern part of the East Province. Figures for 1992/93 were not available. The enactment of the forestry law in 1994 aggravated exploitation dramatically (Fig. 8).

2.2.1.2.5 Commerce in wild plant parts

There is a current luxuriant trade in the leaves of the vines *Gnetum africanum* (Okok, Eru) and *Gnetum buchholzianum* which are widely consumed as a vegetable within the country and large quantities are exported weekly to neighbouring Nigeria. Although the coastal ecosystem does not yield significant quantities of the product, it serves as the exit point for trade with Nigeria. **The *Gnetum* vines referred to above have been declared by the IUCN as endangered.** Other plant parts with significant quantities exported through the area include the bark of *Prunus africana*, the fruits of *Voacanga* and *Yohimbe*.

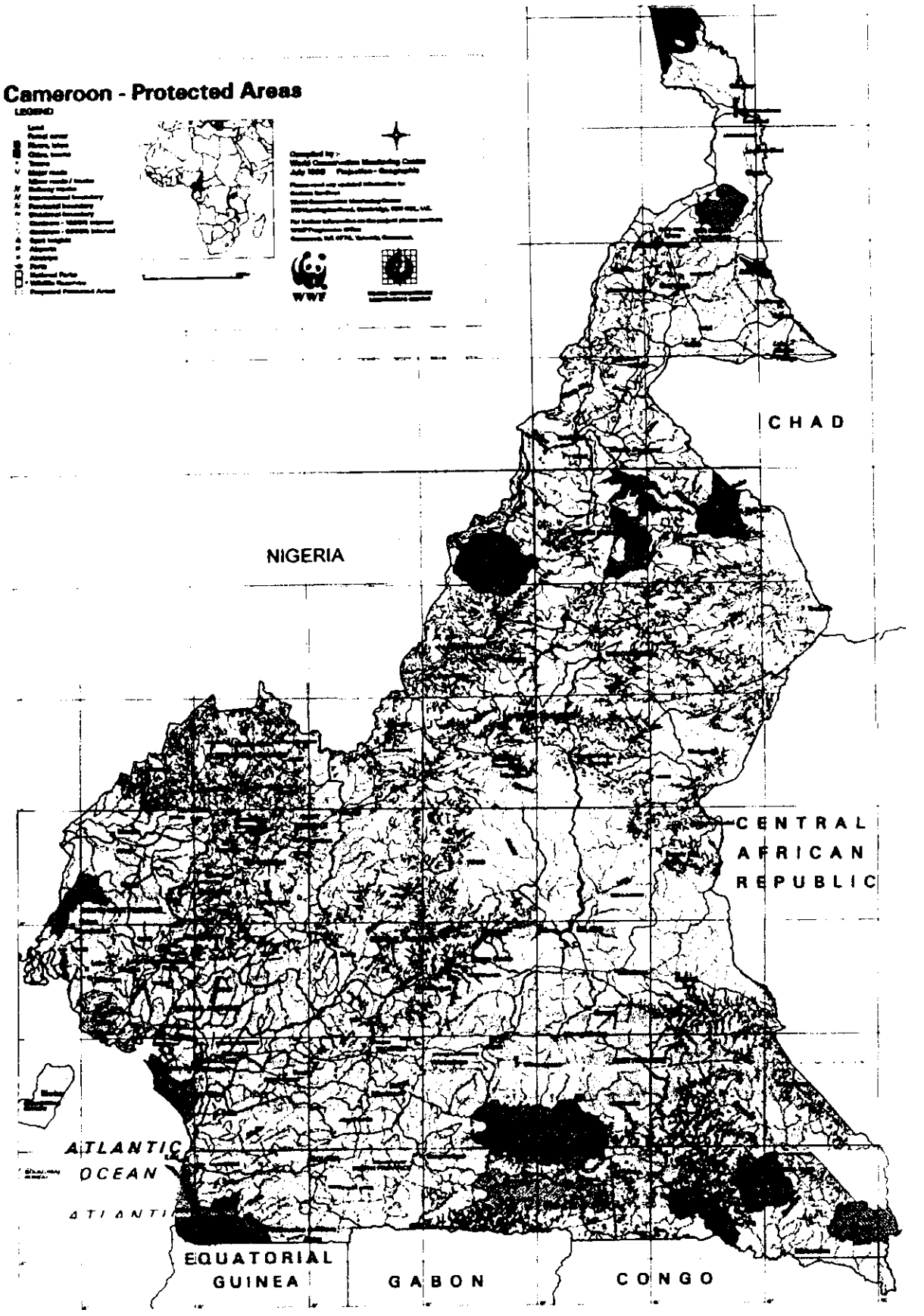


Figure 9 : Map of Protected Areas of Cameroon

2.2.1.2.6 Biodiversity conservation efforts

Major conservation efforts, started around the 1930s, involved production forests, wildlife reserves and national parks are shown in Table 2.4.

Table 2.4 Plant biodiversity: Major protected or managed areas of the Marine-Coastal and Tropical Humid Dense Forest Ecosystems (Fig. 9) *

Name of reserve	Principal functions	Surface area (ha)	Date created	Present state
Takamanda Forest Reserve	Production forest	67,599	1934	NA
Bambuko Forest Reserve	Production forest	26,677	NA	NA
Bayang-Mbo Forest Reserve	Production forest	38,500	NA	NA
South Bakundu Forest Reserve	Production forest	19,425	NA	NA
Mungo River Forest Reserve	Production forest	4,622	NA	Inhabited 80%
Bois des Singes Forest Reserve	Recreation forest	25	NA	NA
Bakossi Forest Reserve	Production forest	5,517	Not notified	NA
Ejagham Forest Reserve	Production forest	74,851	1934	NA
Manehas Forest Reserve	Production forest	600	Not notified	NA
Nta-Ali Forest Reserve	Production forest	31,400	NA	NA
Mawne River Forest Reserve	Production forest	44,900	1956	NA
Mokoko River Forest Reserve	Production forest	9,100	1952	NA
Korup National Park	National Park	85,675	1937	NA
Barombi Mbo Lake Reserve	Protection forest	885	NA	NA
Buea Fuel Plantation	Production forest	30,000	Not notified	NA
Edea-Ngambe Forest Reserve	Production forest	60,000	Not notified	NA
Bonepoupa Forest Reserve	Production forest	20,000	Not notified	NA
Mangombe Forest Reserve	Production forest	20,000	Not notified	NA
Loum Chantier Forest Reserve	Production forest	1,000	Not notified	Inhabited 100%
Loum Forest Reserve	Production forest	893	Not notified	NA
Melong Forest Reserve	Production forest	2,000	Not notified	Inhabited 100%

Bakaka Forest Reserve	Production forest	13,000	Not notified	NA
Muyuka Forest Reserve	Inhabited at 30%	5,000	Not notified	Inhabited 30%
Eko Forest Reserve	Production forest	100	Not notified	NA
Dibombe-Njongo Forest Reserve	Production forest	2,000	Not notified	Inhabited 100%
Letia Forest Reserve	Production forest	45,000	Not notified	NA
Dibamba Forest Reserve	Production forest	14,000	Not notified	NA
Kompina Forest Reserve	Production forest	2,000	Not notified	NA
Douala-Edea Wildlife Reserve	Faunal Reserve	160,000	1932	NA
Lake Ossa Wildlife Reserve	Mostly destroyed	4,000	1968	NA
Sanaga Wildlife Reserve	Mangrove forest	NA	NA	NA

* *NA = not available*

Source: MINEF/DF, 1996 b; World Conservation Monitoring Centre, 1993.

NB. The management of production forests currently consists of occasional control visits by forest guards.

2.2.1.2.7 Other biodiversity conservation activities in the Marine and Coastal Ecosystem

The Global Environment Facility (GEF) provides funding to the Government of Cameroon through the Mount Cameroon Project (MCP) for protection against degradation of the unique and valuable biological resources around the mountain and its lowland slopes. The intervention and protection activities of the Mount Cameroon Project (MCP) within the coastal and the montane ecosystems and have included:

- Biological surveys;
- Community participation in forest management; and
- Socio-economic studies.

It should be mentioned that GEF's assistance in conservation is intimately integrated with the on-going activities of the MCP which also receives funding from the DFID and the GTZ. The World Wildlife Fund (WWF) is also involved in conservation activities through the KORUP project situated in the Ndian basin. WWF also provides support to marine surveys and studies, while the Wildlife Conservation Society (WCS) provides support through wildlife surveys and inventories in the ecosystem. The MCP and the KORUP are pilot projects whose impacts are localised within their immediate areas of operation

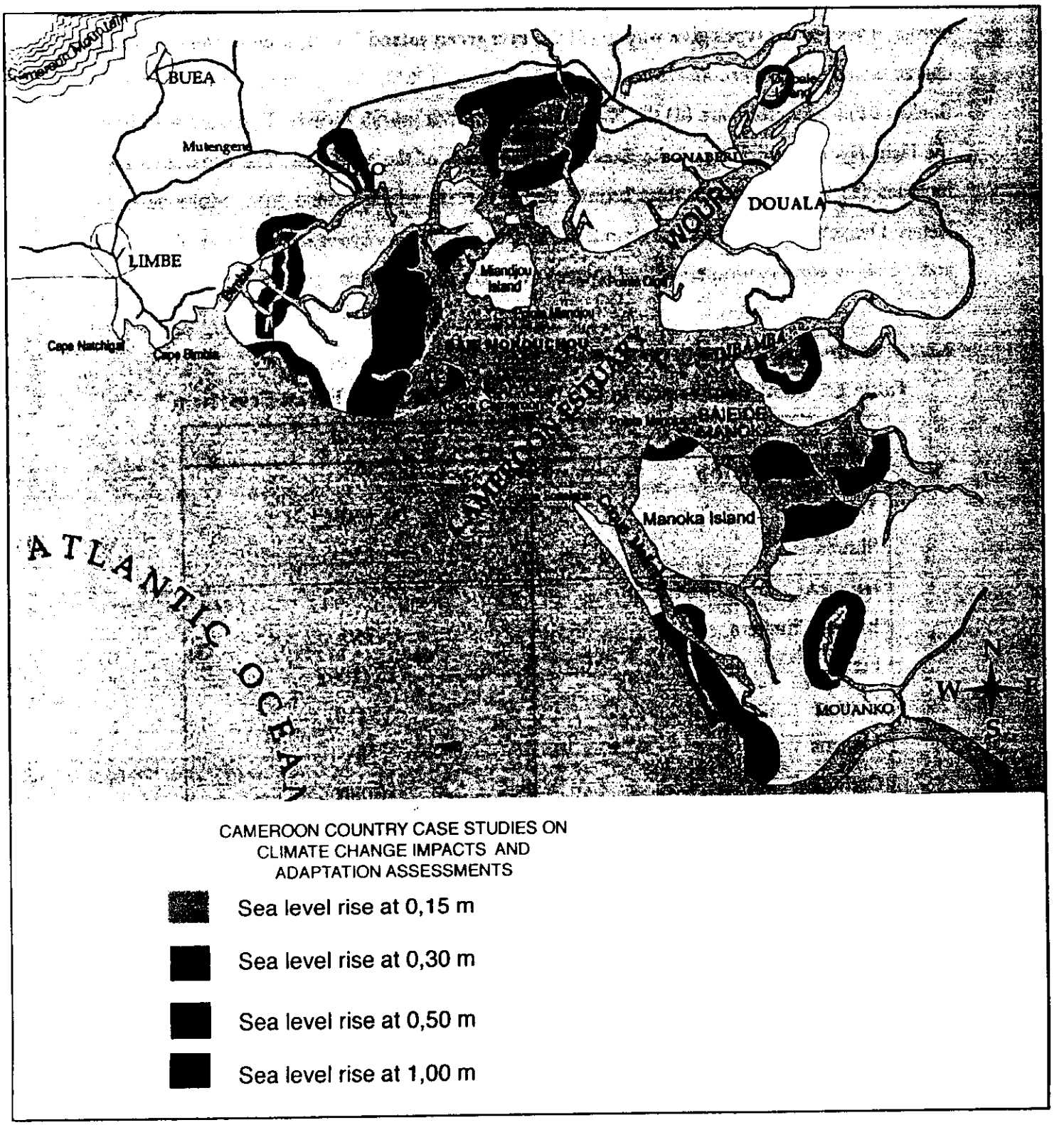


Figure 10 : "Cameroon Estuary" Mangrove Ecosystem

2.2.2 The Tropical Humid Dense Forest Ecosystem

Beyond the coastal zone, the dense forest ecosystem presents (1) an **Atlantic humid dense variant** made of three levels, namely: tree, shrub and herb, with an abundance of *Lophira alata*. Beyond the atlantic humid zone lies (2) the **biafran forests** corresponding to the mid altitude forest type. They extend from Cameroon's border with Gabon to the Nigerian border. These forest types give way to (3) the **evergreen mixed forest,** such as the Dja forest characterised by *Gilbertiodendron deweri* (Letouzey, 1985). Also included in the eastern flanks of this ecosystem are (4) the ***Sterculia subviolacea* marsh forests**. These are mainly in the Haut Nyong Division and the Sangha flood forests of the southeast. The ecosystem also includes (5) the **Semi-deciduous humid dense forests** which extend from Moloundou to Bétaré-Oya, characterised by the abundance of Obeche (*Triplochyton scleroxylon*) Tables 2.4 and 2.5 show conservation effort and species numbers so far known.

