

Nature & Faune

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The Value of Biodiversity



FAO Regional Office for Africa





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The Value of Biodiversity

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Preface

In the past few months some important initiatives regarding Biodiversity have taken place. On 22 May it was the UN International Day for Biological Diversity with a focus on Climate Change. Neil Pratt, of the Convention on Biodiversity secretariat kindly wrote a Special Feature for this issue of Nature & Faune (see 'Special Feature'). The 14th Conference of the Parties (COP) to the Convention on International Trade in Endangered Species (CITES) took place in the Netherlands (see 'News'). At the same time, the United Nations University instated a Database for wildlife trade; 'Wildlife Enforcement Monitoring System' (see 'Links'). FAO organized the second inter-sessional meeting to the AFWC in Rabat, where it was decided that next year's African Forestry and Wildlife Commission, which will be held in Sudan on February 17-22, will embrace the theme 'Forests and Wildlife in a Changing Environment'. The Commission shall dedicate a full day to the Role of Wildlife and Protected Areas in the Sustainable Development of Africa (see 'News')

Hence, this issue of Nature & Faune, focusing on the theme 'The Value of Biodiversity' comes at an important moment. We received varied articles discussing the value of biodiversity at various levels. The article by Endamana *et al.* on conservation and development, focuses on the trade-offs between 'natural' capital and social, human, physical and financial capital in Cameroon and the effects of accessibility, participative management and immigration. Palmberg-Lerche examines concepts, strategies and priority setting in the conservation of forest biodiversity, focusing on the management of forest tree and shrub genetic resources. The article by Ingram and Nsawir looks at one particularly precious tree species, *Prunus africana*, and the regulatory framework for its exploitation. El Mongy gives an overview of the value of entire forest ecosystems in Kenya and the reasons for deforestation.

Whether you are living in the choice neighborhoods of Tunis or in the dense evergreen rain forests of Equatorial Guinea, biological diversity is of value to you. Besides the timber and fuel wood procured from forests, access to medicinal plants, fruit trees, wild vegetables, fish, bushmeat etc. are all well known values of biological diversity, especially to rural people. The environmental services provided by forests, woodland and protected areas include sequestration of carbon; moderating soil; hydrological and aquatic systems; reducing the risks from natural disasters (floods, landslides, drought); regulation of pests and disease; landscaping and, off course, conserving biodiversity. Values of biodiversity which are marketable could benefit communities, such as income from Non-Wood Forest Products trade including fuel wood, hunting and trade in bushmeat or through benefit sharing schemes based on eco-tourism and trophy hunting revenues. An increasing number of projects are being initiated to market ecological services such as hydrological regulation and carbon sequestration.

The need for expressing the values of biodiversity and the ecosystem services it supports in monetary values remains an issue of debate amongst scientists and practitioners. For the time being, many natural resources and services do not have a price tag, nor a market to establish the price and promote trade. Political and economic decisions can only be sensibly made when the advantages and disadvantages of various alternatives are explicit. By increasing the understanding of biodiversity values, monetary and non-monetary, we can only hope the costs and benefits stemming from biodiversity can be revealed, decision makers become more aware, and more informed management choices are made based on the consequences of preserving and sustainably using these resources.

We wish you continued reading pleasure.

Changing baton at Nature & Faune

We say good bye to Michel Laverdiere, who held the mantle of leadership as the Editor for Nature & Faune from July 2006 to April 2007. Mr. Laverdiere has been appointed as the new Forestry Officer for the FAO Subregional Office for Eastern Africa with base in Addis Ababa, Ethiopia. The Editorial Board thanks him for the role he played and wishes him the best at his new post.

At the same breath we are pleased to inform you that Mr. Eduardo Mansur arrived in Accra, Ghana in July 2007 to assume the post of Senior Forestry Officer at FAO's Regional Office for Africa. We welcome him as the new Editor of Nature & Faune magazine.

Saluting our board of reviewers!

Nature & Faune would like to recognize and honor its board of reviewers for their valuable feedback on the articles submitted to the magazine. Members of Nature & Faune Board of reviewers include: Alan Rodgers; Douglas Williamson; El Hadji M. Sène; Guy Debonnet; Jean Djigui Kéita; Kai Wollscheid and Philippe Chardonnet. The editorial board and the readership salute their expert advice and look forward to continuing collaboration.



The Value of Biodiversity

Douglas Williamson

Biological diversity relates to the variety of life forms: the different plants, animals and microorganisms, the genes they contain, and the ecosystems they form. Three different forms of biodiversity are recognized: *genetic diversity*, which refers to “the variety of genetic information contained in all of the individual plants, animals and microorganisms” (1); *species diversity*, which refers to the variety of plant, animal and microorganismic species; and *ecosystem diversity*, which “relates to the variety of habitats, biotic communities, and ecological processes, as well as the tremendous diversity present within ecosystems in terms of habitat differences and the variety of ecological processes” (2). Ecosystems can be difficult to delineate because an ecosystem is essentially a human concept rather than a self-defining, self-evident entity in the way that trees and birds are.

Biodiversity provides many material benefits to people, as is apparent from the following list of ecosystem services (3)

- Provision of food, fuel and fiber
- Provision of shelter and building materials
- Purification of air and water
- Detoxification and decomposition of wastes
- Stabilization and moderation of the Earth's climate
- Moderation of floods, droughts, temperature extremes and the forces of wind
- Generation and renewal of soil fertility, including nutrient cycling
- Pollination of plants, including many crops
- Control of pests and diseases
- Maintenance of genetic resources as key inputs to crop varieties and livestock breeds, medicines and other products
- Ability to adapt to change

Biodiversity also provides people with cultural, aesthetic and spiritual benefits, so there are manifestly many ways in which people currently benefit from biodiversity, as they have done throughout human history.

But it is possible that “the greatest value of the variety of life may be the opportunities it gives us for adapting to change. The unknown potential of genes, species and ecosystems is of inestimable but certainly high value. Genetic diversity will enable breeders to tailor crops to new climatic conditions, while the Earth's biota is likely to hold still undiscovered cures for known and emerging diseases. A multiplicity of genes, species, and ecosystems is a resource that can be tapped as human needs change.” (4)

These human-centred considerations are not the only reason for valuing biodiversity. There are many people who believe that biodiversity, especially in the form of highly intelligent species such as great apes, elephants and whales, should be valued for its own sake and not merely for its usefulness to humans. This view is eloquently expressed by the distinguished conservationist, David Ehrenfeld:

“The non-humanistic value of communities and species is the simplest of all to state: they should be conserved because they exist and because this existence is itself but the present expression of a continuing historical process of immense antiquity and majesty. Long standing existence in Nature is deemed to carry with it the unimpeachable right to continued existence” (5).

Given its undeniable value, it is disturbing that biodiversity is so obviously and so widely being used unsustainably, or wantonly destroyed for short term commercial gain. There is thus an urgent need to take all possible steps to reduce the rate of biodiversity loss in Africa. Effective action will require contributions from African governments and conservationists, international conservationists working in Africa, and the provision of adequate financial resources by rich countries.

References

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5. <http://redpath-museum.mcgill.ca/Qbp/2.About%20Biodiversity/importance.html#non-humans>
Ehrenfeld, D. 1972. *Conserving Life on Earth*. New York, NY: Oxford University Press



News in Africa

Guinea creates the first African vulture sanctuary

Source: Guy Rondeau, Afrique Nature International, 20 November 2006

To conserve some of the last populations of six species of vultures in West-Africa, Guinea has created a new protected area in the Fouta Djallon Massif, with a size of approximately 450,000 ha.

According to Guy Rondeau, main threats to these 'epidemiological containments', consists of killing of the birds for medicinal purposes and fetishism, as well as for meat; collection of the eggs and death through scavenging on carcasses of problem animals such as hyenas and lions poisoned by farmers. Other factors influencing the decline in vultures could be the lack of carcasses due to the disappearance of large game and better health of farm animals.

Afrique Nature International, in collaboration with Fauna and Flora International, the Endangered Wildlife Trust and Guinée Ecologie have established a regional programme to prevent the vultures in West-Africa from going extinct, entitled Duga. The goal is to stabilize rediscovered populations, which currently do not benefit from any protection, in rural areas in Guinée, Mali and Gambia.

For more information, please see:

<http://www.afnature.org>

or write to: g.rondeau@afnature.org

Largest Conservation Park in the world: Kavango-Zambezi Transfrontier Park

Source: BBC, 28 June 2007

While the biggest game park in Africa is currently the Great Limpopo Transfrontier Park, a Memorandum of Understanding signed in December 2006 between Botswana, Zimbabwe, Zambia, Namibia and Angola paves the way for the establishment of the largest park in the world: Kavango-Zambezi Transfrontier Park (or Kaza Park). The park shall cover 280,000 km², encompassing the Okavango and Zambezi river basin, including a total of 36 national parks, game reserves, community wildlife areas and wildlife management areas such as Victoria Falls, Okavango Delta, Chobe Game Reserve and Caprivi Strip. It is anticipated that the park shall be fully established in 2010 and shall attract up to eight million tourists to the region, as well as generate employment.

For more information, please see:

<http://www.kazapark.com/>

Draft Norms and Standards for the Management of Elephants in South Africa

Source: Website of Ministry of Environment and Tourism, South Africa, 28 February 2007

On 2 March 2007, the Government of South Africa published the Draft Norms and Standards (DN&S) for the Management of Elephants in South Africa. In the light of the idea that scientific information alone cannot resolve value differences, policy guidelines were needed to provide a framework within which government can make decisions, and within which management plans can be formulated by agencies responsible for protecting elephants and the ecological systems in which they exist.

Guiding Principles, that will inform decision making, are based on respect for elephants, reverence for humans and recognition that policy makers are faced with a degree of scientific uncertainty in their decision making.

The DN&S therefore provide for population control of elephants using one or more of the following options:

- range manipulation (meaning water supply management, enclosure or exclosure, the creation of corridors of movement between different areas or the expansion of the range by acquisition of additional land)
- removal by translocation;
- introduction of elephants;
- contraception; and
- culling.

Numerous individuals and organizations commented on the DN&S, and the consolidated document with comments will be discussed with relevant stakeholders and finalized.

For more information, please see:

<http://www.info.gov.za/gazette/notices/2007/29674.pdf>

Zimbabwe dehorn's rhino's

Source: Reuters, 1 June 2007

Zimbabwe's Parks and Wildlife Authority announced that it shall engage in dehorning of black and white Rhino's in order to deter poachers. The horns shall be kept in a secured place for Zimbabwe's future generations.

Congo Basin receives US\$ 98 million from British Government

Source: Reuters, 29 March 2007

At a news conference, the British Ambassador to the Democratic Republic of Congo announced that the British government shall deposit 50 million pounds (US\$ 98 million) to the African Development Bank, to start an African environment fund as requested by an African Union summit in January in Addis Ababa. In order to safeguard the Congo basin ecosystem, ten central African countries seek a total of US\$ 2 billion to fund a conservation plan agreed upon in 2005 and envisaged to run until 2013.

News Worldwide

IPCC adopts major assessment of climate change science

Source: IPCC, 2 February 2007

On 1 February, Working Group I of the Intergovernmental Panel on Climate Change (IPCC) adopted the Summary for Policymakers of the first volume of "Climate Change 2007: The Physical Science Basis" also known as the Fourth Assessment Report (AR4). The report draws on work by about 2500 specialists from more than 130 nations and assesses the current scientific knowledge of the natural and human drivers of climate change, observed changes in climate, the ability of science to attribute changes to different causes, and projections for future climate change.

The report says it is at least 90% certain that mankind is to blame for the warming in the last half century, and that temperatures will rise by 1.8 to 4.0 degrees Celsius this century.

For more information, please see:

<http://www.ipcc.ch/SPM040507.pdf>

12.4% of the total of 9,821 extant bird species in the world is considered threatened with extinction

Source: BirdLife International, 21 May 2007

Of the total of 9,821 extant bird species in the world, 1,221 species of birds, representing 12.4%, are considered threatened with extinction. BirdLife International's annual Red List update made known that "an additional 812 bird species are now considered Near Threatened, adding up to a total of 2,033 species that are urgent priorities for conservation action. The overall conservation status of the world's birds has deteriorated steadily since 1988, when they were first comprehensively assessed. Now, more than a fifth (22%) of the planet's birds is at increased risk of extinction".

For more information, please see :

www.birdlife.org/datazone/species/index.html

ZSL launches The EDGE of Existence programme

Source: ZSL, January 2007

The Zoological Society of London (ZSL) launched the EDGE (Evolutionarily Distinct and Globally Endangered) programme to protect some of the world's most bizarre and unusual animals. It is the first global-scale programme which will focus on those species with few close relatives and which are highly distinct genetically. These animals are also extremely endangered and desperately in need of immediate action to save them from becoming extinct.

ZSL is starting work to protect ten EDGE species this year, including the Yangtze River dolphin, Attenborough's long-beaked echidna (egg-laying mammal), Hispaniolan solenodon (venomous shrew-like creature), Bactrian camel, Pygmy hippopotamus, Slender Loris (a shy, nocturnal primate with gigantic eyes), Hirola antelope (antelope known as "four-eye antelope", as their preorbital glands look like a second set of eyes), Golden-rumped elephant shrew (the size of a small rabbit; can run at speeds of up to 25km/h), Bumblebee bat (possibly the world's smallest mammal), Long-eared jerboa (mouse-like animals with the largest ear to body ratio of any mammal).

For more information, please see:

<http://www.edgeofexistence.org/home.asp>

FAO News

The Working Party on Wildlife and Protected Areas (WPWPA) of the African Forestry and Wildlife Commission (AFWC): Looking at its achievements and potentials for improvement

Source: Nhantumbo, March 2007

The Working Party on Wildlife and Protected Areas (WPWPA), a subsidiary body of the African Forestry and Wildlife Commission (AFWC), has been the object of an independent evaluation.

The AFWC is one of the FAO statutory bodies, created in the 1950's. According to the Statutes and Rules of Procedure approved by the FAO Council in November 1988 its mandate is '...to advise on the formulation of forest policy and to review and coordinate its implementation at the regional plane, to exchange information and generally through special subsidiary bodies, advise on suitable practices and action in relation to technical problems, and make appropriate recommendations...'.

The WPWPA was established in the early 1960s as a subsidiary body of the AFWC. Its first mandate was to draft the African Convention on Wildlife Conservation. This later expanded to include the addressing of emerging issues and to respond to the continuous internal reflection, monitoring and strategic evaluation of its role in wildlife management in Africa. In 1978 the FAO Assistant Director General and Director of Forestry Department highlighted three reasons *why* the Working Party played an important role in FAO's business: (i) Wildlife as a source of food demands prominence in respect to sustainable utilization and science based cropping for increased production of protein for human consumption; (ii) Wildlife provides opportunity for increased foreign exchange earning through responsible tourism; (iii) The recreational role of wildlife.

In October 2006, the FAO Regional Office for Africa commissioned an assessment of the WPWPA. The focus of the assessment was to review the documentation of the various meetings of the WPWPA and analyse the issues addressed over the years and the challenges encountered in the process; as well as to discuss the issues through interviews with key stakeholders within the AFWC/WPWPA, fairly covering all regions in Africa. The aim of the assessment was to respond to some critical aspects including (i) the functionality of the Working Party in terms of mandate, relevance, structure and linkages with its main body the AFWC; (ii) the benefits brought by the WPWPA to the AFWC and wildlife management in Africa and (iii) the lessons that could be the base for consolidating achievements and making improvements. The assessment was concluded in March 2007 with the report outlining the main findings and recommendations.

According to the report of the independent evaluation, Africa still needs a platform such as WPWPA that brings together member countries and other stakeholders to jointly address the many challenges related to wildlife management and protected areas. The report highlights main areas of importance regarding the functionality of the WPWPA: issues with the membership representation; the mandate; the leadership as represented by the bureau, who owns and drives the working party; and finally the priority of wildlife within FAO.

The report made two urgent recommendations: the first calls for a new vision on the role and responsibilities of the WPWPA whose focus must be more about responding to key issues in wildlife sector relevant to the region; the second

recommendation demands a new Terms of Reference (TOR) embodying the new vision for WPWPA.

The AFWC held its second Intersessional meeting in Rabat, Morocco in July 2007 during which it approved the report of the independent evaluation of the WPWPA. It also agreed to set aside an entire day during the next regular session of the AFWC commission in early 2008 to discuss wildlife and protected area issues including a review of the recommendations of the evaluation report. This meeting is seen as an opportunity for developing a roadmap for a reform and a revamping of the WPWPA/AFWC. The reform, it is envisaged, would align the Working Party activities with current and emerging international discourse and overarching goals. For more information on WPWPA and AFWC visit:

<http://www.fao.org/forestry/site/afwc/en>

AFWC Inter-sessional: 16th AFWC and 18th NEFC sessions to be held in Sudan in early 2008.

Source: E. Mansur, July 2007

The second intersession meeting of the Bureau of the African Forestry and Wildlife Commission (AFWC), and that of the Near East Forestry Commission (NEFC) were held in Rabat, Morocco, between 3 and 5 July 2007. For the first time, two Commissions' intersessional meetings were held together, taking advantage of the fact that both Commissions have 9 Northern African countries as common members.

On the occasion, Sudan formalized its offer to host the next sessions of both Commissions. The proposal, warmly welcomed by the two Bureaus, will allow for the 16th AFWC and the 18th NEFC to be simultaneously held in Khartoum, from 17 to 22 February 2008. It promises to become a major forestry event for Africa and the Near East.

In line with the current global debate, the AFWC Bureau proposed the theme of "*Forests and Wildlife in a Changing Environment*" as the overarching issue for debate, highlighting the importance of forests and wildlife relations with other sectors, and with activities of common influence.

The joint sessions will be preceded by two Seminars, one concerning 'Forests and Climate Change', and another on 'Institutional Adaptation: Governance and decentralization in forestry and wildlife related sectors in Africa'. The conclusions and recommendations of the pre-session Seminars will be brought to the attention of the Commissions for approval and endorsement.

For more information, please see www.fao.org/forestry/site/31088/en or contact the Secretaries of the Commissions (eduardo.mansur@fao.org for AFWC; djiby.kone@fao.org for NEFC)

FAO's Forestry Department establishes Community-based Tree and Forest Enterprise Development (CBED) Programme with funding from the Norwegian government.

Source: FAO, 3 February 2007

An innovative new approach from FAO is helping poor people around the world turn trees into cash income - without felling the trees. It's not just timber companies that benefit from forests -- about 1.6 billion people worldwide depend on them for all or part of their livelihoods. And they often do so in ways that don't always involve cutting down trees, but through harvesting of renewable, non-wood forest products.

Fruits, nuts, herbs and spices, resins, gums, fibres -- all these non-wood forest products (NWFPs) provide poor families around the world with food, nutrition and income. Indeed, some 80 percent of the population of developing countries use such products in one way or another to meet health and nutritional needs.

People could do even more with these renewable resources in order to fight hunger and poverty. There are possibly more efficient ways to harvest and process them into products that sell for more in local markets, and can be marketed overseas as well. That is why FAO's Forestry Department established its Community-based Tree and Forest Enterprise Development (CBED) Programme with funding from the Norwegian government. Under the programme poor communities are helped to set up, sustain and grow small businesses while giving them incentives to better manage and protect their resource base, allowing them to tap the wealth of nearby forest resources without hurting or depleting them.

