CONSERVATION OF BIOLOGICAL DIVERSITY IN AFRICA

Le Xuan Quynh and **Luc Hens**

Human Ecology Department, Vrije Universiteit Brussel, Brussels, Belgium.

Keywords: Africa, biodiversity, conservation, National Park.

Contents

Summary

Africa is very rich in biodiversity both in terms of ecosystems and species. However, biodiversity conservation in Africa is facing different threats. Poverty, pollution, disease, and policy failures, are some of the major concerns. Many efforts have been undertaken both by international communities as well as by African countries to conserve biodiversity on the continent. However, biodiversity loss will still remain a major issue in the future if the necessary actions are not implemented with dedication.

1. Introduction

1.1. Definitions and Concepts

1.1.1. Biodiversity

"Biological diversity" means the **variability among living organisms** from all sources including, *inter alia*, terrestrial, marine and other aquatic ecosystems and **the ecological complexes** of which they are part; this includes diversity within species, between species and of ecosystems" (Convention on International Trade in Endangered Species

of Wild Fauna and Flora - CITES, 1993).

This definition emphasises also three categories of biodiversity that are managed by the Convention. They are genetic diversity, species diversity and ecosystem diversity. However, there is one more category that is not mentioned in the Convention: cultural diversity. To protect and conserve biodiversity, it is essential to recognise the importance of cultural aspects, especially those associated with indigenous communities.

Genetic diversity refers to the variety at DNA level. Genes are the foundation of biodiversity and raw materials for ecological evolution. Variation in genetic materials is the basis of diversity within species. This allows populations to adapt to changes in climate and other local environmental conditions.

For practical reasons, biodiversity is usually referred to as the total number of species and ecosystems existing on Earth. With current knowledge and technology, just a small fraction of all living organisms have been described and named. It is estimated that, around 14 million species exist on Earth while only slightly more than 1.5 million species have been described by scientists.

Although the total number of species on Earth is only an estimated figure, and it may change at any time, it suggests that there are many species that have not yet been recognised.

While genetic diversity and species diversity have to do with variation of genetic material and the way this variation is expressed in different environmental conditions, ecosystem diversity considers not only organisms but also physical environments to which organisms adapt and in which they evolve. Ecosystem diversity plays an important role in providing human beings with ecological values such as regulating climate, maintaining energy and biogeochemical processes, etc. It also entails socio-economic and cultural values such as aesthetics, recreation, indigenous knowledge systems, etc.

1.1.2. Conservation

Conservation is the way we protect, manage and use biodiversity resources so that economic, social, cultural and environmental goals are achieved sustainably. Conservation, therefore, is not the way we try to ISOLATE biodiversity from human beings. Rather, conservation means protecting biodiversity so that human beings can benefit from it sustainably.

However, it is not easy to assess conservation efforts. Many conservation projects failed to achieve their intimate goals: to protect natural biological resources and to use them wisely. Studies showed that success of conservation efforts is based on five main conditions:

- Clarity in conservation goals and objectives;
- Equitable and effective social processes and alliances (participation and

partnerships);
- Appropriate incentives for biodiversity valuation and conservation;
- Supportive policies (local, national and international); and
- Sufficient awareness, knowledge and capacity to conserve biodiversity.

In addition, other indicators like flexible and adaptive management and a long-term commitment of steady support and financing may increase the possibility of success and sustainability. Too often, one or more of these elements are missing (IUCN, 2001).

Biodiversity conservation can be carried out in different forms and at different levels. Biodiversity can be conserved by reducing consumption of wildlife, halting exploitation of natural ecosystems, preventing pollution, changing policies, etc. Technically speaking, biodiversity can be conserved *in situ* or *ex situ*. *Ex situ* refers to a wide range of techniques to conserve biodiversity outside its natural places, such as the use of botanic gardens, zoos, gene banks, etc. This form of conservation requires intensive scientific knowledge and financial investment. *In situ* conservation refers to the protection of biodiversity on the spot and usually necessitates protected areas and nature reserves. *In situ* conservation is widely used all over the world.

