

Guidelines on sustainable forest management in drylands of sub-Saharan Africa



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For further information and comments, please contact:

Nora Berrahmouni, Forestry Officer (Arid zones)
Forest Conservation Team (FOMC)
Forest Assessment, Management and Conservation Division
Forestry Department
FAO
Viale delle Terme di Caracalla
00153 Rome, Italie
Email: nora.berrahmouni@fao.org

Or

Moujahed Achouri, Team Leader
Forest Conservation Team (FOMC)
Forest Assessment, Management and Conservation Division
Forestry Department
FAO
Viale delle Terme di Caracalla
00153 Rome, Italie
Email: moujahed.achouri@fao.org

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Forestry Department

Food and Agriculture Organization of the United Nations

Arid Zone Forests and Forestry Working Papers

Guidelines on sustainable forest management in drylands of sub-Saharan Africa

Forest Conservation Team (FOMC)
Forest Assessment, Management
and Conservation Division
Forestry Department

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Contents

Foreword	iv
Acknowledgements	vi
Acronyms	vii
1. Introduction	1
2. Economic significance of dryland forest commodities: gums and resins	3
3. Major challenges to forests and the forest sector in sub-Saharan Africa	7
4. Guiding principles and options for sustainable forestry in dryland sub-Saharan Africa	11
Safeguarding and maintaining the resource among growing pressures	13
Maintaining or enhancing biological diversity to assist forests' multifunctional services ..	16
Promoting healthy and vigorous forests and combating difficult growth conditions	20
Addressing the new challenge of climate change: mitigation and adaptation	23
Enhancing forests' productive and protective capacities	26
Promoting socio-economically relevant forest resources	30
Legal, policy and institutional framework for sustainably managed forests	32
Awareness raising, education and capacity building	34
Capitalizing on growing regional and international cooperation in sub-Saharan Africa ..	36
Glossary	38
References	45

Boxes

Box 1. Sub-Saharan African countries covered by dryland forests	2
Box 2. The Network for Natural Gums and Resins in Africa (NGARA)	6
Box 3. Sub-Saharan Africa: general considerations	12
Box 4. Importance of forest game and bushmeat	18
Box 5. Major threats to the reproductive capacity of dry forests in sub-Saharan Africa	20
Box 6. Forests and climate change	25
Box 7. Major benefits of forest management	30
Box 8. Areas of capacity building and engagement for forest management professionals	35
Box 9. The Great Green Wall for the Sahara and the Sahel Initiative: the Senegalese experience	37

Maps

Map 1. World dryland systems	2
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Tables

Table 1. Major African Producing and Exporting Countries	4
Table 2. Raw Gum Arabic Exports (tonnes) 1992-2006	4
Table 3. Current prices of the main resins in Somalia, Ethiopia and Kenya	5

Foreword

More than elsewhere, forests in the drylands of sub-Saharan Africa have the potential to contribute to poverty reduction and food security, as long as they are well valued and sustainably managed. The inhabitants of these areas are mostly farmers, herders and forest product gatherers. Their livelihoods are therefore largely dependent on forest and woodland services, and forest management has to respond to their many and diverse needs.

During recent decades, scarcer water resources, droughts, increased human pressure on forests and rangelands, and bushfires have created conditions conducive to degradation, deforestation and desertification. These dynamics are driven by interrelated factors, including inadequate land-use policies, poor governance, complex land tenure issues, and a general lack of understanding of the importance of forest and woodland resources, leading to a lack of investment in their sustainable management. In sub-Saharan Africa, the majority of natural resources remain under government control, but governance issues are a fundamental constraint to their adequate management.

For drylands (with their rich and diverse but fragile ecosystems and resources) to be effectively protected and sustainably managed, communities must derive the consequent benefits, but this is rarely the case. Instead, the situation is marked by a lack of appropriate, integrated land-use planning, and poor practices in natural resource and forest management.

In response to the request of member countries, FAO launched and coordinated a process for the preparation of “Guidelines on sustainable forest management practices in drylands of sub-Saharan Africa”. They are intended to guide forestry decision-makers and managers in prioritizing the issues and aspects that need to be addressed.

The guidelines’ objective is to improve forest planning and management in the drylands of the region, so as to contribute to the well-being of local populations and enhance their social, cultural, environmental and economic benefits.

This document was developed with enormous contributions from international, regional and national forestry experts and partners active in the region. It is based on:

- the experience and process of preparing *Guidelines on good forestry and range practices in arid and semi-arid zones of the Near East* (FAO and Near East Forestry Commission, 2009);
- FAO’s in-house forestry expertise and the inputs of international experts and consultants;
- written contributions and comments from partner organizations and experts active in the region and involved in forest issues;
- comments and recommendations from the expert consultation workshop organized in Addis Ababa, Ethiopia, in March 2009 involving experts from several countries and the African Union Commission;
- outcomes and recommendations of the technical validation workshop organized in Dakar from 20 to 22 January 2010 by FAO, in collaboration with the Agence Nationale de la Grande Muraille Verte (Senegal), which gathered more than 70 participants representing forestry and environment-related departments and ministries from 12 countries, regional and international organizations, non-governmental organizations (NGOs), United Nations agencies, research centres and networks.
- recommendations resulting from the 17th session of the African Forestry and Wildlife commission, held in Brazzaville in February 2010.

The guidelines are based on widely accepted international standards for sustainable forest management. The area they cover comprises the arid, semi-arid and sub-humid zones of sub-Saharan Africa, and the major forest and tree formations concerned are:

- xeric desert and desert fringe formations of scrubs and steppes;
- arid tree and grass savannah formations;
- semi-arid to sub-humid tree formations and dry forests and woodlands.

The main body of the document is organized in four sections: an introduction to dryland forests in the sub-Sahara; a section highlighting the economic significance of these forests with the example of gums and resins, another section focuses on major challenges facing forests and the forest sector in this region; and a section giving details on the nine guiding principles. These four sections are followed by a glossary and a list of references.

It is hoped that the extensive consultation process and significant participation of national experts and regional and international institutions in the preparation of these guidelines will encourage their widespread use and further improvement and adaptation for the benefit of all stakeholders. FAO will pursue a facilitating role in this regard, and I seize this opportunity to convey our thanks to all the individuals and institutions who contributed to this exercise, while inviting other partners who did not have the chance to participate to join this long-term and iterative process.

Moujahed Achouri
Team Leader
Forest Conservation Team (FOMC)
Forest Assessment, Management and Conservation Division
FAO Forestry Department

A handwritten signature in black ink, consisting of a stylized, cursive script that appears to read 'Moujahed Achouri'.

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The process and finalization of these guidelines were coordinated by Nora Berrahmouni, Forestry Officer (Arid Zones), in collaboration with Moujahed Achouri, Team Leader (Forest Conservation Team); Susan Braatz, Senior Forestry Officer (Forests and Climate Change); Jesper Tranberg, Associate Professional Officer; Walter Kollert, Forestry officer (Planted Forests), Simmone Rose, Forestry Officer (Bioenergy and Climate Change); Paolo Ceci, Consultant; Foday Bojang, Senior Forestry Officer (FAO Regional Office for Africa); Michel Laverdière, Forestry Officer (FAO Sub-Regional Office for East Africa); and forestry officers from the FAO Sub-Regional Office for West Africa.

Mr John Dawson and Ms Jane Shaw edited respectively the previous and final versions; and Mr José Luis Castilla Civit assisted in the lay-out of the document. Mr Mustapha Kerdi has provided administrative assistance during the whole process.

Special thanks are due to the Government of Italy for providing financial support through the Acacia Operation Project "Support to Food Security, Poverty Alleviation and Soil Degradation Control in Gums and Resins Producing Countries (Burkina Faso, Chad, Kenya, the Niger, Senegal and the Sudan)", supplementing FAO budget available for the publication of these guidelines.

Acronyms

AFF	African Forest Forum
ANGMV	GGWSSI National Agency (Senegal)
AR4	Fourth Assessment Report (IPCC)
AU	African Union
CBD	United Nations Convention on Biological Diversity
CEN-SAD	Community of Sahel-Saharan States
CIFOR	Center for International Forestry Research
CILSS	Permanent Interstate Committee for Drought Control in the Sahel
CIRAD	International Cooperation Centre of Agricultural Research for Development
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
COMIFAC	Central African Forests Commission
ECA	Economic Commission for Africa
ECOWAS	Economic Community of West African States
FAO	Food and Agriculture Organization of the United Nations
FRA	Global Forest Resources Assessment
FSC	Forest Stewardship Council
GEF	Global Environment Facility
GGWSSI	Great Green Wall for the Sahara and the Sahel Initiative
ICRAF	World Agroforestry Centre
IGAD	Intergovernmental Authority for Development
IPCC	Intergovernmental Panel on Climate Change
IPF	Intergovernmental Panel on Forests
ITTO	International Tropical Timber Organization
IUCN	International Union for Conservation of Nature
IUFRO	International Union of Forest Research Organizations
MEA	Millennium Ecosystem Assessment
NEPAD	New Partnership for Africa's Development
NGARA	Network for Natural Gums and Resins in Africa
NGO	non-governmental organization
REDD	reducing emissions from deforestation and forest degradation
TOF	trees outside forest
UNCCD	United Nations Convention to Combat Desertification
UNCED	United Nations Conference on Environment and Development
UNFCCC	United Nations Framework Convention on Climate Change
UNDP	United Nations Development Programme
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
UNFF	United Nations Forum on Forests
WFP	World Food Programme



1. Introduction

Forests are not the first thing that comes to mind when thinking of arid zones or drylands. Nearly 50 percent of the African continent is covered by drylands (Map 1) spread entirely or partially over 15 countries of Western and Central Africa and 15 countries of Eastern and Southern Africa (Box 1). The large diversity of vegetation depends on rainfall patterns and geomorphology; the diversity of Africa's unique wildlife resources has been recognized for centuries. Because a substantial part of Africa is arid, the contributions of forests and woodlands to combating desertification and conserving watersheds are critical, especially for ensuring long-term food security.

In sub-Saharan Africa, dryland forests play a significant role in biodiversity conservation, harbouring unique and endemic species that are well adapted to extreme ecological conditions, providing essential ecosystem goods (e.g., fodder for livestock, fuelwood, medicines and tradable goods such as resins and gums) and services (e.g., soil formation and conservation, water conservation and quality improvement, regulation of water regimes and micro-climates, reduction of wind velocity, control of wind erosion, and retardation of water and moisture depletion). With increasingly uncertain climatic conditions and related impacts across the drylands, there is need for new management approaches that support and promote land uses that are more resilient to climate variability and change. Forests' role in climate change mitigation and adaptation is important; the sustained provision of ecosystem goods and services can help people adapt to the local consequences of a changing climate, while the carbon stored in these ecosystems, if well managed, can contribute to climate change mitigation. It can be argued that the role of forests and woodlands is even more important, both biologically and socio-economically, in arid lands than it is elsewhere. Further unquantified areas of rangelands, agroforestry parklands and trees outside forests also play important ecological and socio-economic roles in Africa's arid lands.

Poverty and environmental degradation are major problems in dryland sub-Saharan Africa, where forests and trees contribute significantly to rural livelihoods. Dryland people have developed resilient and adaptive livelihood systems that enable their survival in difficult conditions. Supporting these systems and promoting the sustainable use of resources are therefore key to reducing poverty. Drylands offer significant potential for socio-economic development, but despite their value, these ecosystems are caught in a spiral of deforestation, fragmentation, degradation and desertification.

The guidelines described in chapter 4 are designed to support the decision-makers and actors responsible for planning and managing forests and related resources, by helping them address complex and interlinked issues and social, environmental and economic challenges, as well as the needs related to policies, markets and lack of technical capacity, awareness and knowledge. These challenges and issues are explored in detail in chapter 3.