In CBED projects, FAO teams up with government extension agents and non-governmental organizations to work with forest communities and learn how they are making use of the available forest products. Using a participatory learning process, detailed surveys of local forest resources are conducted, studies of local and regional markets are undertaken and new products, manufacturing and marketing opportunities are identified. At the same time, the communities draw up management plans for the sustainable use of the targeted natural resources and develop business plans for pilot

enterprises, which run from harvesting, production and processing to marketing.

For more information, please see :

<http://www.fao.org/newsroom/en/field/2007/1000487/index.html>

FAO and UNEP to lead GEF's cross-cutting Strategic Programme on Sustainable Forest Management

Source: FAO, July 2007

The Global Environmental Facility (GEF), the funding mechanism that supports implementation of Multilateral Environmental Agreements (MEA), initiated a cross-cutting programme on sustainable forest management. FAO and UNEP were defined as leading agencies of the initiative, which focuses on two Strategic Objectives:

1. *Conservation of globally-significant forest biodiversity*, aiming to contribute to forest biodiversity conservation and sustainable use in protected area systems;
2. *Sustainable management and use of forest resources*, aiming at the sustainable management of production forests.

Under Protected Areas, the new strategic programme will focus on projects that will demonstrate clear additionality and global environmental benefits on:

- Sustainable financing for Protected Area systems;
- Strengthening terrestrial Protected Areas networks;
- Forest conservation to protect carbon stocks and avoid CO₂ emission.

Under Production Forests, the project will target global environmental additionalities in:

- Strengthening policy and regulatory framework to mainstream forest biodiversity;
- Prevention, control and management of invasive alien species in forest ecosystems;
- Fostering markets for forest biodiversity goods and services;
- Sustainable forest management (SFM) in production landscapes;
- Promoting sustainable energy production from biomass.

Funds for projects under this new strategic programme are being allocated from the GEF thematic areas of Biodiversity, Land Degradation and Climate Change.

For more information and for the development of project ideas, please contact the FAO GEF Focal

Point at the Forestry Department (wulf.killmann@fao.org), the Forestry Officers of your FAO Sub-Regional office, or the Regional Forestry Officer in your Region (eduardo.mansur@fao.org in Africa, djiby.kone@fao.org in the Near East, patrick.durst@fao.org in Asia, and carlos.carneiro@fao.org in Latin America and the Caribbean).

Thematic News

CITES COP 14

Source: CITES, Nature, BBC, ENS, June 2007

From 3-15 June 2007, the 14th Conference of the Parties (COP) to the Convention on International Trade in Endangered Species (CITES) was held in The Hague, The Netherlands. The COP is administered by the UN Environment Programme (UNEP) and is held every three years to discuss international trade in species. Some of the following issues were discussed and decided upon:

- The international trade in ivory was banned in 1989. Only a one-off sale of a total of 50 tons of stockpiled ivory had been allowed from Botswana, Namibia and Zimbabwe into Japan, approved in 1997, and amounted to US\$ 5 million. While more than a dozen African countries, led by Mali and Kenya had asked for a 20-year moratorium on ivory trade, Botswana (20 tons), Namibia (10 tons), South Africa (30 tons) and Zimbabwe will be allowed an additional sale from stockpiles. Exports were agreed in principle in 2002, but were made conditional on the establishment of up-to-date and comprehensive baseline data on poaching and population levels. The elephant populations of southern Africa are listed on Appendix II, while all other populations are on Appendix I. No further sales from the four countries will be considered by CITES for nine years;
- Uganda's request to allow a limited export of leopard (*Panthera pardus*) skins was approved, Mozambique's request to increase the annual export quota for hunting trophies and skins was approved;
- The meeting called upon better cross-border regulation between countries along rhino horn smuggling routes and tougher domestic controls, as well as better management of horn stocks in response to concerns over a continued decline in rhinoceros populations;
- The trade in *Corallium*, red and pink corals, shall be limited;

- The red-tinted Brazil wood (*Caesalpinia echinata*) used for making violin bows, shall be protected against over-logging;
- The trade in three species of slow loris (*Nycticebus bengalensis*, *N. pygmaeus* and *N. coucang*) in South and Southeast Asia, traded as 'tame' pet primates, shall be banned;
- All trade in sawfish (members of the Pristidae family), occurring all over the globe, shall be banned;
- Proposals to regulate the trade in Spiny dogfish (*Squalus acanthias*) were rejected;
- CITES issued a statement on tiger breeding programmes, saying that they should be used for conservation only, as a response to China's intention to reconsider a 14-year-old domestic ban on trading tigers.

For more general information, please see:

www.cites.org/eng/news/meetings/cop14.shtml

www.iisd.ca/cites/cop14

<http://www.ens-newswire.com/ens/jun2007/2007-06-15-01.asp>

For information on the ivory trade, please see:

www.cites.org/eng/news/press/2007/070614_ivory.shtml

A new international, multidisciplinary initiative that promotes Agricultural biological diversity

Source: FAO, March 2007

A new international initiative on biodiversity for food and nutrition under the umbrella of the Convention of Biological Diversity has taken root. FAO, together with Bioversity International (formerly IPGRI), leads this new international, multidisciplinary initiative that recognizes the essential role of biodiversity and promotes its sustainable use for food security and nutrition, as a contribution to the achievement of the Millennium Development Goals. An innovative aspect of the initiative is that it promotes the use of local biodiversity/traditional foods of indigenous and local communities, within well-managed ecosystems, with their many sources of nutritionally-rich foods as a readily accessible, locally empowering, and sustainable sources of quality nutrition through dietary diversity. The overall aim of this collaborative effort is to promote the sustainable use of biodiversity in programmes contributing to food security and human nutrition, and to thereby raise awareness of the importance of this link for sustainable development.

In early 2008, FAO and Bioversity International intend to conduct the first West African Graduate Course on Food Composition and Biodiversity in Accra, Ghana.

For more information, please see:

http://www.fao.org/infoods/biodiversity/index_en.stm and

<http://www.biodiversityinternational.org>



Biodiversity and Climate Change

Neil Pratt¹

There can be few sights more emblematic of the impacts of climate change than the disappearing snows of Mount Kilimanjaro. Images from just a few decades ago, showing an abundant white cap on the majestic peak, contrast starkly with the tiny patch of glacier remaining today. Within 20 years, it is projected, the glacier may disappear entirely.

Beyond this very visible symbol of the changes humans have made to the natural systems of the planet, the mountain holds a more subtle message for the African continent and beyond. It demonstrates the vital link between climate change and the urgent need to conserve the dwindling variety of life on Earth.

Kilimanjaro has lost more than its glaciers. In the last 30 years, it is estimated that around 10 per cent of the richly-diverse cloud forests on its slopes have been lost to fire, in part provoked by the hotter and drier conditions that have caused the snow and ice to disappear. The mountain forests have also been diminished by illegal logging and by clearing for plantations of crops and fast-growing alien tree species.

The impact of this deforestation on the lives of people in the region is arguably much greater than the disappearance of Kilimanjaro's cap of ice. While the glacier has provided some water to the rivers that flow off the mountain, a far greater quantity has been trapped by the trees from the clouds that swirl around it, and filtered through the lush vegetation into watercourses. According to a recent report by the Organization for Economic Co-operation and Development (OECD), the fresh water lost to Tanzania and Kenya from the destruction of cloud forests since 1976 is equivalent to the annual drinking water needs of around three million people.

Protecting the remaining forests of Kilimanjaro therefore has immense practical value to communities in the region, helping to secure a regular supply of water over a wide area at a time when drought is likely to become an increasing problem. This is apart from the scientific value of conserving unique plant and animal species in the Eastern Afro-Montane biodiversity "hotspot" areas of exceptional diversity under a high level of threat.

The wider lesson from this example is that protection of biodiversity can often help directly in the effort to help people adapt to climate change, an effort whose urgency is becoming ever-more apparent across the African continent. Whatever steps are taken worldwide to reduce the emissions linked to global warming, they will unfortunately be too late to save the snows of Kilimanjaro. Investing in the biological diversity of the mountain, on the other hand, could make its ecosystem far more resilient to the further impacts of climate change in the coming decades.

In recognition of the link between these two great challenges facing the planet, the Convention on Biological Diversity made biodiversity and climate change the theme of this year's International Day for Biological Diversity, on May 22nd.

The last thing we want to do is to inflict yet another story of doom and gloom onto a public weary of being told of new ways in which the planet is being wrecked. Rather, we believe we can highlight a message of hope: that if priority is given to strengthening the ecosystems of Africa, the prospects for human development on the continent can be made very much brighter.

The connections between biodiversity, climate change and the reduction of poverty were made clear in the Millennium Ecosystem Assessment (MA), published in 2005. One of its overriding conclusions was that the rural poor are most directly dependent on the wide range of services provided by well-functioning ecosystems, from the provision of fish, crops and fresh water to protection from natural disasters and regulation of pests and disease. Two-thirds of these services were found to be in decline worldwide.

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Another important point arising from the assessment was that these services are underpinned by the diversity of living organisms - biodiversity - from the smallest insect to the largest mammal, and that the benefits we derive from ecosystems can be jeopardized when parts of this web of life are removed.

Climate change emerged in the MA as a factor that would become increasingly important as a driver of biodiversity loss in coming decades. Animal and plant species have adapted to past climate shifts through evolution and migration, but fewer options are now available due to the pace of change and the conversion of potential habitats to other uses such as cities and farmland.

Even if all burning of fossil fuels were stopped today, global temperatures could be expected to rise for several more decades, since current concentrations of greenhouse gases are the result of past as well as present industrial activities. This does not, however, mean we need to be fatalistic about the impacts of climate change on biodiversity and the benefits it brings.

Investment in the resilience of ecosystems can take the form of reducing any or all of the various human pressures we know to be threatening them. Loss of habitat, over-exploitation of wild species through hunting and fishing, pollution and introduction of alien invasive species are each identified in the MA as important factors directly driving loss of biodiversity. If sufficient priority is given to addressing these issues, some at least of the negative impacts of climate change may be avoided.

In many parts of Africa, efforts are under way to use biodiversity protection as a tool to improve climate change adaptation. One example is the Sustainable Livelihoods Framework in the drylands of Sudan, where millions of people are entirely dependent on rain-fed agriculture, and therefore extremely vulnerable to the increased periods of drought projected to be an impact of climate change. The process of desertification, in which soils become so degraded that it is impossible to grow crops or to graze livestock, results from a combination of drier conditions and poor use of the land; so this project looks at ways in which better management can improve the productivity of soils and prevent the migration of people which has exacerbated social conflicts including the unfolding tragedy in Darfur.

In the Bara province of Northern Kordofan State, for instance, a pilot project has helped villagers to carry out activities such as replanting sand dunes with native species which can help stabilise them, the collection and storage of rainwater for use in dry periods, and the construction of windbreaks to prevent soil erosion. Early evaluation of this project - and another similar example in Darfur itself suggests it is having good results for local livelihoods. It shows how simple measures can add resilience to an extremely fragile ecosystem, and so help to protect people from the worst effects of climate change.

In another program led by the Center for International Forestry Research (CIFOR), efforts are being made to explore policy options to reduce climate change impacts on the forests of the three West African countries of Mali, Burkina Faso and Ghana. Part of the Tropical Forest Climate Adaptation project funded by the European Union, this is at an early stage. However, it is looking at ways to enhance livelihood options from non-destructive activities such as the sale of baobab fruit and butter made from shea nuts, and minimise the stress placed on these ecosystems through unsustainable logging and over-grazing of livestock. Once again, the focus is on using protection of biodiversity to help bolster ecosystems against climate change, and thus improve the development prospects for people in the region.

Another African ecosystem with exceptional vulnerability to climate change is the area known as the Cape Floral Kingdom on the South-Western tip of South Africa. Its unique combination of Mediterranean-style climate, soil type and susceptibility to fire has produced an extraordinary variety of plants - more than 7000 species, of which 80% are endemic, in other words they occur nowhere else in the world. It is feared that changes in soil moisture and winter rainfall patterns could drive many of these species to extinction. Among the strategies being looked at here is the expansion of existing protected areas, and the creation of "migratory corridors", to give species greater opportunities to shift their ranges over time as local conditions change.

Throughout Sub-Saharan Africa, climate change is likely to intensify pressure on water resources as authorities struggle to meet the competing demands of households, agriculture, industry and aquatic wildlife. Here, too, biodiversity protection can play an important role. A project to restore degraded wetlands in several river basins running through South Africa's Kruger National Park is attempting to reverse some of the damage caused by

erosion and the reduction of flows through over-sedimentation at the same time, it is helping local livelihoods by protecting vegetable plots in the valley bottoms, and conserving plant species used in traditional medicine.

Under the Convention on Biological Diversity, virtually all governments have agreed to the very challenging target of slowing the loss of biodiversity by 2010. The time has come to recognize that meeting this target is an essential step in making future generations in Africa better able to prosper in the less stable climate they will unfortunately inherit.



Conservation and development: The influence of accessibility, participatory management and immigration around the Bénoué National Park in Cameroon

Dominique Endamana¹, Jeffrey Sayer², Gilles Etoga³ and Lambert Bene Bene⁴

Summary

This article evaluates the state of conservation and development of the landscape of Bénoué National Park and its surroundings in Northern Cameroon. Thirty indicators classified into five “capital asset” groups were the object of a participatory judgment between 2nd and 13th May 2006, by 13 local communities living in the hunting areas around the park. The mode of evaluation based on the scales of value going from 1 (worst situation) to 5 (optimal situation) was used. The data collected were presented in a spider web diagram to show the weak and strong points of each category of asset: natural, social, human, physical and financial, on the assumption that the different categories of assets are exchangeable. The overall results of the landscape show that local stakeholders perceive the natural asset as being weaker compared to other categories of assets. The national road that passes through the network of protected area and links the two big towns of Garoua and Ngaoundere, the immigration, the mode of involvement of the population in the management of natural resources are the main factors which affect the landscape. It is necessary to think of the best way to reconcile the conservation interests with those of development through the development of scenarios to stimulate communication between stakeholders in the landscape and national and international decision makers. The internalization of the conservation of biodiversity within communities and decentralized municipalities benefiting partly from land lease taxes is yet to be promoted. It is the same for the development of synergies between the ministry responsible for wildlife and protected areas and other departments that influence the management of natural resources.

Key words: Biodiversity, conservation, development, landscape, capital assets, Bénoué National Park

1. Introduction

In *Sauver la Planète*, (Save the Planet) published in 1991, the International Union for the Conservation of Nature (IUCN), the United Nations Environmental Programme (UNEP) and the Worldwide Fund for Nature (WWF) presented a “strategy for the future of life” the main elements of which were on one hand the link between conservation and development (C& D), and on the other the recognition of the importance of “giving to communities the means to manage their own environment”. For this reason, field projects interventions aim to improve the living conditions of the people as well as the state of the environment. Thus, the conservation and integrated development approach is gradually being incorporated into the plan of activities of organizations responsible for the conservation of biodiversity. This initiative operates in large areas (territory or landscape; ecosystem; eco-region ...) (Sayer and Campbell, 2004). Sayer *et al.* (2006) define territory or landscape as “a geographical conception which includes not only the biophysical components of an area, but also the social, political, institutional and aesthetic components”.

In Cameroon, several initiatives aimed at the dual C&D objective have been developed and implemented by the government with private partners (NGOs, Bilateral and Multilateral Cooperation). The most recent is the Biodiversity Conservation and Management Programme (BCMP) initiated in 1994 and implemented from 1995 to 2003. Its objective was to guarantee that ecological integrity remains permanent and to ensure that management of wildlife and flora resources contribute to the fight against poverty. In the northern Savannah ecosystem, several approaches have been tried from the protection of wildlife to the implementation of eco-development initiatives to improve the income of the populations. Decentralized local communities or municipalities and communities organized into judicial and legal entities benefit respectively 40% and 10% of the land lease tax, for the realization of social services.

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The problem is that in spite of all these initiatives, the results remain mitigated regarding the conservation and development balance because of the lack of a logical framework which enables identification of where the ideal balance between conservation and development should be. Where then is this balance between the two paradigms? Who has the right to take this decision? Sayer *et al.* (2006) observe that conservation organizations have very often made unjustified hypotheses regarding what is good for the fringe local populations in protected areas. Objective and fair processes are necessary and these must be accompanied by monitoring methods of performance indicators at landscapes level.

The WWF / World Bank alliance has developed a monitoring tool called "Rapid Evaluation Method and Classification of Management Priorities of Protected Areas" (RAPPAM) for assessing the effectiveness of the management of protected areas (WWF and World Bank, 2003), www.panda.org/about_wwf/what_we_do/forest/our_solutions/protection/tools/rappam/index.cfm). However, this instrument is limited only to monitoring the effectiveness of the management of protected areas without showing the impact of management on the change in the welfare of the fringe populations of protected areas. Consequently, in 2004 in Kribi, Cameroon, and in 2005 in Bayanga, Central Africa Republic (CAR), the WWF and the CIFOR undertook to train a team of experts to evaluate the performance indicators for C&D project/integrated programmes. The approach adopted is based on the conception of acquired results (Carney *et al.*, 1999, Sayer and Campbell, 2004). The hypothesis is that local stakeholders can agree on a series of indicators of key assets to provide a basis for performance evaluation of the landscape.

This approach was implemented during the fourth phase of the bilateral programme between the WWF of the Netherlands and the WWF Programme for Cameroon to examine the link between conservation of biodiversity and the improvement in the welfare of the fringe populations of protected areas.

The current study shows how to evaluate these indicators of change in the landscape of the Bénoué National Park and its environs. This simple tool enabled us to monitor the impact of interventions which aim at promoting C&D at the landscape level. Furthermore, the tool will help to improve vertical communication (between the local people, the technical staff on the ground responsible for the management of the landscape, donors and regional decision makers) and horizontal communication (the comparison of results of the different sectors of the landscape) (Sandker, 2006).

2. Study area

The area of study covers all the eight Hunting Areas of Interest (HAI) which surround the Bénoué National Park (figure 1). This whole area constitutes the Technical Operational Unit (TOU). The Bénoué National Park (BNP) is situated between latitude 7°55 and 8°40 North and longitude 13°33 and 14°02 East. Administratively, it is located in the Mayo Rey district. The park and the HAIs cover a total area of 800 000 ha 77.5% of which is meant for sport hunting and human activities. The borders of the HAIs are determined by Ministerial Decree N°0580/A/MINEF/DFAP/SDF/SRC of 27th August 1998. Compared to the park which is for conservation, the HAIs are for sustainable exploitation of fauna. These HAIs differ from one another, according to the management mode. Some are leased to guides (HAI 2, 3, 5, 7, 9 and 15) who organize safaris and others (HAIs 1 and 4) are under community and administrative joint management. A tarred road borders this park and links the Northern Province of Adamaoua, crossing HAIs No 1, 4, 5, 7, 9 and 15. An un-tarred feeder road with less traffic passes through the others, No 2, 3 and 9. In each HAI the local communities are organized into legal entities to promote sustainable management of natural resources and sound management resulting in financial gains. Each legal entity is managed by an executive committee called HAI management committee (HAIMC) where each village is represented by at least one person. The area of study comprised more than one hundred thousand inhabitants more than 60% of whom are migrant populations from the extreme north and from neighboring countries like Chad and the Central African Republic in search of fertile soil.

3. Methods and tools for data collection

The methodology is based on a procedure of participatory selection of indicators, their validation and the collection of data by a representative group of local stakeholders.