Conservation strategies have changed over the years. In the past, protected areas were established as hard-boundary territories. In many cases, protected areas were formed without considering local communities' needs and opinions. Biodiversity conservation has been approached from a "Preservation" point of view, which has promoted conservation as a management job of national parks. Management concerns (such as how to prevent encroachment) have been put at the first priority. Conservation practices, therefore, have been solely designed by a group of managers and have been applied widely using forces and punishments as primary tools. However, this kind of set-aside, top-down approach proved, as a rule, to be ineffective and biodiversity loss continued. Gradually, influences from outside national parks have penetrated into the conservation process. What is emerging is participatory, bottom-up approaches, which try to involve all stakeholders, especially local communities and indigenous people, in the conservation process. These approaches have gained consensus from people living in and around protected areas and initial outcomes were positive. However, a rational mix between top-down and bottom-up approaches should be studied in-depth to adapt conservation strategies to the local context.

1.2. Biodiversity in Africa

In view of its extreme climatic and physical conditions, Africa has a wealth of diversity in terms of ecosystems. There is an abundance of species in ecosystems, ranging from deserts to moist tropical forests. Typical African ecosystems are mostly savannahs. They are the world's richest grasslands and the home place of more large mammals than any other ecosystems in the world. Elephants, rhinos, hippopotamuses, lions, leopards, buffaloes, wildebeests, zebras, countless antelopes, gazelles, giraffes, baboons, mountain gorillas, chimpanzees, lemurs, hyenas, and African wild dogs, are some of the best well-known animals that live in the savannah and tropical rainforest regions.

The total forest cover in Africa was estimated to be 650 million hectares in 2000. This

represents 17% of the global forest cover, and approximately 22% of Africa's land area. Africa has 14 different types of forests, in temperate and tropical climates, although the extent of forest cover varies between sub-regions. Forests make up approximately 45% of the land area of Central Africa, constituting 37% of Africa's total forest cover. In contrast, only 8% of the land cover of countries in Northern Africa is forest and most of this is in Sudan (Sayer, 1992).

The tropical moist forests of Africa support an estimated 1.5 million species. The fauna of Africa's tropical moist forest accounts for 84% of the continent's primates, 68% of passerine birds and 66% of butterfly species (Sayer, 1992). The forests also contain over 8000 plant species. Hundreds of wildlife species are used by local people on a daily basis as the main supply of vital proteins.

Africa has five of the global 25 internationally recognised biodiversity hotspots and shares one hotspot with other Mediterranean countries (Gil and Mittermeier, 2000). They are:

- The **Mediterranean Basin Forests** constitute just 1.5% of the world's forests. Yet they are home to 25 000 plant species with 14 endemic genera.
- The **Guinean Forest** hotspot is a strip of fragmented forest running along the coast of Western Africa. It has the highest mammal diversity. The sub-region contains 2250 plant species, 90 bird species, 45 mammal species and 46 reptile species found nowhere else.
- The **Eastern Arc Mountain Forests** of Eastern Africa are 30 million years old and are thought to have evolved in isolation for at least 10 million years. As a result, more than 25% of the plant species are endemic.
- The **Western Indian Ocean Islands** have extremely high levels of endemism due to their isolation. This is especially true for Madagascar which has the highest number of endemic species in Africa (including 700 endemic vertebrate species), and ranks 6th in the world in terms of vertebrate endemism.
- The **Succulent Karoo**: this hotspot is situated on a large area between South Africa and Namibia. It is the richest desert in the world with 40% of its 4849 plant species being endemic.
- The **Cape Floristic Region**, in South Africa, is the smallest and richest of the world's floral kingdoms with 68% of the 8700 plant species being endemic to the region.

Eastern Africa has the highest numbers of endemic species of mammals (55%), birds (63%), reptiles (49%) and amphibians (40%), whereas species endemism is relatively low in North Africa. Madagascar is the most endemic-rich country in Africa, and sixth in the world for higher vertebrates with more than 700 endemic species, and the third-most plant-rich country in Africa after South Africa and the Democratic Republic of Congo." (UNEP/GRID-Arendal, 2002 and World Resource Institute, 2003). One of the six most significant concentrations of plants in the world is the Cape Floral Kingdom. Table 1 shows the number of endangered species in African and its sub-regions.