BOX 1

Sub-Saharan African countries covered by dryland forests

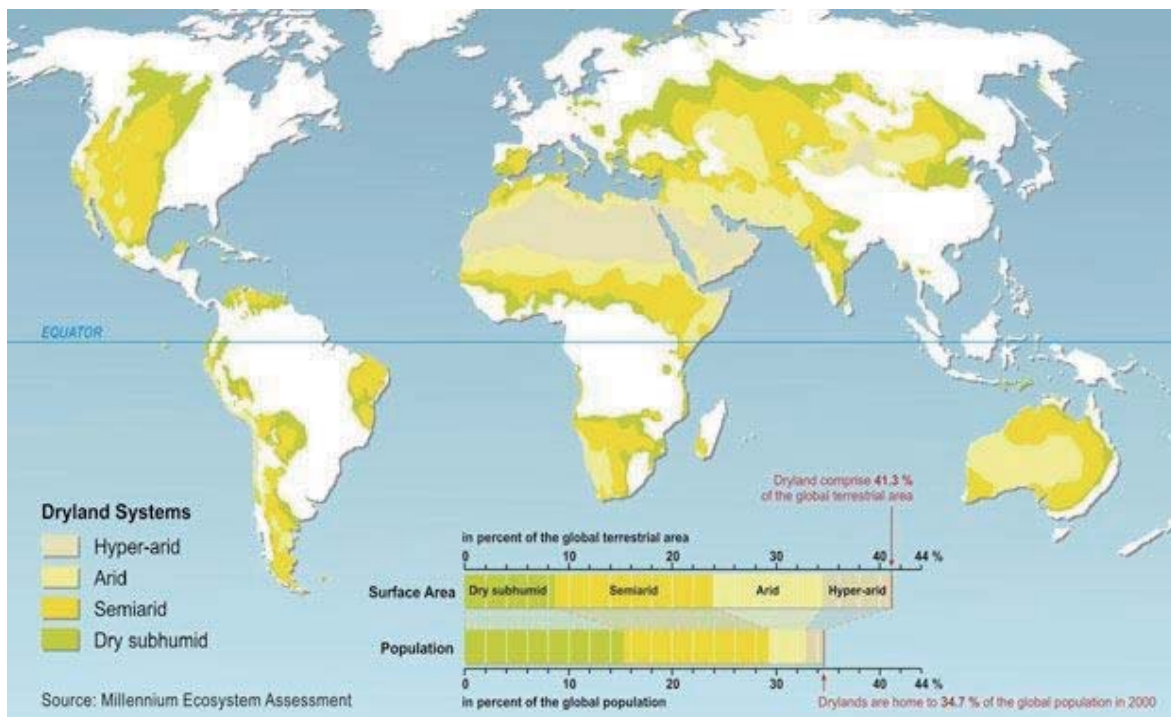
Western and Central Africa

Benin (northern part)
 Burkina Faso
 Cameroon (northern part)
 Côte d'Ivoire (northern part)
 The Gambia
 Ghana (northern part)
 Guinea-Bissau (northern part)
 Mali
 Mauritania
 The Niger
 Nigeria
 Central African Republic
 Senegal
 Chad
 Togo

Eastern and Southern Africa

Angola
 Botswana
 Eritrea
 Ethiopia
 Kenya
 Madagascar (southern and western parts)
 Malawi
 Mozambique
 Namibia
 South Africa
 Somalia
 The Sudan
 United Republic of Tanzania
 Zambia
 Zimbabwe

Map 1. World dryland systems



Source: MEA, 2005.

2. Economic significance of dryland forest commodities: gums and resins

Dryland forest resources with the potential to improve rural communities' livelihoods in sub-Saharan Africa include plant gums (gum arabic) and resins (myrrh, hagar and frankincense).

Gum arabic is a dried exudate obtained from the stems and branches of *Acacia senegal* or *A. seyal*. It is the oldest and best-known of the natural gums, having been an important article of commerce for thousands of years. Its high solubility combined with low viscosity in water gives gum arabic the highly valued emulsifying, stabilizing, thickening and suspending properties that have enabled it to withstand international market competition from other natural gums and semi-synthetic substitutes. Gum arabic is in demand both in producing countries and internationally. Traditionally, it is eaten by children and herders in the bush, and is also used as medicine to ease joint and back pain. Its major uses are in the food and pharmaceutical industries.

Gum arabic of varying quantities and qualities is produced mainly in 17 African countries namely; Burkina Faso, Cameroon, Chad, Eritrea, Ethiopia, Ghana, Kenya, Mali, Mauritania, Niger, Nigeria, Senegal, Somalia, Sudan, Uganda, United Republic of Tanzania and Zimbabwe (Table1).

The current world demand of gum arabic is about 100 000 tonnes, compared with a supply of about 70 000 tonnes, and a 15-year mean supply (1992 to 2006) of about 46 085 tonnes/year (Table 2). Globally, gum arabic imports rose significantly in 2004, 2005 and 2006. Demand is projected to reach 150 000 tonnes by 2020. Future perspectives for development of gum arabic are good, with only about 60 percent of global demand currently being met.

The European Union (EU) is by far the largest market. Between 2003 and 2007, the EU imported 200 000 tonnes, valued at close to US\$432 million. France is the world's leading importer, accounting for more than 30 percent of global imports, followed by the United States (17 percent), the United Kingdom (10 percent), Germany and Italy, combined represent another 10 percent. Imports by the United States



Gum arabic, Niger

Table 1: Major African Producing and Exporting Countries

Country		%
Major producing countries	Sudan	43
	Chad	35
	Nigeria	18
Minor producing countries	Senegal	1.05
	Mali	0.83
	Tanzania, United Republic of	0.52
	Ethiopia	0.40
	Mauritania	0.38
	Cameroon	0.28
Others	Eight African countries	0.54
		96
		3.46
		0.54

Source: ITC, 2008; Commodity Trade Database (COMTRADE) statistical data, 1992-2006.

Table 2: Raw Gum Arabic Exports (tons) 1992-2006

Year	Sudan	Chad	Nigeria	Africa/others	Sub-Total Africa	Asia	Total
1992	17 061	2 450	8 358	3 073	30 942	726	31 668
1993	13 475	3 701	7 042	2 243	26 461	756	27 217
1994	23 341	4 558	9 822	3 751	41 472	684	42 156
1995	18 143	7 001	9 914	2 821	37 879	814	38 693
1996	17 671	7 365	12 164	3 349	40 549	435	40 984
1997	17 342	8 527	10 199	5 301	41 369	696	42 065
1998	25 053	12 584	8 166	2 296	48 099	384	48 483
1999	19 305	11 312	8 598	3 399	42 614	912	43 526
2000	21 916	11 682	8 239	4 009	45 846	2 251	48 097
2001	26 105	12 881	8 747	2 137	49 870	471	50 341
2002	34 162	10 664	6 556	2 724	54 106	258	54 364
2003	13 217	9 672	50	3 097	26 036	835	26 871
2004	27 444	12 044	15 407	2 393	57 288	762	58 050
2005	33 078	14 186	19 313	3 930	70 507	1 879	72 386
2006	23 149	17 812	21 231	3 474	65 666	709	66 375

Source: ITC (Trade map) based on COMTRADE statistical data, 2008.

and India have increased dramatically over recent years, rising by 647 percent between 1993 and 2007 in the United States.

Gum arabic is consumed on all continents, and increasing numbers of countries are importing it. Four processors in the United States and Europe account for about 70 percent of world trade in raw gum, buying it for transformation and resale as additives for industry. The main uses of gum are confectionery in Europe and soft drinks production in the United States. Japan accounts for slightly less than 10 percent of world trade. India, the Republic of Korea and China are emerging markets.

Trade data reveal that Sudan, Chad and Nigeria yielded 96 percent of the gum arabic supply in 2007; 80 percent of the global supply was consumed by 13 countries, three of which – France, the United Kingdom and Germany – were responsible for 70 percent of re-exports.

It is difficult to obtain and index the prices for gum arabic set by producer countries, which vary widely, along with the name under which the gum is sold. Prices are also subject to the trade policies and strategies of importing countries, which results in differences between the established rates and those actually used by countries and their trading partners. In the Sudan, the price for gum arabic from *A. senegal* was about US\$1 500/tonne in 2003/2004, rising significantly to about US\$4 500/tonne in 2006/2007, and dropping back to US\$3 500/tonne in 2008/2009. Production volumes influence the price, as does the origin, with gum arabic from the Sudan attracting the highest prices.

Renewed global interest in flaky gum, for which Nigeria and Chad are the major suppliers, is also driving prices up. This market is now larger than that for hard gum, invigorating the gum arabic sector in countries such as the Niger and Mali.

Gum resins

Commercial gum resins – myrrh, frankincense and hagar – are also known as oleo gum resins; they contain an essential oil component, a water-soluble gum and an alcohol-soluble resin.

Myrrh is an oily resin exudate produced from trees of *Commiphora myrrha*. Traditionally, myrrh is used to make ink, repel snakes and dangerous insects, and as a medicine. Commercially, it is an expensive highly prized ingredient used in perfumes, cosmetics, flavours and medicines.

Hagar is an oilier resin exudate than myrrh, and is produced from trees of *Commiphora holtziana*. Hagar is essentially medicinal, and is used to kill ticks and treat wounds and snake bites. Commercially it is used in medicines, cosmetics, incense and mosquito repellents.

Frankincense (commonly known as *olibanum*) is a resin exudate from *Boswellia* spp. Traditionally it is used as chewing gum, incense and medicinally, for a wide range of ailments. The essential oil is used in the perfumery, cosmetics and flavouring industries.

Only a few countries include frankincense, myrrh and hagar in their official trade statistics. This makes it difficult to quantify international trade. However, the limited data that do exist show that Somalia, Kenya and Ethiopia are the major producers and exporters of gum resins.

Global annual export volumes are between 2 000 and 4 000 tonnes for frankincense, 2 000 to 3 000 tonnes for myrrh, and about 1 500 tonnes for hagar. Prices vary, with Somali Maydi (*Boswellia frereana*) being the most sought-after and fetching the highest prices. Table 3 shows the prices of resins in Somalia, Kenya and Ethiopia.

Table 3: Current prices of the main resins in Somalia, Ethiopia and Kenya

Origin	Grade	Unit price in USD
Somalia	Frankincense(<i>Boswellia carteri</i>)	4/kg
	Frankincense(<i>Boswellia frereana</i>)	6/kg
	Myrrh	900/tonne
Ethiopia	Gum olibanum(Grade 1)	2 100/tonne
	Gum olibanum(Grade 2)	1 500/tonne
	Gum olibanum(Grade 3)	1 200/tonne
Kenya	Myrrh	5.2/kg
	Black frankincense	2.3/kg

Source: ITC, 2009; Commodity Trade Database (COMTRADE) statistical data, 2009.



Woman cleaning gum Arabic, Sudan

BOX 2

The Network for Natural Gums and Resins in Africa (NGARA)

Since 2003, FAO has supported two projects to develop the gums and resins subsector in Africa. These have been implemented within the framework of the Network for Natural Gums and Resins in Africa (NGARA), a regional African network with 15 member countries, whose secretariat is hosted in Kenya at the Kenya Forestry Research Institute (KEFRI). The first of these projects “Strengthening the Production and Quality Control of Gums and Resins in Africa”, implemented by FAO’s Food Quality and Standards Service (AGNS) focused on strengthening NGARA in the region, through resource assessment, training programmes and information sharing in 14 NGARA member countries. This project was implemented in synergy with the “Acacia Operation Project (AOP) – Support to Food Security, Poverty Alleviation and Soil Degradation Control in the Gums and Resins Producer Countries”, funded by the Italian Trust Fund for Food Safety and Food Security. Implemented in six NGARA member countries (Burkina Faso, Chad, the Niger, Kenya, Senegal and the Sudan), AOP aimed to promote and integrate gums and resins within rural economies. Its objective was to strengthen the analytical and operational capacity of the six pilot countries to address food security and desertification problems through the improvement of agro-silvo-pastoral systems and the sustainable development of gum and resin sectors. By strengthening local resources, the project focused on improving and sustaining agricultural and pastoral systems, as well as diversifying and increasing household income sources, in this way contributing to the socio-economic development of concerned populations. The project focused particularly on the poorest and most vulnerable groups of rural society: women and children, most often assigned to harvest and process gums and resins. A mechanized water harvesting technology (Vallerani Technology®), by which micro basins can be dug while ploughing degraded soils, was adopted to develop Acacia-based agro-silvo-pastoral systems and reverse land degradation in the six pilot countries. Ploughing and planting of sites was carried out successfully with local communities with a total cover of 13,240 ha. Local communities have also been empowered through an intensive capacity building programme on use and application of the mechanized water harvesting technology, nursery establishment, agriculture production, gums and resins production, tapping and quality control including post harvesting handling. The pilot phase was successful, and the project has been expanded into a ten-year programme, involving 8 sub-Saharan countries, to address wider aspects of forest lands rehabilitation, livelihoods, market development and climate change mitigation and adaptation in the context of the Great Green Wall for the Sahara and Sahel Initiative (GGWSSI).

Currently NGARA is implementing national and regional projects, including development of the gum arabic sector in Karamoja, with the Government of Uganda; aromatic resins and gums in Somaliland and Puntland; and gum arabic in Southern Sudan. NGARA also undertakes research programmes to improve the quality of gums and resins, and capacity building programmes for service providers and communities in the production, processing and marketing of gums and resins and other dryland resources.

NGARA is currently undergoing registration as the Network for Forest Livelihoods in Africa (NEFOLA) to cover a wider scope of forest commodities in line with requests from stakeholders.

For more information, contact Sheila Shefo Mbiru and Ben Chikamai, NGARA Secretariat, at info@ngara.org

3. Major challenges to forests and the forest sector in sub-Saharan Africa

Forests and the forest sector face a number of difficulties in sub-Saharan Africa. The driving forces generating these difficulties are described in the following paragraphs.