3.1 Choice and validation of indicators

The choice of indicators was a complex exercise which calls for the participation of several stakeholders on the ground. A participatory approach for selection and evaluation of indicators for monitoring C&D performance of the landscape was drawn up. Sayer and Campbell (2004) recommend a maximum of 30 indicators grouped into 5 types of assets: natural, social, human, physical and finally financial represented in figure 2. The approach is based on the principle of interchangeability of different categories of assets. A loss of natural asset could be justified if it results in the improvement of another category of asset. Monitoring of indicators should be modified according to the distinctive characteristics of the areas. In the Sudan-Sahalian site of Northern Cameroon, the background study on the management of natural resources around the BNP led to the drawing up of a five-year action plan of communities of HIA 1 and 4. The list of monitoring indicators of the landscape was drawn up, discussed and then validated during the scientific committee meeting of the BNP in May 2006.

3.2 Data collection

Data were collected over 2 weeks, between 2nd and 13th May 2006, in eight HAIs surrounding the BNP through surveys of representative sociological groups. The objective was to evaluate the state of the whole landscape and also differentiate by sub areas the said landscape according to the conditions of management of natural resources and accessibility. The groups for the selection and evaluation of indicators comprised members of the executive committees of legal entities of the respective areas, assisted by the village chiefs, women and the youth. Table 1 shows the indicators used, grouped into 5 types of assets. They are on a scale of 1 to 5. Value 1 represents the worst case and 5 is the optimal situation, that is to say the desired state. Several studies used this approach to evaluate the landscape and the impact of change (Campbell *et al.* 2001; Sayer and Campbell. 2001, Buck *et al.* 2006).

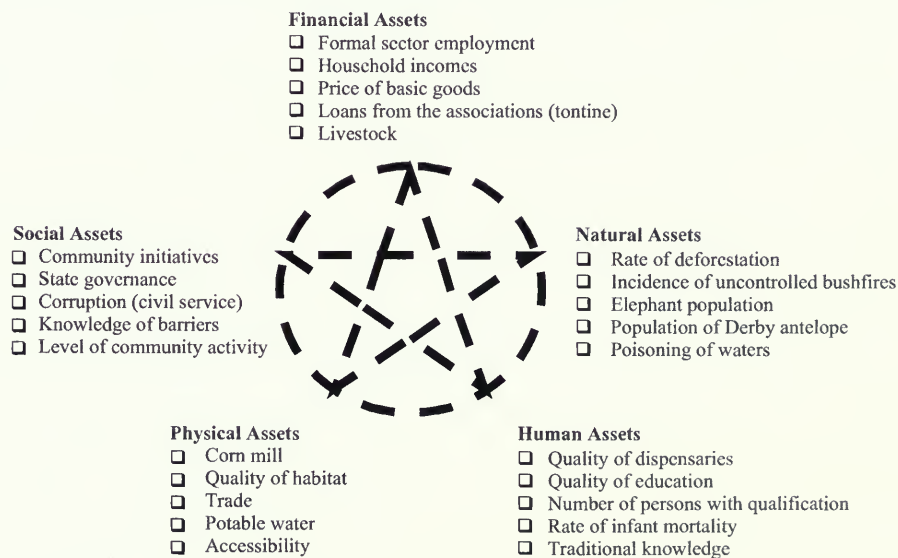


Figure 1: Monitoring indicators on Conservation of biodiversity. Welfare of the people in the BNP landscape and its peripheries
Source: Adapted from Sayer *et al.* (2006)

A mark was given to each indicator by the people in a concerted manner. These assessments were supported by precise examples and figures. The data collected were captured on an Excel sheet. For each asset, an average mark was calculated and placed on an axis. This made it possible to show the strengths and weaknesses of the landscape as expressed by stakeholders on a spider web diagram. The quantitative data collected by the WWF on the social works enabled the calculation of ratios of certain socio-economic parameters. MS Excel was used to process the data. The mean averages were calculated with the help of this software. Given our small sample (n=8 HAIs), a test of statistical comparison of averages of parameters between the sub sectors was not done.

Table 1: Indicators of the Conservation – Development situation of the landscape of the Bénoué Technical Operational Unit (TOU)

Source: Adapted from Sayer et al. (2006)

	Assessment scale of indicators				
	5	4	3	2	1
Natural asset					
Rate of deforestation (felling of wood)	Zero	0% - 1%	1% - 2%	2% +	Major deforestation
Incidence of uncontrolled bush fires	Zero	A few isolated ones	Several	Big fires	Widespread fires
Elephant population	High growth	Slight growth	Stable	Slight loss	Great loss
Derby Antelope population	High growth	Slight growth	Stable	Slight loss	Great loss
Poisoning of waters	Zero flow of poisoned water	Very little poisoned flow	Half flow of poisoned water	>50% flow of poisonous water	All the water flows poisoned
Social asset					
Community initiatives CBNRM	Efficient systems in place on a large scale	CBNRM functional	Early systems in place	First attempts	Zero
State governance (number of active NGOs)	Very many	Many	Average	Not many	Non existent
Traditional governance (resolution of litigations)	Very equitable	Relatively equitable	Equitable	Inequitable	Very inequitable
Corruption (civil service)	Non existent	Uncommon	Common	Very common	Totally corrupt
Level of community activity	Very high	High	Average	Weak	Non existent
Human asset					
Quality of dispensaries (vaccination coverage)	Very good	Good	Average	Weak	Very weak
Quality of education (literacy)	Very good	Good	Average	Weak	Very weak
Number of people with qualification	Very many	Many	Average	Not many	Zero
Tate of infant mortality	High reduction	Reduction	Stable	Increase	High increase
Traditional knowledge	Very influential	Influential	Averagely influential	Hardly influential	Non existence
Physical asset					
Corn mill	Very many	Many	Average	Not many	Non existent
Quality of housing	Very good	Good	Average	Not quite good	Not good
Trade	Very diversified	Diversified	Averagely Diversified	Hardly diversified	Absent
Potable water	Very available	Quite available	Available	Hardly available	Absent
Accessibility	Much cheaper	Accessible	Averagely available	Difficult accessibility	Inaccessible
Financial asset					
Formal sector employment	Very many	Many	Quite a lot	Not many	Non existent
Household incomes	Very high increase	Increase	Stable	Reduction	High reduction
Price of basic products	Much cheaper	Cheap	Stable	Slightly expensive	Too expensive
Tontine	Very active	Active	Averagely active	Not very active	Non existent
Livestock	Very many	Many	Average	Very little	Non existent

The present approach has a limitation. Some indicators are qualitative since they are measured by the mere perception of the people. It will therefore be difficult to monitor the evolution of this type of indicator within the context of the area where immigration has increased.

4. Results

4.1 Some human development ratios

The socio-economic parameters presented in Table 2 involve sectors perceived as priority and vital for the people themselves. This concerns health, education, access to potable water, trade. There is a high consensus of local stakeholders that these capital assets are of utmost importance for the assessment of social welfare.

Table 2: Ratios of some development indicators for villages around the BNP in 2006

Sectors	Ratios
Health	
Inhabitant per Health Care	11176
Inhabitant per doctor	100587
Inhabitant per nurse	6707
Inhabitant per health assistant	7185
Education	
Pupil per school	286
Pupil per class	60
Pupil per teacher	72
Access to water	
Inhabitant per well	1037
inhabitant per borehole	2140
Trade	
Inhabitant per shop	585

The table shows a low presence of health infrastructure and personnel. There is one doctor for more than ten thousand inhabitants. Regarding education, the ratios are better, compared to those of the Mayo Rey District in general, which are 110 pupils per class and 110 pupils per teacher. Access to water is quite difficult, a well for a thousand inhabitants whereas one borehole serves more than two thousand inhabitants. Concerning trade, the number of shops is quite large. There is at least one shop and/or one small table in each village.

4.2 Evaluation of Conservation – Development assets

The evaluation of assets from the dual conservation – development objective makes it possible to know the influence of certain vectors of change on the landscape like accessibility, level of involvement of people in the conservation and management of natural resources and immigration.

4.2.1 Influence of accessibility

Figure 2 shows the perception of stakeholders of the situation in two of the sectors of the superimposed landscapes. The first sector of access is easy because a tarred road passes through, comprising HAI No 1, 4, 5, 7 and 15; and the other sector of access more difficult, because a feeder road passes through, comprising HAI No 2, 3 and 9. A look at the graph shows that there is a difference between each group of asset except the social asset evaluated at 3/5. The sector situated along the national road (tarred) presents better human, physical and financial assets than that of the sector situated along the feeder roads (untarred). This gap is more pronounced with the physical asset, followed by the financial asset. Regarding natural assets, the state of the environment is better in the villages accessible by the feeder road.

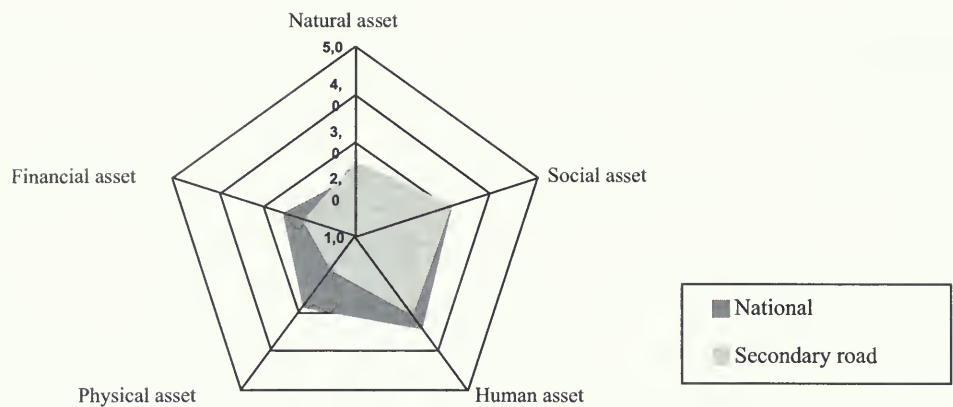


Figure 2: Comparison of the landscape of two sectors, served by the national road (tarred) and secondary roads (untarred)

4.2.2 Influence of the participatory management strategy of natural resources

Figure 3 shows the landscape in the HAIs leased to professional hunting guides and those of HAIs jointly managed by the administration and the local people. From the graph, these financial, physical and human assets are better in the areas of joint management than in the leased areas. Concerning social assets, the situation is rather better than in the leased HAIs.

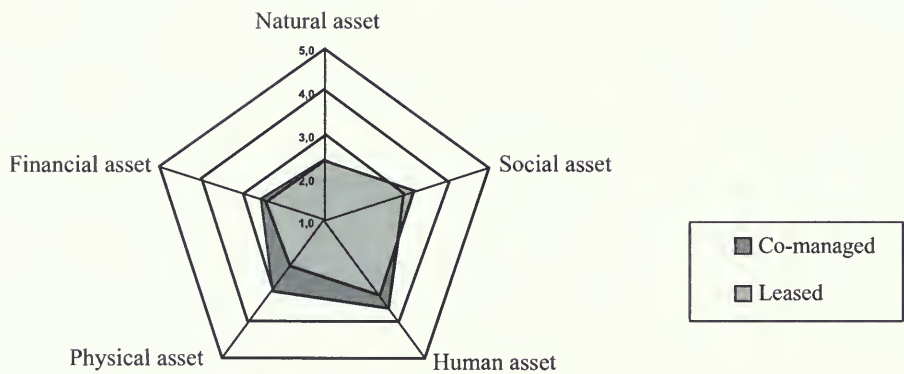


Figure3: Comparison of the landscape of two sectors located in the co-managed HAIs and leased HAIs

4.2.3 Influence of immigration

Figure 4 compares two types of landscapes: the first has a strong presence of migrants (HAI 1, 4, 5, 7, 9 and 15) and the second a weak presence or absence of migrants (HAI 2 and 3).

The graph shows that the natural asset is more degraded in the areas with high migration than the areas without the migratory phenomenon. Apart from the human and social assets where the difference is not very big, there is a big gap in the physical and financial assets.

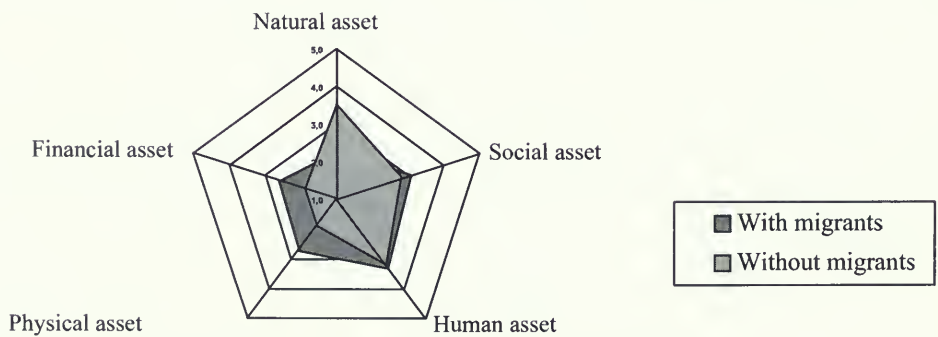


Figure 4: Comparison of the landscape of two sectors with and without migrants

4.3 Evaluation of the Bénoué TOU landscape

Figure 5 presents the entire Bénoué TOU landscape. The graph shows that the natural asset is highly degraded by deforestation, uncontrolled bush fires and rampant poaching. At the socio-economic level, the social and human assets are more developed than the financial and physical assets. Biodiversity is weak and show that the natural resources are under human pressure. Socio-economic development is therefore taking a toll on conservation.

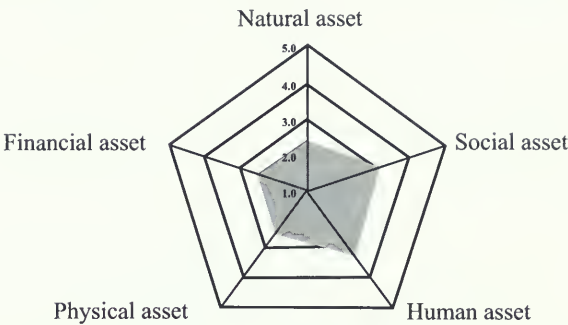


Figure 5: Landscape of the Technical Operation Unit (TOU) Benoue (park and hunting area)

4.4 Evaluation of indicators by hunting area

On a map of a Bénoué TOU the landscape for each hunting area is indicated (Figure 3). This visualization shows the differences between the natural heritage management and the state of the welfare of the people. Generally, the natural asset at the east of the TOU (HAI No 2 and 3) is still well managed. These areas are more enclosed and not much exposed to the migratory phenomenon. Concerning social and human assets, the difference is not great between the HAIs. Organisation of communities is effective in terms of community initiatives, traditional governance and community life. Concerning physical assets, the areas situated along the national road are better endowed compared to those situated on the feeder roads. Out of the 74 corn mills in the inventory, 92% belong to villages along the tarred road. These are the areas with a concentration of houses with roofing sheets (indicator of wealth). Trade is diversified with several shops. At the financial level, the same observation is made for physical capital, except in HAI 9 which is an area with high migration. The migrants are big-time farmers who produce and sell the fruits of their harvest. The prevalent of a dense population of Mbororo Fulani in this area explains the increase of livestock which is a financial indicator.

5. Discussion

5.1 Human development ratios

The social infrastructure present in health, education, access to potable water does not satisfy the needs of the people due to the migratory influx. 25973 inhabitants passed through the periphery of the BNP in 2000 (MINEF, 2002), 100 587 inhabitants in 2006 (Endamana and Etoga, 2006). Among the parameters for welfare, education seems to have the best ratio compared to the national average, but the quality is not good. Some classrooms do not have tables and chairs and the pupils have classes sitting on the floor. Most of the teachers are temporary and often unpaid. Some associations and professional hunting guides in the area take care of the salaries of these temporary teachers. Good educational structures will encourage good education for the children, especially environmental education.

With the poor level of health infrastructure the cost of healthcare is high. In the face of this constraint, the people resort to traditional medicine. Unsustainable use of medicinal plants could bring about scarcity or even extinction of these plant species. Since the health of the population has an influence on the management of resources, the area needs health infrastructure. Self-medication is practiced because of lack of doctors.

Water is a vital resource in the area, for the people, wild and domesticated animals. In the dry season, scarcity results in numerous conflicts. The lack of a water sources in villages and transhumance tracks would, according to cattle farmers, be one of the reasons for the presence of cattle in the Bénoué Park and in the HAIs. In some villages of HAI 4 and 5, the water sources are in the park. The permanent presence of people in the park results in other activities incompatible with conservation such as poaching and excessive felling of trees. Development programmes like National Participatory Development Programme (NPDP) or the West Bénoué Development Programme (WBDP) will be solicited to develop this infrastructure.

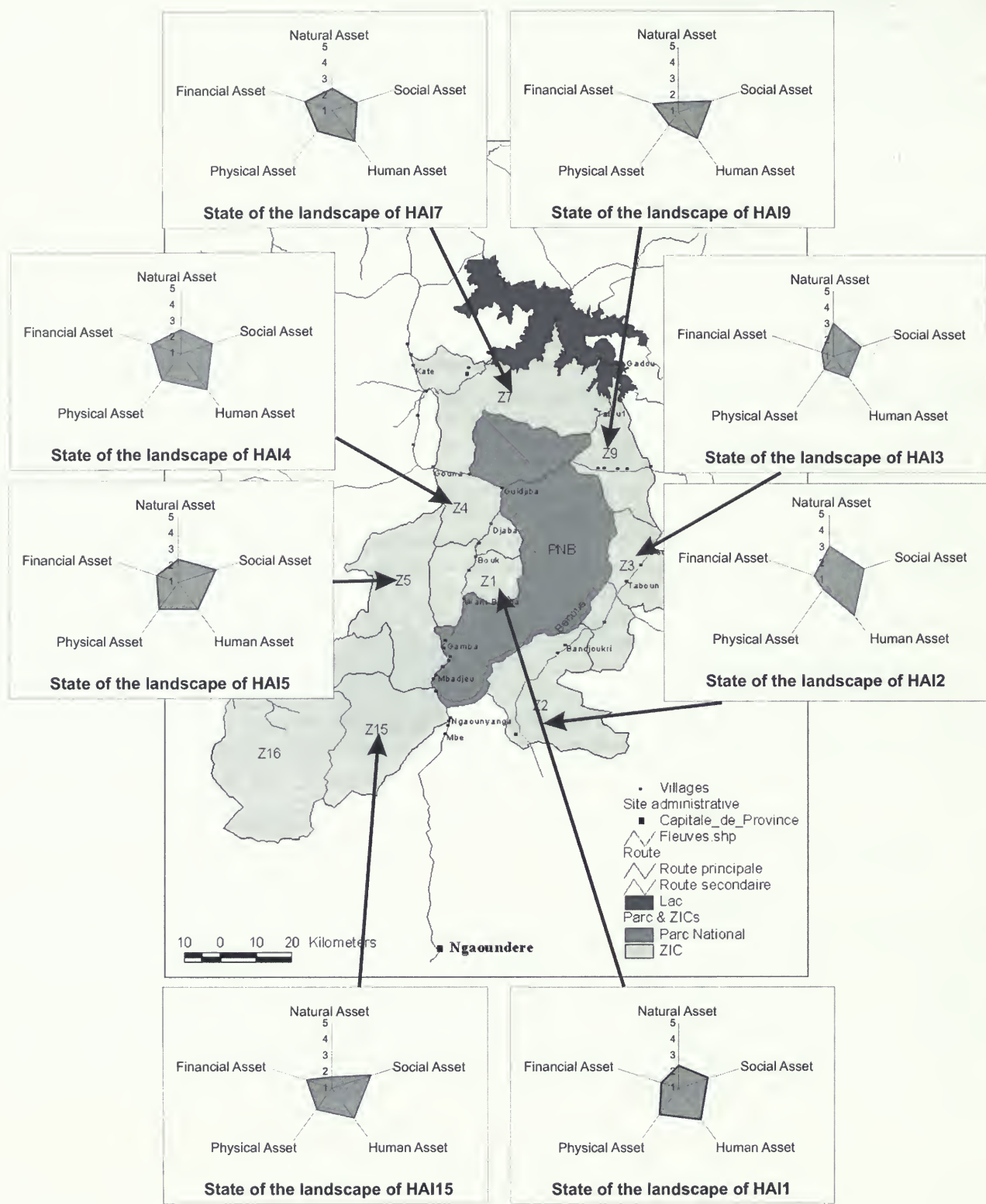


Figure 6: State of the landscape in each hunting zone.