Category	Northern Africa	West Africa	Central Africa	East Africa	Southern Africa	Whole Africa

Plants	4	39	24	109	62	195
Amphibians	0	1	0	1	2	3
Reptiles	3	3	1	12	5	12
Birds	3	5	17	32	20	57
Mammals	18	37	47	54	26	108
TOTAL	*28*	*85*	*89*	*208*	*115*	*375*

Table 1. Number of endangered species in Africa according to IUCN 2002 Red List categories (Adapted from GEO Data Compendium, 2002)
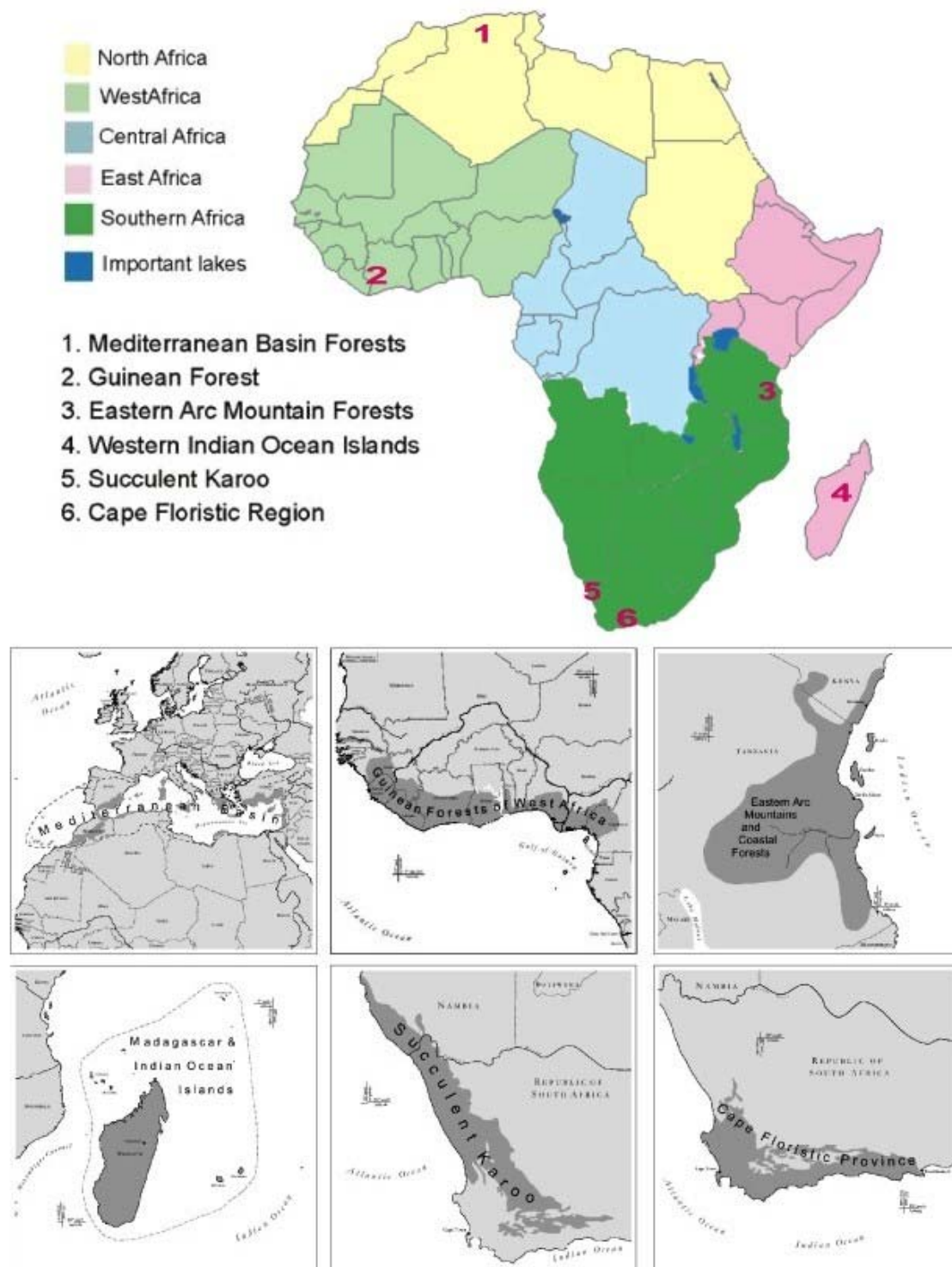
Figure 1. Internationally recognised biodiversity hotspots located in Africa (adapted from Conservation International, 2003)

Savannah is one of the most important ecosystems in Africa. Almost half of the

continent, about 13 million km^2, is covered by savannah where the world's greatest diversity (over 40 different species) of ungulates (hoofed mammals) is found. The antelopes are especially diverse and including eland, impalas, gazelles, oryx, gerenuk, and kudu. Buffalo, wildebeest, plains zebra, rhinos, giraffes, elephants, and warthogs are widespread herbivores. They divide the scarce resources by specialising in food preferences, grazing/browsing height, time of day or year to use a given area, and different migration seasons. Savannah is found widely in the West, the East and the Southern sub-regions.