Population increase and growing demand for resources: Sub-Saharan Africa is an area of fast population increase. Rapid urban development in West Africa has created large human concentrations with high demand for natural resources. Increased reliance on forests for energy, food and other products, from medicines to household items, constitutes a growing threat to the physical integrity, richness, biological diversity and productivity of woodlands and forests. Grazing, cultivation for subsistence and sometimes industrial forest exploitation place intense, competing demands on the remaining natural landscapes. Organizing and planning responses to this challenge is a prerequisite for development among the concerned communities. A comprehensive knowledge and planned and managed utilization of the available resources, particularly forest and woodland resources, have become pressing needs. Assessment and sustainable management of natural resources is a foundation for sustainable rural development in sub-Saharan Africa.

Decreasing crop yields entailing increased cropland: Rainfed agriculture is dominant in the region, and supports many rural livelihoods. Rainfall is scarce and unreliable in drylands, and long dry spells threaten crop production. Agricultural land is becoming scarce, as more is needed for subsistence. Fallow periods are being shortened, and far greater pressure is being exerted on forests, woodlands and rangelands as agricultural frontiers are extended. Fallow crops are becoming less valuable or in the best cases leguminous species dominate agroforestry parklands, where single isolated trees render valuable environmental, social, socio-economic and cultural benefits.

Negative consequences of current natural resource uses: Forest resources utilized as described in the previous paragraphs become fragmented into scattered remnants that are impoverished and susceptible to further selective exploitation and felling. As habitat quality reduces, wildlife becomes prone to migration or extinction. Woodlands, tree savannahs and steppes continue to degrade into poor fallows and wastelands, and can no longer serve as a buffer during drought-related crises or offer food, fuel and fodder alternatives for communities. The mechanisms described in the previous paragraphs can become self-perpetuating, aggravating deforestation and loss of biological diversity and leading to increased poverty and ultimate migration.

Insufficient knowledge of resources and low institutional capabilities: Most forestry administrations do not have differentiated forest inventory and forest management services. The figures used to enumerate forest resources are often old – generally more than ten years – and inadequate, and the processes affecting resources are accelerating, leaving many negative impacts undetected. All countries in dry sub-Saharan Africa need enhanced knowledge and expertise for the systematic assessment, inventory and monitoring of forest and woodland resources and processes. There are insufficient human resources to satisfy the huge needs for trained foresters, silvopastoralists and other rural development specialists in the dry zones. Institutions in charge of forest and woodland management are often weak and isolated. Progress in changing this situation has been slow, although much improvement is starting to be made.

The need for an integrated and inter-sectoral approach and policies for forestry beyond forest boundaries: Forest management is not regularly practised, and is strongly dependent on external assistance. Forest management should be conceived and planned within a larger framework for sustainable land management. Forests have multiple functions, and there are considerable overlaps among agricultural, pastoral, urban/rural and forest systems, requiring integrated and multiple forest-use management. Dryland forest systems are fragile and easily affected by erosion, fires, overgrazing and

browsing, and human pressure from agriculture and rural and urban development; forest management initiatives should consider these factors if they are to have any chance of success. Forestry must be part of comprehensive and sustainable land-use planning and management, and there is an urgent and clear need for the forestry sector to work with other relevant sectors to improve and design appropriate policies and establish appropriate mechanisms. Policies are still not sufficiently comprehensive, but the impact of international policy frameworks and the work of social groups is improving this situation.

Poverty alleviation: The zones considered in this document are economically poor (the world's poorest countries are in the Sahelian and Sudan zones). Dryland forest resources may contribute greatly to alleviating poverty and sustaining communities by responding to many of their subsistence needs, which adds to the difficulty and complexity of managing these resources. Demonstrating the ways through which forestry contributes to increasing income and reducing poverty, particularly in the dryland areas of sub-Saharan Africa, would lend additional weight and relevance to forest management initiatives. During implementation, surveys should monitor changes in the well-being and living standards of beneficiary communities. However, forests and forestry alone cannot address the major challenge of poverty alleviation; other mechanisms and solutions are needed to complement their contributions.

Social conflict: Social turmoil, disorder and armed conflict have affected several parts of the region, with negative economic and social consequences resulting in the depletion of resources. In some cases, however, the isolation imposed by these conflicts may give forest and tree formations some respite, allowing their regeneration.

Conservation of biological diversity: Forest management has to be informed by biological and ecosystem inventories that show the biological richness of forests and attached lands. This objective is not new but has been strengthened by the processes that emerged from the United Nations Conference on Environment and Development (UNCED), where the United Nations Convention on Biological Diversity (CBD) was signed. CBD's objectives are the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of the benefits arising from use of genetic resources. CBD has developed programmes of work on forests and on dry and sub-humid lands to address these objectives in these ecosystems. In this context, forest management should make further efforts to save the rich but delicate biological diversity of dry forests and other tree formations in sub-Saharan Africa.

Maintenance of forest health and vitality: The vigour of forest ecosystems should not be compromised by the use models established under management plans. Forestry has to be more sensitive to the consequences of all techniques when translating management objectives into forest operations. It must also react more quickly to threats to forest health and vitality. The control of invasive pests and the management of destructive bushfires should be prominent in management plans.

Control of land degradation and desertification: Forest management has always been sensitive to land degradation and has envisaged measures for land rehabilitation, particularly since the United Nations Convention to Combat Desertification (UNCCD) was signed in Paris in 1994. Good forest management options make a measurable contribution to the control of land degradation and desertification.

Climate change – the big challenge: Climate change is emerging as a driving force behind many of the current issues facing natural resources, and is likely to intensify the already dramatic transformations and problems arising across Africa. The Intergovernmental Panel on Climate Change (IPCC) has predicted significant increases in annual mean surface air temperatures and decreases in precipitation over the subtropics and tropics, from Africa to Indonesia, affecting drier subtropical regions in particular. The only areas likely to see increased annual mean rainfall are East Africa, the Sahel, the Guinean coast and the southern Sahara, with a high level of uncertainty (IPCC, 2007). The subtropics contain some of the world's most important biodiversity hotspots, which are highly sensitive to climate change under a wide range of climate change scenarios. Projections suggest that 40 percent of the biodiversity of subtropical forests could be lost, even under stable climate scenarios (Fischlin *et al.*, 2009). Many subtropical forest

species live in highly fragmented environments and are therefore at particular risk of extinction, with subsequent negative impacts on the livelihoods of forest-dependent people. Changes induced by climate change are likely to result in species range shifts and altered tree productivity, adding further stress to forest ecosystems. For example, warmer and drier conditions on Kilimanjaro in East Africa have led to increased incidence of forest fires, degrading the environment and inducing a downward migration of animal and plant species (Agrawala *et al.*, 2005). In regions with large forest-dependent populations, such as sub-Saharan Africa, decreased rainfall and increased severity and frequency of drought can be expected to exacerbate current exploitation pressures on forest and the impact of agricultural expansion into forest lands. This can be expected to impose additional stresses on people in these locations who depend on fuelwood for their domestic energy needs and on non-wood forest products for their livelihoods. There is great concern that many sub-Saharan African countries are already in a precarious position regarding food production and agriculture, and that climate change is likely to have a far greater human impact in these countries than in more temperate regions.



FAO/CFO-0719/S. Braatz

Men watering trees in a sand dune stabilization project, Niger



International Technical and Validation Workshop on the Guidelines for Sustainable Forest Management Practices in Drylands of sub-Saharan Africa, 20–22 January 2010, Dakar, Senegal

4. Guiding principles and options for sustainable forestry in dryland sub-Saharan Africa

Dryland forest management and silviculture incorporate a set of practices that can facilitate the expansion, regeneration, growth and functional utility of forests, and the human activities essential to the conservation and sustainable development of forest and woodland resources in drylands, helping these resources to become ecological and environmental buffers that tone down the often harsh climatic conditions and their impacts. The biological diversity of forests and woodlands in drylands, and the elaborate physiological functioning that allows their survival under harsh conditions are conducive to a number of vegetative adaptations and processes, which should be known and used as tools to underpin sound silvicultural practices in and management of dry forests.

Box 3 outlines considerations to be taken into account when developing sustainable management practices for dry forests. The following sections offer guiding principles and related options for achieving sustainable forest management in the drylands of sub-Saharan Africa.



FAO/CFU000384/R. Faidutti

Participation of local people in forest management, Mali

BOX 3

Sub-Saharan Africa: general considerations

In the region, attention focuses on forests, woodlands and trees that are closely associated with the landscape. Land-use models have been developed addressing all three of these components and associated practices, and can offer guidance on the sustainable use of forests, woodlands and scattered trees in agroforestry parklands and the overall landscape. One ultimate aim is the integrated management of all land resources, to achieve sustainable land management.

Forest, tree and range resources are not well known. National and regional efforts are needed to improve capabilities in resource assessment. Assessment processes should be applied to improve knowledge of the forest resources of dryland sub-Saharan Africa.

The region includes some of the world's poorest countries and communities, especially rural communities that still rely heavily on forests, trees and pasturelands for their livelihoods (food items, medicines, domestic energy, habitat, etc.). Many of these are pastoralist communities, and fodder and browse are of prime importance in sustaining their livelihoods. To the extent possible, forest management should address the need to deliver food (both human and animal), wood, medicines and other relevant socio-economic and environmental services. Forests generate about 6 percent of sub-Saharan Africa's gross domestic product – triple the world average. Eighteen African countries, including Cameroon and Ghana, depend on forests for at least 10 percent of their economies.

In most countries of the region, a strong institutional set-up for forestry was established during the colonial period. However, forest administration has since generally become weaker, as growing constraints (structural adjustments, the global economic crisis) and the absence of bold reforms have hindered drastic changes in administrative structures and lines of command. Although some countries have created more dynamic corporations to manage aspects of the sector, more action is needed to promote national forestry services.

Mitigation and adaptation options for African forest must be fully understood and used to promote sustainable development. An important component of the ongoing international climate change negotiations is whether and how to incorporate reducing emissions from deforestation and forest degradation (REDD) into efforts to reduce greenhouse gas emissions. Active steps are needed to enable Africa to make use of REDD, starting with: i) putting forests under effective management plans; ii) applying management baselines to determine how much carbon the forests can hold; iii) collecting data on forest cover, biomass productivity, deforestation and degradation; and iv) securing ownership.

A number of initiatives in the region address environmental and forestry issues: i) the Action Plan for the Environment of the New Partnership for Africa's Development (NEPAD); ii) recent initiatives by regional organizations, such as the Permanent Interstate Committee on Drought Control in the Sahel (CILSS), the West African Economic and Monetary Union, the Economic Community of West African States (ECOWAS), the Economic Commission for Africa (ECA), and the Community of Sahel-Saharan States (CEN-SAD); and iii) the involvement of river basin organizations in environmental issues, such as sand dune stabilization along the River Niger by the Niger Basin Authority, and promotion of natural resource management and mobilization of water resources for agriculture, livestock and the environment by the Organization for the Development of the Senegal River, which includes Guinea, Mali, Mauritania and Senegal. Actors in forest management initiatives should take stock of and move to benefit from and support such developments.

Forestry is not clearly perceived as a sector and often does not receive its share in resource distributions. The sector's profile should be raised and its apparent marginalization ended, particularly as forestry supports many of the region's assets through safeguarding ranges, providing a wide array of livelihood-relevant products, and contributing to water economy.

The flow of financial resources for investment is low in sub-Saharan Africa. This flow must be increased if progress is to be made in promoting forest and pasturelands and making them genuine socio-economic options, rather than reserves waiting for other sectors.

There is insufficient documentation and evaluation of the goods and services provided by forest ecosystems. Countries of the region should be encouraged to start valuation exercises by themselves. To increase momentum and improve methodology and the use of relevant economic techniques, the countries of the region should call on Economic Commission for Africa, CA, the United Nations Development Programme (UNDP), FAO and regional organizations to provide support.

SAFEGUARDING AND MAINTAINING THE RESOURCE AMONG GROWING PRESSURES

General considerations

In most sub-Saharan countries, in the colonial era, the forest estate was managed very authoritatively, with involvement of local populations. At that time, no tools were available to project accurately the development of communities and the increase in their needs. Since then, progress in medical structures and the development of communications have contributed to population growth, resulting in many cases where the limits in which populations are constrained are inadequate for their subsistence needs. The resulting demand for new land is creating pressure on forest resources.

Since independence, governments in the region have considered the need to do more than maintain the status quo of the forest estate. In some cases, new forests have been gazetted. In others, progressive laws and regulations have transferred the responsibility for land resource management to local communities, which have become more assertive in establishing the directions that forestry practices should take on their lands.

Under current heavy human pressure and rapid population growth, management practices, directed by either the State or rural communities, should be negotiated with local authorities and populations at various levels.

Management practices should also take account of:

- knowledge and understanding of the current change (expansion or reduction);
- the possibility of delimiting new areas of forest;
- appropriate forest management measures that help to maintain or increase the extent of the forest estate;
- categories of people who have access to the resource, physically and by rights;
- the sustainability of the overall set-up around the forest estate;
- transitions towards other types of land use that should be expected and facilitated.