2.2.2.1 Status of biodiversity components

Table 2.5 Plant Biodiversity in the Tropical Humid Dense Forest Ecosystem *

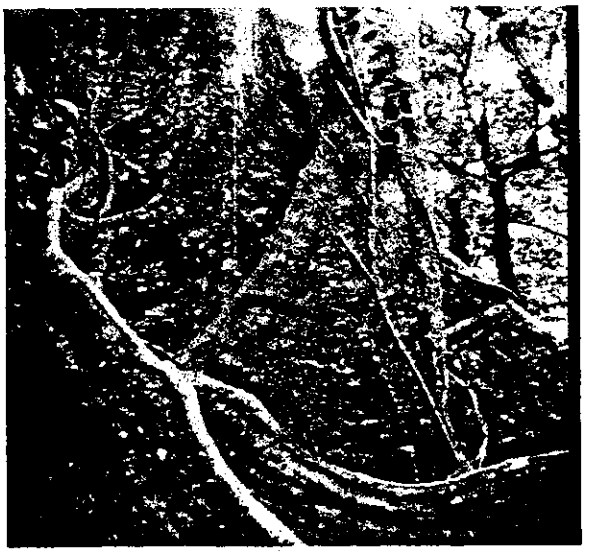
Species	Total
WOODY SPECIES:	
Trees	650
Shrubs	850
HERBACEOUS SPECIES:	
Lianas/Climbers	750
Ferns	15 (200)
Mosses	15 (10)
Lichens	NA
Orchids	3080
Other Herbs	NA

** NA = not available*

Source: Satabie (1997); Letouzey (1985); Cheek, (1992)

2.2.2.1.1 Plants

a) Woody species



Buttresses are characteristic of most trees in the Tropical Humid Dense Forest.

Plate 2.6 Desbordesia glaucessens

According to Letouzey (1985) and Satabie (1997), about 650 tree species and 850 liana species have been identified in Cameroon's Tropical Humid Dense Forest Ecosystem. Studies to determine endemicity are not yet complete but botanical inventories by Cheek (1992) and studies by Satabie (1997) already give indications of potentially endemic species. Some of the species proposed by these studies are mentioned in Table 2.7 Satabie (1997) has also identified some species considered to be under threat in the ecosystem. These are presented in Table 2.6

The Tropical humid dense forest ecosystem is the store-house of Cameroon's timber industry. The most important species ranked by their commercial value include the large leaf Acajou (*Khaya grandifolia*), the white Acajou (*K. anthotheca*), the bassam Acajou (*K. ivorensis*), Assamela (*Pericopsis elata*), Ayous / Obeche (*Triplochyton scleroxylon*), and Azobe (*Lophira alata*) (Foteu, 1997). Species most appreciated by the local population include the Moabi (*Baillonela toxisperma*) which serves as good timber and a source of cooking oil (from seeds); Njangsang (*Ricinodendron heudolotii*) whose seeds are used in soup thickening; bush onion (*Afrostyrax lepidophyllus*), a savoury spice; and the bush mango (*Irvingia gabonensis*) whose fruits are used in the preparation of slimy soups.

b) Liana and climber species

From studies by Letouzey (1985) and floral specimens held by the National herbarium, about 750 species of climbers and lianas have so far been identified in the Tropical Humid Dense Forest Ecosystem. Satabie (1997) states that studies to determine the level of

endemicity of the above species are still going on, and indicates that the lianas, *Gnetum africanum* (Okok, Eru) and *Gnetum buchholzianum* (Okok, Eru) are already under threat from over exploitation for local consumption and export. The above vines are mainly found in the Congolian bi-modal rainforests of the Centre and South provinces. Some lianas such as *Landolphia foretianna* yield fruits appreciated by the local population, while *L. owariensis* whose pulp is acidic is used in the preparation of a fermented drink. Also in high demand are the seeds of *Coula edulis*, commonly called the "African nut", which is consumed raw as a snack (Fube, 1997).

c) Ferns, mosses and lichens

Fifteen (15) species of ferns have so far been described, but Letouzey (1985) mentioned the existence of about 200 species in the tropical humid dense forest. These include tree, rock and ground ferns represented by the genus *Hymenophyllum: H. kuhnii, H. splendidum, H. triangulare;* the genus Trichomanes: *T. africanum, T. ballardianum, T. crispiforme.* Fifteen (15) species of mosses have also been described from the ecosystem including *Frullania spongiasa, Porella subdentata.* Although the number of Lichen species has not been obtained, the group is known to be present in the tropical humid forest ecosystem. Ferns, lichens and mosses are currently harvested from the wild and used for *ornamental purposes.*

d) Orchids

Orchids constitute the largest group of plants in the Tropical Humid Forest Ecosystem, Satabie (1997). Up to 3,080 species have been identified and are represented by a number of genera including *Angraecum, A. angustipetalum, A. egertonii, A. vagans, Bulbophyllum: B. bibundiense, B. calamarium, B. calyptratum.*

e) Other herbaceous species

The Tropical Humid Dense Forest is rich in herbaceous species. They include common wild flowers such as the begonias or grasses such as the elephant grass (*Penisetum purperum*) whose tender shoots are eaten as a vegetable. Other useful species are represented by the genus; Afromomum, *A. citratum* (Aligator peper), and. *melegueta*. The fruits of the preceding species are borne at the base of the plant and serve either for medicinal purposes or for food as a snack.

According to Fube (1997), a dried fruit of the species fetches up to 50 francs CFA in local markets. Meanwhile the grass species, *Microgracoides squamosus,* is indicated to be under threat (Satabie, 1997) due to its intense employment in colourful decorative works of art, sold in the country's big cities.

Table 2.6 Major threatened tree species of the Tropical Humid Dense Forest *

Scientific Name	Common Name	Uses	Degree of threat
Afraegle asso,		Bark used in traditional medicine	V
Afrostyrax lepidophyllus	Olom	Bark / fruits are used as condiment in soup	E
Araliopsis soyauxi	Tanda	Bark used in traditional medicine	R
Brachystegia laurentii	Ekop Leke		V
Dacryodes buttneri	Asia		R
Daniella klainei	Nsou Mez		R
Fagara xanthoxyloides	Bongo, Ngatchou	Bark is used in traditional medicine	V
Guibourtia ehie	Oveng Nkol	Timber	V
Hua gabonii	Olom - Bikwe	Bark used as a condiment in soups	E
Kantou guereensis	Mbele	Timber	R
Olfieldia africana	Alen Ele		R
Pausynistalia yohimbe,		Bark is used in traditional and modern medicine	E
Piptadenia griffoniana	Ekop F.		R
Podococcus barteri,		Used in local construction work and housing	R
Scorodophleus zenkeri	Olom	Bark used as a condiment in soups	E
Stemonocauleus micranthus	Ekop A.		R
Tabernanthe iboga	Iboga	Aphrodisiac, claimed to provide mystic powers.	R
Testulea gabonensis	Izombe		R

** E = Endangered, R = Rare, V = Vulnerable.*

Source: Satabie (1997)

Table 2.7 Some endemic tree species of the Tropical Humid Dense Forest Ecosystem

Families	Species
CESALPINACEAE	*Gilbertiodendron pachyanthum*
	Brachystegia cynometroides
	Microbelinia bisulcata
LAURACEAE	*Ocotea angustifolia*
	Beilchmiedia ndongensis
	Beilchmiedia staudtii
	Beilchmiedia nitida
SAPOTACEAE	*Baillonella toxisperma*
	Manilkara letouzeyi
	Synsepalum zenkeri
	Synsepalum letouzeyi
	Synsepalum batesii.

Source : Satabie (1997)

Numerous endemic herbaceous plant species occur in the dense forest ecosystem. Some of such species include *Afromomum kamerunensis, Afromomum longiligulata, Renealmia densispica, Afrothisma pachyantha.*

Discovered in the Korup National Park in 1993, this plant is known to contain a compound active against the HIV.

Plate 2.7 Ancistrocladus korupensis

2.2.2.1.2 Animals

a) Mammalian species

Studies by Gadsby and Jenkins (1992) and Cortfield *et al* (1970) indicate that about 340 species of mammals have been identified in the Tropical Humid Dense Forest Ecosystem (Table 2.8). Major groups include the primates represented by the genera *Lorisidae, Cercopithecidae*, and the *Pongidae*. Representative species of these genera include the galagos, the monkeys and the chimpanzees, respectively. Rodents, canivores, as well as the *Bovidae* are also richly represented.

The Department of Wildlife and Protected Areas states that the following mammalian species are under immense threat due to *over hunting* within the ecosystem. They include: the drill (*Mandrillus leucophaeus*), African forest elephant (*Loxodanta africana cyclotis*) with tusks less than 5 kg, gorilla (*Gorilla gorilla*), galago, beecroft flying squirrel, African Pygmy squirrel *(Myosciurus pumilio), Hylomyscus parvus, Hylomyscus fumosus, Prionomys batesi, Crocidura grassei, Crocidura wimmer and* the *Myosorex ollula.*

Furthermore, Fedden *et al* (1986) report that certain species of bats are associated mainly with the lowland dense forest , a typical example being the *Scotonycteris zenkeri* while others such as *Nycteris major* and *Tadarida nanula*, are mainly found in disturbed secondary forest.

The above study also mentions three bat species associated with human habitation: *Tadarida nanula, Nycteris hispida* and *Eptesicus tenuipinnis*.

Table 2.8 Animal biodiversity in the Tropical Humid Dense Forest Ecosystem*

Species	Total	Endemic	Rare or Endangered	Protected
Mammals	340	NA	5	(all class A)
Avian Species	520	1	NA	(all class A)
Reptiles	135	NA	NA	NA
Amphibians	150	NA	2	NA
Insects (Butterflies)	1050	NA	NA	NA
(Termites)	105	30	NA	NA
Nematodes				

**NA = not available.*

Source: Assembled from Njoh à Diang (1997), Gadsby and Jenkins (1992), Cortfield *et al* (1970), Bloemers *et al* (1997), Eggleton *et al* (1995), Decoux *et al* (1991), Lees (1989).

b) Domestic mammalian species

Domestic animals found in the Tropical Humid Dense Forest Ecosystem are common nation-wide and include various breeds of dogs, sheep, goats, cats, pigs and cattle. However, some species found in other ecosystems are absent from the dense forest ecosystem. These include the ass, the horse (rare), the camel and the mule.

c) Avian species

According to Decoux *et al* (1997), about 520 bird species (Table 2.8) have been described for the Tropical Humid Dense Forest Ecosystem. Of these, 437 are resident, 83 are migrants and 166 are characteristic. The single endemic and seriously *threatened species* is the *Grey-Necked Picathartes* also known as the Bare-Headed Rock-Fowl. Birdlife International (1998) has classified the Cameroonian lowlands area which fall within the Coastal and Tropical Humid Dense Forest ecosystems as being one the world's Endemic Bird Areas. The Department of Wildlife and Protected Areas (Djoh, 1997), has recently identified various species (Table 2.9) as being under threat in the ecosystem. This is debatable as Birdlife International suggests that the endangered bird species in the ecosystem exclude Yellow-footed Honeyguide *(Melignomon eisentrauti)*, Grey-necked Rockfowl *(Picathartes oreas)*, Bate's weaver *(Ploceus batesi)* and Dja River Warbler *(Bradypterus grandis)*. Collection and identification of domestic fowl breeds is handicapped (Mbah, 1997).