Wetlands cover about 1% of Africa's total area and are present in every country. The largest wetlands include swamps in the Democratic Republic of Congo, Upper Nile wetlands, the Lake Victoria and Chad basins, and the floodplains of the Niger and Zambezi rivers. Lake Tanganyika, being the third largest lake in the world by volume and the second largest lake in Africa, is one of the most important wetlands in Africa. Although it is less than half the size of Lake Victoria, it drains an area approximately the same size (around 200 000 km^2). Lake Tanganyika is home to more than 2000 plant and animal species, and is one of the richest freshwater ecosystems in the world. Its biodiversity includes cichlid fish species (over 250 species), non-cichlid fish (145 species) and invertebrate organisms, including gastropods (15 species), copepods (69 species), leeches (20 species), and sponges (9 species) among others. The Lake is one of the richest freshwater ecosystems in the world with more than 600 species endemic to the Tanganyika Basin (Allison et al., 2000). The total diversity of flora and fauna in the wetlands of Africa is enormous with endemic and rare plant and animal species, including many migratory bird species. However, a large part of the species diversity has not yet been described.

The African coastal region is vast, and includes a variety of habitats from spectacular coral reefs along the Red Sea coast of Egypt to mangrove forests and sea-grass beds in many other areas. Diversity of fish species is high, with more than 4000 species described. Some important fish species include tuna, marlin, and billfish. Other important marine animals in African waters are sea turtles and dugongs.

Africa has rich and varied biological resources that contribute not only to the development of the continent but also to global well-being. Approximately 64% of Africans still depend on traditional energy sources, which are generated from African forests (World Bank, 1999). For instance, bush meat provides 70% of the animal proteins in southern Ivory Coast, 80-90% in Liberia and 55% in Sierra Leone (FAO 1990).

In addition to such tangible benefits, forests and woodlands are important for cultural, spiritual or religious purposes. The Zigua ethnic group in Tanzania, for example, protects 748 forests, which they use for burial sites and ceremonies, worshipping, traditional practices and training.

At a national level, the commercial exploitation of African forests and woodlands is an important source of income, foreign exchange, and employment. For example, in 1998, South Africa's exports of wood products amounted to US$837 million.
Apart from timber, forests also provide a wide range of valuable non-timber forest

products: oils, gum, latex, resins, tannins, steroids, waxes, edible oils, rattan, bamboo, flavourings, spices, pesticides and dyes (Park 1992). Many commercial crops originate from tropical forest plants, including coffee, bananas, oranges, sugar, pineapples, rice, maize, and cocoa.

-
-
-

TO ACCESS ALL THE **34 PAGES** OF THIS CHAPTER,
Visit: http://www.eolss.net/Eolss-sampleAllChapter.aspx

Bibliography

Africa Wildlife Foundation (2003). *Conserving Wildlife, Protecting Land, Empowering People*. Annual Report 2003. http://www.awf.org. Retrieved February 2004. [This is an inclusive report on efforts and achievements in biodiversity conservation in Africa. Practices of AWF at local level have been reported in detail.]

Allison, E.H., R.G.T. Paley, G. Ntakimazi, V. J. Cowan And K. West (2000). *Biodiversity Assessment and Conservation in Lake Tanganyika: BIOSS Final Technical Report*. Pollution Control and Other Measures to Protect Biodiversity in Lake Tanganyika (RAF/92/G32). [The Lake Tanganyika Biodiversity Project has been formulated to help the four riparian states (Burundi, Congo, Tanzania and Zambia) produce an effective and sustainable system for managing and conserving the biodiversity of Lake Tanganyika into the foreseeable future. It is funded by the Global Environmental Facility through the United Nations Development Programme.]

Blanc J.J., Thouless C.R., Hart J.A., Dublin H.T., Douglas-Hamilton I., Craig C.G. and Barnes R.F.W. (2003). *African Elephant Status Report 2002: An update from the African Elephant Database*. IUCN/SSC African Elephant Specialist Group. ICUN, Gland, Switzerland and Cambridge, UK. vi + 304pp. [A comprehensive report on the most recent status of African Elephants].