Checking the availability of land at the local and wider levels

Land availability is the first issue to clarify when government or community forestry activities are being planned. As forestry has to be fully integrated into the overall rural development system, the land on which it is to be practised should be clearly designated. This involves gathering information on and mapping characteristics of the forest area at both the local and national levels, including:

- location, characteristics and capacity of the land;
- demographic characterization of the area;
- village land management options in the area;
- overall land use in the area;
- biological, ecological and agronomic characteristics of the location;
- the human communities occupying land resources;
- the legal situation of the land resources, to derive compatibilities and incompatibilities of various uses.

These findings are essential both for existing forest resources and when new options for forest land are considered.

Gazetting new forest or forest-related lands, or reassigning gazetted forests to other uses

Land is becoming an increasingly scarce resource in dry sub-Saharan Africa. Extensive land-use methods have developed, imposing very land-intensive options. Land-use patterns in most parts of West and Southern Africa are often firmly established, making it difficult to delimit land for forest, range and other related activities, although the following steps can prove helpful:

- **Dialogue and negotiations with local communities:** Local communities consider their environment to be their own. Their ancestors cleared parts of the forest, establishing villages and



FAO/FO-5571/M. France-Lanord

Fuel wood market, Niger

investing labour in cultivation and herding. Fire, tree cutting, cultivation and animal husbandry have built strong bonds with the land, and communities find it difficult to envisage their land under the custody of any force other than their own ethnic groups and ancestral leaders. The establishment of forest parks by colonial administrations was difficult and protracted. Governments today face the same difficulties when attempting to keep forest parks intact, let alone when creating new forest reserves. However, there are examples of the de-gazetting of gazetted forests in sensitive areas under political or economic pressure. In either case, negotiations must be undertaken, assisted by approaches that promote community participation and the sharing of assets and benefits, including environmental ones. Villages and communities have become partners in forestry, and sometimes own or are responsible for forests, enabling them to engage in forestry operations either as partners or leaders.

- **Considering compensation and land transfers:** The processes of taking natural forests from communities or releasing forests to them both entail a number of provisions, which may include exchanges of land. The exchanges made when gazetting forests have often produced inequalities; entire communities have often felt robbed of their land. The reverse process of establishing community, and later communal, forests may lead those who view themselves as the existing owners to attempt to claim or retain their former rights. Forest departments and agencies should take care to avoid such conflicts. Compensatory measures should be secured when commercial companies de-gazette forests.
- **Preparing for long negotiation processes to reach agreement:** It is still possible to create or expand the forest estate. Large expanses of dry forests are still left nearly wild, and forestry or ecosystem conservation could make good use of them. In densely populated plateaux, however, all surviving natural vegetation is in the former forest reserves; elsewhere it has disappeared or is in a state of advanced degradation. The administration should prepare for long negotiations with

sometimes very diverse communities, including traditional farmers, livestock herders and forest dwellers, who may prefer to maintain the resource in its natural, freely accessible state, rather than have it gazetted as forest reserve.

Identifying and implementing measures to maintain or improve the forest estate

In many instances, the prospects for the forest estate are very bleak – it has disappeared or been fragmented and degraded under various deforestation and forest degradation processes, and continues to be subject to the major threats and challenges described in the previous section. Good practices in forestry should reverse or mitigate forest degradation and deforestation processes. Possible actions to counteract these threats could be based on:

- promoting family planning and birth control methods, to mitigate population growth and its impacts;
- implementing effective modern farming practices and agricultural technologies that can help maintain or increase yields, including better land management techniques and proper water resource management;
- improving governance for land resources management, to address the intense and often conflicting demands on village land resources;
- enhancing knowledge and expertise in the systematic assessment, inventory and monitoring of forest and tree resources;
- supporting international and regional programmes and projects such as the Great Green Wall for the Sahara and the Sahel Initiative (GGWSSI), and ensuring that their goals are realistic and could help to raise general awareness, leading to a call for higher-level action on forest expansion.

Promoting the accessibility of forest resources

Providing good access to forests contributes to the maintenance and conservation of the forest estate. The national road grid should be connected with secondary or forest roads, to improve access to forests. Forests should also be securely controlled, to avoid situations where their increased accessibility accelerates their exploitation and degradation.

Improving sustainability of the forest estate, and facilitating transition as needed

Improved sustainability could be facilitated by the timely application of the following measures:

- leaving sufficient cropland accessible to populations in the neighbourhood of forests;
- ensuring that the forest contributes significantly to the livelihoods of local populations, in ways that are not heavily consumptive and do not lead to degradation;
- integrating the forest estate into local land-use practices, while respecting its borders and accepted traditional and subsistence practices;
- making forest boundaries clearly visible, and ensuring regular renewal of demarcation;
- opening or renewing firebreaks, to indicate the gazetted boundary clearly at all times.

MAINTAINING OR ENHANCING BIOLOGICAL DIVERSITY TO ASSIST FORESTS' MULTIFUNCTIONAL SERVICES

CBD defines biological diversity as “the variability among living organisms from all sources including, *inter alia*, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems”. Forest biological diversity therefore encompasses varied components: the abundance and variability of animal and plant species (within and among species), their genetic variability, and the diversity of ecosystems and variety of landscapes.

The following aspects of biodiversity should be taken into account:

- Drylands of sub-Saharan Africa, including forests, have multiple functions (agroforestry, pastoralism, energy supply, food, climate change mitigation) that can only be sustained if the diversity of components is reasonably maintained. Biodiversity, particularly genetic diversity, is an important basis for successful adaptation to climate change. About two-thirds of the African population live in rural areas, deriving their main income from agriculture. Land degradation, deforestation, lack of access to safe water, and loss of biodiversity, compounded by climate variability, are among the major concerns.
- Pastoralism and transhumance are the predominant human activities in drylands, and strongly affect the biodiversity of the environment.
- An understanding of the functioning of agroforestry parklands and their relationships with local livelihoods will contribute to an understanding of biological diversity.
- The agriculture practised in sub-Saharan Africa is strongly linked to the natural environment, both negatively and positively; for example, insects can be pests and disease vectors, but also perform the valuable function of pollination. Agriculture has impacts on the environment, such as through fallowing to improve yields, and the use of fire to promote grass regeneration (with the risk of fires getting out of control).
- Agriculture affects the diversity of the landscape and can have a negative impact on biodiversity, especially if it is not well conceived and managed when large contiguous areas are cleared.
- When deciding which options to adopt, forestry practitioners and policy-makers should consider the capacity of trees, forests and, particularly, shrubs to provide environmental services and various products.
- Some species support traditional healers and health practitioners; the biological diversity of their various formations is essential in supporting these functions.

The following principles should contribute to maintaining or enhancing the variety and permanence of life forms in forests and parklands of dry sub-Saharan Africa.

Improving knowledge of forest formations, to help conserve forest's biological diversity

Biological diversity is valued only when there is full awareness of its nature and of the functions and services it helps perform. This is of fundamental importance for forests, and efforts should be directed to increasing knowledge of forest's biological composition and functioning among all the people involved in its management and use. The principal operations for forest management are reviewed in the following, and should be embedded in the life of the forests and in the actions of managers and users:

- **Capacity strengthening for biological forest inventories:** To develop and maintain optimal performance of foresters, their expertise requires renewal and updating, such as through courses in the curricula of forestry and veterinary sciences schools. Cooperation with these schools and other scientific and technical institutes should also be established for refresher courses on biology and systematic botany. Studies can be developed to improve knowledge about specific forests. Such cooperation could include: i) students working in gazetted forests for their master and doctoral degrees; ii) projects in areas close to forests that have been targeted for addressing aspects of biological diversity; iii) studies contracted to science and technical institutes; and iv) projects undertaken at fieldwork stations designated by a university or institute.

- **Expanding the scope of forest inventories to embrace the biological component:** Forest inventories do not always examine the various non-timber species of forests, but some can be expanded to include these species. This would help increase knowledge about the forest's biological content, which is key to informing and improving resource management.
- **Inventories of wildlife:** These can be undertaken periodically in cooperation with wildlife and hunting services and organizations at the national and local levels. Birdlife is important in forest production and reproductive cycles, and should be studied to build knowledge of its environmental interactions.

Including the animal and invertebrate components of the forest in management decisions

Animals can intervene significantly in strategic phases of forest management, affecting the regeneration, growth and productivity of stands. Consideration of wildlife assists effective forest management decision-making. Game and bushmeat provide social benefits for poorer forest-dependent people, and could make forest management more economically relevant (Box 3). In dryland forests, the species most likely to interfere with management are:

- the many rodents that prosper in the forest, from wild rats to squirrels;
- the ungulates, including antelopes and savannah buffaloes;
- the Suidae (pig family), including warthogs and forest hogs;
- monkeys preying on young shoots and posing a threat to regeneration;
- invertebrates, fungi and microorganisms.



FAO/FO-5569/M. France-Lanord

Protected area in Niger

BOX 4

Importance of forest game and bushmeat

Conservation and use of wildlife-based resources: The bushmeat crisis (Nasi et al., 2008) is a technical paper published by the Secretariat of CBD and the Center for International Forestry Research (CIFOR). It summarizes the state of knowledge on this controversial topic. The bushmeat trade constitutes a significant, if largely hidden, component of the economies of tropical forest countries, with estimates ranging from US\$42 million to \$205 million per year for countries in West and Central Africa. However, "voluminous and varied" empirical evidence suggests that current rates of bushmeat extraction are unsustainable, and are leading to wildlife depletion in many areas. Large mammal species are particularly vulnerable, and many are already locally extinct.

The empty-forest syndrome is not just of interest to conservationists. Bushmeat is an important source of protein and fats in rural diets – providing up to 80 percent in Central Africa – as well as an important seasonal safety net. In many countries, there is no clear substitute available if wild meat sources are depleted, or off-take reduced to unsustainable levels.

The conclusion derived from these findings is that forest management should pay greater attention to wildlife resources. Managers should study wildlife presence, dynamics and socio-economic linkages more systematically and robustly. Work that tends to improve wildlife resources, their movements and their overall conservation should be clearly defined, described and costed.

Source: Nasi et al., 2008.

Taking different habitats into consideration in forest management decisions

Drylands may harbour forests of high-value habitat for biodiversity conservation. The following principles should be kept in mind, depending on the specific circumstances:

- Wildlife can be supported in various ways: preserves for particular species or groups of species could be set up within the forest.
- Wetlands may exist in or adjacent to forests, and their management should take account of: i) the abundant wildlife depending on their conservation; ii) their rich biodiversity; and iii) the endemic species they may contain whose survival depends totally on the wetlands. Wetlands in productive forest areas should therefore be identified and managed appropriately.
- The same applies to coastal forests, where mangrove formations may harbour particular animal and plant associations that have value for fishery production and tourism development.

Training of foresters and rangers to improve their knowledge of forests and pasturelands

Forestry is a multidisciplinary technical activity. Training of foresters should take account of this, and curricula should be modified or reinforced to respond to these multidisciplinary needs, particularly in the domains of:

- economic science and forests' economic roles at the local, national and regional levels;
- biological and ecological considerations of the forest estate;
- ecosystem approaches and forests' environmental services;
- the various types and characteristics of dryland forests;
- forest climates and climate change;
- the positive and negative impacts of grazing in forest areas.

Taking biological diversity into account in management plans and silvicultural practices

Plant formations of different types are often clearly demarcated. For example, water can limit the distribution of plant species to privileged locations. Forest managers can therefore often differentiate plant groupings and biological components easily, which assists the identification of homogeneous groups and the inclusion of their roles in the overall forest management plan. Patterns of biological

diversity within an ecosystem can be delineated as sections or subsections in the management plan, which assists the planning process. Considerations to be taken into account include the following:

- Native species provide the base for stability of the forest; they should be carefully documented to enable proper management of the forest's core components.
- Indigenous species also have strong connections with local practices and traditional knowledge, and arrangements should be made to authorize sustainable uses by local traditional practitioners whose knowledge can assist forest managers.
- Management for production and other services should include protective practices to safeguard important local species.
- When introducing new species into forest areas, care must be taken and demonstration trials be made, to ensure that the species is suitable for local conditions and to avoid undesirable effects.

Improving the adaptive capacity of dryland forests

Forests can contribute to adaptation at the landscape level through the creation and expansion of functional habitat networks, flood risk management, protection of water quality and quantity, and protection against soil erosion. The location and composition of forests and woodlands can facilitate or hinder the migration of species. For example, forests and woodlands that are connected with each other and with other natural habitats can facilitate the movement of species through the landscape and provide a better opportunity for species and ecosystems to adapt to new conditions. The following actions are required to ensure that forests respond to the effects of climate change and to help society and the environment adapt to these changes:

- Fragmentation of existing natural habitats should be avoided, and the impacts of new plantations on the ecology of adjacent sites should be considered.
- Introduction and development of genetically modified organisms is an emerging issue to be taken into account in the management of dryland forests.
- The ecological connectivity of the landscape for forests and woodland species can be improved by extending, maintaining and restoring existing natural habitats using the forest landscape restoration approach, while taking into consideration the environmental, social and economic needs.
- The movement of populations of non-indigenous species that are invasive and problematic in forests and woodlands and their surroundings should be controlled.