Regarding trade, shops offer manufactured goods for basic needs such as soap, kerosene, matches, radio batteries, torches. Although not so well-stocked, the shops demonstrate the dependence of the populations on the local market. Almost every village has a weekly market. The development of trade could be an opportunity to enhance the development of eco-tourism in the area.

5.2 Accessibility

The BNP and its periphery are vulnerable due to the two national and district roads that serve the locality. This opening brings about a big change in the socio-economic, cultural and environmental plans. At the socio-economic level, the community management initiatives for natural resources exist and function in all the HAIs. The 14 legal entities created for the implementation of the PCMB encourage social works with the share of lease tax which is resold to them by the state (Endamana 2004). The Cotton Development parastatal (SODECOTON) and development projects have led to the emergence of Community Initiative Groups (CIG), and Economic Initiative Groups (EIG) in the area. Concerning finance, the villages situated along the national tarred road have easy access to the market. This road links the provincial capitals of the North and of Adamaoua. The road traffic encourages the supply and demand of resources like firewood and bush meat. The road also encourages settlement of migrants, whose main activities are agriculture, felling and trading in firewood. Urban centres like Mayo Bocki (HAI7), Gouna (HAI4), Sakdjé (HAI1), Gamba (HAI5) and Mbé (HAI15) are known as centres for sale of bush meat. Strategies must be developed to reduce the impact of this road which passes through the network of protected areas of the Northern Province. Concerning the environment, the strategy of corridors in HAI No 1, No 4 and No 5, initiated by the WWF to ensure connectivity between the park and the hunting areas is a good and far-reaching initiative. These corridors are for the moment the only means of guaranteeing the future of the network of protected areas in the province. They call for a strong involvement of public administration in the management of natural resources and the appropriation of these corridors by the local populations. The local people must be in the forefront since in the long term these hunting areas are likely to be converted into community hunting territory. An accompanying capacity building project for these populations is necessary.

5.3 Participatory management strategy for natural resources

The second vector which influences change in the landscape of the BNP and its periphery is the manner in which the local people and other stakeholders involve themselves in the management of natural resources. These changes are more noticeable at the level of physical, human and financial assets. Although it is the economic operators who seek to maximise profit, the guides are obliged to involve the fringe residents in the sustainable management of the RNs. Moreover, the terms of reference oblige them to maintain optimal population of wildlife. This is only feasible when the people feel involved in the management of the natural heritage. The fact that these people benefit at different levels from part of the lease tax, from permanent and temporary employment, negotiate and sign agreement, is proof of their participation in the management of natural resources (Endamana *et al.* 2005).

At the environmental level, the mode of joint management has no real influence on natural resources. This result must be confirmed by further studies on the impact of the mode of joint management applied to HAI 1 and 4 in the management of natural resources. This study is all the more important as fringe communities in these areas benefit from constant support from projects and the authorities. If they gained more at the financial level, it would have positive repercussions on changes in behaviour of people in order to preserve the natural heritage.

At the level of decentralized local communities, a strategy of social communication could result in the negotiation of a percentage (at 5%) of the amount of tax collected by communities to sustain the wildlife conservation. For this, it would be desirable to recruit community hunting guards who would come to the help of MINFOF delegations in the fight against poaching. The municipal advisors could then constitute themselves into messengers or links in their respective villages to sensitize the local populations on the contribution of wildlife to local development. The people must be made to understand that these natural resources are their heritage, and that in the end, the decentralization process could result in the management of these areas by the communities themselves. While maintaining the welfare of people, it is necessary to develop accompanying measures to minimize the impact on the environment. As already pointed out, this means actively involving the people in the surveillance of the sensitive areas, putting in place a mechanism for adequate ecological and socio-economic monitoring to enhance the quality of the environment and estimating the level of balance C&D. These results emphasize the fact that conservation organizations can no longer claim that improvement in infrastructure for access to areas of interest in wildlife is necessarily a bad thing. Considering the point of view of indigenous people, these constructions are greatly welcome.

5.3 Immigration

Immigration can be a vector of socio-economic change, but this development is not sustainable. It is a determining factor in the change of the landscape around the Bénoué National Park. The migrants arrive in waves each year in search of fertile land. The main activities as means of existence for this social group are agriculture (cotton) and trading in firewood. Immigration around the protected areas is a subject for reflection and calls for a strong intervention of the state which has international commitments to set up 30% of its territory as protected areas. The future of protected areas of the Northern Province will depend on the management of migratory influx.

An observation from the evaluation of the indicators is the changes which operate and help to give direction for interventions by the different stakeholders. It is all the more necessary since despite the numerous efforts through projects and programmes, the standard of living of fringe residents is low and degradation of natural resources remains. The ideal would be to have a figure to show the perfect balance between the asset groups. This is a situation to which the programme should turn its intervention. What is not the case today we observe is that the natural asset is weak to the benefit of other groups of assets. The exploitation of natural resources, especially fauna in the savannah ecosystem, should contribute to the improvement of living conditions of the populations and maintain natural resources to an optimal level (win-win option). Conservation of biodiversity should be internalized within the local interventions of decentralized local communities organized at the grassroots. In the plan of action of some communities, conservation activities like surveillance of the area by community guards and sensitisation should occupy a prominent position in the same way as social work.

6. Conclusions and Recommendations

This study shows a simple approach of evaluation of natural, human, social, physical and financial asset in a conservation – development situation of the Bénoué National Park landscape and its periphery. In the entire landscape, the state of biodiversity is unfavourable, compared to other assets (human, physical financial and social). The natural resources are exploited in an unsustainable manner. The factors which would affect this situation are among others, anarchic occupation of the space by migrants; the road linking the two provinces of the North and Adamaoua and that linking Guidjiba to Tcholliré; and finally the mode of involvement of the people in the management of natural resources.

The landscape of each HAI also depends on the types of relationship that the guides maintain with the fringe residents. Currently, it is clear that development in the living conditions of the people is relatively favourable, but this is at the expense of the environment. This situation is precarious. Since the principle should be that the results of the intervention of projects lead to a conservation – development balance (“win-win option”), changes in interventions are indicated. A reflection is necessary on the best way to reconcile the interests of conservation with those of development in the landscape. This reflection should be based on the conclusions of the application of a monitoring tool. This approach could enable the development of scenarios to stimulate communication between stakeholders in the landscape and national and international decision makers.

The WWF and its partners should maintain the option to facilitate a framework for effective collaboration between the different administrations involved in the TOU. The emphasis should be placed at the grassroots on the platform of collaboration between the hunting guides and local people. At the level of communities organized at the grassroots level, it would be desirable to incorporate more the conservation of the biodiversity in their action plans and in more sensitisation on the prudent use of national resources for the current and future populations with the aim of guaranteeing intergenerational equity. Decentralized territorial communities must also be encouraged to sustain the action of MINFOF in the fight against poaching, development and layout of basic infrastructure of the landscape and structures in it (roads, tracks, observation of animals hideouts, etc.) in order to promote tourism. They must work with and join all concerned parties in initiatives compatible with the conservation of the biodiversity.

List of abbreviations

CBNRM:	Community Based Natural Resource Management	PDWB:	Programme for the Development of West Bénoué
CCPO:	Cameroon Country Programme Office	PNB:	Bénoué National Park
CIFR:	International Centre for Forestry Research	NPPD:	National Programme for Participatory Development
DWPA:	Department of Wildlife and Protected Areas	PSSN:	Projet Savanes Soudanienne du Nord
CIG:	Community Initiative Group	CAR:	Central African Republic
GIE:	Economic Initiative Group	SDF:	Sous Direction de la Faune
MINEF:	Ministry for Environment and Forests	SODECOTON:	Société de Développement du Coton
MINFOF:	Ministry for Forests and Wildlife	UICN:	Union for the International Conservation of Nature
ONG:	Non Governmental Organisation	TOU:	Technical Operational Unit
BCMP:	Biodiversity Conservation and Management Programme	WWF:	World Wide Fund
		HAI:	Hunting Areas of Interest

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Forest Biological Diversity and Forest Tree and Shrub Genetic Resources: concepts, conservation strategies, priorities and values

Christel Palmberg-Lerche¹

Summary

The present paper discusses concepts, strategies and priority setting in the conservation of forest biological diversity. It focuses on the management of forest tree and shrub genetic resources, and reviews information on values derived from their sustainable use in support of local and national development. The paper highlights the need to address gaps in information on status and trends in forest biological diversity and genetic resources using relevant indicators, and to clarify variation and variation patterns in forest tree species as a basis for their conservation, breeding and sustainable use. It supports the notion that forest genetic resources action plans, based on country-derived information on status, trends and national priorities, should be placed within larger conceptual frameworks at regional and global levels in order to help strengthen the impact of efforts in individual countries and make full use of comparative institutional strengths among countries. In order to be sustainable over time, conservation and genetic management should also be incorporated in wider planning frameworks, such as national forest programmes and rural development plans.

1. Concepts and Definitions

“Forest biological diversity” denotes the variability among living organisms in forest ecosystems and the ecological processes of which they are part. It includes variation at landscape, ecosystem, species, population, individual, genetic and molecular levels of biotic organization (FAO 2007).

As the various levels of diversity are inter-related, a comprehensive approach to conservation is necessary. At the same time, it is essential to specify clearly the level or levels targeted by specific management action, as it is possible to conserve an ecosystem and still lose given species, and to conserve a species and lose genetically distinct populations, genes or valuable gene complexes. Goals for conservation and the management of forest genetic resources ought to be made explicit and agreed as broadly as possible at the beginning of any conservation effort (“of what, for what, for whom, how, with what time-scale and with what institutional and financial resources?”). Since economic, social and environmental priorities continually shift, conservation and management objectives will however need to be kept flexible to address new needs, and will need to incorporate new knowledge and understanding as they become available.

While it is recognized that the concept of biological diversity includes variation and genetic resources of plant, animal, insect and microbial species, the present paper is focused on the conservation of diversity through the management and sustainable use of forest tree and shrub genetic resources. Only general principles are referred to in relation to other groups of forest species.

2. Present situation

There is today a worrying loss of forest ecosystems in all tropical and sub-tropical regions caused by deforestation due to changes in land use. In addition, extensive tracts of forests and woodlands in most regions of the world are being degraded to various degrees through damage from pests, diseases, fire, atmospheric pollution, climatic fluctuations and lack of management or non-sustainable forest management practices.

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Over the past 35 years the number of international, regional and national institutions, mechanisms and discussion fora which are concerned with forests and forest biological diversity have greatly increased. These institutions, which generally cover different aspects of work, are discussed in some detail in a recent document by FAO on status and trends of the world's forest genetic resources (see Section 5, and Annex 1 of FAO 2007).

Increasing data is becoming available on status and trends of the forests of the world (see Box 1 and FAO 2006, 2007a). Information on changes in forest area and qualitative variables commonly recorded today cannot be directly used to estimate changes in variation at the level of species, provenances, populations and genes. However, forest loss and degradation can be expected to have overall negative effects on diversity. Reliable general data on forest resources is thus an important starting point for assessing and monitoring forest biological diversity and efficiently managing forest genetic resources.

Information is gradually also becoming available on status, trends and priorities in the management of forest genetic resources (see Box 2). However, such information is still incomplete and patchy. Monitoring diversity and variation at the different levels at which they occur is, furthermore, hampered by the lack of agreed-upon indicators to identify changes and trends (FAO 2007).

Box 1

TRENDS IN SELECTED VARIABLES RELATED TO BIOLOGICAL DIVERSITY IN FOREST ECOSYSTEMS

Africa. The area of primary forest in Africa decreased by some 270,000 ha annually during 1990-2005. However, information for this variable was based on only 46 countries that together accounted for 67% of the forest area, with information missing from most of the countries in the Congo Basin, which represents the second largest area of tropical primary forest after that of the Amazon Basin. Some of this decrease was caused by deforestation, some by alteration of forests through selective logging and other human interventions. This "altered" forest area was subsequently classified in the Global Forest Resources Assessment as, "modified natural forest". On the other hand, an increase of close to 3 million hectares since 1990 was documented in the area of forests designated primarily for the conservation of biological diversity.

General Conclusions: Progress towards sustainable forest management in Africa appears to have been limited over the past 15 years. There are some indications that the net loss of forest area has slowed down and that the area of forests designated primarily for the conservation of biological diversity has increased slightly. However, the continued, rapid loss of forest area (the largest of any region in the world during the 15-year period under review) is disconcerting.

Extracted from: FAO (2006), Chapter 8: Progress towards sustainable forest management.

Box 2

INFORMATION ON FOREST TREE AND SHRUB GENETIC RESOURCES IN AFRICA

The FAO Forest Genetic Resources Homepage hosts information on various aspects of conservation of biological diversity (http://www.fao.org/biodiversity/Forests_eco_en.asp); and the management of forest genetic resources: <http://www.fao.org/forestry/site/fgr/en/>

In collaboration with FAO, national information on status and needs has to date been prepared by 36 African countries and published as Forest Genetic Resources Working Papers <http://www.fao.org/forestry/site/fgr/en/> (click on Publications/Working Papers in the left-side menu). These countries include: Benin, Botswana, Burkina Faso, Cameroon, Central African Republic, Chad, Congo (RDC), Congo Rep. (ROC), Côte d'Ivoire, Eritrea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Kenya, Lesotho, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Nigeria, Sao Tomé & Príncipe, Senegal, South Africa, Sudan, Swaziland, Tanzania, Togo, Uganda, Zambia, Zimbabwe.

In addition, information on forest genetic resources in a number of African countries is available in documentation published on sub-regional workshops in the Sahelian/North Sudanian Zone (Working Paper 2E - English: <http://www.fao.org/DOCREP/003/X6883E/X6883E00.HTM>; Southern Africa Development Community countries (WP 41E: <http://www.fao.org/DOCREP/005/AC850E/AC850E00.HTM>); and Central African countries (available, in paper copy only, from the Forest Resources Division, FAO, Rome).

Regional up-dates on status, needs and priorities are found in Working Papers 34E and 73E. Information on genetic resources of tree and shrub species, by region, sub-region and country, generated within the framework of the FAO Panel of Experts on Forest Gene Resources, can be viewed at: <http://www.fao.org/forestry/site/fgr-region/en/>.

Complementary information has been collected i.a. within the framework of the Sub-Saharan African Forest Genetic Resources Programme, SAFORGEN, coordinated by Bioversity International, see:

<http://www.bioversityinternational.org/Networks/saforgen/introduction.htm> and

<http://news.bioversityinternational.org/nucleus/plugins/print/print.php?itemid=193>

The World Agroforestry Center, ICRAF, collaborates with African countries in support of forest genetic resources programmes dealing with trees grown in agroforestry systems (<http://www.worldagroforestrycentre.org/>).

3. Strategies and Methodologies

Neither forest ecosystems nor the genetic resources provided by them are static. Conservation must not be aimed at freezing a given state, as this would imply an arbitrary fixation of dynamically evolving, living systems.

Decisions regarding conservation strategies and methodologies will depend not only on the biological characteristics, genetic variation and variation patterns of given species, but also on the degree of knowledge available on their silviculture and management; present use; importance and uniqueness; perceived threats; and, quite decisively, institutional possibilities in the countries concerned, including human resources, infrastructure and availability of medium- and long-term funding.

Conservation implies varying intensities of human intervention, including non-intervention. In order to be sustainable over time, efforts to maintain or enhance diversity requires that forests and woodlands be managed to meet stated productive, protective, social and environmental goals in a balanced manner, and that available natural renewable resources be wisely utilized in support of local and national development, including poverty alleviation and food security, economic and social advancement and the safeguarding of cultural values.

The maintenance of an appropriate combination of genetic resource areas in a number of different locations, under diverse environmental and silvicultural conditions and varying intensities of management, is the most efficient way to conserve genetic variation at its various levels. In practice, this implies, (i) the conservation of forest biological diversity and genetic resources in protected areas, (ii) the incorporation of genetic considerations in forest resource management for productive or protective purposes (including forest plantation establishment and management), and (iii) the incorporation of such considerations in tree improvement and breeding strategies (Palmberg-Lerche 2002).

Action within countries needs to be coordinated to ensure that policies and implementation are consistent across sectors. To ensure sustainability and long-term success, conservation concerns should be integrated in broader local and national development plans. Such plans might include national forest programmes and poverty reduction strategies, which promote harmonization of action between sectors and cooperation among national agencies dealing with these. Integration should be assured both at policy-making and implementation levels. Appropriate links should also be made to efforts by countries to meet the Millennium Development Goals (MDGs), notably MDG 1 ("Eradicate Extreme Poverty and Hunger") and MDG 7 ("Ensure Environmental Sustainability"), to which forestry can make substantial contributions (FAO 2006a).

Wider policy and action frameworks at regional, eco-regional and global levels will strengthen the impact of genetic management in individual countries, and can help draw attention to issues of regional and global concern which might inadvertently be overlooked or neglected in national forest genetic resources strategies. Regional collaboration will also help avoid wasteful duplication of effort by making full use of institutional strengths and comparative advantages among countries (see FAO 2007, Palmberg-Lerche 2001, 2002).

Conservation must be accompanied by regular monitoring, using relevant indicators, to ensure that progress is being achieved in reaching stated objectives, and management must be adjusted, should the need to do so arise (see FAO 2002a, 2002b for information on genetic indicators). Information on expected and realized benefits and returns should be analyzed and widely disseminated to all stakeholder groups.

4. Priority-setting

Estimates of the total number of tree species in the world vary from 80,000 to 100,000. It is clear that there is a need for priority setting among the many species and ecosystems which may qualify for action.

The general aim of priority setting is to compare the consequences and trade-offs of a number of alternative choices and actions. It implies that some ecosystems, species or genetic resources will be given lower priority than others. This is not to say that they have no conservation value, rather, that in relation to agreed-upon, common local, national or international goals in any one programme, some species or actions are not as urgent as others (FAO 2007, Williams 1999).

Relative priorities within any one country will be determined by balancing socio-economic, environmental and cultural values assessed in the light of susceptibility or likelihood of loss or degradation of ecosystems and genetic resources of species targeted for action. At the regional and global levels, priority-setting will, in addition, take into account common interests and commonality of priority species and activities. Priority setting is complicated greatly by the lack of even basic information on the variation, variation patterns and potentialities of many (or most) species.

Forest management interventions and non-intervention, which are based on local and national priorities, will have varying effects on different social and economic sectors. To ensure broadly-based support and sustainability of action, genuine efforts are needed to meet the needs and aspirations of the fullest possible range of interested parties. This underlines the necessity for wide stakeholder participation, in order to agree on compromises. What is valued in biological diversity, how it can be managed and for whom, are critical issues.