CI (2003). Conservation International. http://www.conservation.org. [This website provides detailed information on the work of Conservation International in different regions, including Africa]

Critical Ecosystem Partnership Fund (2000). *Ecosystem Profile: Upper Guinean Forest Ecosystem of the Guinean Forests of West Africa Biodiversity Hotspot*. [It is a joint initiative of Conservation International (CI), the Global Environment Facility (GEF), the Government of Japan, the MacArthur Foundation and the World Bank. CEPF provides financing to projects located in biodiversity hotspots]

Greenwood, P. H. (1974). *Cichlid fishes of Lake Victoria, East Africa: the biology and evolution of a species flock*. Bull. British Museum (Natural History), Zoology Suppl. 6:1-134.

Greenwood, P. H. (1984). *African cichlids and evolutionary theories*. A.A. Echelle and I. Kornfield, eds. Evolution of Fish Species Flocks. University of Maine Press, Orono. Pp 141-154.

Groombridge B. and Jenkins M.P. (2002). *World Atlas of Biodiversity*. University of California Press. USA.

Sandwith T., Shine C., Hamilton L and Sheppard D. (2001). *Transboundary Protected Areas for Peace and Co-operation*. IUCN-WCPA Best Practice Protected Area Guidelines Series No. 7. IUCN, Gland, Switzerland and Cambridge, UK. xi + 111pp. [The guideline provides, in a clear way, extensive examples related to transboundary conservation efforts all over the world.]

Sayer J.A., (Ed) Harcourt, C. S. & Collins, N. M., (1992). *The Conservation Atlas of Tropical Forests: Africa*. IUCN. Macmillan Publishers Ltd. United Kingdom. [A comprehensive report on tropical forests in Africa with useful details about values and conservation efforts related to tropical forests. Information about important forest countries in Africa is also provided.]

UNEP (1995). *Global Biodiversity Assessment*. Cambridge University Press. UK. [The Global Biodiversity Assessment is an independent analysis of issues regarding the main aspects of biodiversity. The Assessment provides a wide range of analyses on biological and social issues pertaining to biodiversity. It also provides a foundation for designing and implementing biodiversity policies in accordance with the Convention on Biological Diversity.]

UNEP (2001). *Report of the African Preparatory Conference for the World Summit on Sustainable Development*. Nairobi, Kenya. [This report provides details about the situation and position of Africa before the World Summit on Sustainable Development. Strengths and weaknesses as well as opportunities and threats were discussed from the points of view of the insiders. The report has set the ground for Africa to join the WSSD and the follow-up activities.]

UNEP/GRID-Arendal (2002). *Africa Environmental Outlook: Past, Present and Future Perspectives*. Published by UNEP/GRID-Arendal. Arendal, Norway. http://www.unep.org/aeo/index.htm. [The Africa Environment Outlook (AEO) Integrated Assessment Report Project is a collaborative initiative between the African Ministerial Conference on the Environment (AMCEN) and the United Nations Environment Programme (UNEP). It is the first comprehensive integrated report on the African environment reflecting a variety of sub-regional perspectives and priorities.]

UNFPA (2003). State of the World Population 2003. New York, USA. [The publication provides full list of up-to-date indicators related to population and health care all over the world. Data of Africa's sub-regions is also provided.]

World Resources Institute (2003). *EarthTrends: The Environmental Information Portal.* Available at http://earthtrends.wri.org. Washington DC: World Resources Institute. [Very good collective databank arranged according to topics, providing up-to-date data from different aspects.]

Biographical Sketches

Professor Luc Hens obtained his Licentiate in Biology from the Free University of Brussels (FUB) in 1974, Aggregation of Higher Secondary School Teaching from the FUB in 1975, and PhD from the Faculty of Science of the FUB in 1981.

Professor Hens is a member of several professional societies and recipient of a number of honours and awards, including the prestigious award of the Belgian Royal Academy of Sciences and Arts which he was awarded in 1984. Currently he is the Head of the Department of Human Ecology at the FUB.

He has been responsible for organising and/or participating in several international research and postgraduate teaching programmes in many countries including Bolivia, Bulgaria, Brazil, Brussels, the Czech Republic, Ghana, Hungary, Turkey, the Ukraine and Vietnam.

To date the publications of Professor Hens number about 200 including twenty-six books. He is also the co-editor of the journals *Environment, Development and Sustainability* and *Environmental Pollution.* His teaching and research interests include environmental management, sustainable development, human ecology, and related issues.

Ms. Le Xuan Quynh obtained her Master degree in Human Ecology in 2004 from the Free University of Brussels (VUB) after she had obtained her first degree of Bachelor of Science in Environmental Sciences in 1999 from Vietnam National University in Hanoi, Vietnam. She has working experience in biodiversity conservation with several non-governmental organisations and international non-governmental organisations in Vietnam.