Table 2.9 Threatened species of birds in the Tropical Humid Dense Forest

Scientific Name	Common name
Tauraco persa	Green turacco,
Tauraco persa	Mayers parrot,
Psittacus erithacus	Grey-headed parrot,
Malimbus ribricollis	Red-headed weaver,
Ploceous albinucha	Black-breasted weaver,
Agaparnis pullaria	Green Congo parrot
Sagittarius serpentarius	Snake messenger,
" "	Small snake messenger,
" "	Red-headed perruche,
Ephippiorhynchus senegalensis	Senegal jabirus

d) Reptiles and amphibians

Studies by Gadsby and Jenkins (1992) and reports from the Department of Wildlife and Protected Areas state that about 135 reptile species and 150 amphibian species (Table 2.8) have so far been identified in the Tropical Humid Dense Forest Ecosystem. The most representative families include the *Manidae* or the pangolins, the *Crocodylus* (crocodiles), the *Chameleo* (chameleons), and various genera of snakes, lizards, tortoises, etc. The amphibian species include various genera of tree and ground frogs as well as toads.

e) Insect species

The 1,050 species (Table 2.8) of butterflies and hoppers reported by Lees (1989) for the Korup area are considered to be representative of the Tropical Humid Dense Forest Ecosystem. Butterfly diversity is directly proportional to overall species diversity due to their feeding habits and livelihood pattern. Two butterfly species, *Euriphene schultzei* and *Thermoniphas bibundana*, established to be *rare world-wide* (Lees, 1989) were found to exist in Cameroon's tropical dense forest.

Results of studies conducted by Eggleton *et al* (1995) on termites in the Mbalmayo region are indicative of the situation in the Tropical Humid Dense Forest Ecosystem. According to the above study, a total of 105 termite species have so far been identified, 30 of which have not been described before. The termite species identified have been classified according to their feeding group (Table 2.10). Termites are mediators of ecological processes and they are important as agricultural and silvicultural pests (Eggleton *et al*, 1995). They eat-up plant roots and the bark of trees but also enhance soil aeration.

Table: 2.10 Classification of termite species according to feeding groups

Feeding group	Species
soil feeders	*Apilitermes acanthothorax*
	Cubitermes gaigei
	Cubitermes heghi
	Cubitermes fungifaber
soil/root feeders	*Acidnotermes praus*
	*Adaiphrotermes sp.*n.1
	*Adaiphrotermes sp.*n.2
soil/wood interface feeders	*Proboscitermes sp.*n.
	Pericapritermes magnificus
	*Pericapritermes.sp.*n.
wood feeders	*Microcerotermes parcus*
	Microcerotermes edantatus
	Coptotermes sjoestedti
wood feeder/fungus growers	*Microtermes congoensis*
	Microtermes grassei
	Odontotermes sp.
litter feeders	*Acanthotermes acantothorax*
	Pseudacanthotermes militaris
root feeders	*Sphaerotermes sphaerothorax*

Source: Eggleton *et al* (1995)

g) Nematode species

Results of a study conducted by Bloemers *et al* (1997) on nematodes in the Mbalmayo forest area are indicative of the trend in the Tropical Humid Dense Forest Ecosystem. From the above study, 431 species of the nematodes have so far been identified in the ecosystem and are classified according to their tropic groups (Table 2.11).

Table 2.11 Classification of nematode species according to feeding groups

Feeding Group	Family / Genus
Plant feeding	*Capilonchus,* *Sclerostylus,* *Encholaimus,* *Glochidorella,* *Meylis*
Hyphal feeding	*Tyleptus,* *Doryllium,* *Aphelenchoides* *Aphelenchus*
Bacterial feeding	*Teratocephalus* *Pristionchus*
Substrate ingestion	Unidentified
Animal predation	*Hadronchus* *Iotonchus* *Jensenonchus* *Coomansus* *Prionchulus*
Animal parasites	*Neotylenchidae*
Omnivorous feeding	*Afrodorylaimus* *Coomansinema* *Thornenema*

Source: Bloemers *et al* (1997)

2.2.2.1.3 Micro-organisms and insects

There are numerous organisms including soil microfauna and microflora as well as various plant and animal infectors and infestors in the ecosystem. The species that are pests to economic plants/crops of the ecosystem are shown in Table 2.12.

Plant infecting/infesting organisms (Bacteria, Viruses, Fungi, Insects) (Table 2.12)

Table: 2.12 Plant infecting/infesting organisms

Plant Diseases	Infecting Organisms
Coffee leaf disease	*Hemeleia vastatrix*,
Cocoa pod disease	*Phytopthora palmivora*,
Panama disease and bunchy top disease (infect banana and plantain)	
Plantain and banana nematode	*Cosmopolites sordidus*,
Irish potato blight	*Phytopthora infestans*,
Maize stalk borer	*Chilo simplex*,
Cabbage caterpillar	*Plutella maculipennis*,
Iroko seedling dwarfing disease	*Phytoloma alata*

b) Major animal infecting/infesting organisms (Bacteria, Viruses, etc.)

Various bacterial/viral agents responsible for at least 19 bacterial/viral diseases of domestic and wild animals are suggested but not inventoried.

2.2.2.2 Principal issues affecting biodiversity and Stakeholder Roles

Major problems affecting the degradation of the Tropical Humid Dense Forest Ecosystem include:

- poor management of state forests and biosphere reserves,
- increasing deforestation resulting from logging and road construction and
- inadequate involvement of local people in forest and wildlife management.

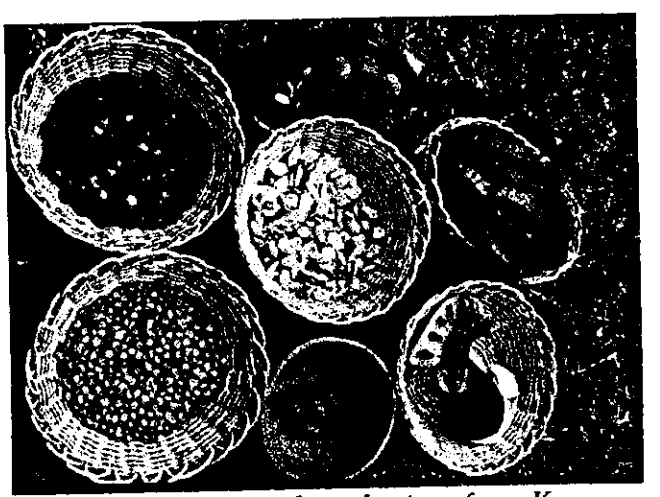


Plate 2.8 Some selected spices from Korup

These are some of the widely consumed non-timber forest products. They also constitute an important source of income for the local population and if they are not sustainably harvested, many may get threatened and finally extinct.

2.2.2.2.1 Management problems of state forests and biosphere reserves

Most of the activities aimed at the *in situ* conservation of the country's biological resources in general and those of the dense forest ecosystem in particular are implemented and supervised by the Ministry in charge of Environment and Forestry with assistance from various external funding agencies. Two of the five objectives of this Ministry's Forestry Policy are dedicated to the preservation of the nation's biological diversity:

- to ensure the protection of the nation's forest heritage by participating in the conservation of the environment and the preservation of biodiversity in a lasting manner, and
- to ensure the renewal of forest resources through regeneration and reforestation so as to perpetuate its productive capacity.

Plate 2.9a Slash and burn farming

Plate 2.9b logging

Here, the slash-and-burn agricultural method and logging are serious forest destructive practices.

Plate 2.9 Deforestation-Agriculture/Logging

The Government attempts to achieve the above objectives by establishing forest plantations, protecting natural forests, wildlife reserves, floral and faunal sanctuaries, biosphere reserves. Foteu (1977) reports that a total of 2,205,523 hectares of land have been gazetted as "state forests" in the Centre, South and Eastern Provinces, which constitute the bulk of the Tropical Humid Dense Forest Ecosystem. Some of these forests, however, are known to be partially encroached upon by the population due to:

- inadequate control by the field staff who do not have the logistics needed to facilitate field supervision,
- the non-involvement of local communities in the management of the reserves, and
- the contested ownership rights of these forests by some stakeholders.

Awareness creation and sensitising the population on the role and functions of these forests as well as participatory management are the main ingredients needed to save the reserves. Adequate equipment of staff with the logistics needed for control, and their training are the other ingredients.

2.2.2.2.2 Increasing deforestation

Regulations in Cameroon require that the logging process should respect prescribed minimum tree diameter depending on the species. This process involves the construction of roads into the forest leading to forest degradation. If recommended methods were used, the degradation could be minimised.

The economic interest group, through taxes and job generation from timber exploitation, contributes to the economic development of the nation as a whole. Fig. 11 gives an indication of timber production from the period 1989/90 through 1996/97. The trend indicates that forest degradation is increasing. It should be indicated that more than 80% of the production is from the Tropical Humid Dense Forest Ecosystem.

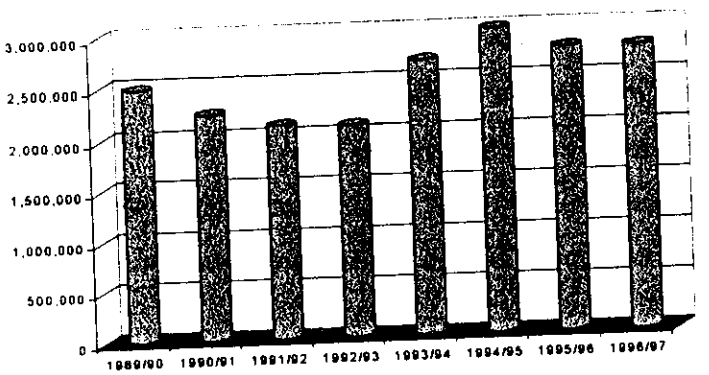


Fig. 11 Timber production in m^3 from 1989/90 – 1996/97.

Source: Department of Forestry - Yaounde

2.2.2.2.3 Inadequate participation of local communities in forest and wildlife management

Socio-economic surveys conducted by pilot forestry related projects (API - Dimako, MCP) reveal that local people do not understand why they are questioned and sometimes reprimanded when they sell bush meat or sell sawn timber. They argue that the resource is found in their neighbourhood and that they depend on it for their livelihood. This situation has persistently led to conflicts between the local population and the Forestry and wildlife Administrations. Consequently, the Government, through the new Forestry Law of 20th January 1994, has proposed measures expected to resolve this difficulty by allowing the *local population to "own" the forest resource* on Government land through *Community forestry*. The process will permit the population to fell planted or spontaneous growth timber in its community forest. Similarly, provisions in the new law allow the population to manage wildlife in *community hunting zones*.

The Government, however, through its forestry executing agency (ONADEF), implements a number of experimental forest management projects which could be of practical assistance for the solution of the above problem. Some of these projects include:

- the "Southern Bakundu Forest Management project",
- the "Tropenbos - Cameroon project",
- the "SIKOP Forest Management Project",
- the "So'o Lala forest management project".