When evaluations of priorities among stakeholders are similar, concerted action is possible, but when dissimilar, independent but coordinated action is more likely to succeed. There will frequently be substantial differences in perceived values and priorities between sectors of the economy and among governmental and non-governmental organizations and other groups active in forest biological diversity conservation, genetic management and related development programmes. In such cases, it will be necessary to form coalitions for action and harmonize these under a coherent framework, at appropriate level.

5. Values of Diversity

Many values derive from forest ecosystems as well as from their component parts. They include the provision of goods and services and the maintenance of environmental and life-support values. These latter values, such as soil and water protection, carbon sequestration, the conservation of biological diversity and recreation, are typically associated with the ecosystem and forest population levels. Goods (wood and non-wood products) harvested from forests are usually provided at the species or forest population levels; while evolution and adaptation to medium and long-term environmental change, and breeding to meet present-day and future needs, are mainly dependent on gene-level and molecular variation.

There is no single measure for the value of biological diversity or genetic resources. Measures are only possible for particular aspects, seen in relation to specific goals (see e.g. FAO 2007, Palmberg-Lerche 2002, Williams 1999).

A search for information related to, "value of forest biological diversity", using a leading Internet Search Engine, provided 1.2 million hits in 0.13 seconds. However, at closer look, the majority of the studies and papers which were listed concerned the value of forest resources, or forest (vegetation) cover, rather than the value of diversity. A number of other studies reviewed the value of given species as food, fodder and medicine, however, they seldom dealt with the value of using or enhancing genetic variation found within these species. Others, again, focused on the value of useful chemical compounds in given species, with little or no regard to analysing the benefits of maintaining variation in such compounds among populations or individuals. Information on the actual values of diversity seems to be scarce. A systematic review of available information is urgently called for.

Some examples of studies related to forest tree and shrub genetic resources which have, in actual fact, reviewed the value of diversity and intra-specific variation, are given in Boxes 3 and 4.

In managing natural forests and woodlands or establishing forest plantations, foresters use species and intra-specific genetic variation found in natural tree populations, which buffer them against environmental heterogeneity, changes in the environment and variations in end use requirements over time. Intra-specific variation between geographically distinct forest tree populations is referred to in forestry as “provenance variation”. Most documented information on the social and economic gains which can be achieved by maintaining, wisely utilizing and enhancing genetic variation in forest trees, is related to the use of provenance variation in forest plantation establishment, tree planting and breeding (see Box 3 for examples).

Another area in which studies have confirmed that high socio-economic returns can be achieved by the exploration and use of intra-specific variation, is tree breeding. Yet, surprisingly, scientifically valid, genetic information which is needed to advance in improvement and breeding, is still today available for only some 50 tree species, and only some 500 species have been systematically tested for their present-day utility (Anon 1991, FAO 2007).

Some case studies on gains achieved through the use of existing variation in tree breeding programmes are reported i.a. in Libby and Palmberg-Lerche (2002), and Palmberg-Lerche (2001, 2002a). Of special interest to breeders in Africa might be the case study on breeding for high gum yield in *Pinus elliottii* in South-Eastern USA, summarized in Box 4. This spectacularly successful programme was based on the selection and use of naturally occurring intra-specific variation, combined with improved silviculture and forest management techniques. While a subsequent decrease in the demand for natural gums in the USA slowed and finally led to a termination of the programme, interesting lessons can be learned from the experiences gained and could potentially be applied in breeding for increased gum yields in African tree and shrub species.

6. Conclusions

Forests and the products and services provided by them are vital for local and national development, human well-being and environmental sustainability. Genetic variation in trees and shrubs underpins the continued health and vitality of forest ecosystems, buffers forests against environmental fluctuations and changes, and helps ensure that new and emerging needs of human populations can be adequately met. Deforestation and forest degradation can be expected to have deeply negative effects on diversity and genetic resources in affected areas.

Vigorous efforts are needed to expand presently existing genetic resources information, both in regard to country and species coverage. There is, furthermore, an urgent need to clarify variation and variation patterns in forest tree species as a basis for their genetic management, including conservation, breeding and sustainable use, and to integrate such action in wider regional, national and local frameworks aimed at overall, sustainable development. Priority setting will help ensure that conservation programmes are adequately focused to make optimal use of scarce resources. The development and application of reliable indicators to monitor changes in status over time is an important priority.

Strategies and methodologies for the conservation of forest biological diversity and the management of forest genetic resources will vary according to biological, social and economic environments, institutional realities and local and national needs and priorities. While progress in conservation is dependent on action in individual countries and national institutes, efforts can only be fully effective if they are related to larger, regional, eco-regional and global forest genetic resources frameworks which can help ensure that important issues are not inadvertently overlooked, that wasteful overlap is avoided, and that comparative institutional advantages, at all levels, are drawn upon to streamline action.

A series of systematic reviews of available information on the quantification of values of various aspects of biological diversity and the use of tree and shrub genetic resources, seen in relation to specific conservation and management goals, should be carried out as a basis for demonstrating to policy and decision makers both the potential advantages and gains of conservation and the economic, social and environmental consequences and costs of mismanagement or neglect.

While the existing information base is weak and needs to be enhanced, there are no fundamental scientific and technical obstacles to meeting conservation objectives in forests and woodlands managed or established for the production of timber, non-wood products and the protection of soil, water and other environmental values. The

main problem in achieving conservation goals is the lack of adequate policy and institutional frameworks under which land use and operational management choices, fair to all stakeholders, can be considered and efficiently implemented. In addition to unplanned or unwise changes in land use, the failure to comply with sound forest management practices, including those related to tree planting and plantation establishment, has been to date a common cause of loss of diversity and unnecessary damage to site, vegetation and regeneration in all kinds of forests.

Recent increased attention and expression of wishes for intensified action and collaboration at national and international levels is a clear indication of growing recognition of the fact that conservation of forest biological diversity and wise management of forest genetic resources is of vital importance, and that they are not limiting factors to development but preconditions for lasting well-being.

Box 3

VALUE OF FOREST GENETIC RESOURCES: PROVENANCE VARIATION

Forest tree species are among the genetically most variable organisms on earth. They are generally characterized by long life cycles and wide natural distribution areas. The span of time over which external changes may assert selective pressure on forest tree species and populations varies from days to decades, and the spatial scale varies from local to regional. In response, trees have developed complex mechanisms to maintain high intra-specific (within species) diversity, which allows them to evolve and adapt to changing conditions.

The manifested, high level of differentiation in adaptive genetic traits among and within forest populations has underpinned the development of forest genetic studies and tree breeding programmes over the past century. In addition to overall intra-specific variation, tree species have frequently developed genetically diversified local populations of actual or potential value both for adaptation to natural environmental change (including climatic fluctuations and emerging threats from pests and diseases), and for selection and breeding by man. Such inter-population variation, referred to in forestry as *provenance variation*, may at times be as significant and practically important as that between different tree species, and must consequently be explored and used as a basic component in forest plantation and tree breeding programmes. Genetically diversified local populations which may possess valuable attributes, or reproductive materials collected from them, must also be included in genetic conservation programmes, with due regard to safeguarding such gene pools from hybridization with introduced provenances (Palmberg-Lerche 2001, 2002a).

The practical importance of systematic testing of provenance variation has been convincingly demonstrated in economic terms (see information in e.g. Evans 1999, FAO 2002, Libby and Palmberg-Lerche 2002, Palmberg-Lerche 2001, 2002a). The international provenance trials of *Eucalyptus camaldulensis*, coordinated by FAO in the 1960s, were among the first of a number of such trials. Experiments were established on 32 sites in 18 countries, and they showed that the potential gains in growth and yield which could be achieved by selection of the best-adapted provenances for prevailing environmental conditions, amounted to several hundred percent, with differences in growth between provenances planted at any one experimental site ranging from 300% in northern Nigeria, to 800% in Israel (Lacaze 1978, Palmberg-Lerche 2001). Spectacular provenance differences were also found in dry-zone *Acacia* and *Prosopis* species and provenances in a series of FAO coordinated trials in the 1980s and 1990s (Palmberg-Lerche 2001).

Following species and provenance selection in *Acacia*, *Casuarina* and *Eucalyptus* species and the introduction of better silvicultural methods, yields in forest plantations in China more than doubled in the 1980s and 1990s, and rotation times decreased by 30%. The mean internal rate of return in the plantation schemes reviewed, using a 5% discount rate, was 35%. In the case of *Acacia mangium*, the productivity of large-scale plantations in Indonesia was doubled by the use of better adapted provenances, as compared to yields obtained using the relatively poor quality seed previously used. These stands were also of better quality in regard to stem straightness and branching (McKenney 1998).

**VALUE OF FOREST GENETIC RESOURCES:
BREEDING FOR HIGH GUM YIELD IN *Pinus elliottii***

Research to breed high gum-yielding strains of a native pine species, *Pinus elliottii*, was initiated in 1941 in South-Eastern USA, to meet increasing needs of the naval stores industry. By 1950, over 1000 plus trees had been selected for superiority in gum production, based on variation in natural stands of the species. Field trials established and evaluated between 1956 and 1972 using progenies of the selected plus trees showed that these produced considerably more, and up to several times as much, gum as the average trees. Seed orchards were subsequently established, using the most promising clones; this resulted in an increase of gum yields of 50-106%, as well as increased amounts of wood, tall oil (rosin) and turpentine. There were also appreciable gains in stem straightness and crown form, which had been included among the selection criteria when selecting the plus trees and the clones included in the seed orchards. In parallel with the development of high gum yielding strains, efforts were also started to apply more intensive silvicultural practices than those normally used when growing forest trees, and this further increased gains in all traits selected for, including gum yields.

(Squillace *et al.* 1972; see also Libby and Palmberg-Lerche 2002).

For more information, please refer to the FAO Forest Genetic Resources website <http://www.fao.org/forestry/site/fgr/en/>, or contact the Editorial Board for a 5-page list of internet-based information on Forest Genetic Resources focusing on selected references to forest tree and shrub genetic resources in Africa, presented by region and sub-region. References to some country-specific information is also available. See also Box 2.

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Pygeum: Money growing on trees in the Cameroon Highlands?

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Summary

Cameroon supports some of the largest populations of the Afromontane hardwood pygeum (*Prunus africana*), a tree used traditionally for timber, fuel-wood and medicine. It is also the raw material for the pharmaceutical industry. Its economic importance is indicated by Cameroon's annual permit to export 2000 tonnes since 2005, providing export revenues of about 1,320 million CFA (2,685,929 US\$). It is also one of the major income sources for forest based communities in the Highlands areas of Cameroon. Pygeum is one of thirteen keystone species in high altitude, montane mixed forest, vital in terms of adding to biological diversity in this 'hotspot' ecosystem. However, it is an endangered species in a shrinking and increasingly degraded montane ecosystem and its annual trade has been restricted since 1995. Despite the quota-based regulatory framework in place and over two decades of research, development of sustainable harvesting techniques and regeneration planting, the species faces major problems of over-exploitation, illegal harvesting and degradation of its montane forest habitats. There is no current scientific knowledge of the quantities of natural or planted stock of pygeum available for sustainable harvesting, no monitoring system and no long term management plans. This paper details the effects unsustainable exploitation of pygeum has on biodiversity and provides recommendations for creating win-win situations for sustainable economic exploitation of this NTFP that also allows its ecological, social and cultural values to be maintained.

1. Introduction

Prunus africana is also known as Iron Wood or Stinkwood and locally known in Cameroon as pygeum or kanda stick, and locally³ as Kirah, Elouo, Eblaa, Bi'beh'kemb'oh' and Wotangu. It is an evergreen hardwood tree with dark-brown longitudinal fissured bark and simple, thick, leathery, oval, leaves with pointed ends (Fig. 01). It grows at 700-3000 meters above sea level, up to a height of 40 metres. It has creamy white flowers and produces black fleshy fruits resembling a cherry when ripe, which are eaten and dispersed by monkeys, birds and squirrels, some of which are endemic and endangered. Seeds can be collected mid-end February or seedlings collected in May-June. It is long lived - up to 100 years and is patchily distributed as one of thirteen critical species that forms 90% of the rainy high altitude montane mixed forest ecosystems in Cameroon (Masiels and Forboseh 1999, Cheek 2000). The majority of pygeum populations are in the North West (NW) in the Kilum-Ijim forests, South West (SW) around Mt Cameroon and Adamoua Provinces of Cameroon, where they have been extensively exploited for their bark since the 1980s. It is a multiple-use species, locally used as fuel wood and for charcoal, for poles, hoe and axes handles, as a bee loving plant in honey production, in protecting water catchments, as a boundary marker, and especially medicinally for humans and animals; powdered into a tea for genito-urinary complaints, allergies, inflammation, kidney disease, malaria, stomach ache, fever, chest pain, heart burn, madness and for animal medicines.

Internationally it is of medicinal economic value. The bark is exported dried, chipped or powdered to USA and Europe to produce an extract used to treat benign prostrate hyperplasia. The extract is also a raw material for the burgeoning health, bio-product, diet supplement and pharmaceutical industry. If the bark is partially stripped according to methods developed by the Mount Cameroon Project (Cunningham 1993, Nkuineku and Remi 1998) of two quarter panels from a tree of more than 30 cm diameter at breast height (approximately 12 to 15 years old) it will regenerate and may be exploited at between 5 to 15 year intervals without killing the tree. 200 kg of fresh bark are about equal to 100 kg of dried bark, which is needed to make 1 kg of extract. An average mature tree yields 55-75 kg of bark per harvest (Cunningham and Mbenkum 1993, Acworth 1999).

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³ Respective languages of Nso (Lamnsò), Kom, Oku, Fulfulde (all used in the North West Province) and Bakweri (South West Province)

Prunus harvesting and export have been regulated¹ as a 'Special Product' since 1994, through a system of annual, non-renewable, tonnage based permits for dried bark harvested each year from provincial zones allocated by auction and quotas. Permits are granted by an Inter-Ministerial Committee, based on technical reports from Provincial Chiefs of Forestry which should provide a "reasoned recommendation" of the species, quantities, exploitation areas and harvesting modalities. *Prunus* seized after having been illegally harvested (without a Simple Management Plan (SMP) or sold to a person without a permit) is auctioned at a public sale. The buying price is usually below the current market price. The buyer, who does not need a permit, pays the Treasury and an additional 12% of the buying price to the Ministry of Forestry and Wildlife (MINFoF) division making the seizure. A "Regeneration Tax" of 2% of the quota value is payable to the Government, by permit holders, in three instalments, one of which is an advance. Since 2006, regeneration is the responsibility of the National Forestry Development Agency (ANAFOR). Felling of trees, without special permission, is illegal.

*Prunus*¹ is IUCN Red List of Threatened Species as "Vulnerable" highlighting its higher risk of global extinction. The Convention on International Trade in Endangered Species (CITES), of which Cameroon is signatory, listed pygeum as an Appendix II species in 1995, meaning *Prunus* is not threatened by extinction, but may be so if trade is not regulated. In 2006 Cameroon and DRC were the only listed countries for *Prunus africana*, previously this included Kenya, Madagascar and Burundi. Producing countries have to declare exports, to set a "scientific non-detriment finding" for any annual quotas and these have to be reported to CITES. It was recommended that Cameroon would within 1 year: undertake an inventory of standing stock in harvest areas, establish estimates of sustainable off-take and a scientific monitoring system, revise the quota and set out a long term management plan for the species (CITES 2006).

In practice, the majority of inventories have been one of baseline, performed by projects e.g. the Kilum-Ijim and its predecessor Bamenda Highlands Forest Project (1987 to 2004), the Mount Cameroon Project (1990-2002), and in Community Forest² (CF), SMPs which do not quantify, but do state harvesting schedules and forest areas. The World Agroforestry Centre (ICRAF) with its partners has been researching domestication techniques³ (Tchoundjeu *et al.* 2002) and with University of Dschang, Cameroon researching genetic diversity and bark extracts (Avana 2004 and Pers. comm.). A current Austrian financed Biodiversity International Project concentrates conservation and sustainable use, focusing on conservation and use of reproductive material, genetic analysis, reproductive biology and bark extracts (BFW 2007).

2. Economics

In the NW and SW Provinces of Cameroon, *Prunus* is a major secondary source of income for individuals, CFs, NGOs, agro-forestry enterprises and schools. Figures on export quantities and prices are difficult to obtain, the following being from a variety of mainly non-government sources. Between 1985 and 1991, prior to it's CITES listing, an estimated 9,309 tons of *Prunus* were exported from Cameroon, amounting to at least 143 million CFA (290,976 US\$). Turnover for Plantecam (a drug manufacturing company operating in Cameroon) in 1998 is reported at 4,000,000 US\$. The export value of *Prunus* in 1999 was 700,000 US\$⁴. Prices at export for dry bark⁵ (chips) in 2006 ranged around 660 CFA to 1000 CFA per kilo⁶. In 2000 the Plantecam sold for 2000 CFA per kg. In

¹ Decree No. 74/357 of 17 April 1974; Law No. 81/13 of 27 November 1981; Decree No. 83/169 of 12 April 1983; Law No. 94/01 of 20 January 1994 and its decree of application, Decree No. 95/531/PM of 23 August 1995

² Community Forests are allocated for up to 25 years by the Government to a community(ies) near or in forest areas. The forest must be managed by a legally registered entity comprised of community stakeholders and forest user groups in a way that benefits the local population and ensures forest preservation. The government approved 5 year renewable Simple Management Plan is participatorily produced and assesses the potentials of CF, establishes their sustainable management and exploitation and agrees revenue distribution accruing from the forest.

³ Diversification of smallholder farming systems in West and Central Africa through cultivation of indigenous trees, IFAD financed project executed by ICRAF from 2000-2004

⁴ Chupezi T.G., Ndoye O., National analysis of trade related instruments influencing trade in African cherry and the African Grey Parrot, applications and impacts on poverty alleviation and sustainable forest management in Cameroon, FAO Rome, 2005

⁵ "Dry bark" = 12-18% humidity

⁶ Interviews members Syndicat des Exploitants Transformateurs Industriels Exportateurs des Produits Speciaux (STIEPS), Pers. Comm., March 2007

2005 and 2006, between 1500 to 2000 tonnes was harvested annually, valued at approximately at 260 million CFA (540,000 US\$) to producers (harvesters, community organisations and individuals), with an export value estimated at over 2,649 million CFA (5,470,000 US\$), based on an average export price of 660 CFA (1.34 US\$) per kg (Ingram 2007). In NW estimated around 88,400 trees were harvested in 2005 (based on average 75 kg per mature tree) when 6,630 tons were bought by 40 authorized buyers. The chain in Cameroon involves at least 60,000 people in communities with CFs, an unknown quantity of individuals with plantations, about 500 harvesters, approximately 11 exploitation permit-holding small scale enterprises and approximately 5 small to medium seized exporting enterprises.

There are substantial differences in opinion between the regulators (Ministry of Forestry and Wildlife and ANAFOR as the Cameroon CITES scientific authority), exporters, forest users, researchers and development organisations on how to exploit *Prunus* sustainably and the quantities available for exploitation. This is combined with declining populations, particularly in the NW and SW Provinces (Ingram and Jam 2007, Gotz Pers. Comm.).

This paper details the effects unsustainable exploitation of pygeum has on biodiversity and provides recommendations for creating win-win situations for sustainable economic exploitation of this NTFP that also allows its ecological, social and cultural values to be maintained.