Reducing the vulnerability of dryland forests to unfavourable natural events

Dryland forests are vulnerable to a number of constraints and natural hazards: flooding, drought, wind storms, erratic rainfall, moisture stress, etc. In addition, ever-increasing population pressure has created a situation where the demand outstrips the supply from dryland forests. Dryland forest development should therefore consider mechanisms for minimizing forests' vulnerability to these factors.

Designing and managing effective forest protected area networks

One option for biodiversity conservation is the design and effective management of protected area networks. These networks lead to improved ecological connectivity of forest and woodland habitats and species.

Creating synergies between climate change and biodiversity

There is good potential for co-benefiting from the development of greater synergies between climate change and biodiversity. Forest managers should focus on plans and measures aimed at increasing these synergies and on finding ways to secure co-benefits, particularly by strengthening mutually supportive activities and measures for climate change adaptation, such as through generating income from non-wood forest products, agroforestry, cottage industries etc.; mitigation, including reducing emissions from forest degradation; the sustainable use of energy from forest biomass; and associated concerns regarding the conservation of forest biodiversity and ecosystems. Land-use measures should be applied that support the adaptation of forests, such as by increasing the areas of protected natural forests to enable species and populations to adapt, which is also indispensable for achievement of the biodiversity target.

PROMOTING HEALTHY AND VIGOROUS FORESTS AND COMBATING DIFFICULT GROWTH CONDITIONS

Simple and useful answers for forest health and vitality are needed if people are to be fully involved and interested in forests' responses to the various actions exerted on them. The use models and levels stipulated in management plans should not alter the vigour of forest ecosystems in any way. Forestry has to be more sensitive to the consequences of all the techniques for translating management objectives into forest operations; it also has to be more reactive to threats to forest health and vitality (Box 5). The control of invasive and destructive bushfires should be prominent in management plans. Important actions to be given high priority in forestry practices are described in the following subsections.

BOX 5

Major threats to the reproductive capacity of dry forests in sub-Saharan Africa

Forests and woodlands regenerate from either seeds or the vegetative growth of extracted matter (e.g., buds and cuttings) in the specific favourable conditions that facilitate sprouting and regrowth. In dry sub-Saharan Africa, the regeneration process is easily threatened by local conditions or pests and diseases. The following natural, physiological, biotic and human factors influence and may constrain regeneration and growth, and may be important factors in sustainable forest management.

Physiological factors: Sexual reproduction presupposes that the pathway from flowering, to seeding, to germination is successful. The many threats to this include:

- dry and hot winds, which may block the flowering process or burn the flowers;
- flower development and seeding in difficult, dry, hot and windy conditions, which may result in seeds being destroyed or failing to prosper;
- seedlings that do not mature properly or at all, as they are confronted by various threats such as forest fires.

Biotic factors: Insects – especially bees and wasps – play crucial roles, from pollination to fruiting. Factors that are threatening the healthy existence of bees include the increasing use of pesticides, the use of fire in honey collection, and the increasing numbers of browsing domesticated animals feeding on flowers and seeds within the forest.

Human factors: Humans are modifying the natural balance of forests considerably. Previously, forest produce was collected for subsistence, in quantities and concentrations that did not affect natural regeneration processes, but nowadays collection is often geared towards urban markets, which are huge consumers of forest products, including fruits and seeds, disrupting the sexual reproduction process.

Natural regeneration and growth processes face several obstacles and constraints, which are growing rather than receding. These make it more difficult to reproduce trees and forests in forest management and silviculture cycles.

Climate change: There is still considerable uncertainty about how changes in the global climate system will affect the local climates of different African agro-ecological zones. It is also difficult to analyse the impacts of climate change in isolation from those of degradation owing to unsustainable natural resource management. However, it is evident that natural resource management and climate change act jointly as drivers for ecosystem change.

Building knowledge and establishing a forest protection service within the administration system

Forestry services in sub-Saharan Africa do not systematically monitor forest health. Often, actions are taken only when a disease or other depredation attracts attention, by which time it is usually too late to counter the phenomenon effectively. Typically, very few staff are dedicated to combating pests and diseases.

If forestry is to progress and prosper, and if the expected expansion of plantation forestry takes place, it will be necessary to:

- improve the institutional capacity of forest protection services, by engaging other relevant institutions such as research, academia and local authorities;
- take entomology more seriously, and develop related curricula in forestry education;
- expand and deepen knowledge on factors that may encourage disease, including microbiological factors;
- train a core group in the forestry department on the detection of potentially dangerous developments regarding forest pests and diseases;
- create a central unit of forest pathology and protection that can take early measures to avoid the flare-up of lethal forest diseases.

Securing community participation in the monitoring and prevention of threats to forest health

Institutions in charge of forest protection should work with other stakeholders, such as forest loggers, charcoal makers, farmers, hunters' groups and herders, in the prevention and control of diseases, fires and other threats to dryland forests. Populations of potential helpers should be carefully identified, and reliable sources of information should be designated and encouraged to maintain in contact with the forestry department. These people should receive short training courses, which would be the culmination of other activities, including:

- exploratory visits to forest areas and communities of forest neighbours and dwellers, which are sufficiently frequent to identify groups and families living around and in the forest and who are interested in its conservation and development;
- identifying active groups and setting up committees that can be involved in the defence and surveillance of forests;
- designating volunteers to serve as focal points to help in simple actions for monitoring health- and pest-related developments in the forest;
- establishing contact and regular communications with nomadic and semi-nomadic groups, and sensitizing and training them to recognize environmental markers, taking advantage of their mobility and encouraging them to exercise control over burning from their camps;
- inspection tours by responsible officers and information collection by volunteers and others.

Minimizing the risk of extreme climatic conditions

Dry forests are at high risk from climate change extremes (extreme temperature, droughts and floods), which could increase the incidence of pest and diseases, fire outbreak and shifts in species composition, especially at ecosystem margins (Schozle *et al.*, 2006; Gonzalez, 2001). Forest management strategies should aim to:

- maintain a set percentage of indigenous species;
- reduce and control erosion and topsoil loss;
- reduce the compounding of environmental pressures;
- maintain and increase above-ground carbon stocks;
- maintain and increase below-ground carbon;
- reduce and control environmental degradation;
- raise awareness among different stakeholders about the climatic risks, and prevention and adaptation actions to minimize their impacts.

Identifying and preventing threats or limitations to forest growth and reproduction

As well as fires, pests and diseases, a number of other events may threaten forests and tree or shrub formations and their smooth development. Forestry practices should be aware of these, and should design operational measures to minimize their impacts. Possible events include:

- other land uses that affect the forest and its neighbourhood, including road building and the expansion of dwellings into the forest domain;
- construction of industrial sites, whose effluent gas or liquids may affect the forest;
- construction of major public works, including reservoirs;

- civil strife, including overexploitation of forest reserves by new settlers or refugees from wars and ecological catastrophes.

Securing seasonal or partial protection of forests and pastures from fire

To maintain the fragile balance of dry forests, attention should be given to forest fires, particularly regarding:

- the development of knowledge on fire ecology in drylands;
- training in fire prevention and fire fighting techniques and related exercises, through appropriate seminars;
- the behaviour of various species in response to fire;
- the role of early burning and its impact on the forest's biological diversity;
- improved knowledge, among foresters and pastoralists, of the physiology and biology of fire-affected formations;
- enhancement and sharing of reclamation techniques for burned forests and ranges;
- potential impacts of climate change on forest and people's livelihoods;
- physical protection of forests against fire, and the establishment and maintenance of a firebreak network.

Adopting an adaptive forest management approach

Climate change adaptation requires a flexible, reactive and anticipatory approach to management. Vigilance and monitoring to detect the effects of climate change on forest ecosystems are necessary for informing adaptive management. In large forest areas, monitoring systems based on local conditions should be established. Management decisions that may need to be reviewed in response to changing conditions include:

- rotation lengths, in response to changing precipitation and temperature risk;
- planting seasons, in response to changing climate and the success of natural regeneration;
- enhancing natural regeneration through enrichment planting, where species diversity and potential adaptability are likely to be limited;
- planting species and varieties that minimize vulnerability to the impacts of climate change;
- assessing forests' vulnerability to forest fire, pests and pathogens, and devising strategies for protection.



Dryland forest landscape, Namibia

ADDRESSING THE NEW CHALLENGE OF CLIMATE CHANGE: MITIGATION AND ADAPTATION

Climate change and forests are fundamentally linked (Box 6). On the one hand, changes in global climate are putting stress on many forests, owing to higher mean annual temperatures, altered precipitation patterns and more frequent and extreme weather events. On the other hand, while healthy forests and the wood they produce trap and store carbon, which plays an important role in mitigating climate change, destroyed or degraded forests become sources of greenhouse gases, particularly carbon dioxide.

In summary, forests and the forest sector have four major roles in climate change:

- They store huge amounts of carbon and have the potential to absorb and store even more in their biomass, soils and products.
- Through deforestation and degradation, they can also increase global carbon emissions.
- They offset the use of fossil fuels by providing carbon-neutral products and wood for fuel.
- They can help other sectors such as agriculture and water to adapt to a changing climate.

It is important to bear in mind that forests themselves are sensitive to climate changes, so forest adaptation and management are essential to forests' role in mitigating climate change.

In Africa, as elsewhere, it is important to support and explore synergies between climate change adaptation and mitigation measures. This is particularly true of forestry, as increased resilience of forests and trees to climate change will help to maintain forests' mitigation capacity. Forest adaptation measures can also help reduce climate change impacts on vulnerable people, who might otherwise increase the pressure on forests for land or products, thus reducing their mitigation potential. Mitigation measures that improve the sustainable use of forests can also enhance their adaptive capacity.

Mitigation and adaptation at the policy level

Using forests to help mitigate and adapt to climate change may represent a long-term opportunity for Africa to make a significant contribution to a low-carbon future and to adapt to the changes that are already happening. However, this only makes sense if Africans view mitigation and adaptation in the context of sustainable development. Climate change policies must therefore encourage forestry activities that promote sustainable livelihoods and rural development.

To address the need for mitigation and adaptation, forest policy-makers should consider:

- assessing existing national climate change and other relevant strategies;
- identifying and assessing mitigation options;
- carrying out risk and vulnerability assessments of adaptation needs, and identifying options;
- revising or developing forest and climate change strategies, including both mitigation and adaptation, and ensuring coherence with development strategies;
- strengthening research on forest and climate change;
- strengthening extension and awareness raising on forest and climate change issues;
- modifying existing assessment and monitoring processes to include forest adaptation and mitigation needs;
- amending institutional and legal structures to facilitate adaptation and mitigation actions.

Mitigation and adaptation at the forest management unit level

Climate change is projected to have negative impacts on dryland forests ecosystems in Africa, which could present risks for forest sustainability and the achievement of forest management objectives. Potential risks of climate change must therefore be taken into consideration during the development of forest strategies and management plans. This requires a better understanding of potential climate change impacts and risks, through systematic inventories and scientific assessments. At the forest management unit level, both adaptation and mitigation require:

- identification and assessment of local mitigation opportunities and adaptation needs;
- assessment of local financial opportunities for mitigation and adaptation;

- amendment of forest management plans to include adaptation and mitigation;
- testing of local mitigation and adaptation practices;
- monitoring and evaluation;
- a focus on local measures that include synergies between mitigation and adaptation.

Mitigation actions at the forest management unit level: Forest managers should implement specific mitigation actions that focus on enhancing and conserving carbon in forests, thereby reducing or sequestering greenhouse gases. In this, essential focus areas are:

- reducing emissions from deforestation and forest degradation;
- conservation of forest carbon stock in conservation areas, and sustainable management of production forests;
- enhancing forest carbon stock, through afforestation, reforestation and forest restoration;
- more sustainable production of woodfuels as a renewable energy source.

Adaptation actions at the forest management unit level: Among the forest management measures that countries could take to facilitate climate change adaptation are favouring forest varieties and species that are adapted or adaptable to new climatic conditions; implementing forest management practices that reduce vulnerability to both incremental climate change and extreme events such as storms and fires; intensifying fire management systems; undertaking *in-situ* and *ex-situ* conservation measures; and introducing spatial plans and corridors to help species migrate.

To address the need for adaptation, forest management should aim to enhance the resilience of forests and forest ecosystems through:

- appropriate forest structure and composition;
- adaptive forest management;
- species selection;
- conservation of biodiversity;
- optimizing contributions to sustainable livelihoods.

BOX 6

Forests and climate change

Forests play a very important role in the carbon cycle (Nabuurs *et al.*, 2007). Globally, they account for almost 80 percent of the annual exchange of carbon between the land and the atmosphere; an estimated 17 percent of all greenhouse gas emissions result from deforestation and forest degradation. Growing or expanding forests act as sinks for carbon (IUCN, 2007). In addition to this carbon sequestration, forests also contribute to climate change mitigation by providing a source of renewable energy and sustainable wood products. It has been calculated that the total mitigation potential of global forests in 2030 will amount to 13.8 gigatonnes of CO₂ (3.8 gigatonnes of carbon).