The national parks, meanwhile, could provide the management experience needed for community hunting areas.

2.2.2.3 Biodiversity Conservation Efforts in the Tropical Humid Dense Forest Ecosystem

2.2.2.3.1 (a) Activities of the Global Environment Facility (GEF) in the Tropical Humid Dense Forest Ecosystem

The GEF currently supports biodiversity conservation work in four specific sites located in the extreme south and south east of the Tropical Humid Dense Forest Ecosystem:

- Lake Lobeke,
- Boumba Bek,
- Nki, and
- Campo Ma'an.

The rationale for considering these sites for conservation is based on 3 factors:

1. the south and eastern parts of Cameroon contain large tracts of semi-deciduous forests, a forest type most threatened in tropical Africa,
2. the sites according to Letouzey (1985), contain extremely rare birds and numerous endemic plants, most of which have not yet been identified, and
3. the areas harbour a truly unique abundance of large mammals including elephants, gorillas, and the bongo (*Tragelaphus euryceros*). Hence the protection of the area is important for the protection of these highly vulnerable species. (Hall *et al*, 1993).

(b) Activities of the Institute of Agricultural Research for Development in the Tropical Humid Dense Forest Ecosystem

Efforts of conservation of agricultural species / varieties made by IRAD include a gene / seedbank at Nkolbisson and "life" genebanks at Nkoevone (South Province) and Nkolbisson (Centre Province). At Ekona (IRAD) (South West Province) germplasm (cassava, yams, cocoyams) is conserved while at Barombi Kang (IRAD) coffee and cocoa germplasm is conserved (Mbah, 1997). A more feeble attempt is made at conservation of the Black Belly sheep breed at Nkolbisson station.

2.2.2.3.2 Activities of other Funding Agencies

Various inventories and socio-economic studies have been carried out in the region and furnish the basis for further work in the area. Conservation areas have been circumscribed and detailed analysis of more technical domains such as the soil and water flow are expected to follow. The WWF meanwhile is a partner in the surveys and conservation of these GEF funded project sites. This is also true of GTZ. The World Conservation Society (WCS) which has its main field office in Nguti, also supports conservation activities in the area and carries out pilot studies in community organisation for effective forest management and biodiversity sampling. Management/research/development projects in the ecosystem are shown in Box 2.4.

Box 2.4

Biodiversity Management/Research and other ongoing Development Programmes/Projects in the Tropical Humid Dense Forest Ecosystem

NAME OF PROGRAMME/PROJECT	LOCATION	SPONSOR
• ONADEF	National Territory	GoC, ITTO
• KORUP Project	Ndian Division, SWP	EU, GTZ, WWF, GoC
• Cameroon Biodiversity Project	SWP (South West Province)	WCS
• DJA Project	SWP (South West Province)	
• LOUKOUDJE-NYONG Project	SP (South Province)	GoC, Canadian Co-operation
• TROPENBOS-Cameroon	SP (South Province)	GoC, TROPENBOS-Holland; ITTO
• API DIMAKO Project	EP (East Province)	French Cooperation
• TAKAMANDA FOREST RESERVE	SWP (South West Province)	GoC, WWF, GTZ
• ECOFAC	EP (East Province)	GoC; EU
• LAKE LOBEKE FOREST Reserve	EP (East Province)	GEF, GTZ, WWF, GoC
• BOUMBA-BEK FOREST Reserve	EP (East Province)	GEF, GTZ, WWF, GoC
• NKI FOREST Reserve	EP (East Province)	GEF, GTZ, WWF, GoC
• CAMPO FOREST RESERVE	SP (South Province)	GEF, Tropenbos, GoC
• MBALMAYO FOREST MANAGEMENT and REGENERATION Project	CP (Centre Province)	DFID, GoC
• Mt. CAMEROON Project	SOUTH WEST	DFID, GTZ, WB/GEF
• SO'OLALA SUSTAINABLE FOREST MANAGEMENT Project	CP (Centre Province)	ITTO, GoC
• TIGER Project	CP (Centre Province)	DFID
• CDC	SWP, LT, W, NWP	GoC, UK
• PAMOL	SWP (South West Province)	GoC
• SOCAPALM	LT (Littoral Province)	GoC
• BDCP-C Project	SWP, NWP, LT, CP	Shaman Pharmaceuticals
• Genebanks Research (IRAD)	All Provinces except East Province.	GoC, etc.

2.2.3 Tropical Wooded Savannah Ecosystem

Beyond the humid dense forest zone, the Tropical Wooded Savannah Ecosystem is found in the highland plateau region of the west (West and North West Provinces), and the transition plain of the Adamawa highland plateau. The western highlands and the Adamawa plateau lie on virtually the same average altitudes i.e., 1,100 and 1,000 metres, respectively (Amou'ou *et al,* 1985). The altitudinal similarity of the two zones account for the uniformity of their biodiversity components.

The climate of the Tropical Wooded Savannah Ecosystem is particularly agreeable as a result of altitudinal modification, e.g. Bamenda (on the western highlands) experiences mean annual temperature of 19.5 °C, while Ngaoundere (on the Adamawa plateau) experiences mean annual temperature of 22 °C. The rainfall is abundant: e.g. Ngaoundere receives a mean annual rainfall of 1,575 mm; Dschang, 1,919 mm; Bamenda, 2,630 mm; Foumbot, 1,179mm, (Amou'ou *et al*, 1985).

The Tropical Wooded Savannah Ecosystem is generally referred to as the "grassfields". The vegetation is either primarily woodland as in gallery forests and in the southern and western flanks of the ecosystem or primarily grassland with a reduced shrub or tree representation as in the northern parts of the ecosystem.

Agriculture and cattle rearing are the main activities leading to the degradation of the savannah ecosystem.

Plate 2.10 Tropical wooded Savannah Landscape

2.2.3.1 Status of Biodiversity Components

2.2.3.1.1 Plants

Little information is available on the wild plant species (except forage species) found in the ecosystem. However, Table 2.13 gives the species mostly exploited to meet human needs. Crop species are numerous but maize dominates making the ecosystem the "grainary" of the country.

Table 2.13 Some floristic trends of the Tropical Wooded Savannah Ecosystem

Plant Types	Species
Woody	*Daniella oliveri* *Lophira lanceolata* *Anogeissus leiocarpus* *Uapaca togoensis* *Eucalyptus spp.** *Pinus sp.** *Cola sp.* *Garcinia lucida* *Zanthoxylum lepieuri* *Terminalia glaucoscens*
Herbaceous (forage)	*Andropogon sp.* *Hyparrhenia diplandra* *Panicum phragmitoides* *Imperata cylindricum* *Afromomum sp.* *Stylosanthes sp. (local and the exotic)*

* *Exotic Species*
Source: Letouzey (1985) and Fube (1997)

2.2.3.1.2 Animals

a) Wild mammalian species

The number of mammalian species in the ecosystem has not been obtained but the area is known to accommodate most of the species found in the Tropical Humid Dense Forest Ecosystem. It accommodates some species that are rare or absent from the dense forest ecosystem notably the Hyena, the west african golden cat (*Profelis aurata*), and the buffalo, *Syncerus sp.* Mammals inhabiting the ecosystem are grassland species.

b) Domestic mammalian species

Mbah (1997), citing Hall (1992), mentions the extinction of the cattle breed, *Bos taurus* Var. Bamileke, resulting from crop culture. Mention is also made by Mbah (1997) of the endemicity of the following cattle breeds in the Tropical Wooded Savannah Ecosystem:

- the Gudali, a *Bos indicus* breed with 3 varieties: the Ngaoundere, the Banyo and the Yola.
- the Kuri , the Namchi, Kapsiki breeds (all *Bos taurus).*

- the Grassland Dwarf sheep and Grassland dwarf goat may be endemic in the ecosystem.

c) Avian species

According to Decoux *et al* (1997), 437 bird species have been recorded in the tropical wooded savannah ecosystem. Of these, 379 are resident and 58 are migrants. Little information is available on the levels of endemicity and threat to these species. However, the Bamenda Apalis (*Apalis bamendae)* is said to be endemic (savannah gallery forest of the Adamawa plateau) and vulnerable .

2.2.3.1.3 Micro-organisms and insects

Very little information is available on the insect species and micro-organisms of the Tropical Wooded Savannah Ecosystem. The area is, however, known to contain numerous sp ecies of ground insects, hoppers and butterflies, termites and fungi. Winged termites as well as seasonal green locusts constitute a delicacy in the region. These insect species, including a number of moth, butterfly and beetle larvae, contribute remarkably to the protein needs of the local people of this ecosystem.

2.2.3.2 Principal Issues affecting Biodiversity and Stakeholder Roles

Some major problems inherent to the conservation of the Tropical Wooded Savannah Ecosystem include:

- poor methods of agricultural practices,
- inappropriate understanding of/or rejection of the land tenure system by the users, and
- the absence of a well defined land-use strategy.

2.2.3.2.1 Unsustainable agro-pastoral practices

The southern half of the Tropical Wooded Savannah Ecosystem which administratively includes the West and North West provinces, has a relatively high population density, 113.5 persons per km^2 against 29.4 for the national average (MINEF, 1996a). The northern part of the ecosystem made up of the Adamawa plateau, has the highest concentration of large cattle in the country. Agriculture is characterised by shifting cultivation while livestock breeding largely is nomadic. The above situations lead to pressure on land:

- extensive agricultural cultivation,
- nomadic cattle grazing (overgrazing), and
- unsustainable fuel wood exploitation.

This results in ecosystem degradation (bush fires, deforestation and soil erosion).

Various Non-Governmental Organisations (NGOs) operating within the ecosystem are engaged in teaching the local population in the use of adapted agricultural methods. These organisations include:

- SASH involved in training the population on sustainable agricultural practices,
- UCCAO, a Coffee co-operative organisation involved in agricultural extension activities and
- MIDENO, North West Development Authority also, attempts to address the situation.

More is expected from grass-root organisations which must reach the poorest layer of the population in the ecosystem in order to help in finding acceptable solutions to these cultural problems.

Further Government intervention to check degradation is through the creation of reserves and protected areas. Foteu (1997) reports that a total of 202,161 hectares of land in the ecosystem have already been gazetted as state forests and another 325,259 hectares will soon be gazetted. The population should be involved in this venture in order to ensure that gazetted forests effectively exist without encroachment.

2.2.3.2.2 Land tenure and land-use

Land is very priced in this high population density ecosystem. It is usually fragmented and handed down to descendants, becoming smaller each time it is passed down. This strong attachment to land leads to its constant and intensive use. The tradition in the area is for everyone to own land and live off the land.

Solutions for the above issues have been attempted by the agricultural extension and community development services, which target concerned communities with specially prepared extension packages ranging from *family planning* to *alternative income generating opportunities*. New construction sites should be known and planned.

2.2.3.2.3 Biodiversity Conservation Efforts in the Tropical Wooded Savannah Ecosystem

This ecosystem, being typically agricultural, has conservation efforts directed at agricultural species only so far. Conservation involves *ex situ* genebanks (cereals and Irish potatoes) at IRAD, Bambui and livestock collections / studies at IRAD, Wakwa. The Ministry of Livestock, Fisheries and Animal Industries has started efforts at protecting livestock breeds (Mbah, 1997). Collections of pasture species are also at Bambui and Wakwa. Management/research/development projects in the ecosystem are shown in Box 2.5.

Box 2.5

Biodiversity Management/Research and other ongoing Development Programmes/Projects in the Tropical Wooded Savannah Ecosystem

NAME OF PROGRAMME/PROJECT	LOCATION	SPONSOR
• MIDENO	Northwest Province	GoC; ADB
• UNVDA	Northwest Province	GoC
• NAEP	MINAGRI-Nation-wide	GoC; WORLD BANK; ADB
• SODEPA	Nation-wide	GoC
• ONADEF	Nation-wide	GoC
• KIMBI RIVER GAME RESERVE	Northwest Province	GoC
• MBAKAOU (Mbam et Djerem) GAME RESERVE	Adamaoua	GoC
• MAPE WILDLIFE RESERVE	West Province	GoC
• SANTCHOU GAME RESERVE	West Province	
• MBEMBE AREA FOREST RESERVE	North West Province	GoC
• Gene banks (Research/IRAD)	Adamawa, NW, W Provinces	GoC, etc.