3. Methodology

Interviews from July- August 2005 (Whinconet 2005) and November 2006 to March 2007 were held with pygeum users and harvesters, CFs, private sector exporters, government ministries and administration, traditional authorities, researchers, ANAFOR and development organisations (reported in Ingram 2007). These were supplemented by literature reviews, data gathering, field observations in the NW and SW provinces and two rapid inventories in the NW Province (Ingram and Jam 2007)

4. Results: Unsustainable exploitation threatens a viable *Prunus* market and biodiversity

Recent research (Stewart 2007) combined with actor interviews and field observations (Ingram 2007), all indicate that in spite of, and because of, its economic and social value, wild *Prunus africana* populations appear in major decline. Reasons include:

1. Uncontrolled exploitation and illegal harvesting (out of 1,241 tons harvested from January 2000 to March 2007, 257 tons were illegal (Photo 1) (WHINCONET 2005, Ingram 2007).
2. Unsustainable harvesting techniques (stripping entire trees or felling) results in die-offs of between 13 to 50% of natural stands, especially mature seed producers, in Kilum-Ijim.
3. Inappropriate techniques and timing have contributed to poor health of surviving trees. Even if trees were unsustainably harvested initially, subsequent illegal harvesting has resulted in die offs of between 13 to 50% of trees in the NW, see Photo 2 (Stewart 2003, Ingram 2007).
4. Bushfires, associated with herders', beefarming and agricultural clearing, devastating approximately 5-10 hectares of forest annually, which pygeum seedlings and mature trees can not tolerate, leading to very low levels of natural regeneration.
5. Current levels of cattle and goat grazing result in almost zero natural regeneration (Stewart 2007).
6. Insufficient management, controls and enforcement (according to SMPs) of natural stands in CFs results in "illegal harvesting", a lack of planned regeneration and protection against encroachment and bush fires. CF's SMPs take years to be processed, impeding control over resources, interfering with investment incentive and slowing down the upsurge in product value. Many CFs also lack adequate management, financial and administrative skills (MOCAP 2007, Ingram 2007).
7. Declines in *prunus* may have long term consequences for the health of threatened and decreasing montane ecosystems and their biodiversity, as it comprises one of the keystone species (Masiels and Forboseh 1999).



Photo 1: Illegal harvesting has resulted in die offs of between 13 to 50% of trees.

Planted stands by the aforementioned projects and by ONADEF¹, PAFRA² and ANAFOR have tended not to have been monitored until of harvestable age or had their available sustainable harvestable quantities evaluated. Most were monitored in the first few years of planting (ANAFOR and PAFRA³ Pers. comm.). The result is a lack of data on plantation locations and harvestable quantities in any given year. However, from available data a conservative estimate can be given of over 120,000 saplings planted in at least 273 hectares since 1976 (Ingram 2007). Approximately 15 to 30 nurseries still exist, some actively supported as local partners of ICRAF, that provide *Prunus* seedlings for approximately 150 CFA (0.30 US\$) per 6 month seedling.

5. Discussion

The Cameroon Highlands contain the largest remaining patches of afro-montane forest in West Africa, defined by the World Wildlife Fund one of the top 200 worldwide *Ecoregions*. It contains 35 restricted-range endemic bird species (third richest ecoregion for birds in mainland Africa), 10 endemic reptiles, 55 endemic amphibians, 6 endemic mammals and around 100 rare/endemic plant species. The Bamenda Highlands mixed forest and savannah grasslands have some of the highest levels of *endemism* in the Western Highlands. However deforestation has increased dramatically in the last 100 years: in the Bamenda Highlands an estimated 93% loss of original forest from 1965 to 2000 has left approximately only 98km² of montane forest. Rapid degradation of up to 25% of montane forest cover in 8 years (Cheek, 2000) threatens all the keystone species, which include *Prunus africana*. Given the species' vital value in terms of its key status in the biological diversity of the montane ecosystem, it is likely that this increases the health of the ecosystem. As one of the many keystone species, *Prunus africana* potentially connects to other plant species, and its fruit drupes are certainly a key high protein food source for various species of frugivorous mammals and birds, such as the endemic Bannerman's Turaco (*Tauraco Bannermani*), Bannerman's Weaver (*Ploceus bannermani*), Cameroon Montane Greenbul (*Andoropagus montanus*) and Preuss' Guenon (*Cercocepithecus preussii*), and consequently improves the resilience of the entire ecosystem. Its ecological values also extend to cultural (carving), economic (bark export and firewood) and social (medicinal) uses.

Constraints identified by actors to develop the Cameroonian *Prunus africana* sector and increasing local revenues, production and employment, include;

- Complete lack of scientific knowledge of the state and total amount of the resource of *Prunus* available in the wild and in plantations, in any given year and its location. Even where inventories are recent (such as Mt Cameroon), actors' perceptions of sustainable harvest were over-reported. Notable differences of opinion exist between harvesters, CFs, researchers, exporters and buyers.
- Local knowledge does exist on locations of natural and planted stands of pygeum. Buyers tend to be the most knowledgeable, but also reluctant, for commercial reasons, to share this knowledge. They generally believe that more than 2000 tonnes of dried pygeum bark is available in Cameroon, noting that costs have increased as increasingly remote areas (such as Adamoua and Centre Provinces), are exploited, while traditional high yielding locations in the NW and SW are depleted. Community based knowledge also exists on a local level, although no CFs could give accurate reports of quantities available in the short or

long term. Locations of replanted *Prunus* mostly privately owned by individuals but also through ANAFOR, PAFRA and ONADEF, are also not available. This absence of hard data is compounded by the annual quota system which does not allocate site specific permits and is not inventory based.

- Lack of market information and its dissemination regarding:
 - Price, among harvester-producers and between producers, harvesters and buyers in Cameroon, as well as between exporters and internal buyers and industries. This has lead to low prices for CFs and harvesters and wide regional variations. Changes in the market structure from the monopoly of Plantecam in the 1980s to the current quota system (Ondigui, 2001; MINFoF Decisions 2006 and 2007) also are viewed as inefficient and not business friendly. Most CFs dealt with different buyers, did not compare prices and did not contact the buyers themselves but were contacted when buyers were ready. Most did not store and sold “wet” or “fresh bark”. The lack of knowledge about market prices and buyers especially between the SW and the NW, means selling prices in Mt Cameroon in the SW can reach 240 CFA (0.48 US\$) per kg for dried bark, while in the NW range from 40 CFA (0.08 US\$) to an average 65 CFA (0.13 US\$) per kg for lower value wet bark (equivalent to 20-33 CFA (0.04-0.07 US\$) per kg dried bark (Ingram, 2007).
 - Methods to add value in the production and transformation (e.g. drying, chipping or extraction).
 - International manufacturers and consumer awareness about pygeum, which potentially could influence buying patterns and the development of alternatives, such as competing natural (e.g. Saw palmetto-*Serenoa repens*, *Urtica dioica*, *Hypoxis rooperi*, *Populus tremuloides*, *Secale cereale*, *Cucurbita pepo*) and synthetic products replacing *Prunus africana* extract (Pomatto 2001).
 - Resource availability, such as total sustainable resource available per year and location, amounts harvested per year and total value (for producers, exporters, customs, ANAFOR etc.), quantity replanted per area and organisations, quantity destroyed per area (poor harvesting techniques or natural).
- Expensive, time consuming administrative and bureaucratic requirements coupled with corruption involved in obtaining exploitation licenses and export permits.
- Low level of transformation processing (into chips, powder or extract), currently only by 2 or 3 exporters in Cameroon, means little value is added to the product and the potential for increasing income, employment and production to alleviate poverty is not utilised.
- Difficult access to capital to invest in transformation/processing, particularly for community organisations and CFs.
- Lack of quality control and lack of certification for export, particularly powdered or chipped products (certifying that the product is *Prunus* and not other barks).
- Poor governance and transparency: Most Forest Management Institutions (FMIs) were not able to report on quantities harvested, locations and revenues from sales, who was buying (and therefore the legality), amounts paid to harvesters or how benefits were shared in their community. The FMIs are village or community level organisations and are nongovernmental; and the majority of them did not report in advance to their MINFoF delegates their harvest operation schedules (as required by CF procedures). Many CFs were also not harvesting according to their SMPs.

6. Recommendations from Lessons learnt

Radical changes are necessary in the sector to allow continued but sustainable exploitation and enable a win-win situation between income generation and biodiversity conservation and sustainable resource use, particularly in poor, rural, montane forest areas. Such lessons include;

- A. Sustainable management of wild, forest based pygeum can only be possible via a national inventory of stands, implementation of substantial regeneration measures (potentially linked to implementation and increased transparency regarding the Regeneration Tax), enforcement of sustainable harvesting methods and long term monitoring. This will also allow its ecological value to be at least maintained.

- B. Meeting CITES requirements is essential to ensure continued exports from Cameroon and to ensure that the sector does not collapse in the short term. This would have negative consequences for all the producers and exporters in the chain, as well as lower the revenues for the government of Cameroon. Furthermore, it has implications for consumers and it would lead to the development of alternative products and/or sources of *Prunus*. The inventory should reinforce whether *Prunus* remains a “Vulnerable” species.
- C. Further promotion of domestication, plantations and individual planting of *pygeum* (via programmes such ANAFOR, but also through ICRAF, CFs, individuals and innovative, demand lead collaborations with exporters), is critical to counter decreases in wild stocks and maintain its economic value.
- D. In order to balance ecological and economic values of biodiversity, the regulatory system needs to be adapted to:
 - Review the quota system to a location specific, quantity capped quota system
 - Introduce site specific tracing and tracking systems e.g. Certificates of Origin
 - Implement enforcement measures and capacity building for government authorities such as MINFoF, Customs and taxes regarding transportation and permit holders reporting.
 - Streamline administrative hurdles and increase business friendly practices in the exploitation permit and registration process for ispecial forest productsî e.g. increasing time period of the permit and revising the rules for sales of confiscated *Prunus*.
- E. Regarding enhancing the market chain; the following recommendations can be made:
 - Particularly small and medium sized enterprises and CFs should be targeted to operate more efficiently and sustainably;
 - Optimal use of resources could be achieved through sustainable and alternative harvesting methods;
 - Quality control should introduced at key stages in the chain e.g. through certification of NTFPs or business in the process;
 - A system of value-addition by Cameroonian enterprises and organisations should be aimed at, through improving processing and transformation such as drying, chipping and extract removal in Cameroon;
 - Links with pharmaceutical companies and end users should be reinforced to increase awareness of resource constraints and sustainability. In addition, *pygeum* extract use should be diversified e.g. for vetinary applications.
- F. Increasing institutional and organisational networks should also balance ecological and economic values. This holds in particular for collaboration between regulatory agencies with exploiters, producers and other institutions with regulatory functions such as traditional authorities and councils, but also between producers and exploiters and among exporters and international manufacturers.
- G. Increasing knowledge of the resource allows biodiversity to be economically valorized and can also optimize exploitation, such as increasing knowledge of genetic diversity, and exploring alternative harvesting options such as leaves or coppicing.

7. Suggestions for further research

Further research and development is necessary to address the problems and solutions identified. The following current activities will ensure that many of these issues are addressed; a two year European Commission financed Programme "Mobilisation et renforcement des capacités des petites et moyennes entreprises impliquées dans les filières des produits forestières non ligneux en Afrique Centrale" (Mobilisation and strengthening of small and medium-scale enterprises involved in the NWFP sector in central Afrika) lead by the FAO with SNV, CIFOR and ICRAF, started in 2007. Its projected results include reinforcing small and medium sized enterprises in the sector, developing the *Prunus* chain as a priority NTFP in Cameroon and Democratic Republic of Congo, reinforcing techniques for sustainable management, particularly harvesting and domestication and ensuring that national and regional institutional and legal frameworks are adapted and function.

SNV is also building capacity in the Cameroon Highlands with the Association of Environmental Education and the Western Highlands Conservation Network (WHINCONET), which includes CFs in Kilum-Ijim, working with partners such as MINFOF, ANAFOR, a Community Forestry capacity building project (RIGC), the German Technical Development Agency (GTZ) and the Mt Cameroon Prunus Management CIG (MOCAP). The French Cooperation FORINFO Project is supporting researchers at the University of Dschang, Cameroon in researching genetic diversity. The Institute of Ethnobotany, Florida USA is examining the effects of grazing, fire and harvesting on Prunus. ANAFOR is seeking finances to fulfil its obligations to CITES. Further research on the experience in other countries with *Prunus africana* is welcomed, as is work on comparable NTFPs and issues.

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Gaps in the Forest Valuation Equation: The Case of Kenya

Mohammed El Mongy¹

Abstract

In Kenya like many other countries, the forests resources are valued according to the direct material benefit of forest products market prices. This view might be leading to short term economic gains from sales of wood products and non wood products. However, on the long term reliance on this method of valuation is unsustainable ecologically and economically.

Ecologically it leads to deforestation and environmental degradation that is caused by the reduction of the forest domain or fragmentation of forest. Some consequences of the deforestation will be soil degradation, biodiversity loss and deficiency in the ecological services provided by the forest like air quality, water catchments, pollination and flood protection. These ecological services are incommensurable by nature; this means if it is lost it is impossible to compensate them be it with financial investments or technology.

Economically lack of adequate forest valuation is a symptom of chronic poverty on a micro level and unsustainable economic strategies. The benefit of forests marketable products if enjoyed by today's generation will not be enjoyed by the future generations if exploited in an unsustainable manner. Addressing the chronic poverty and ensuring that forest preservation make livelihood sense to the forest communities are essential for this sustainable management.

The Economic methodology challenged is the Cost Benefit Analysis method and the theory proposed is the Total Economic Valuation that takes into account the forest direct and indirect values as well as the optional values and non use values.

1. Introduction

The purpose of this article is to question the conventional understanding of forests' values that are based only on natural resources extraction for short term economic purposes, and to challenge that this valuation method is neither ecologically nor economically sustainable and leading to accelerated deforestation. The case study taken for demonstrating this is the deforestation process in Kenya. To understand the root causes of deforestation in Kenya, it is important to analyze the ways forest valuation is conducted and how they affect forest management. Based on literature review this article tries to address the views on forest valuation from a Macro and Micro level and to provide an insight on alternative forest valuation, stemming from Ecological Economics theories, to ensure sustainable management of forest resources.

2. Valuing forests' resources in Kenya on Macro level

About 83% of land area in Kenya is categorised as arid or semi arid based on annual rainfall rate not exceeding 600 millimetres. Forests cover 6.1% of the country (Matiriu 1999), with 35,000 km², with the other land area covered with savannah, grassland, woodland-grassland and desert (OECD 2006). The average rate of deforestation is at 0.53% per year (FAO 2006). Figure 1 shows that over the last years Kenya's economy and GDP has grown, while the forest landscape has been steadily shrinking (OECD 2006). In Kenya the main focus of forestry has been on commercial logging and forest valuation has been associated with the timber revenue and fuel wood usage (IUCN 2001).

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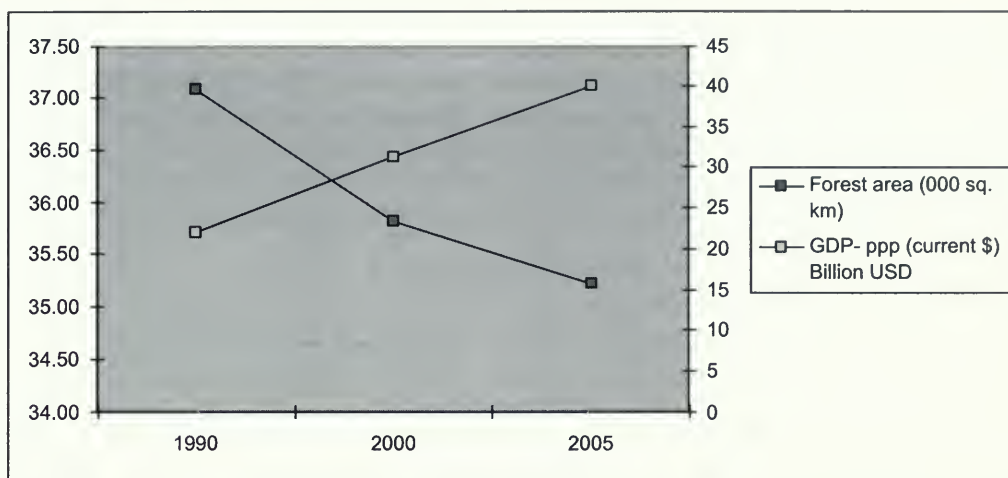


Figure 1: Growth of GDP and rate of forest conversion. Left axis represents forest cover, right axis GDP-ppp. Source: OECD 2006

The main reason for this inadequate forest value is that forest resources income statistics and accounting systems consider only the output of formal sectors of marketable goods and do not reflect the Total Economic Value (TEV) of the forest (Emerton and Mogaka 1996):

$$\text{Total forest value} = \text{direct values} + \text{indirect values} + \text{optional values} + \text{non use values}$$

TEV provides an all-encompassing measure of the economic value of environmental assets (Pearce 1995). TEV direct values are divided into marketable (directly paid for) and non marketable (non-consumptive) values. The option values the potential future use of the ecological goods and services, whether direct or indirect (Edwards-Jones *et al.* 2000)

Among the major macro reasons for deforestation in Kenya, is the unsustainable exploitation of forests' direct marketable values mainly timber-.These direct marketable values are valued according to the common monetary valuation methods without TEV (Pearce 1995). Another manifestation of the need of proper forest valuation in addressing macro economic issues is the conversion of forest landscape to agriculture (Emerton 2001). According to Cost Benefit Analysis (CBA), decisions to convert tropical forest to agriculture are justified if the net benefits from agriculture exceed the net benefits from conservation (Pearce 1995). Valuing the forest according to its direct benefits rather than its TEV leads the agricultural expansion to have a comparative advantage over forests' sustainable maintenance. Table 1 below indicates that agriculture, with 48% of Kenya's exports, outweighs the forestry sector in this aspect.

Table 1: Imports and exports in forestry and agriculture.

Forestry Sector Int. Trade		Agricultural Sector Int. Trade	
<i>Forestry imports</i>	<i>4*</i>	<i>Agricultural imports</i>	<i>483*</i>
<i>% For. Imports in tot. imports</i>	<i>0.09%</i>	<i>% Agr. Imports in tot. Imports</i>	<i>11%</i>
<i>Forestry exports</i>	<i>21*</i>	<i>Agricultural exports</i>	<i>1 296*</i>
<i>% For. Exports in tot. exports</i>	<i>0.07%</i>	<i>% Agr. Exports in tot. exports</i>	<i>48%</i>

Source: FAO Statistical Yearbook 2004

This skewed CBA overlooked the forests' TEV and accelerated the deforestation during the post-independence period from the Shamba policy that subsidized agricultural expansion (Kahuthu 2006). Moreover, the circumstances of international trade stimulates agricultural expansion; farmers' subsidies and import taxes in Europe and North America prohibit Kenya from exporting products in which it has comparative advantage, like livestock and dairy products. Hence, the structural adjustment policies in the 1980s led to the shift from subsistence crops to cash crops for exports like tea and coffee, and, lately, horticulture (Andersen 2002). Pearce (1995) suggests that, even if only forests' direct benefits are valued, conversion to agriculture leads to economic failure in the long term. The marginal profit (M in figure 2 below) will decline as the forest conversion increases.

This is due to the rising conversion cost as the agriculture land is spatially expanding, which is the case of the forest landscape from Mount Kenya through the upstream of Tana River. This inevitably leads to an increase in infrastructural developments to enhance forest access which, along with population growth, facilitates forest degradation, biodiversity loss and deforestation (curve M + Sub) (Pearce 1995).