As well as contributing to the well-being of African people, Africa's dryland forests also provide global benefits from their climate change mitigation capacity. However, they are vulnerable to climate variability and change. IPCC's Fourth Assessment Report (AR4) forecasts that global greenhouse gas emissions will continue to grow over the next few decades, and indicates that the likely impacts of climate change may be greater in Africa than in other continents, including an increase in extreme climatic conditions (drought, flash floods and coastal inundations, and wildfire). Southern and Northern Africa are likely to experience water stress. According to AR4, climate change could result in shrinking of tropical forests in Africa. Other studies conclude that forest productivity and total biomass are likely to decrease in many parts of Africa, such as the gum belt in the Sudan (Seppälä *et al.*, 2009). In-depth assessments and monitoring of sub-Saharan dryland forest ecosystems and their vulnerability to climate change are needed. There is also need to develop and promote forest adaptation options and guidelines for the region, to enhance the adaptation capacities of human populations.

Recent studies at the national, regional and global scales have estimated the mitigation potential (areas, carbon benefits and costs) of reducing tropical deforestation. Jung (2005) estimates that in the short term (2008 to 2012), reduced deforestation will account for 93 percent of the total mitigation potential in the tropics. Reducing deforestation could therefore be a viable mitigation option in tropical regions, and would achieve a number of environmental and other benefits, in addition to significant carbon gains. Chomitz *et al.* (2006) suggest that successful implementation of mitigation activities and the reversal of tropical forest losses depend on understanding the root causes of deforestation, which are multiple and locally based. Murdiyarsa *et al.* (2005) consider reduced deforestation as the best mitigation option for tropical regions, as it helps to lessen the pressure on natural resources. The REDD mechanisms that are currently under negotiation may provide incentives for reducing emissions from forests. Some sub-Saharan African countries are already engaging in REDD-readiness activities and are preparing national strategies for a REDD framework that could be introduced after 2012.

ENHANCING FORESTS' PRODUCTIVE AND PROTECTIVE CAPACITIES

Adequate management secures the survival of forest ecosystems and enhances their functions. Good forestry practices ensure that forests' major function – producing wood and non-wood goods and services – is performed to the satisfaction of forest users. Proper governance of forests' productive and protective functions depends on the following prerequisites:

- Forests' various functions must be delineated.
- Government requires a policy that guides the steps it takes to secure optimum forest production and protection.
- Quantitative and qualitative objectives are needed, to guide forest management and silviculture.
- The government must establish a clear framework within which forest production is to operate.
- Forest management techniques must be diversified and adapted to take better advantage of the productive capacities of the various forest and tree resources available locally.
- People in or near the forest often have a good understanding of the effectiveness of forest's protective functions, and can provide much valuable information; they should therefore be involved in the monitoring process.
- Forestry departments should link up with forestry research units and academic institutions, to develop further techniques for managing the forest for optimum yields.

The main measures for optimizing forest production and protection are described in the following subsections.

Preparing a legal and institutional framework for forest management and practices

Forest production and environmental services need to evolve in an appropriate legal framework. Existing frameworks in sub-Saharan Africa should be revised to:

- identify protection forests and plantations, and incorporate them into land-use management and village land planning;
- ensure that forestry and plantations are included in distributions of land for various purposes;
- integrate plantation issues into land-use plans;
- identify who has the right to harvest, and clarify these rights;
- organize forest production cooperatives;
- clarify the decentralization of forest production, including the growing roles of rural communities and forest owners
- clarify the forest production supply chain, from extraction to transport, storage and final distribution.

Implementing silviculture practices and selecting the most appropriate species

In many silviculture practices the most critical steps relate to the regeneration of forest and tree formations. In sub-Saharan Africa, many forest species have adapted themselves to resist natural destruction due to water stress, forest fire and constant browsing by animals. Protection forests should withstand the elements they are intended to offer protection from. Species must be selected to ensure greater resistance to wind and fires. Research and practice should be directed to identifying plant species that can provide diversity, as this increases ecosystems' resistance to pests and offers multiple uses at the end of the plants' cycles. To ensure compatibility with local conditions, the following factors should be taken into account:

- In some conditions, pure stands of some species may regenerate properly from seedlings or regrowth, such as stands of some acacia species, including *Acacia seyal*, *Mitragyna inermis*, *Balanites aegyptiaca* and *Combretum* spp.
- Assisted regeneration, with vegetative offspring from layering and cutting, may secure strong regrowth of some species.
- Enrichment through complementary plantation of the desired species may secure complete regeneration of the forest.
- Extension work can be used to develop new vegetative regeneration techniques.
- When soil and projected climatic conditions are appropriate, the range of species and varieties planted can be diversified to meet management objectives.

- A percentage of exotic non-local species can be maintained, rather than restricting the choice to only African dryland-tolerant species.

Expanding forest cover and optimizing landscape and land conservation

Forest degradation and deforestation processes can easily combine to claim vast areas of forest. Protection against these processes is more efficient in large, contiguous forests or woodlands, but can also be achieved when a mix of smaller forests are well distributed in the area concerned. In sub-Saharan Africa, woodfuel is likely to remain the major source of energy, and an important forest and socio-economic issue, into the near future and beyond. Forest and woodland degradation can be prevented and forest areas extended through:

- adoption of better management practices for woody biomass resources;
- improved fuelwood collection and charcoal production techniques;
- design and promotion of efficient conversion technologies for domestic wood energy; various charcoal kilns and charcoal and wood stoves have been developed and used, but have not been widely adopted; efforts should be made to improve the designs and encourage uptake;
- facilitating local populations' access to alternative renewable energy sources, such as solar energy systems;
- creation of an enabling environment that provides fuelwood operators with alternative income-generating activities, such as basketry and fence panelling;
- establishment of forest plantations to increase the production of wood for energy and reduce the pressure on native woodlands;
- adoption of new mechanical processes using heavy machinery to improve water economy and accelerate the growth of plantations;
- further consideration of the use of wastewater resources for irrigated planted forests, taking into consideration the potential risks for health and groundwater contamination;
- design and promotion of appropriate techniques and materials (e.g. polymers) to increase the water-holding capacity of soils and the efficiency of water use.



Agroforestry system with Acacia albida, Burkina Faso

Regular assessment and improvement of the economic environment for forest production

Forest production alone may not be sufficient to meet the needs of interested communities. It is also essential that the economic and social environment allows economic use and provides an absorptive market. The following activities should be carried out regularly and continuously:

- selecting and maintaining appropriate species and production technologies for products that can find markets, in line with social and economic changes;
- assessing and monitoring the demand for non-wood forest products, and encouraging measures to adjust production in line with demand; non-wood forest products are the most important outputs of many dry forests, so foresters should periodically assess the markets for these products, and adjust their production options accordingly;
- encouraging the private sector's participation in enhancing production of various forest goods, and organizing downstream sectors for processing and marketing;
- managing the forest component of the energy sector, to align the production of fuelwoods and related products with the demand, and to integrate output more smoothly in the forest production cycle;
- identify protection forests and plantations, and incorporate them into land-use management and village land planning;
- ensure that forestry and plantations are included in distributions of land for various purposes;
- integrate plantation issues into land-use plans.

Locating forests for optimum landscape and land conservation

Advocacy for forestry is best undertaken during planning phases and at the highest level possible. Foresters are not usually directly represented at these levels, but they should use networking and lobbying to try to ensure that sufficient land is allocated to forest and tree cover options in land-use planning and decision-making. Particular attention should be focused on fragile situations and resources, such as:

- coastal areas, which often harbour fragile systems and are threatened by shifting sands;
- plateaux and higher-altitude areas, which are appropriate locations for catchment area protection using suitable management practices;
- along riverbanks, lake shores and other wetlands, to help protect the precious water resources contained in these areas;
- around villages and other dwelling sites (camp grounds, nomad settlements, nomadic trails);
- in urban areas, in conjunction with city development, when urban parks and peri-urban and other green areas are being planned to break up massive urban continuums;
- trees in agricultural systems, where agroforestry can respond to the needs of agriculture, with adapted species and appropriate associations of trees, shrubs and crops, which should be established with due consideration to water constraints.

Matching protection and production objectives

No forest has an exclusive production or protection function. In any sustainably managed forest, both functions should be possible, so they can be called on when required. The design and implementation of management and silviculture techniques should therefore be adapted to the specific production or protection objectives, which depend on the local circumstances or needs, including those for water resources management, protection of agricultural production assets, protection against wind erosion and control of sanding processes, protection against water erosion, and the various protection services required in urban forestry.

It is recognized that forests in dry areas perform a host of protection functions. Most prominent of these are those related to providing rangeland, fuelwood and water resource conservation. Managing dry forests entails optimizing the overall delivery of these services and products, many of which may be delivered jointly. However, incompatibility may arise, as in the following cases:

- Consumption that entails tree cutting is incompatible with most other uses, unless management and silviculture ensure regeneration and continued growth.

- It may be possible to carry out more than one type of consumption simultaneously, but one or more of these may not achieve optimal levels. The efficiency of protection services may be enhanced or reduced by the presence of pasture, and some types of wood collection may be positively or negatively affected by clear felling.

Various types of consumption may become compatible when properly implemented and managed. Management usually helps to reconcile the contradictory needs for and uses of a resource, so proper management can promote forest use, with minimal harm and optimal individual yields. Activities that can assist this process include:

- identifying the primary need and objective of management;
- establishing the expected yields and related production;
- studying alternative use options and the possible yields and benefits that could be obtained from the resource without harming other objectives;
- strengthening national plans and programmes for forest management, inventory and monitoring, including through the participation of stakeholders, such as communities and the private sector;
- maintaining protected areas, by improving capacities, developing regional programmes, restoring landscapes, etc.

The value of management rests in its capacity to combine and reconcile as many products and services as possible as forests, woodlands and other tree formations are integrated into a multiple-use forestry system.



Group working in a tree nursery, Senegal

PROMOTING SOCIO-ECONOMICALLY RELEVANT FOREST RESOURCES

Forests are a source of both subsistence for rural populations and, increasingly, produce for urban populations, which depend on the output of rural areas around the cities. Forest management should facilitate access to the many benefits of forests and contribute to their sustainability (Box 7).

BOX 7

Major benefits of forest management

The decision to manage the forest or woodland on a piece of land brings a number of advantages and benefits that free access does not provide. The following are findings from forest management programmes facilitated by FAO.

Ownership and access to resources: A managed resource cannot provide free access to all potential beneficiaries. The administrative authority or community must decide how to recognize and compensate those responsible for governance of the resource. Defining these stakeholders clearly will help reduce conflicts, facilitate participation and make benefits traceable.

Definition of responsibilities and benefits: The community or group of forest-dependent neighbours should know what is expected of them and what they can expect from the forest. The management document must make these arrangements clear. These responsibilities and benefits can be defined for communities that have applied to manage part of a State forest or a community forest, according to the land regulations and forest access schemes in the country concerned. This process clarifies the actions to be carried out by each player, and the time frame and location for these. This provides many advantages over the system of general access to resources that pertains in many parts of sub-Saharan Africa.

Definition of products and services expected from the forest and the modes and timing of their exploitation: To improve the well-being of local communities or local forest workers it is important to define which products are included in the management process, and how access to these products will be authorized and facilitated. Forest management provides neighbouring communities with an improved environment and other services. It also defines the core operations to be carried out to ensure proper maintenance of the forest, including reduced occurrence of forest fires.

Jobs and income opportunities from management operations: Proper forest management can provide measurable economic and social benefits to the community or forest neighbours. It has been noted in several forest management initiatives (e.g., in the Nazinon forest of Burkina Faso) that the groups involved, especially women's groups, improve their incomes, which can result in increased family expenditures on food, transportation, school fees and medicines. Income-generating activities that can be made available to communities and forest operators through training and sensitization include wood-related handicrafts, basketry, bee-keeping, and trade in non-wood forest products.

Social organization through community forest management: Social organization is often improved through the combination of these separate benefits. The cooperatives and other groups established have led to the development of solidarity, capacity for innovation, greater openness, growing expertise, and capacity to negotiate.

International cooperation and funding opportunities: Although Africa contributes less than 4 percent of global CO₂ emissions, most of its mitigation opportunities are linked to improvements such as sustainable land and forest management, which bring solid development benefits. Several African countries are beginning to participate in REDD efforts, and Africa could derive major benefits from future REDD instruments.