2.2.4 Semi-arid Ecosystem

Beyond and to the north of the Tropical Wooded Savannah Ecosystem, lie the Mandara highlands and the tropical lowlands referred to as the Semi-arid ecosystem. This ecosystem is shared by two provinces namely, the North and Far-North. The region is dominated by three main features: the Benoue basin, the dry and hilly Mandara region, and the western floodplain also known as the Yaérés and Bovés.

Generally, the climate is severe with marked differences between the day-time and night-time temperatures, as well as between the maximum and minimum temperatures. Maximum temperature (end of April) varies between 40 and 42°C, while the minimum temperature (December/January) is about 17°C (Amou'ou *et al*, 1985). The rainfall follows a mono-modal pattern and decreases from south to north. Generally, rainfall patterns are different between the Benoue region which experiences a sudanian climate of equal dry and rainy season duration, with mean annual rainfall averages of 1,000 to 900 mm, and the

sudano-sahelian Far North which receives only 4 to 5 months of rainfall with a mean annual output of 400 to 900mm.

In this Semi-arid zone with low water availability, the yaérés serve as a source of water for cattle.

Plate 2.11 Yaérés in the Far North Province

2.2.4.1 Status of Biodiversity Components

2.2.4.1.1 Plants

Table 2.14 shows the most exploited plant species in the ecosystem. However, a lot of work has to be done in inventory and classification. For cultivated species, millet dominates but maize is gaining ground (Mbah, 1997). Groundnuts and onions are also produced heavily in the ecosystem. Cotton is the "Cash Crop" of the region.

The Waza park serves as a touristic attraction since it conserves important wildlife species.

Plate 2.12 Some Attraction of the Waza National Park in the North

The dominating herbaceous vegetation enables this touristic attraction to be viewed by tourists to the Far North Province.

Plate 2.13 The Kapsiki touristic site in the Far North Province

Table 2.14 Some floristic trends of the Semi-arid Ecosystem

Plant types	Species
Woody (wild)	*Ziziphus mauritiana*
	Acacia sieberana
	Salvadora persica
	Acacia senegal
	Acacia seyal
	Balanites aegyptiaca
	Haematistaphis bateri
	Selerocarya birrea
	Detarium microcarpum
	Teclea oubanguuiensis
	Cotton sp.
Herbaceous (Wild forage species)	*Pennisetum ramosum*
	Hyparrherrnia rufa
	Vetiveria nigritana
	Echinochloa stagnina
	Nymphaea sp.
	Brachiaria stigmatisata
	Chloris lampropania
	Chloris preurrii
Cereals (cultivated)	Millet (2 varieties)
	Maize
	Sorghum

Source: Letouzey (1985), Fube (1997) and Satabie (1997)

2.2.4.1.2 Animals

a) Wild mammalian species

The fauna species (Table 2.15) found in the country's semi-arid ecosystem have been declared "Threatened" by the Department of Wildlife and Protected Areas.

Table 2.15 Threatened wildlife species of the Semi-arid Ecosystem

Scientific Name	Common Name*
Cercopithecus nictitans	Putty nosed monkey
Hyemoschus aquaticus	Water chevrotain
Pan troglodytes B	Savannah chimp.
Colobus abyssinicus	Colobus
Loxodanta africana	Savannah elephant
Gazella rufifrons	Red faced gazelle
Potamochoerus porcus	Red river hog
Diceros bicornis	Black rhinoceros
Gorilla gorilla	Gorilla
Acinonyx jubatus	NA
Trichecus senegalensis	NA
Panthera leo	Lion
Orycteropus afer	NA
Manis sp.	Giant Pangolin
Felix caracal,	Caracal
Redunca redunca	NA
Giraffa camelopardalis	Girafe
Crocodylus niloticus	Nile crocodile
Crocodylus cataphractus	Long-nosed crocodile
Osteolaemus tetrapis	Dwarf crocodile
Struthio camelus	Austrich
Balaeniceps rex	Horn bill
Threskiornis aethiopicus	Ibis
Ephippiorhynchus senegalensis	Jabirus
Sagittarius serpentarius	Snake bird

**NA = not available*

Source: Djoh à Diang (1997) and Decoux *et al* (1997)

An almost disappearing mammal whose protection is the concern of each and everyone

Plate 2.14 Lion in the Waza Park

b) Domestic mammalian species

At the level of domestic animals, the *Bos taurus* breeds (Kuri, Kapsiki and Namchi), endemic to the ecosystem are under threat (Mbah, 1997). Other livestock species important to the ecosystem include sheep, goats, donkeys, pigs and horses (the Pony Moussey is endemic in the ecosystem (in Mayo Danay)).

c) Avian species

Meanwhile, a total of 316 bird species has so far been recorded in the Semi-arid Ecosystem. Of these, 259 are residents and 57 are migrants (Decoux *et al*, 1997) various reptile of lizards also exist in the ecosystem (Djoh, 1997).

Highly threatened, because their skins are used for making leather wears, bags and other decorative objets.

Plate 2.15 Crocodiles

2.2.4.1.3 Micro-organisms and insects

The semi-arid ecosystem is an area frequently infested by migratory crickets or locusts (*Locusta migratoroides*). The locusts attacks all green vegetation/crops during their landing phase.

2.2.4.2 Principal activities Affecting Biodiversity and Stakeholder Roles

Some major problems contributing to the semi-arid ecosystem degradation include:

- water shortage, inappropriate river and flood plain water management,
- inappropriate cultural practices which enhance desertification,
- overexploitation of wildlife species,
- deforestation for fuel wood, and
- locust/grain-eating bird/elephant attacks or destruction of crops.

2.2.4.2.1 Unsustainable water management practices

The Semi-arid Ecosystem constitutes the driest zone of Cameroon. It also contains large flood-plains which unfortunately are not efficiently managed. The essential problem on the eastern half of the region results from a conflict of interest between grazers, farmers and fishermen. Pastoralists graze their cattle on the yaérés (flood pastures) as the flood waters recede in the months of October through November of each year. Within the last 10 to 15 years, the construction of dams and water canals was encouraged particularly by the Rice Development Authority, SEMRY, to facilitate the irrigation of red millet, sorghum and rice by the sedentary farming population. This situation effectively reduced the amount of water available for villages at higher altitudes as well as rendering it insufficient for any substantial fishing. Moreover, cattle of the nomadic grazers usually destroy the canals on their way to and from the yaérés (low-lying water/green pasture land in the dry season), a situation which leads to conflicts between the different users of the ecosystem.

The Government, with the collaboration of the IUCN and the Netherlands Development Organisation (SNV), are seeking ways of resolving this conflict which otherwise would lead to serious degradation of the ecosystem. The Waza Logone Conservation and Development Project has been set-up to guide the preparation of a workable integrated management plan for the area. A major problem which persists is the questionable level of resource management knowledge by the local population expected to manage the resources of the area.

2.2.4.2.2 Unsustainable cultural practices which enhance desertification

The Mandara mountain region is the most water-stressed area of the semi-arid ecosystem. The region contains 20 % of the population within the ecosystem (North and Far North Provinces) (Amou'ou *et al,* 1985), and has a population density of 320 inhabitants /

km^2, (MINEF, 1996a). It is mountainous, the rains are meagre and the climate is generally hostile. The scarce but torrential rains cause soil erosion from the cultivated mountain slopes. The few rivers which drain the area, such as the Mayo Louti and Mayo Tsanaga, virtually dry out during the harsh dry period. The major solution to the water shortage for the area, which is already being pursued by Government and international NGOs, is the drilling of wells. The economic crisis facing the nation is a barrier to the drilling of sufficient wells to match the need.

Meanwhile the Government, with the collaboration of the Canadian Development Agency, CARE, and SNV are implementing a project titled " Conservation of the Soil and Water in the Mount Mandara Region". The general objective of the project is to enhance rational management of the natural resources of the region by both men and women. There is insufficient information on the biological resources (apart from the Kapsiki cattle) at stake and their scientific thresholds for survival.

2.2.4.2.3 Overexploitation of wildlife species

Various studies (World Bank, 1995) indicated that the semi-arid ecosystem, particularly the northern part of the ecosystem, experiences the highest level of poverty in the country. It is the only area where more than 50 % of the population falls below the poverty level, judged by its level of education, housing, and nutrition status. The high population density of the region, accentuated by its relatively high level of poverty, leads to increased dependence on wildlife. In addition to the meat of captured or shot game which is eaten, the skin of large snakes, crocodiles, antelopes and other game, is in high demand for the artisanal leather industry. Easy-wear shoes, bags, mats, hats, chair cushion covers, jackets are some of the products made from the skin of the wildlife in the area. This situation results in many animal species entering the threatened threshold level within the ecosystem, a situation which will weaken the already feeble tourism industry sustained by this ecosystem.

The Government has attempted to check the trend by establishing the Waza and Kalamaloue National Parks in the region. Foteu (1997) indicates that a total of 1,124,568 hectares of state land has been gazetted within the ecosystem (North and Far North Provinces). The report also states that 136,399 hectares shall soon be gazetted in the area. Nevertheless, the population still succeeds in poaching around the region. Alternatives such as individual or group game farming could be encouraged, as well as managed community hunting zones, as measures to reduce pressure from wildlife held under *in-situ* conditions.

2.2.4.2.4 Biodiversity activities in the Semi-arid Ecosystem

The GEF / GoC support biodiversity conservation efforts in the Benoue and Boubanjidah national Parks and the intervening area. The following activities are either under implementation or are scheduled :

- social and biological surveys as well as resource inventories around protected areas,
- enhancement of basic infrastructure for protected area management and biodiversity monitoring,
- strengthening of institutions concerned with conservation, renewable natural resource management, and related research,
- strengthening of the capacity of MINEF in managing natural lands for biodiversity conservation and for integrating natural resources conservation in the national framework for development planning and for environmental protection.

One of the major targets of GEF in the area is the conservation of the Black Rhinoceros. Assistance is given to the local communities in developing management plans for sustainable harvesting of non-endangered game species. The WWF is a partner in these activities which include the Waza-Logone Wetland Restoration Project.

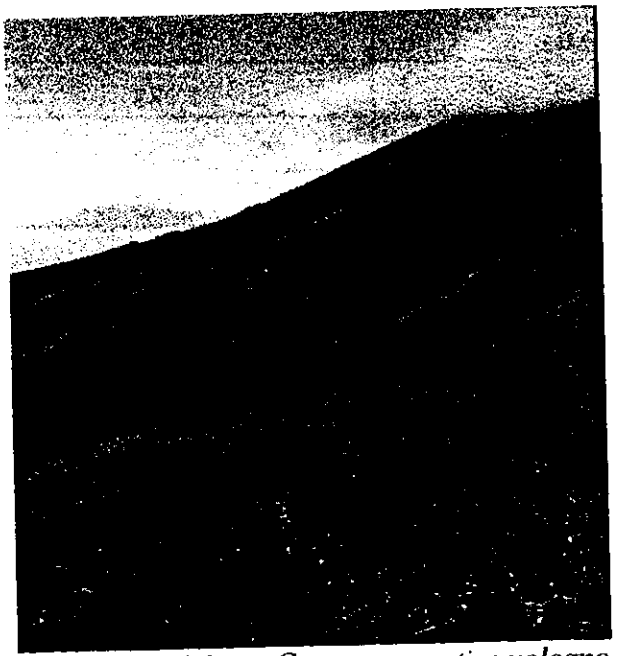
In the field of agriculture (Mbah, 1997), a genebank (cereals, legumes) is available at the IRAD Centre at Maroua. Similarly, IRAD has a collection of Namchi and Kapsiki breeds of cattle on station. A live collection of forage species is available at IRAD, Garoua (Mbah, 1997). Management/research/development projects on going in the ecosystem are shown in Box 2.6.