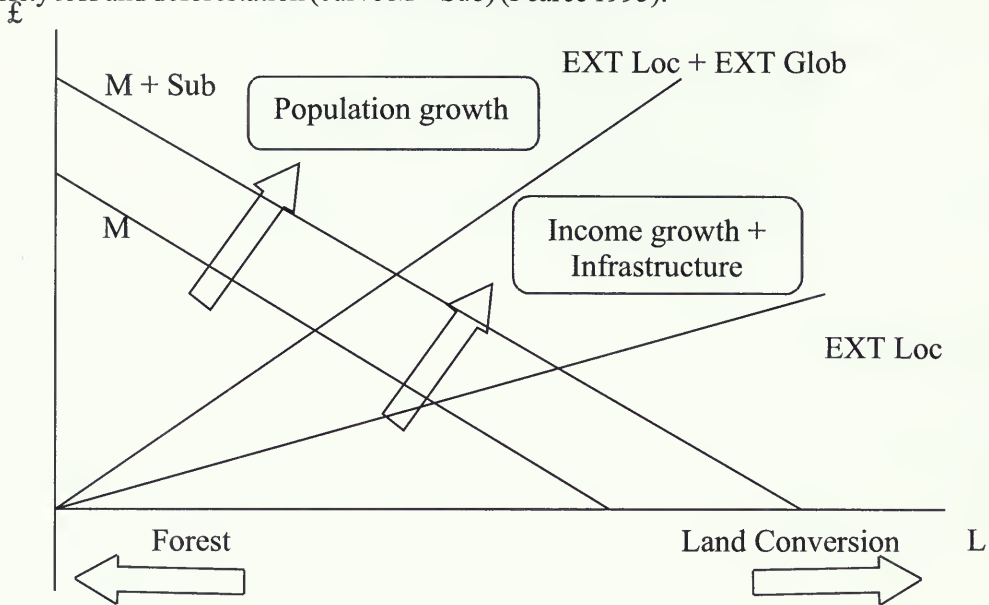


Figure 2: Marginal profit and cost of forest conversion to agriculture.
 Source: Pearce, 1995

Agricultural conversion imposes local externalities (EXT Loc); soil erosion, biodiversity loss and carbon sequestration reduction (Andersen 2002). These externalities are not only affecting Kenya, but also have global effects (Ext Glob). In his study for the IUCN, Karanja suggests that in addition to the spatial dimension, a temporal one needs to be looked at in order to have a sustainable CBA; as forests resources decline in quantity and quality, a direct cost is implied in terms of the expenditure necessary to prevent environmental degradation occurring (e.g. soil installation). Moreover, the replacement cost necessary to substitute the ecological goods and services lost by the degraded forest resource (e.g. non-wood fuel, construction materials etc.). Traditionally the counterargument presented is that the opportunity cost of forest degradation will be invested in economic improvements and increased productivity of all sectors (Andersen & Grove 1987). This view disregards the incommensurable nature of forests resources that, if degraded, will potentially result in inhibiting the production of other sectors. A clear example of this is downstream flood control and watershed catchments protection; these ecological functions, if no longer provided by the forest ecosystem, will need high financial investments to be replaced, as is the case in Ethiopia (McCann 1999).

Other costs include future economic opportunities foregone; we do not yet have adequate scientific knowledge to know the full range of production and consumption possibilities which may be obtained from the forests' genetic pool. We also cannot fully predict human and economic needs for goods and services in the future (Emerton *et al.* 2001)

Table 2 below suggests the elements to be taken into consideration with forests valuation using TEV as well as the forest type to consider when extracting the values in question.

Table 2: Elements to be taken into consideration with forests valuation using TEV and forest type to consider.
Source: Edwards-Jones et al. 2000

	M D	N M D	I	O	N-U	VET	Stake	Forest
Industrial wood-timber	X			X		XX	National	P
Fuelwood-Charcoal	X			X		XX	Loc. + Nat.	P
Fruits	X			X		XX	Loc. + Nat.	N+P
Vegetables	X			X		XX	Loc. + Nat.	N+P
Building Poles	X			X		XX	Loc. + Nat.	P
Nuts	X			X		XX	Loc. + Nat.	N+P
Herbs	X			X		XX	Local	N+P
Medicine	X			X		XX	Local	N+P
Hunting	X			X		XX	Int. + Nat.	N*
Crafts	X			X		XX	Local	P
Labor		X		X		XX	Loc. + Nat.	N+P
R&D		X		X		XX	National	N+P
Education		X		X		XX	Loc. + Nat.	N+P
Tourism		X		X		XX	Loc. + Nat. + Int.	N+P
Health		X		X		XX	Local	N+P
Local recreation		X		X		XX	Local	N+P
Scenery		X	X	X	X	XXXX	Loc. + Nat. + Int.	N+P
Wildlife		X	X	X	X	XXXX	Loc. + Nat. + Int.	N+P
Biodiversity			X	X	X	XXX	Loc. + Nat. + Int.	N+P
Community Identity		X	X	X	X	XXXX	Local	N
Climate regulation			X	X	X	XXX	Loc. + Nat. + Int..	N+P
Carbon sequestration			X	X	X	XXX	Loc. + Nat. + Int.	N+P
Air quality			X	X	X	XXX	Loc. + Nat. + Int.	N+P
Water quality			X	X	X	XXX	Loc. + Nat.	N+P
Water cycle			X	X	X	XXX	Loc. + Nat. + Int.	N+P
Soil erosion control			X	X	X	XXX	Loc. + Nat.	N+P

M D - Marketable Direct Values. N-M D - Non Marketable Values. I - Indirect Values. O - Option Values. N-U - Non Use Values. P - Plantation. N - Native Forest.

3. Valuing the forests in Kenya on Micro level

From the micro level, the access of rural population to forests' resources, mainly for fuel wood, is always stated as the primary driving force of deforestation. Regarding the forest as a common asset by the local population, Hardin suggests through his theory of the “Tragedy of the Commons” that individual members want to maximize their individual and/or collective benefit(s) from the common resource, without due consideration to its sustainability (Hardin 1968). A deeper analysis of this notion led to conclude that the issue of the commons is actually the open access to these assets (Kituyu & Lane 1998). People living inside and adjacent to the forest consider the open access to forest resources as an integral part of their identity, past and future livelihoods. They cut and sell trees as a

source of energy and income, as well as use the forest as their open super market (Abdel Galil 2003). This led to the main proponents of early colonial land alienation to argue that Kenyans did not own the land rather they enjoyed only immediate use rights at zero cost in occupied lands (Kituyu & Lane 1998). This latest view also failed to recognize the effort and risks invested in collecting forest resources, which mainly affect women and children in absence of affordable alternatives. It does not also consider the opportunity cost of education, health and other family and community obligations that are affected in the process of collecting wood for fuel (Basset & Crummey 2003)

Fuel wood and charcoal provides 70% of total Kenyan energy consumption and 93% of the rural household energy requirements (Emerton *et al.* 2001). In the last two decades, with population growth, demand for fuel wood has outstripped supply, rising from 18.7 million tons in 1980 to 47.1 million tons in 2000. The rate of establishing forest plantations is slow, consequentially the new forest stands do not satisfy the needs, hence felling takes place in the indigenous forests as is the case for Lembus, Kakamega and Machakos. This leads to not only accelerated deforestation but also to forest fragmentation and a consequential reduction in soil fertility in the cleared forest batches (Kirubi *et al.* 2000)

Wood scarcity and inadequate valuation of forest resources on micro level were seldom isolated problems, but rather manifestations of a much broader and complex problem of poverty (Kirubi *et al.* 2000); people in their efforts to enhance their livelihoods, have neither available nor affordable alternatives except to exploit the forests resources (e.g. alternative energy sources). Additionally in the absence of material or immaterial incentives, poor communities have no benefits from conserving the forests (Emerton *et al.* 2001). Deforestation rate increases during the period of drought, famine and food shortage, which also proves the link between poverty status and deforestation. Besides, it shows that poverty is not only expressed in financial terms but also in access to resources. The local population increases logging during periods of hardship, in order to increase sales of fuel wood and charcoal in order to live up to their alimentary needs. In such periods, decision making is based on uncertainty avoidance of future risks hence increased resources exploitation (Mortimore and Tiffen 1994). Additionally, when the rainfall is scarce, agricultural communities look at the forest for supplying their livelihood resources (Sankhayan and Hofstad 2001)

Economic benefits derived from tourism are always used as an argument to express the forests' values to their fringe human communities. Tourism indeed provides 38% of foreign exchange, 8% of the total employment, 5% of GDP and it is estimated that Wildlife brings 70% of gross tourism earning (Karanja *et al.* 2002). However, according to Sindiga, the value of forests for nature tourism in Kenya cannot be argued for. The top 6 National Parks and Game Reserves destinations in Kenya are actually in Grassland and Savannas; Massai Mara, Tsavo, Nakuru, Hell's Gate, Nairobi and Amboseli (Sindiga 1999). Forests' tourism remains underdeveloped and communities are neither involved in tourism activities nor benefit from their income distribution (Sindiga 1999)

4. Conclusions

In conclusion, Kenya's economy and livelihood of the forests' population lose in the long term by inadequate forests' resources valuation (Emerton *et al.* 2001). Figure 3 represents a scheme that summarizes the process of forest degradation resulting from an inadequate CBA.

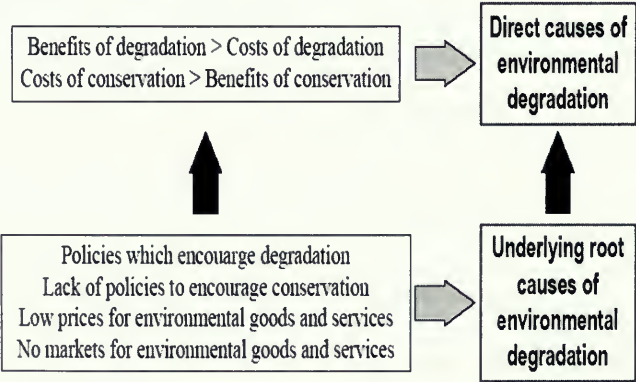


Figure 3: The process of forest degradation resulting from an inadequate CBA.
 Source: Emerton *et al.* 2001

Local populations harvest forest trees because they do not have other options for sustaining their livelihoods and energy (Karanja *et al.* 2002). Addressing the chronic poverty of rural population is extremely vital, and it is advisable that national policy should encourage the use of other energy sources; biogas, animal dung or solar energy. Another solution would be agro forestry, which is basically the planting of trees in the agriculture land for household fuel wood consumption, as well as a source of income to the farmers, and a possibility to increase the soil fertility by nutrient fixing trees (Stone *et al.* 1993)

Along with this, afforestation programs would need to accelerate, following the footsteps of Dr. Wangari Maathai, who initiated the Green Belt project.

It is crucial to understand the total value of the forests and apply a Multi Criteria approach to forest management to ensure that forests continue to deliver their economic, social and ecological services for our generation and the future ones.

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Biodiversity surveys in file of Nature & Faune

Below is a list of biodiversity surveys in file of Nature & Faune.

Kindly send an email to nature-faune@fao.org in order to obtain a copy of one of these surveys.

- Provisional checklist and migratory status of waterbirds in the Douala-Edea Wildlife Reserve, Cameroon
Ajonina, G.N., Ayissi, I. & Usongo, L. 2002
- Flora-diversity of the wetland of Udu and Ughievwen communities, Delta State, Nigeria
Idu, M., Omonhimin, C. & Akinnibosun, H. 2003
- Flora diversity of Okumu forest reserve in southern Nigeria
Idu, M., Osemwegie, O.O. and Akinnibosun, H. A. undated
- Avifauna of the Gouraya National Park, Algeria
Mahmoudi, A. undated
- A provisional checklist of Kishwahili bird names of Morogoro Urban Area, Tanzania
Wambura, J.M., Maganga, S.L.S., Tarimo, T.M.C., Mbije, N.E., 2002
- Biodiversity of the Mangrove Marine Park in the Democratic Republic of Congo: Ichthyologic fauna
Ndey, I., Bilongo, K., Likou, K., Kakay, K.K., Kinakina, K., Kongo, K., Sampie, L., Lundengo, L., Mamud, M., Kajam. & Bidiongo, N. 2007



In what ways do the local people living in and around the protected areas, forests and woodlands of Mozambique benefit from the diversity of the biological resources of these natural ecosystems?

What are the price-tags like for conserving, sustaining and developing the diversity of these finely balanced ecosystems?

Nature & Faune talks to two Mozambiquan government officials.

Mr. M. C. S. Foloma is the Head of Wildlife Department and coordinator of CBFWM (community-based forest and wildlife management Unit) in the Directorate of Land and Forestry in the Ministry of Agriculture in Mozambique. Mr. B. Soto is the national Director for Conservation Areas in the Directorate of Conservation Areas, Ministry of Tourism, Mozambique.

This text has been edited for publication.

Nature & Faune: *Within the context of biological diversity, what would you consider the most important practical experience that Mozambique could share with African countries and other parts of the developing world?*

Soto: We would readily choose to share our practical experiences in striving to share equitably the benefits that accrue to Mozambique from the conservation and use of wildlife and natural resources between the local communities, the private sector and the government. The access to these resources should be fair and they should be made available to everyone.

Nature & Faune: *Identifying the benefit-sharing mechanism that is just right for Mozambique's rural people seems to be one of the top priorities for the government and non-governmental agencies in your country. Would you consider this an appropriate statement?*

Foloma: You have aptly stated the current thinking concerning this subject; more so considering that the government of Mozambique has instituted benefit sharing at various levels and to differing degrees, to ensure that there is fair play and equity in resource sharing and also to serve as incentive for sustainable use of the wildlife and renewable natural resources. Among the most innovative schemes so far are: (i) the 20 percent decree, which promotes a mandatory devolution of 20 percent of the revenue accruing from consumptive and non-consumptive natural forests and wildlife uses to be transferred to the local communities; and (ii) a proposal to allocate to a given community member or individuals 50 percent of any penalty fees collected from offenders, when this community member acts as an environmental agent to support law enforcement.

Nature & Faune: *Could you let us into the core principle underlying these new and evolving benefit sharing schemes?*

Soto: Mozambique is richly endowed with a diversity of biological resources and the government's conservation policy aim is to make natural resource conservation of benefit to its people and to humankind at large. The novelty of the new schemes is to be aware that conservation and sustainable use of these resources have a price tag and for the sustainable development of Mozambique, the nation and its people are being encouraged to pay their fair and appropriate price. At the same time the price for the global benefits accruing from conservation of these biologically diverse resources will have to be defrayed by the world governments and citizenry.

Nature & Faune: *Could you address the issue of wildlife benefits/cost-sharing in the context of biological diversity? What are the realities of attempting to distribute equitably both the costs and benefits of wildlife and protected areas in Mozambique?*

Soto: Access to wildlife resources should be fair; everyone should have a just and reasonable share. The communities living in and around the Protected Areas pay a much higher price for conserving the biological resources and their very valuable diversity than the urban dwellers. In the case of the rural communities the costs are due to human-wildlife conflicts which are a pressing problem in many locations, as well as limitations on the use of natural resources such as restrictions to hunting and gathering, and limited access to certain land-uses (cattle ranching, farming). To cushion the higher and unbalanced price paid by the frontline communities, the

government of Mozambique in 2005 introduced a special deal in which the government allots to the neighboring communities 20% of revenues it collects from the private operators. To this end, a special management plan needs to be put in place to control the use of wildlife and forest resources. The central government approves licenses for Protected Areas and for Hunting and Forestry Concessions; while all simple licenses are allotted by the provinces.

Foloma: The vision of the administration is to pursue an expanded programme of Community Based Natural Resources Management and community enterprises. A legal instrument has been approved which promotes the participation of the economically disadvantaged in decision making and management. So far about 68 initiatives have been developed, involving the government, the private sector and the rural people. The challenge in this set up is the organization of the local people into functional groups (registration of the group, opening of bank account, and providing end of year reporting and accountability to government). To maintain the balance between the economic, socio-cultural and ecological dimensions of biodiversity, the costs and benefits must be meticulously calculated and shared in such a manner that the poor do not suffer unduly from the negative impacts of misuse of these natural resources.

An important incentive that is still being worked out is the 50% decree, which depicts that 50% of the fines paid by defaulters are shared out to rangers, forest guards, and communities from the area within which the resources were illegally harvested. This scheme is still in the process of being improved and subsequently institutionalized (development of relevant and accurate databases is still ongoing).

Besides that, the government acknowledges the needs in local communities and builds schools, infrastructure and helps with improved farming techniques.

***Nature & Faune:** It is argued by some scholars that 'paying' communities should be avoided, while communities would get 'free money' without producing goods or providing services for it. What is your view on that?*

Soto: The government in Mozambique does not see it as 'free money'. After all, the communities bear the largest cost of conservation by having to change their livelihood practices. For this, communities are compensated with money stemming from the benefits conservation produces. If, for example, no benefits would stem from wildlife and forest resource conservation, people would become very uncooperative, human-wildlife conflicts as well as conflicts with forest concession holders would be on the increase.

***Nature & Faune:** Could you shed some more light on the licensing system in place for the commercial use of wildlife and forest resources in Mozambique?*

Foloma: There are two types of forest licensing systems which the government is operating: (i) simple license system and (ii) concession long-term licenses. Whereas the simple license system is annual in duration and can draw on forest resources in a certain site of its choice with consultation from the local community concerned, provided it respects the 500 cubic meters per year volume limit, and is restricted to the specified species; the concession long-term licenses are issued for specific geographical areas only. Moreover a map of the area and an inventory as well as a management plan must precede exploitation. In Mozambique private wildlife-based activities such as game farming requires a title deed.

With regard to wildlife concessions, private sector players such as lodges, restaurants and bars get charged annually for the area they occupy. In the case of trophy hunting, companies are required to pay a certain price for each individual animal they intend to hunt.

***Nature & Faune:** What are the ecological footprints of ecotourism in Mozambique like? Is ecotourism militating for conservation and development of biodiversity in the country or does it have an overall negative impact?*

Foloma: Ecotourism as an industry is still in its early stages of development in Mozambique and as such it is premature to pronounce on its real or perceived effects on the environmental resources and the people.

The overwhelming footprints that loom in everyone's mind and is evidenced in the state of our environment and its resources are the footprints left by the 16 years of civil war (1976 to 1992). The civil war affected dramatically the rich potential of wildlife resources and the status of protected areas with reduction of a diversity and abundance of the most economic wild animals, such as elephant, rhinos, etc. With the peace agreement in 1992, a new era of wildlife management emerged and various conservation initiatives (e.g. transfrontier programmes, CBNRM programmes) have been established associated with new policy and legislation to accommodate efficient wildlife management. Investments have been made in protected areas, aiming to contribute to poverty alleviation and sustainable development of the country.

***Nature & Faune:** It is understood that Mozambique aims to conserve the wildlife and the biological diversity within its national territory for the universal good. So how would the world (the international community)*

contribute in offsetting the costs of conservation and development of the biological diversity to which Mozambique is home?

Soto: Finances from Overseas Development Assistance and the donor community constitute the key elements of the price paid by the International community. Other important players are the transnational businesses operating in Mozambique who bear a portion of the cost for the existence of the wildlife, forests and other biological resources being maintained and developed by the people of Mozambique.