Young woman carrying fuel wood, Tanzania

As described in the previous subsection, forests and tree formations provide a large array of social and economic benefits that are tangible and quantifiable; their effects are reflected in the well-being of local communities, labourers and forest workers. These benefits can be assessed during the monitoring process; periodic formal assessments of the managed forest's social and economic impacts can be made, and the economic and social sustainability of the management system can be documented. To optimize these benefits, forest practitioners should:

- organize neighbouring populations for increased participation in forestry work and benefits;
- train the people engaged in forest work as forestry labourers or self-employed artisans or traders;
- promote processing models for forest products, to improve marketing;
- facilitate social organization, to minimize the incompatibility between forestry and cropping;
- improve the sharing of forest benefits and income among primary woodcutters, farmer producers, local communities and the State;
- facilitate the advanced processing of timber, wood and non-wood products, to increase incomes from forests;
- maintain trees at the landscape level, as single trees contribute to local people's food, fodder and medicinal needs.

At the same time, forest managers should work with non-governmental organizations (NGOs), other development partners (public and private) and local communities to develop sustainable markets for sub-Saharan forest products to the benefit of local people. Various unique goods such as gums, resins, medicinal plants and oils, come from dryland forests of the sub-Sahara, and could be an important source of income for poor people in these areas. However, this requires a supportive trade regime. Currently, access to markets for the sale of locally produced goods is often a problem, leaving poor rural people unable to tap potentially valuable markets. There is need to develop market analyses and strategies for sub-Saharan forest products that have the potential to provide multiple benefits for local communities. Priority should also be given to strengthening the capacity of local forest product producers, processors and traders, to ensure sustainable harvesting and management of forest resources while increasing the quality and added-value of the products.

LEGAL, POLICY AND INSTITUTIONAL FRAMEWORK FOR SUSTAINABLY MANAGED FORESTS

Establishing and maintaining good practices is a serious challenge in sub-Saharan Africa. Poverty tends to encourage people to find easier ways of coping. New rules may be observed for a while, but are then progressively forgotten as the momentum dies down. This syndrome can only be tackled by continually examining and renewing laws, regulations and commitments, which provides a very important tool for the operation and monitoring of management programmes. Language barriers must be overcome, with forest administrations and NGOs enhancing communications with local communities through building their understanding of basic documents and procedures, explaining and commenting on these, and translating them into the major local languages. The following subsections outline the region's main needs in terms of the legal, policy and institutional framework.

Updated legislation and regulations

Legislation and regulations should:

- provide a flexible legal framework, which gives more say to populations in and around forests and allocates a greater share of benefits to local users;
- clarify how roles are divided between national and local government, especially in areas of concern to the rural communities and municipalities that are acquiring new responsibilities;
- cater for new challenges to forest management, including climate change and loss of biological diversity;
- recognize and promote the potential for payment of environmental service systems for dry forest ecosystems.

Appropriate policies

Strong and clearly articulated policies are essential for improving forestry administration and practices in dryland sub-Saharan Africa. Recently some countries have drawn up specific policies that clearly present the vision, objectives and strategic elements for developing the forestry sector. As legislation evolves and needs are defined, policies must embrace all aspects of the sectors linked to managing forests and woodlands in sub-Saharan dry landscapes. These sectors include agroforestry, pastoral and animal husbandry, and production and protection forestry. A forestry policy should be wide enough to address the overall management of rural territories, natural resources, agricultural production, animal production, and forest management, while being precise enough to be useful to forestry practitioners and policy-makers.

Strong and sustainable institutions

The colonial era left the newly independent governments of sub-Saharan Africa with relatively strong forestry administrations, established systems, assertive services and firm policing. However, as social considerations brought strong governance approaches into question, and economic difficulties started to increase, many forestry services have since progressively lost their former strength, and their infrastructure has not evolved to keep up with new needs and policy directions. Interest in forestry governance was rekindled in the 1980s, and several sub-Saharan forestry services expanded their physical presence and undertook reforms to adapt to more socially and economically oriented forestry and forest policies.

Forestry departments have had to shed their monolithic structures, and share their missions with other departments, offices or agencies. They have developed appropriate materials and approaches for the international, regional and national levels, in the wake of UNCED (Rio de Janeiro, 1992) and the subsequent international dialogue on forestry. Many regional organizations to assist forest governance have also been developed. However, all of these initiatives have yet to filter down to the national and local levels, and more work is needed to clarify how they should perform their functions, including how to:

- adapt but retain forestry's central role in managing or assisting the management of natural tree resources;
- expand the functions of the forestry sector through initiatives such as plantation forestry;

- harvest the wood and non-wood products of forests;
- assist other institutions and society in carrying out these functions on their own and on non-State, other public and private land.

Efforts to strengthen or establish forestry institutions should take these developments into consideration. As society increases its involvement in resources management, forestry departments should enhance their legislative, regulatory, policy and planning capacities, so they can prepare and provide a regularly updated framework for appropriate management and sustainable use of the region's forest and woodland resources. The following functions will be very important:

- updating legal land regulatory instruments to incorporate new issues and paradigms of forest management;
- developing capacity and practices aligned to the needs of forest landscapes;
- supporting decentralization processes and assisting emerging local institutions;
- reinforcing and organizing the dissemination of understanding about laws and regulations at all levels, especially the local;
- supporting the progressive transformation of forestry administrations' role from direct management to facilitation and advisory monitoring;
- maintaining long-term monitoring of natural and anthropogenic production systems, and engaging in more systematic observation of dryland forests in sub-Saharan Africa, such as by using permanent sample plots for monitoring changes in the forest, including the impacts of climate changes on species composition, the emergence of invasive species, and the spread of pests and diseases, and their responses to different management approaches;
- maintaining national and regional information databases and networks to provide information exchange and easy access to research results and baseline information on forests in dryland sub-Saharan Africa, to improve understanding of their cultural and social roles, mitigation and adaptation potentials, and contribution to human well-being, biodiversity conservation and land rehabilitation.



Women gathering medicinal plants in the forest, Guinea

AWARENESS RAISING, EDUCATION AND CAPACITY BUILDING

Dryland forest can contribute to socio-economic development by reducing deforestation and land degradation (assisted by REDD activities), thereby promoting livelihoods, providing sustained incomes for poor communities, and supplying forest products such as fuelwood, fibre, food and construction materials, and other services. Such benefits may also help slow human migration. A capacity building programme for human and institutional development should be given high priority (Box 8). The following are examples of appropriate awareness raising, education and capacity building activities:

- training programmes that combine action research with studies of the social and economic impacts of climate change on dryland forests;
- capacity building in conservation and the efficient use of dryland forests;
- supporting the production, processing, value addition and marketing of dryland wood and non-wood forest products, given their importance for livelihoods in dryland sub-Saharan Africa;
- creating and raising awareness among different stakeholders on the benefits and needs related to sustainable management of dryland forests in sub-Saharan Africa, including the benefits related to climate change;
- involving local communities in the identification of viable adaptation options;
- identifying the needs and demands of communities, particularly the most vulnerable and marginalized groups, such as people without access to extension and education services, especially women;
- considering successful examples when initiating new national and local initiatives in dryland management or carrying out awareness and extension programmes, including successful adaptation measures, new management approaches, and efficient participatory resource use and conservation;
- ensuring that all initiatives and programmes are fully documented and their results are analysed to inform other similar programmes;
- ensuring that local communities' interests and demands are taken into account during the development of forest management plans and strategies.



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Forester explaining to a villager how to plant a tree

BOX 8

Areas of capacity building and engagement for forest management professionals

The forestry sector needs new capabilities and paradigms for managing forest and tree resources in ways that are compatible with the ideals of UNCED (Rio de Janeiro, 1992) and the World Summit on Sustainable Development (Johannesburg, August 2002). It is essential to diagnose training gaps, ensure a supply of adequately qualified professionals and technicians in the forestry sector, and encourage the recruitment and training of new personnel.

In line with the ever-diversifying mission of the forestry sector and allied services, the education and training of forestry and range staff should also be diversified and expanded to address the major issues confronting them, including food security, wildlife and conservation, agroforestry, water resources, biological diversity and climate change. More research is needed to improve understanding of how climate change will affect dryland forests in Africa and how effective different adaptation responses will be.

Scientific work and methodology should be increased and formalized to provide backstopping and support to sustainable forest management. Forest science and technical networks and groups should be promoted to accompany and support the development of forest management in dry areas. The African Forest Forum (AFF) and other regional networks of national forestry research organizations are already helping in this. The development of regional environmental and forest policies will also generate other networks to support discussion and dialogue on research for sustainable forest management.

A joint database on dryland forests in Africa should be encouraged, to allow the monitoring of key parameters such as forest surface, habitats and species, carbon stock, biomass, and conservation or degradation status. Indicators should be developed, based on the online database system for Africa and FAO criteria and indicators for sustainable management of tropical forests, for example. It is important to strengthen capacities related to the monitoring and observation of forest changes, and to establish a pool of experts on greenhouse gas inventories, in accordance with IPCC methodological guidance to support monitoring, reporting and verification.

A strong body of both traditional and modern knowledge, research results and technologies has been accumulated over the years. The identification, location, collection and processing of such valuable material should be encouraged, to improve the advancement of forestry, range management and agrosilvopastoral practices in sub-Saharan Africa.

The Rio Conventions on biological diversity, climate change and desertification all support forest management. To assist forest management and forestry practices, synergies should be developed at the national and regional levels among these and other forest-related conventions, such as the African Convention on the Conservation of Nature and Natural Resources, the Convention on Wetlands of International Importance especially as Waterfowl Habitat (the Ramsar Convention) and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

Measures to assist the conservation of biological diversity, including forest genetic resources, should include: i) arranging management and use so that important species and their associations are not tampered with; ii) with scientific support, characterizing local biological diversity, valuing it and using it sustainably; and iii) carefully monitoring biodiversity, especially where valuable or unique gene pools are threatened and susceptible to loss.

Forest and woodland resources play a central role in domestic energy supply in sub-Saharan Africa. This affects the resources and is a constant concern of forest managers. It is likely that forestry will continue to contribute a large share of the region's energy supply, with traditional collection augmented by more modern and dynamic approaches to energy production from wood.

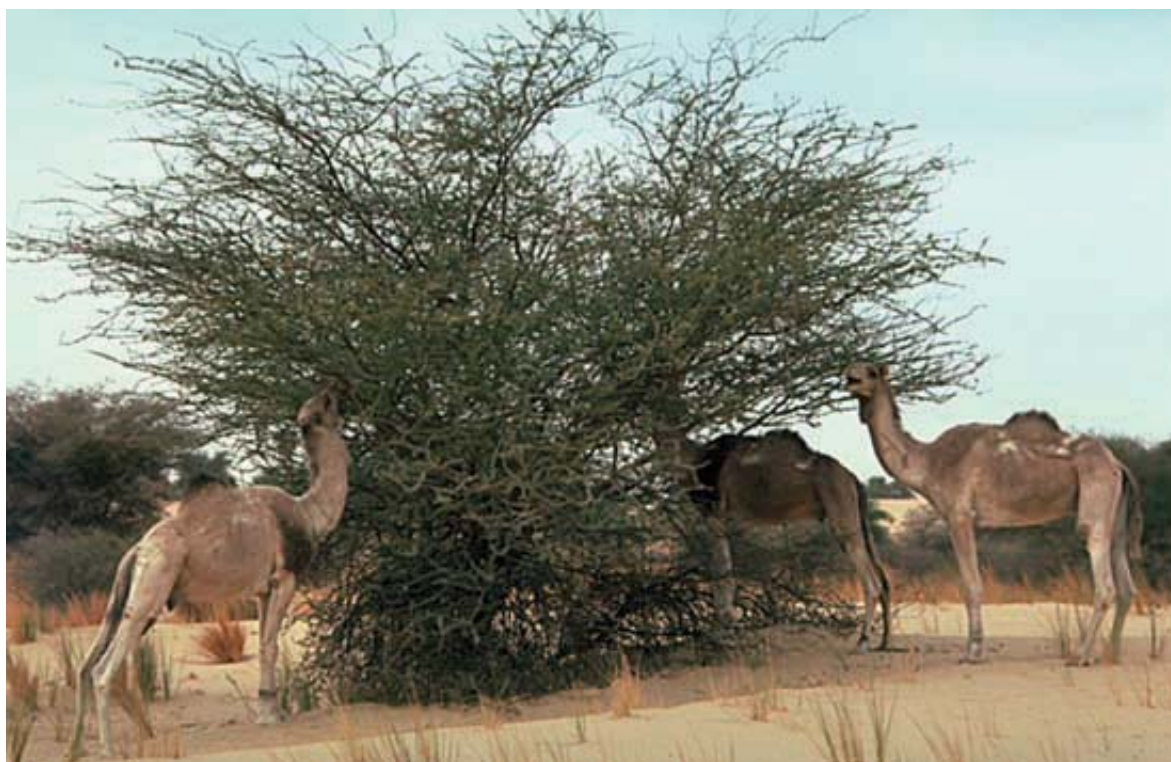
Combating desertification has become a strong element of national policies, but has not received sufficient budgetary support. Initiatives such as the formulation of regional environmental policies and the Great Green Wall for the Sahara and the Sahel Initiative (GGWSSI) should provide fresh impetus. Forestry practices have the potential to support these initiatives through control of land degradation and restoration of the resource base.