Box 2.6

Biodiversity Management/Research and other ongoing Development Programmes/Projects in the Semi-arid Ecosystem

NAME OF PROGRAMME/PROJECT	LOCATION	SPONSOR
• WAZA LOGONE Project	Far North Province	GoC; WWF; IUCN
• KALAMALOUE GAME RESERVE	Far North Province	GoC
• FARO GAME RESERVE	North Province	GoC; WWF
• BENOUE GAME RESERVE	North Province	GoC; WWF
• BOUBA NDJIDAH FOREST RESERVE	North Province	GoC; WWF
• Trypanotolepant cattle Research	N, Far North, Adamawa	AUDELF-UREF
• Genebanks(Research)	North, Far North	GoC, etc.

2.2.5 Montane Ecosystem



Flowing larva destroys biodivetrsity along the larva path.

Plate 2.16 Mount Cameroon, active volcano

Although mountains are found in the parent ecosystems described above, they constitute a particular ecosystem of their own high altitude gives them unique differences in their vegetation, soils and climate from their parent ecosystems. The following mountains (Table 2.16), singly or combined, provide the characteristics which differentiate the Montane Ecosystem from other ecosystems.

Table 2.16 Mountains of Cameroon and their parent ecosystems

Mountains of Cameroon and their Parent Ecosystems		
Ecosystem	Mountain	
	Name	Altitude (m)
Marine and Coastal	Mt. Cameroon	4,095
	Small Mt. Cameroon (Etinde)	1,713
Tropical Humid Dense Forest	Rumpi hills	1,768
	Mt. Kupe	2,064
	Mt. Nlonako	1,825
	Mt. Manenguba	2,411
	Ntem Mt.	1,400
Tropical Wooded Savannah	Bana Mts.	2,097
	Bangou Mts.	1,924
	Fokwe Mts.	1,921

Mts. Bamboutos	2,740
Bali Ngemba Mts.	2,168
Mt. Mbepit	1,988
Mt. Nkogam	2,263
Mt. Mbang	2,335
Mt. Tugyi	2,029
Mt. Tikagwere	2,037
Mt. Oku	3,011
Mt. Ijim	2,563
Mt. Kishong	2,216
Mt. Tabenken	2,222
Koun Maya Mt.	2,032
Tchabal Ouaddé	2,418
Mt. Nganha	1,923
Tchabal Mbabo Mt.	2,460
Mt. Poli	2,049
Mt. Alantica	1,885
Mt. Badjeré	1,468

2.2.5.1 Status of Biodiversity Components

Tree ferns are common in gaps in montane forest and can grow to over 10 m tall

Plate 2.17 Tree Fern (Cyathea manniana) in Montane Ecosystem

2.2.5.1.1 Plants

a) Woody Species

Reports by Letouzey (1985), Cheek (1992) and Tchouto (1996) show that the Montane Ecosystem is special in that particular plant species are associated with specific altitudes. Table 2.17 presents these results.

Table 2.17 Altitudinal distribution of some plants in Mount Cameroon

Vegetation Type	Species	Altitude
Subalpine	*Adenocarpus manii*, *Blaeria manii*	3,000 - 4,000 m
Montane grassland	*Agauria salicifolia* *Myrica arborea* *Pentas schimperiana*	2,000 -3,000 m
Montane scrub	*Hypericum lanceolata* *Maesa lanceolata* Agauria sp. Myrica sp.	1,800 - 2,400 m
Montane forest	*Schefflera abyssinica* *Schefflera manii* *Syzigium staudtii* *Prunus africana*	1,600 - 1,800 m
Submontane forest	*Xylopia africana* *Turreanthus africanus*	800 -1,600 m

Source: Letouzey (1985, Cheek (1992) and Tchouto (1996)

The following species have been identified (Satabie, 1997), as *threatened* in the montane ecosystem:

- *Agauria salicifolia* whose leaves are used in traditional medicine,
- *Garcinia cola* (bitter cola) whose bark is used in the fermentation of raphia palm wine, while the seed is used as an aphrodisiac, and
- *Prunus africana* used in modern medicine against prostatic hyperplasia. The species is also locally employed in traditional medicine.

b) Endemic plant species

As many as 23 families have 41 species which are strictly *endemic* to the flora of Mt. Cameroon. From reports by Cheek (1992) and Letouzey (1985), these families and species were identified as in Table 2.18.

Table 2.18 Plant species strictly endemic to Mount Cameroon

Family	Species
ACANTHACEAE	*Isoglossa nervosa*
ANTHERICACEAE	*Chlorophytum deisteliamum*
ARACEAE	*Amorphophalus preussii*
BALSAMINACEAE	*Impatiens grandisepala* *Impatiens sp. nov. 1* *Impatiens sp. nov. 2*
BEGONIACEAE	*Begonia hookeriana* *B. jussiaecarpa*
BORAGINACEAE	*Myosotis sp. nr vestergrenii*
BURMANNIACEAE	*Thismieae sp. nov.*
CAMPANULACEAE	*Lightfootia ramosissima*
CARYOPHYLLACEAE	*Silene biafrae*
PIPERACEAE	*Peperomia vulcanica*
COMPOSITAE	*Coreopsis monticola* *Crepis cameroonica* *Helichrysum biafranum* *Mikaniopsis maitlandii* *Vernonia calvoana* *V. glabra* *V. insignis*
CYPERACEAE	*Bulbostylis densa var.cmrunsis* *Camptostylus ovalis*
FLACOURTIACEAE	*Deschampsia mildbraedii*
GRAMINEAE	*Hypseochloa cameroonensis* *Sporobolus montanus* *Hesperantha alpina*
IRIDACEAE	*Afrardisia oligantha*
MYRISINACEAE	*Embelia sp. nr.*
ORCHIDACEAE	*Bulbophyllum modicum* *Diaphananthe bueae*

	Disperis kamerunensis *Genyorchis macrantha* *Habenaria obovata* *Liparis kamerunensis*
POLYGALACEAE	*Polystachya albescens* *Polygala tenuicaulis*
STERCULIACEAE	*Cola sp.*
VERBENACEAE	*Clerodendrum eupatorioides*
ZINGIBERACEAE	*Afromomum sp. A.*
ASPLENIACEAE	*Asplenium adamsii*
PTERIDACEAE	*Pteris preussii*

Source: Cheek (1992) and Letouzey (1985).

With the exception of the *Cola sp.* which is woody, most of the species indicated above are herbaceous.

New discoveries: As botanic surveys continue, new species of plants are added to the existing list. The species indicated in Table 2.19 were recently discovered and added to the country's list of plant species. They are strictly *endemic* to the other mountains of the nation Satabie (1997) and Stoffelen *et al* (1997).

Table 2.19 New Montane endemic plant species

Family	Species	Endemism
DIPSACASEAE	*Dipsacus narcissianum*	Mts. Bamboutus & Oku
	Succisa trichotocephala	" "
ERIOCAULACEAE	*Eriocaulon sp.* nov.	Bamenda and Mt. Oku
FLACOURTIACEAE	*Dovyalis sp.* nov.	Mt. Oku
ISOETACEAE	*Isoetes biafrana*	Oku Crater
LILIACEAE	*Kniphofia reflexum*	Mt. Oku
ORCHIDACEAE	*Disperis nitida*	Mt. Canopy
PODOSTEMACEAE	*Butrumia marginalis*	-
RUBIACEAE	*Coffea montekupensis*	Mt. Kupe

Sources: Satabie (1997), Stoffelen *et al* (1997).

2.2.5.1.2 Animals

The state of animal biodiversity in the Montane Ecosystem is shown in Table 2.20. The protection is good.

Table 2.20 Animal biodiversity in the Montane Ecosystem *

Species	Total	Endemic	Rare	Protected
Mammals	115	NA	10	(all class A)
Avian Species	392	20	7	(all class A)

**NA = not available*
Source: Decoux *et al* (1997); Gadsby and Jenkins (1992), Njoh, (1997).

a) Mammalian species

Following a survey by Gadsby and Jenkins (1992), the species of mammals shown in Table 2.20 were identified as *endangered* in the Montane Ecosystem, namely. A survey conducted by Fedden *et al* (1986), identified the following species of bats as characteristic only of the montane forest, namely; *Rhinolophus clivosus* and *Pipistrellus eisentrauti.* These species apparently depend on undisturbed forest, a condition which should be considered in conservation strategies.

Table 2.21 Endangered mammals in the Montane Ecosystem

Scientific Name	Common Name	Scarcity/Rare
Cephalophus ogilbyi	Ogilby's duiker	Vulnerable
Cephalophus sylvicultor	Yellow-backed duiker	Not seen >30 years
Cercopithecus erythrotis	Red - eared monkey	Endangered
Cercopithecus preussi	Putty-nose monkey / Preuss monkey	At risk
Cercopithecus torquatus	Red – capped monkey	Vulnerable
Mandrillus leucophaeus	Drill	Endangered
Panthera pardus	Leopard	Not seen >30 years
Pan troglodytes	Chimpanzee	Endangered
Potamochoerus porus	Red river hog	Not seen > 18 years
Profelis aurata aurata,	West african golden cat	Not seen >20 years
Redunca redunca	Mountain redunca	Vulnerable

Syncerus caffer nanus	Forest buffalo	Not seen in many years
Tragelaphus spekei	Sitatunga	Vulnerable
Myosorex okuensis		
Praomys hartwigi	NA	Endangered
Crocidura manengubae		
Crocidura eisentrauti		
Lophuromys nov. sp.	NA	Endangered
Grammomys nov. sp.	NA	Endangered

Source: Gadsby and Jenkins (1992), Birdlife International (Languy, personal communication, 1999).

b) Avian species

According to Decoux *et al* (1991), 392 bird species have so far been identified in the Montane Ecosystem. Of these, 256 are residents, 36 are migrants and 48 are characteristic. The 7 *endangered* species : the **Bannerman's Turaco**, the **Banded Wattle eye**, the **White Throated Mountain Babbler**, the **Mount Kupe Bush-shrike**, the **Mount Cameroon Francolin**, the **Green-Breasted Bush-Shrike**, **Bannerman's Weaver and Mount Cameroon Speirops *(Speirops Melanocephalus)***. Wildlife international (1998) has clasified Mount Cameroon as one of the World's Endemic Areas with high numbers of *threatened* restricted-range species (29 species) of birds.

This is one of the species under threat in Mount Cameroon

Plate 2.18 Malimbus nitens

c) Reptiles and amphibians

Most of the information on reptile and amphibian species of the Montane Ecosystem is available from Kilum-Ijim mountain forest (Table 2.22). Numerous species of snakes, pangolins, lizards, may exist in the ecosystem. WCMC (1993) indicates the presence of an

endemic chameleon, *Chamaeleo eisentrauti*, and a very localised toad, *Werneria tandyi*, in the Rumpi hills. The same report mentions the presence of some particular toads, *Didynamipus sjoestedti*, and *Werneria preussi*, as well as a very rare tree-frog, *Hyperolius krebsi* on the Cameroon mountain. The study further reports the existence of numerous endemic species of chameleons, toads/frogs (Anurans) and other reptiles on some of the rest of the country's mountains. According to a survey by Gartshore (1986), three endemic species of anurans have been identified on the Manenguba mountain: *Cardioglossa trifasciata, Phrynodon sp.*, and *Leptodactylodon erythrogaster*. More studies are needed to describe these species and to find out their survival thresholds.