***Nature & Faune:** How strong is the market based mechanism for defraying of costs of biodiversity conservation and development in Mozambique?*

Foloma: The prevailing practice under the market based mechanism includes visual tourism, whereby fees are required to see elephants, lions and other charismatic animals. In the future other latent and undiscovered values of the resources and the value of their diversity will most likely be recognized and should attract generous dividends.

We are struggling to promote benefit sharing that distributes revenue as equitable as possible. In most of the schemes running today the expenditures take place in the cities. The administration in Mozambique will have to strive harder to put in place the necessary measures to ensure that a significant part of the revenues from wildlife, forests and nature parks are spent in the rural areas.

***Nature & Faune:** What are the prospects for maintaining and developing the diversity of Mozambique's biological resources in the future in the face of growing human populations in the country?*

Soto: The future is very bright for the conservation and development of biodiversity in Mozambique. One must remember that the backbone of ecotourism is the diversity of biological resources; Mozambique certainly has much of this to offer the world.

The government is at present working hard to identify potential centers of attraction and putting out tenders for the private investors to develop infrastructure ranging from luxury hotels and lodges to community based enterprises. Foreign investors are required to partner with Mozambiquan investors towards the development and implementation of capital intensive ecotourism initiatives. Labour intensive small scale investment enterprises (US\$ 500) are exclusively under the purview of the local people. Some conservation areas in Mozambique where commercial enterprises are being developed include the Lubombo Transfrontier Conservation Area, the Great Limpopo Transfrontier Park, the Chimanimanu Transfrontier Area and the Southern part of Tete province. Other parks are very remote, and few facilities have been put in place yet. Nevertheless, we do plan to improve the circumstances in the future.

Besides, one of the great centers of attraction still on the drawing board is the Great Limpopo Transfrontier Park which brings into existence a close coordination between Kruger park of South Africa, Gonarezhou in Zimbabwe and the Limpopo Park in Mozambique. This alliance makes "the Great Limpopo Transfrontier Park" one of the largest nature parks in the world. Already the borders are open; numbers of eco-tourists are doubling every month, mainly in South Africa and Mozambique, tented camp sites are on the increase, luxury 10 bed inns are always full to capacity and it will not take too long before the 5 star hotels will be established. The fundamental building block for this flurry of economic developmental activities is the diversity of the biological resources inherent in the ecological systems in Mozambique in particular and Southern Africa in general.

The people of Mozambique definitely have invested interest in taking care of the diversity of its wildlife.

***Nature & Faune:** Thank you so much Messrs Soto and Foloma, for informing us on the interesting work Mozambique is doing in its efforts to distribute equitably the costs and benefits derived from wildlife and protected areas. You have indeed given readers something to think about!*

Non-Wood Forest Products

The term 'non-wood forest products' (NWFPs), and similar terms such as 'minor', 'secondary' and 'non-timber' forest products, have emerged as umbrella expressions for the vast array of both animal and plant products other than wood (or timber, in the case of 'non-timber') derived from forests or forest tree species. FAO uses the term 'non-wood forest products' and defines it as goods of biological origin other than wood that are derived from forests, other wooded land and trees outside forests.

The programme "Promotion and Development of Non-wood Forest Products (NWFP)" is one of the priority areas of FAO's Forestry Department. Its mission is to improve the sustainable utilization of NWFP in order to contribute to the wise management of the world's forests, to conserve their biodiversity, and to improve income-generation and food security.

The programme accomplishes this mission through four main areas of intervention:

- gathering, analysis and dissemination of information
- appraisal of NWFP socio-economic contribution to rural development
- networking
- technical assistance

Non-wood forest products have attracted considerable global interest in recent years because of increasing recognition of their contribution to household economies and food security, to some national economies and to environmental objectives such as the conservation of biological diversity. Some 80 percent of the population of the developing world uses NWFPs for health and nutritional needs. Several million households worldwide depend heavily on these products for subsistence consumption and/or income. At the local level, NWFPs also provide raw materials for large-scale industrial processing; including processing of internationally traded commodities such as foods and beverages, confectionery, flavourings, perfumes, medicines, paints and polishes. At present, at least 150 NWFPs are significant in terms of international trade; they include honey, gum arabic, rattan and bamboo, cork, forest nuts and mushrooms, essential oils, and plant and animal parts for pharmaceutical products.

An important FAO initiative in the African Region is the project 'Enhancing Food Security through Non-wood Forest Products in Central Africa.' The objectives are:

- Raising awareness of and knowledge about the role of NWFP for food security;
- Laying foundations for the systematic Integration of Information on food from forests in relevant policies and programmes.

The project contributes to facilitate actions by governments, non-governmental organizations and the private sector in six Central African countries, i.e. Cameroon, Gabon, Central African Republic, Democratic Republic of Congo (RDC), Equatorial Guinea and the Republic of Congo. It aims to enhance food security in the sub-region through the sustainable use of NWFP from moist dense forests and other tree-based systems.

The project strengthens institutional capacities in the sub-region, enhances knowledge on forest resources and agroforestry production systems and promotes better coordination among all actors concerned involved in activities related to food security and forest conservation through the sustainable use of NWFP.

Another initiative is the development of NWFP inventory guidelines for African ACP countries. The purpose of this activity is to contribute to sustainable forest management in African ACP countries by developing and testing practical guidelines for the assessment of forest resources providing NWFP. Such guidelines will enable national forestry administrations to implement improved and regular monitoring of the NWFP resource base and develop sustainable harvesting regimes in partnership with local and indigenous communities.

For more information, please see:

FAO NWFP site, containing all documents produced in the project 'Enhancing Food Security through Non-wood Forest Products in Central Africa'

<http://www.fao.org/forestry/site/nwfp/en/>

Forest genetic resources

Genetic variation is an important part of biological diversity, since it is the basis of evolution and the adaptation of species to changes in the environment. Variation is also essential for selection and breeding to meet present and future human needs.

The term “forest genetic resources” refers to the actual or potential value of the hereditary variation contained in forest trees and shrubs. The field of forest genetic resources is undergoing significant changes. Traditionally concerned with technical issues of genetic conservation, tree improvement and seed supply, its scope is expanding to include scientific advances in biotechnology and legal developments concerning access rights to genetic resources, which bring new possibilities and challenges. The field is driven not only by the forest sector, but also increasingly by the environmental sector and by developments in crop plant genetic resources.

FAO is actively working with its Members to assess the global state of genetic diversity in the world's forests and find solutions to the threats facing them. The Organization also promotes best practices in forest genetic resources management specifically in the areas of conservation, exploration, testing, breeding and informed use of new biotechnology. The focus is on the transfer of actual information and up-to-date technology, through a wide range of communication tools and publications and through networking and twinning mechanisms. The work of FAO is supported by a Panel of Experts on Forest Gene Resources which meets regularly to report on the latest developments. The panel updates lists of priority tree species, with recommended actions, by region.

Two important FAO projects in the African Region are:

- 'Domestication, Post-Harvest Handling and Marketing of Selected Indigenous Fruit Trees, Namibia'
This project aimed at enabling the populations in northern Namibia to improve their income and living standards through collecting, processing and marketing fruits and other edible products from local tree species. It also aimed at enhancing the role of the Namibian Forestry Directorate as a provider of services to the population in the improvement of wild fruit trees and the development and marketing of fruit production.
For more information, please see: www.fao.org/forestry/site/9473/en
- 'National Forest Seed Programme, Senegal (Programme National de Semences Forestières PRONASEF)'
This project had the objective to développer le PRONASEF est d'assurer un approvisionnement régulier en semences forestières, de qualité et quantité suffisante au moment opportun, en priorité pour la satisfaction des besoins au Sénégal et de la demande des autres pays tropicaux (Afrique, Asie, Australie).
For more information, please see: www.fao.org/forestry/site/6594/fr

In a growing number of countries and areas of the world, detailed documentation on the state of forest genetic resources as well as the most urgent actions for their sustainable management is becoming available. The extensive FAO Web site on forest genetic resources presents a comprehensive coverage of geographic and thematic issues, with relevant links to the forest, agriculture and environment sectors. The REFORGEN database summarizes information available on important tree species by country. National and regional assessments of forest tree genetic diversity are also available. FAO publishes the annual news bulletin Forest Genetic Resources in three languages, of which recent issues are posted online.

The Web site also presents the achievements of a number of FAO field projects related to forest seed and germplasm, tree improvement and breeding, and the integration of genetic conservation into forest and protected area management and agrobiodiversity.

In addition, FAO regularly disseminates information to member countries and relevant national institutions about developments related to emerging issues, including the applications of modern biotechnologies, biosecurity management and biological diversity considerations.

For more information, please see: <http://www.fao.org/forestry/site/fgr/en/>

Related to the Theme

Wildlife Enforcement Monitoring System

The Wildlife Enforcement Monitoring System (WEMS), developed by United Nations University (UNU) in cooperation with the Asian Conservation Alliance (ACA), has the goal to document transboundary illegal wildlife trade as well as to provide a clearer picture, through temporal and spatial analysis of the data, about the current situation of illegal wildlife trade.

<http://www.unu.edu/wems/>

FAO Biological diversity in food and agriculture

<http://www.fao.org/biodiversity/>

FAO Commission on genetic resources for food and agriculture

The Commission on Genetic Resources for Food and Agriculture is a permanent forum where governments discuss and negotiate matters relevant to genetic resources for food and agriculture. The main objectives of the CGRFA are to ensure the conservation and sustainable utilization of genetic resources for food and agriculture, as well the fair and equitable sharing of benefits derived from their use, for present and future generations. The Commission aims to reach international consensus on areas of global interest, through negotiations.

<http://www.fao.org/WAICENT/FAOINFO/AGRICULT/cgrfa/default.htm>

FAO Domestic animals diversity information system

<http://dad.fao.org/>

FAO International Technical Conference on Animal Genetic Resources, 1-7 September 2007, Interlaken, Switzerland

http://www.fao.org/ag/aginfo/programmes/en/genetics/ITC_background.html

FAO Fishery Statistics programme

<http://www.fao.org/fi/statist/statist.asp>

FAO Soil biodiversity portal

<http://www.fao.org/ag/agl/agll/soilbiod/default.stm>

UN World Tourism Organisation

<http://www.world-tourism.org/>

Convention on Biological Diversity

In 1992, the largest-ever meeting of world leaders on environmental issues took place at the United

Nations Conference on Environment and Development in Rio de Janeiro, Brazil. An historic set of agreements was signed at the "Earth Summit", including two binding agreements, the Convention on Climate Change, which targets industrial and other emissions of greenhouse gases such as carbon dioxide, and the Convention on Biological Diversity, the first global agreement on the conservation and sustainable use of biological diversity. The biodiversity treaty gained rapid and widespread acceptance. Over 150 governments signed the document at the Rio conference, and since then more than 187 countries have ratified the agreement.

The Convention has three main goals:

- The conservation of biodiversity,
- Sustainable use of the components of biodiversity, and
- Sharing the benefits arising from the commercial and other utilization of genetic resources in a fair and equitable way

www.biodiv.org

The BioTrade Initiative

Since its launch in 1996, the UNCTAD BioTrade Initiative has been promoting sustainable biotrade in support of the objectives of the Convention on Biological Diversity. The Initiative has developed a unique portfolio of regional and country programmes.

<http://www.biotrade.org/Intro/bti.htm>

Convention on Migratory Species

The Convention on the Conservation of Migratory Species of Wild Animals (also known as CMS or Bonn Convention) aims to conserve terrestrial, marine and avian migratory species throughout their range. It is an intergovernmental treaty, concluded under the aegis of the United Nations Environment Programme, concerned with the conservation of wildlife and habitats on a global scale.

<http://www.cms.int/>

UNEP - Biodiversity

<http://www.unep.org/themes/biodiversity/>

UNDP - Conservation and Sustainable Use of Biodiversity

<http://www.undp.org/biodiversity/>

CITES

CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) is an international agreement between governments. Its aim is to ensure that international trade in specimens

of wild animals and plants does not threaten their survival.

<http://www.cites.org/>

The CITES trade database, managed by UNEP-WCMC on behalf of the CITES Secretariat, is a unique resource and currently holds 7 million records of trade in wildlife and 50,000 scientific names of taxa listed by CITES. Currently, more than 500,000 records of trade in CITES-listed species of wildlife are reported annually.

<http://www.unep-wcmc.org/citestrade/trade.cfm>

Interpol Wildlife Crime

<http://www.interpol.int/Public/EnvironmentalCrime/Wildlife/Default.asp>

Wildlife Working Group

<http://www.interpol.int/Public/EnvironmentalCrime/Wildlife/WorkingGroup/Default.asp>

Wildlife trade in the EU

This website has been designed to provide up-to-date and tailor-made information to commercial EU wildlife trade sectors as well as travel.

<http://www.eu-wildlifetrade.org/html/en/intro.asp>

ASEAN Wildlife Trade Initiative

The joint TRAFFIC/WWF ASEAN Initiative aims to increase regional cooperation in addressing wildlife trade issues of importance to the 10 Member Nations of the Association of Southeast Asian Nations (ASEAN).

<http://www.traffic.org/25/network9/ASEAN/index.html>

The International Ecotourism Society (TIES)

Promoting responsible travel that unites conservation and communities since 1990. TIES is a global network of industry practitioners, institutions and individuals helping to integrate environmental and socially responsible principles into practice.

<http://www.ecotourism.org/>

WWF - Payment for Ecosystem Services

http://www.wwfindia.org/about_wwf/what_we_do/forests/pes/index.cfm

Agriculture and biodiversity

http://www.panda.org/about_wwf/what_we_do/policy/agriculture_environment/index.cfm

Center for Applied Biodiversity Science

The mission of the Center for Applied Biodiversity Science (CABS) is to strengthen Conservation International's ability to identify and respond to elements that threaten the earth's biological diversity. CABS brings together leading experts in science and technology to collect and interpret data about biodiversity, develop strategic plans for

conservation, and forge partnerships in all sectors that promote conservation goals.

<http://science.conservation.org/portal/server.pt>

The Katoomba Group

The Katoomba Group is an international working group composed of leading experts from forest and energy industries, research institutions, the financial world, and environmental NGOs dedicated to advancing markets for some of the ecosystem services provided by forests such as watershed protection, biodiversity habitat, and carbon storage. The Katoomba Group seeks to address key challenges for developing markets for ecosystem services, from enabling legislation to establishing new market institutions, to developing strategies for pricing and marketing, and monitoring performance.

<http://www.katoombagroup.org/>

Katoomba Africa:

<http://www.katoombagroup.org/africa/index.htm>

PES Assessment Inventories ready for download for Kenya, South Africa, Uganda, Tanzania, and Madagascar

European Tropical Forest Research Network

Biodiversity information.

<http://www.etfrn.org/ETFRN/topics/biodiversity/index.html>

Publications and information documents

Livelihoods and the environment at Important Bird Areas: listening to local voices.

A new publication by BirdLife International provides a synthesis of local analyses of biodiversity-livelihoods linkages in key biodiversity sites in developing countries. The studies were carried out by BirdLife partners and focused on sites designated by the organisation as 'Important Bird Areas' or IBAs.

http://www.birdlife.org/news/news/2007/01/listening_to_local_voices_IBAs.pdf

Biodiversity Economics

Information portal designed to promote economic approaches to conservation and provide access to key documents in English, French, and Spanish. The site includes an events calendar and global database of practitioners.

http://www.frameweb.org/ev_en.php?ID=37330_201&ID2=DO_TOPIC

The value of wildlife

Ph. Chardonnet, B. des Clers, J. Fischer, R. Gerhold, F. Jori and F. Lamarque (4)
Rev. sci. tech. Off. int. Epiz., 2002, 21 (1), 15-51
<http://www.oie.int/eng/publicat/rt/2101/Ph.%20CHARDONNET.pdf>

The value of biodiversity

Science and Development Network

<http://www.scidev.net/ms/biofacts/index.cfm?pageid=423>

Geneflow - A publication about agricultural biodiversity

<http://www.bioversityinternational.org/publications/Pdf/1144.pdf>

Of general interest

Encyclopedia of life

The Encyclopedia of Life is an ecosystem of websites that makes all key information about life on Earth accessible to anyone, anywhere in the world. The goal is to create a constantly evolving encyclopedia that lives on the Internet, with contributions from scientists and amateurs alike.
<http://www.eol.org/home.html>

Encyclopedia of Earth

An electronic reference about the Earth, its natural environments, and their interaction with society. The Encyclopedia is a free, fully searchable collection of articles written by scholars, professionals, educators, and experts who collaborate and review each other's work. The articles are written in non-technical language and will be useful to students, educators, scholars, professionals, as well as to the general public.
<http://www.eoearth.org/>

Biodiversity and ecosystem services:

http://www.eoearth.org/article/Biodiversity_and_ecosystem_services

FAO TIGERPAPER

TIGERPAPER is a quarterly news bulletin dedicated to the exchange of information relating to wildlife and national parks management for the Asia-Pacific Region. FOREST NEWS is issued by the FAO Regional Office for Asia and the Pacific as part of TIGERPAPER.

<http://www.fao.org/world/regional/rap/tigerpaper/tigerpaper.htm>

African Hunting Info

African Hunting Info is a free web resource on all facets of African hunting. The site includes hunting articles, hunting and conservation news, forums, opinion polls, photo galleries, directories and much more.

<http://africanhuntinginfo.com/modules/tinycontent/index.php?id=1>

Virunga Survie du premier parc d'Afrique

Une équipe de 36 experts décrivent le passé et le présent du parc et proposent des voies concrètes pour la sauvegarde de ce site du Patrimoine Mondial. Pour la première fois en 80 ans de l'histoire du Parc National des Virunga, cet ouvrage comble un grand vide en décrivant le parc ainsi que les efforts du Congo et de la communauté internationale pour préserver ce premier parc d'Afrique tant d'un point de vue historique que de diversité biologique.

<http://www.virungafund.org/Leaflet%20Virunga%20FR%208%20dec.pdf>

Frameweb

FRAMEweb is an online interactive portal for the natural resources management community. Information is available in English, French and Spanish.

<http://www.frameweb.org/>

Theme and deadlines for next issue

The theme for the next issue of Nature & Faune magazine is “Conservation Beyond Boundaries”. This theme can be understood from several perspectives, such as: international agreements and their practical implications; programmes and activities to harmonize relevant policy and legislation of different countries; the establishment of transboundary wildlife corridors; transboundary protected areas and transfrontier conservation areas; international law enforcement initiatives; investment in eco-tourism by international partners; international trade agreements for non-wood forest products; international schemes for payment for ecological services (e.g. carbon sequestration); impacts of development assistance on conservation; cooperation between governments and international NGOs in conservation; specific species conservation strategies; international training programmes for wildlife and natural resource management; international conferences, seminar and workshops

Deadline for submission of articles, announcements and other contributions is 31 October 2007.

Guidelines to authors, Subscription and Correspondence

We welcome any contribution from our readership!

In case you would like to submit an article, kindly take a look at our ‘Guidelines for Authors’, available on our website. You could also send us an email.

If you would like to subscribe to this magazine, please send us an email indicating your contact details such as full name, organization, position, postal address, email, and country of residence.

If you have suggestions, comments, questions or remarks, or you would like to contribute to the contents of this magazine with news, articles, reports or events, please write to us.

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Nature & Faune is an international publication dedicated to the exchange of information and practical experience in the field of wildlife and protected areas management and conservation of natural resources on the African continent. Nature & Faune has been in wide circulation since 1985.

Nature & Faune is dependent upon your free and voluntary contributions in the form of articles and announcements in the field of wildlife, forestry and nature conservation in the Region.

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