Table 2.22 Reptiles and amphibians of the Kilum-Ijim forest

Group	English name (if any)	Species
Amphibians: Anura	Oku Clawed Toad	*Xenopus sp*
Amphibians: Gymnophiona	Lamottes' Caecelian	*Crotaphatrema lamottei*
Reptilia: sauria	Slender Four-horned Chameleon	*Chamaeleo quadricornis gracilior*
Amphibians: Anura		*Astylostemus ranoides*
Amphibians: Anura		*Wolterstorffina mirei*
Amphibians: Anura		*Leptodactylodon perreti*
Amphibians: Anura	Steindacher's Puddle Frog	*Phrynobatrachus steindacheri*
Amphibians: Anura		*Cardioglossa oreas*
Reptilia: sauria	Weidersheims' Chameleon	*Chamaeleo wiedersheimi weidersheimi*
Reptilia: sauria	Chris Wilds' Skink	*Panaspis chriswildii*
Reptilia: sauria		*Panaspis vigintiserierum*
Reptilia: sauria		*Thrasops flavigularis*
Reptilia: sauria		*Dipsadaboa sp*

Sources: Chirio, L. (1997), Wild, C. (1994)

2.2.5.1.3 Micro-organisms and insects

Cameroon's Montane Ecosystem contains a large variety of insect species and micro-organisms. Termites constitute an important class. Abundantly available are ground hoppers, organisms of the *Myriapoda* order represented by millipedes and centipedes, *Arachnida* order represented by *tarantullas* and various spiders. An important insect product characteristic of the ecosystem is honey, produced by the honey bee, *Apis mellifera*. There is insufficient data

to permit the indication of the number of insects or micro-fauna species available in the ecosystem.

Improved methods of bee keeping constitute an additional source of income. The activities help in reducing pressure on the forest.

Plate 2.19 Honey Production

2.2.5.2 Biodiversity Trends and Stakeholder Roles

Some factors affecting the degradation of the Montane Ecosystem include:

- inappropriate cultural practices on slopes,
- over-exploitation of biological resources (e.g. *Prunus*), and
- under-forest grazing of small ruminants.

Found in the montane ecosystem, this species, whose bark is exploited for medicinal purposes is seriously threatened because of poor harvesting methods and over-exploitation.

Plate 2.20 Prunus africana bark

2.2.5.2.1 Unsustainable cultural practices

The Montane Ecosystem constitutes an extremely fragile environment by virtue of the slope which predisposes the milieu to increased possibilities of soil erosion. Slope cultivation is practised in a large proportion of the mountains cited in Table 2.16. The system of cultivation involves cutting down the small trees and leaving some large stands for mountains of the dense forest parent ecosystem, and a near total clearance on those of the Tropical wooded and semi-arid parent ecosystems. Clearing is followed by tilling on the flat mountains of the Tropical Humid Forest Parent Ecosystem and ridging for those of the wooded savannah and the semi-arid parent ecosystems. It is obvious that any form of cultivation on slopes will almost always be associated with the degradation of the milieu. The agricultural extension services do not appear to give "particular" priority to the activities of this fragile ecosystem. Mountains, if denuded, lose their regulatory functions which include amongst others:

- regulation of the biosphere,
- regulation of the climate,
- regulation of water regimes,
- buffering of carbon dioxide and
- protection of the soil.

2.2.5.2.2 Unsustainable exploitation of biological resources

The Montane Ecosystem is unique in its parent ecosystem. It contains plant and animal species not found below a certain altitude. This is the case with species such as the *Arundinaria* bamboos of Mount Oku used in local fencing and construction, and the *Prunus* tree, found on the Oku and Cameroon mountains, whose bark is harvested and used in the manufacture of pharmaceutical products for the treatment of prostatic hyperplasia, a common disease of the prostrate gland of elderly men. The species is not only over-exploited but wrongly harvested as a result of:

- lack of organisation (in resource exploitation and regeneration) by the local population residing around these mountain forests,
- inadequate control by supervisory field staff,
- insufficient logistics to enhance supervision , and
- insufficient technological knowledge of proper procedures.

The Government, through the Mount Cameroon Project (MCP), working with the local Government services and the main 'economic interest partner', PLANTECAM (main processor of *Prunus* bark), is engaged in endeavours to improve the situation. PLANTECAM has started distributing *Prunus* seedlings to residents for planting. The company has testified that it freely distributed 20,000 seedlings of in 1996/97, and has indicated that most of the wrong bark harvesting which leads to the death of the *Prunus trees*, is carried out by illegal exploiters. It is consequently evident that effective control has to be ensured by the designated services. The Mount Cameroon Project states that an inventory was carried out to determine the quantity of *Prunus* bark available for sustainable exploitation. The Cameroon Development Corporation (CDC), whose activities have negative effects on the ecosystem (Plantation cultivation of tea), attempts to attenuate the damage by cultivating *Prunus* as well.

2.2.5.2.3 Under-storey grazing of small ruminants

Mountains of the Tropical Wooded Savannah and the semi-arid parent ecosystems together with moist valleys (gallery forests), provide the main sources of green vegetation during the dry season. Cattle are known to browse tree seedlings, as well as fallen tree seeds supposed to ensure natural regeneration. These ruminants also eat the bark of some tree species which can eventually die.

Under-forest grazing by small ruminants is rife in the Oku mountain area as well as on mountains of similar parent ecosystems. Non-Governmental Organisations operating in such affected mountains are aware of the problem and their attempts at resolving it, as in Oku, include encouraging the local population to *plant fodder species*.

2.2.5.2.4 Activities of the global environment facility (GEF) in the Montane Ecosystem

The GEF supports conservation activities in the following mountain areas: Mount Cameroon, Mount Kupe, Mount Oku / Kilum. In these areas, GEF intends to carry out or has undertaken socio-economic surveys and resource inventories with the objective of furthering community organisation and more adapted slope and mountain vegetation management. The programme has been more successful in the Mount Cameroon and Mount Oku projects as a result of the synergy achieved with other support organisations such as the GTZ, Birdlife International and the DFID. The WWF is involved in resource inventories in the Kupe, Oku, and Tchabal Mbabo mountains.

Other management/research/development projects on going in the ecosystem are shown in Box 2.7.

Box 2.7

Biodiversity Management/Research and other ongoing Development Programmes/Projects and sponsors in the Montane Ecosystems

NAME OF PROGRAMME/ PROJECT	LOCATION	SPONSOR
• Mount Cameroon Project	Southwest Province	DFID/GTZ/GEF
• Kilum/Ijim Project	North West Province	GEF/DFID/Birdlife Int. Dutch Govt.
• Mount Kupe Project	Southwest Province	DFID/WWF/GEF
• Mount Mandara	Far North Province	EU

2.2.6 Freshwater Ecosystem

Cameroon's Fresh Water Ecosystem, like the Montane Ecosystem has parent ecosystems. It is treated separately because of its particular characteristics which are different from those of the parent ecosystems. The country contains a total in-land fresh water surface area of 39,600 km², made of rivers (1,000 Km²), flood plains and marshes (34,000 Km²), natural lakes (1,800 Km²) and artificial reservoirs measuring 2,800 Km² including about 1,000 abandoned fish ponds (Afian, 1991; MINEF, 1996b).

An important reservoir for freshwater resources

Plate 2.21 Dja River

Rivers constitute the *Lothological* variant of the Fresh Water Ecosystems. They are grouped according to the country's major drainage belts or water basins (Amou'ou *et al.* 1985) as indicated in Fig. 5.

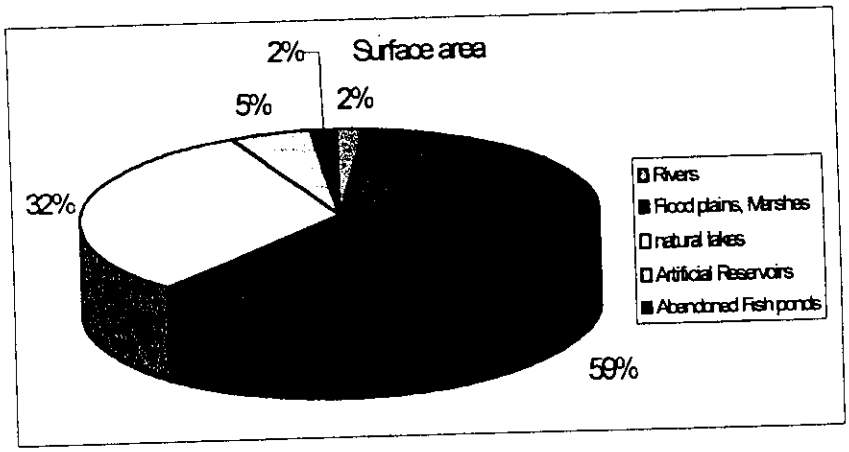


Fig. 12 Distribution (%) of freshwater resources by type

The bulk of resources is composed of flood plains / marshes and natural lakes (Fig. 12). The rivers of the major basins are indicated in Table 2.24 and lakes in Table 2.23. Some of the rivers have features shown in plates 2.24 and 2.25.

Table 2.23 Classification of lakes in Cameroon *

Crater Lakes	Subsistence lakes	Basin lakes	Artificial lakes	
			Lakes	Area Coverage (ha.)
Baleng	Ossa	Chad	Bamendjin	33,000
Barombi	Tissongo	Fianga	Mbakaou	60,000
Nyos,	Dissoni		Mape	50,000
Oku	Ejagham		Maga	24,000
Tizong	NA	NA	NA	NA
Bambulewi	NA	NA	Bambalang	NA
Bini	NA	NA	NA	NA
Sode	NA	NA	NA	NA
Benakuma	NA	NA	NA	NA
Mbakoua	NA	NA	NA	NA

* *NA = not available*

Source: Amou'ou *et al* (1985)

Table 2.24 Rivers of the major water basins of Cameroon *

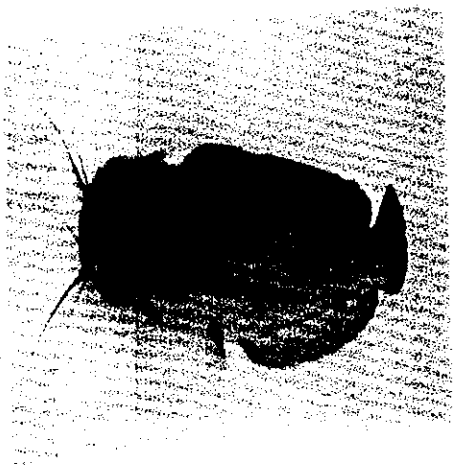
Basin	Rivers	Length (Km)	Area of Valley (Km^2)
ATLANTIC	Sanaga	920	140,000
	Nyong	750	30,000
	Ntem	400	31,000
	Lokoundje	NA	NA
	Kienké	NA	NA
	Lobé	NA	NA
	Cross river	NA	NA
	Moungo	NA	NA
CONGO	Dja	NA	NA
	Bek	NA	NA
	Boumba	NA	NA
	Ngoko	NA	NA
	Sangha	NA	NA
	Kadei	NA	NA
NIGER /BENOUE	Benoue	1,400	92,000
	Mayo Kebi	NA	NA
	Mayo Tiel	NA	NA
	Faro	NA	NA
	Mayo Godi	NA	NA
	Donga	NA	Donga
CHAD	Logone	NA	NA
	Chari.	NA	NA
		NA	NA

**NA not available*
Source: Amou'ou *et al* (1985)

Lakes constitute the *Limnological* variant and are classified into 4 categories (Amou'ou *et al*, 1985) as presented in Table 2.21. Plates 2.22 and 2.25 show a water fall and a lake respectively.

This water flow could get dry if the vegetation around it is destroyed.

Plate 2.22 Menchum Falls



Some of the numerous freshwater life forms, all contributing to the food chain and the equilibrium of the freshwater ecosystem.

Plate 2.23. Floating vosea/Clarias camerunensis

Grasshoppers and butterflies also form part of our rich bio-diversity

Plate 2.24 Grasshopper / Butterfly

2.2.6.1 Status of Biodiversity Components

2.2.6.1.1 Plants

a) Woody species

Numerous species of trees grow in fresh water or on the immediate edges of the fresh water ecosystem. Leaves, dropped by these species act as fodder for water fauna. Some of the fresh water species (Letouzey, 1985), include the Raphias, i.e. *Raphia vinifera*, *R. hookeri* and *R. monobuttorum*. Species characteristic of the Sanaga flood forests include *Guibourtia*

Inland lakes are habitat for numerous rare/endemic species.

Plate 2.25 Lake Manenguba

demeusei and *Irvingia smithu*. Woody species found along water courses include *Andira inermis* and *Mitragna inermis*, while those found in the northern flood-plains include *Isoberlina doka* and *Uapaca togonensis*.

b) Herbaceous species

There is insufficient information on the herbaceous species of the country's fresh water ecosystem. However, Satabie (1997), indicates that the water hyacinth, *Eichhornia crassipes*, is considered rare around the Sanaga flood plain. The report further indicates that 18 species of the family "Podostemaceae", are endemic to some fresh water sites. Examples include

- *Zehnderia microgyna*, endemic to the Sanaga falls,
- *Dicranthus africanus*, and
- *D. zehnderi*, endemic to various water-falls in the country.

Other endemic fresh water species include, *Ledermanniella letouzeyi, L. kamerunensis, L. sanagaensis, L. bossi, L. batangensis etc.* The herbacious species of the northern flood-plains (Yaérés) include *Digitaria gayana, Sorghum aundinacenu, Hygrophila auriculata and Eragrostis diplachnoides*.

2.2.6.1.2 Animals

a) Reptile species

Three (3) reptile species have been reported *threatened* (Njoh, 1997): the *Crocodylus cataphractus*, the *Crocodylus niloticus* and the *Osteolae mustetrapis*. Information on the total number of reptile species in the ecosystem is not yet available.

b) Avian species

Decoux *et al* (1997) report that a total of 312 bird species has been recorded around the Freshwater Ecosystem (particularly around the Lake Chad flood plain), 216 of these are residents and 96 are migrants. Stuart (1986) further indicates bird species associated with the freshwater ecosystem:

- Kingfishers, examples include, the Shining-blue Kingfisher (*Alcedo quadribrachys*), the Malachite Kingfisher (*A. cristata*), the Dwarf Kingfisher (*Ispidina lecontei*),
- Cattle Egrettes, and
- the Little Grey Greenbul (*Andropadus gracilis*).

c) Fish species

Afian (1991) states that 560 fish species identified in the freshwater ecosystem belong to 47 families, 24 of which are monogenetic. Eight (Table 2.25) of the foregoing families account for 415 of all the species. Two fish species (Tilapia) are used in pisciculture: *Oreochromis niloticus* and *Clarias gariepinus*. However, the species *Saretherodon galilaeus* is the most abundant in freshwaters. Other species include *Labeo senegalensis, Lates niloticus* and *Citharinus citharus*. The report "Living Waters of Korup rainforest" produced by the WWF and Reid (1989) indicates that 12 species of fish are *endemic* to the Barombi-Mbo lake. The names of these new species have not been mentioned. It is possible that new species also exist in many of the country's 40 crater lakes.

Table 2.25 Some fish families and species of Freshwater Ecosystem *

Families	Number of species	Information on genus
CYPRINIDAE	90	50 of genus *barbus*
MORMYRIDAE	50	NA
MOCHOCIDAE	50	36 of genus *synocontis*
CYPRINODONTIDAE	50	30 of genus *aphyosemion*
CHARACIDAE	40	NA
CITHARINIDAE	40	NA
CICHLIDAE	40	NA
BAGRIDAE	35	22 belong to the genus *clarias.*

* *NA = not available*

2.2.6.1.3 Micro-organisms and micro-flora/fauna

Various species of annelides and worms thrive in and around freshwater bodies and constitute an important food source for large freshwater fauna. However, an important food source is consists of zooplankton and phytoplankton. These micro-organisms influence fish growth and consequently fish production in freshwaters. The most common and useful

zooplankton species include *Mesocyclops leuckarti, Moina dubia, Thermodiaptomus galebi*, the water bug, and the eggs of crustacea. Phytoplankton such as *Cosmarium spp.*, *Anabaenopsis* and *Euglena* exist in the nation's fresh waters. It should be indicated that further research is needed in this domain.

2.2.6.2 Biodiversity Trends and Stakeholder Roles

Hot spots in the freshwater ecosystem include:

- inappropriate practices in water resources exploitation,
- upstream pollution in rivers, lakes, and
- issues in freshwater fish culture.

2.2.6.2.1 Unsustainable cultural practices in water resource exploitation

Although fisher men are generally referred to as masters of their art, numerous wrong fishing techniques are used by the profession. Many fishermen use fish poisons such as the toxic vine *Strychnos aculeata*. According to Reid (1989), it is an effective way of fishing "For example a 0.5 km stretch of open river on transect Q near Akpasang village, which had been poisoned with 15 - 20 Strychnos pods by fisherfolk (*ca* 03.02.88), was found by a survey team to be devoid of all large fish ..."

Other alkaloids used as fish poisons are obtained from the lemon-sized fruits of the tree, *Massularia acuminata*. The most dangerous of these poisons is the organo-chloride insecticide, Gamaline 20. The chemical has deleterious environmental effects in addition to killing all fish and obliterating all aquatic biota in a given length of the water-course (Reid, 1989). Another issue is the use of small meshed fishing nets which take the small and immature fish.

Fishermen, especially those operating in the freshwater ecosystem receive very little technical guidance. One reason for this situation is the shortage of staff in the fisheries sector. Despite the proliferation of NGO's from the early 90's, very few are involved in the fisheries sector. Government's intervention has been through the Fisheries Development Authority (MIDEPECAM) which has been earmarked for dissolution.

2.2.6.2.2 Upstream pollution in rivers and lakes

The major upstream polluting activity by the local population is the washing of clothes using detergents. Soaps and other detergents alter the taste of fish food, and biologically lead to a decrease in productivity for both freshwater fauna and flora species. The dumping of

domestic wastes in lakes enhance eutrophication. Generally, the level of available water oxygen reduces, leading to inadequate growth of fish species. Although the dumping of domestic waste into lakes is not common, the washing of clothes in water sources is common in the country's fresh water ecosystem.

Agricultural and chemical industries are also known to pollute fresh water sources either through residual fertilisers which enhance eutrophication of lakes or through other chemicals, and heavy metals such as lead, mercury and zinc, which infiltrate the food chain and reduce the life-span of fresh water fauna species.

Very little is effectively done to check these problems. The new framework law dwelling on the management of the environment specifies penalties against polluters but the implementation decisions for the law are still awaited.

2.2.6.2.3 Issues in Freshwater fish culture

Njock (1997) indicates that the trend of fish production and yield from the country's water bodies are on the decline. Fish production from ponds has a remarkably important function in checking the pressure on these resources in their natural habitats by the local population and fishing companies. A critical examination entitled "abandoned fish ponds". MINEF 1996b indicates that up to 1,000 fish ponds have been abandoned. Some of the problems associated with fish culture (Reid, 1989) include:

- the difficulties and capital cost involved in successfully establishing and managing a fish farm,
- inappropriate natural sites for the establishment of aquaculture,
- freshwater fish taste which is less agreable compared with marine fish,
- difficulties in defraying fish rearing costs during marketing in comparison with fish poached from natural water bodies,
- ready supply of dried and frozen marine fish from Douala which is sold at competitive prices, and
- absence or shortage of the appropriate fish feed.

Other problems are related to the adaptability of species and the renewal of fish stocks. The Government, prior to the economic crisis, gave remarkable support to fish farming. Management/research/development projects on going in the ecosystem are shown in Box 2.8.

Box 2.8

Biodiversity Management/Research and other ongoing Development Programmes/Projects and sponsors for Freshwater ecosystems

NAME OF PROGRAMME/PROJECT	LOCATION	SPONSOR
• FISHERIES RESEARCH STATION, FOUMBAN	IRAD, Foumban, West Province	GoC
• LAKE CHAD BASIN COMMISSION	NDJAMENA, CHAD REPUBLIC	CAMEROON, NIGERIA, NIGER AND CHAD REPUBLICS
• UPPER NOUN VALLEY DEVELOPMENT AUTHORITY	Northwest Province	GoC
• WAZA-LOGONE Project	Far North Province	GoC; WWF; IUCN
• RICE DEVELOPMENT AUTHORITY (SEMRY)	Far North Province	GoC

2.3 Biodiversity conservation and management endeavours

Following the creation of the Ministry of Environment and Forestry (MINEF) by Decree N^{0} 92/069 of 09 April 1992, as the focal point on biodiversity in Cameroon, the country's main endeavours can be classified into two categories, namely: those that relate to policy/legal provisions and those that relate to programmes/projects. Protected areas are shown in Fig. 9.

2.3.1 Policy and legal provisions

The elaboration of several sectoral policies relating to the conservation and management of biodiversity include the:

(a) ***Agricultural Policy ("Agricultural Development Policy Letter")*** and the related Agricultural Structural Adjustment followed by the reorganisation of agricultural research: the thrust in these developments has been decentralisation, ecological concerns and participation by various stakeholders.

(b) ***Forest and Wildlife Policy objectives include:***

i. Protection of the nation's forest and wildlife heritage by participating in the conservation of the environment and the preservation of biodiversity in a sustainable manner as well as renewing the forest and wildlife resources through better management.

ii. Regular supply of forest and wildlife products in a sustainable manner for the present and future generation.

(c) ***Forestry and Wildlife Law N^{0} 94/01 of 20.01.94*** and its various implementing decrees: compared with past policies, it makes statutory the involvement of rural populations, partners and stakeholders in its implementation, notably by the ownership of community forests. This innovation is intended to encourage people to better protect their vegetal cover. The

management of forestry resources for actions in the long term with benefits being central to the provisions of the law.

(d) ***National Forestry Action Plan*** (funded by the Food and Agricultural Organisation (FAO) of the United Nations and the GoC): Under the framework of the Tropical Forestry Action Plan, this plan institutes a forestry system which permits sustainable exploitation of timber while ensuring the preservation of existing floral and faunal ecosystems.

(e) ***National Environmental Management Plan*** (NEMP): This was adopted in 1996 to ensure sustainable development through the protection of the environment and sustainable utilisation of resources through policies, strategies and actions considering socio-economic conditions of the country.

(f) ***Plant Protection Law N° 90/013 (and its decree of application N° 92/223 of 25 May 1992):*** This law is aimed at fighting or protecting plants against pests/diseases.

(g) ***National Environment Law N° 96/12 of 5 August 1996:*** This law lays down the general legal framework for environmental management in Cameroon.

2.3.2 Programmes and projects

(a) ***The Mount Cameroon Project (MCP):*** Its goal is the maintenance of biodiversity on and around Mount Cameroon. Central to realising this goal is the real working partnership with forest users, consumers of forest products, governments and industries. This new style of action is aimed at developing realistic strategies for the sustainable management of natural resources. Part of the work involves identifying social, economic and ecological relationships between forest fallow farm land and the actors concerned.

(b) ***Global Environment Facility (GEF):*** The facility manages a number of biodiversity projects.

(c) ***KORUP project*** deals with integrated forest management and

(d) ***Korup Forest Dynamics Plot*** is aimed at generating the scientific knowledge (baseline data) necessary for sustainable management of forest biodiversity.

(e) ***Genetic Resources Project*** (based in IRAD) is aimed at conservation (*ex-situ* and *in-situ*) of agriculturally important plants and animals.

(f) ***IRAD-ICRAF Programme*** involves conservation and studies of plants of agro-forestry importance in West-central Africa. Other interests involve medicinal plants such as *Prunus africana* and "wild" plants important for food such as *Gnetum africana*.

(g) *Private Voluntary Organisations/Non-Governmental Organisations in Natural Resource Management* (PVO-NGO/NRMS) manage other biodiversity projects.