Climate change is also a growing concern in the region. Riverine ecosystems and other water bodies may be drastically modified. Some valuable wetlands of unique ecological and economic significance could be threatened or degraded. Forests and other wetland-related woody formations could be altered. Forestry can help to buffer the effects of climate change. Although dryland plant formations play a relatively small role in carbon sequestration, concerted efforts to increase forest and tree cover at the regional level could be effective.

CAPITALIZING ON GROWING REGIONAL AND INTERNATIONAL COOPERATION IN SUB-SAHARAN AFRICA

Over recent decades, several strategies, programmes and projects have aimed at conserving and developing dryland forests in sub-Saharan Africa. A growing number of organizations and initiatives are working together to put in place a solid foundation for the effective implementation of the recommendations listed in previous sections. There is therefore a need to:

- draw lessons from past experiences and capitalize on the rich and diverse expertise on dryland forest issues accumulated during recent decades;
- examine existing and emerging opportunities for promoting the use and implementation of the guidelines;
- raise awareness of the guidelines and promote their dissemination through regional and international fora and mechanisms;
- secure strong government commitment at the national and regional levels, and the engagement of subregional and regional organizations;
- develop programmes for disseminating the guidelines and implementing them at the national and regional levels, where additional support is needed;
- strengthen forest law and governance, by encouraging the sharing of information on trade in illegally harvested forest products and commitment to the principles of regional and international forums and agreements;
- undertake comprehensive inventories and valuation of forests and woodland resources, and introduce mechanisms that encourage the optimum use of these resources.



Camels browsing on an Acacia tortilis tree

BOX 9

The Great Green Wall for the Sahara and the Sahel Initiative: the Senegalese experience

The Great Green Wall for the Sahara and Sahel Initiative (GGWSSI) is an initiative of CEN-SAD, endorsed by the African Union (AU). Its objective is to counterbalance the impacts of aridity, low land productivity, climate change and difficult livelihoods in the Saharan, Sahel and Sudanese drylands of Africa, from Djibouti to Senegal. The strategy relies on the integrated management of degraded and fragile lands through the establishment of drought-resistant plant species of high economic value, and the creation of water ponds associated with agricultural production systems and other social infrastructure. Covering 11 countries of the Sahel, the GGWSSI concept has gradually shifted since 2005, from a thematic project focusing on a massive tree planting initiative (extending from Dakar to Djibouti across a stretch 7 000 km long and 15 km wide, south of the Sahara) to a more holistic and integrated vision of sustainable land management and restoration of the environmental, social and economic functions of affected ecosystems, including forests and rangelands. It represents a clear and concrete political commitment and technical response to desertification, hunger, poverty and climate change, which affect millions of people living in dryland sub-Saharan Africa.

As the lead country in NEPAD's Environmental Programme, Senegal has volunteered since 2008 to pioneer this initiative by using its own resources to create the first GGWSSI National Agency (ANGMV), which operates mainly from the northern coast to the upper valley of the River Senegal, on an area approximately 545 km long and 15 km wide, covering mainly the Ferlo and silvopastoral zone. ANGMV is under the authority of the Ministry of Environment, and is closely watched by the Presidency of the Republic. The programme gathers a large partnership at the national level, involving local communities, youth and women's organizations, economic operators, the forestry department, universities, research, and many other national stakeholders. At the regional level, official contacts have been made at the highest level with countries such as Mali, Burkina Faso, the Niger, Chad and Ethiopia, which are the natural continuum of the programme. Information and promotional contacts and visits have also been made at the international level, to Argentina, France and Italy, to gather knowledge, explore opportunities and mobilize additional funding.

In 2008 and 2009, ANGMV produced 5 300 000 seedlings and planted more than 10 000 ha of autochthonous trees of great economic, food, fodder or environmental value. A pond of 25 000 m³ has also been created, with assistance from the French army. The most successful activity has been tree nursery development combined with vegetable gardening by women's organizations in four locations in the GGWSSI area. This activity has generated much income and food, and has significantly improved livelihoods in Amaly, Labgar, Tessekre and Widou Thiengoly. Important research activities have been conducted in improved nursery and planting techniques, introducing high-potential and adapted species, and management and harvesting methods.

During 2010, the programme will focus on: i) recuperation and protection of degraded silvopastoral ecosystems; ii) improvement of the knowledge base on the environment, natural resources and human capital; iii) development of business opportunities, mechanisms and instruments to secure reliable incomes and more adequate livelihoods; and iv) management of silvopastoral areas and safeguarding of diversified and sustainable production.

In many respects, Senegal has created a learning ground for other countries to start GGWSSI implementation. It is hoped that the other ten countries, AU, CEN-SAD, NEPAD, ECOWAS, the Intergovernmental Authority on Development (IGAD) and other international partners will provide the necessary political commitment and financial resources to pursue this effort, so that GGWSSI does not end up on the pile of other noble initiatives that were never fully implemented.

Website: www.grandemurailleverte.org (February 2010).

GLOSSARY

This glossary is drawn mainly from the *Guidelines for good forestry and range practices in arid and semi-arid zones of the Near East*, amended, improved and adapted to the specific context of sub-Saharan Africa.

Definitions marked with an asterisk (*) have been taken from the *Global Forest Resources Assessment 2005* (FAO, 2005) (www.fao.org/forestry/site/fra2005-terms).

Definitions marked with two asterisks ** have been taken from H.O. Abdel Nour, 2006, *A vocabulary of contemporary forestry terms*, El-Maarefa Printing House, Sudan.

The remaining definitions have been taken from *Responsible management of planted forests: Voluntary guidelines* (FAO, 2006).

agrosilvopastoral system (also agrosylvopastoral system)**

Land-use system in which woody perennials are used on the same land as agricultural crops and animals, in some form of spatial arrangement or temporal sequence.

afforestation*

Establishment of forest plantations on land that was not previously classified as forest. Implies a transformation from non-forest to forest.

alien species**

Species, sub-species or member of a lower taxon that has been introduced outside its normal past and present distribution: includes the gametes, seeds, eggs, propagules, or any other part of such species that might survive and subsequently reproduce.

biological diversity* (also biodiversity)

Variability among living organisms from all sources, including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; includes diversity within species, among species and of ecosystems
(from CBD, Art. 2: www.cbd.int/convention)

biological resources

Include genetic resources, organisms or parts thereof, populations, or any other biotic component of ecosystem with actual or potential use or value for humanity.

biofuel**

Fuel of biological origin, which recently was either alive (phytomass) or came from living organisms (dung, biogas).

carbon sequestration

Uptake and storage of carbon. Forests, trees and plants absorb CO₂, release the oxygen and store the carbon.

carbon sink

Forest and other ecosystems that absorb carbon, thereby removing it from the atmosphere and offsetting CO₂ emissions. The Kyoto Protocol allows certain human-induced sink activities undertaken since 1990 to be counted towards Annex I Parties' emission targets.

Center for International Forestry Research (CIFOR)**

Established in 1993 as part of the Consultative Group on International Agricultural Research (CGIAR) in response to global concerns about the social, environmental and economic consequences of forest loss and degradation.

Clean Development Mechanism (CDM)

One of the flexible mechanisms of the Kyoto Protocol, designed to make it easier and cheaper for industrialized countries to meet the greenhouse gas emission reduction targets that they agreed to under the protocol. Under CDM, an industrialized country with a greenhouse gas reduction target can invest in a project in a developing country without a target and claim credit for the emissions that the project achieves.

Collaborative Partnership for Forest (CPF)**

Launched in 2001 to enhance cooperation and coordination among CPF members (www.fao.org/forestry/cpf/en/).

deforestation*

Conversion of forest to another land use *or* long-term reduction of the tree canopy cover below the minimum 10 percent threshold.

degraded forest**

Secondary forest that has lost, through human activities, the structure, function, species composition or productivity normally associated with a natural forest type on that site.

desertification**

Land degradation in arid, semi-arid and dry sub-humid areas resulting from factors that include climate variations and human activities.

disturbance*

Environmental fluctuation and/or destructive event that disturbs forest health and structure and/or changes resources or physical environment at any given spatial or temporal scale. Disturbances that affect health and vitality include biotic agents such as insects and diseases, and abiotic agents such as fire, pollution and extreme weather conditions (White and Pickett, 1985; Lindgren and Lewis, 1997; www.mcgregor.bc.ca/publications/interactionswithinsectsandpathogens.pdf).

drought**

Naturally occurring phenomenon that exists when precipitation has been significantly below normal recorded levels, causing serious hydrological imbalances that adversely affect land resource production systems.

ecosystem**

Dynamic complex of plant, animal and microorganism communities and their non-living environment interacting as a functional unit.

employment*

Any type of work performed or services rendered under a contract of hire, written or oral, in exchange for wage or salary, in cash or in kind (based on definitions by the International Labour Organization [ILO] and the Employment Security Commission). May be related to the primary production of goods, or to the provision of services. ILO Core Labour Standards include the following conventions:

- Convention 29 on Forced Labour, adopted in 1929, and Convention 105 on Abolition of Forced Labour, adopted in 1957;
- Convention 87 on Freedom of Association and Protection of the Right to Organise, adopted in 1948;

- Convention 98 on the Right to Organise and Collective Bargaining, adopted in 1949;
- Convention 100 on Equal Remuneration, adopted in 1951, and Convention 111 on Discrimination (Employment and Occupation), adopted in 1958;
- Convention 131 on Minimum Wage Fixing, adopted in 1970;
- Convention 138 on Minimum Age, adopted in 1973, and Convention 182 on Worst Forms of Child Labour, adopted in 1999;
- Convention 142 on Human Resources Development, adopted in 1975;
- Convention 155 on Occupational Safety and Health, adopted in 1981, and Convention 161 on Occupational Health Services, adopted in 1985.

endemic species**

Native species restricted to a particular geographic region owing to factors such as isolation or in response to soil or climatic conditions.

eutrophication

Process by which bodies of water become highly charged with nutrients, leading to massive growth in primary productivity, which may result in the growth of algae (algal blooms), leading to reductions in dissolved oxygen and the death of fish and other aquatic life.

forest*

Land spanning more than 0.5 ha with trees higher than 5 m and a canopy cover of more than 10 percent, or trees able to reach these thresholds *in situ*. Does not include land that is predominantly under agricultural or urban land use:

- Determined by both the presence of trees and the absence of other predominant land uses. The trees should be able to reach a minimum height of 5 m *in situ*. Areas under reforestation that have not yet reached but are expected to reach a canopy cover of 10 percent and a tree height of 5 m are included, as are temporarily unstocked areas resulting from human intervention or natural causes that are expected to regenerate.
- Includes areas with bamboo and palms, provided that height and canopy cover criteria are met.
- Includes forest roads, firebreaks and other small open areas; forest in national parks, nature reserves and other protected areas, such as those of specific scientific, historical, cultural or spiritual interest.
- Includes windbreaks, shelterbelts and corridors of trees with an area of more than 0.5 ha and width of more than 20 m.
- Includes plantations primarily used for forestry or protective purposes, such as rubberwood plantations and cork oak stands.
- Excludes tree stands in agricultural production systems, such as in fruit plantations and agroforestry systems. Also excludes trees in urban parks and gardens.

forest certification

Procedure to assess the quality of forest management in relation to a forest management standard. Designed to send a market signal to buyers that the products they purchase are derived from forests managed to particular environmental and social standards.

forest degradation**

Reduction of the capacity of a forest to provide goods and services (FAO, 2002). “Capacity” includes maintenance of ecosystem structure and functions.

forest functionality

Ability of a forest to provide goods and services and maintain ecological processes.

forest landscape restoration (FLR)

Process that aims to restore ecological integrity and enhance human well-being in deforested or degraded forest landscapes. Rather than aiming to return forests to their previous “pristine” condition, FLR aims to strengthen the resilience and functionality of the forest landscape and keep future forest management options open.

forest management*

Processes of planning and implementing practices for the stewardship and use of forests and other wooded land to achieve specific environmental, economic, social and/or cultural objectives. Includes management at all scales such as the normative, strategic, tactical and operational levels.

intensive forest management*

Forest management regime under which silvicultural practices define the structure and composition of forest stands. A formal or informal forest management plan exists. A forest is not under intensive management if mainly natural ecological processes define the structure and composition of stands.

forest rehabilitation**

Management strategy applied in degraded forest lands that aims to re-establish site productivity and protective functions and many of the ecological services provided by a functional forest or woodland ecosystem.

forest resources*

For the purposes of global forest resources assessments, include those found in forests and other wooded land and as trees outside forests.

Forestry Outlook Study**

In which FAO and its member countries identify a range of issues, possible choices and options for action that could assist countries in achieving their goals for forests and the forestry sector.

function*

Designated function refers to the purpose assigned to a piece of land, either by legal prescriptions or by decision of the landowner/manager. It applies to land classified as forest and as other wooded land.

primary function*

A designated function that is significantly more important than other functions. Includes areas that are legally or voluntarily set aside for specific purposes.

secondary function*

Other functions.

genetic material**

Any material of plant, animal, microbial or other origin containing functional units' heredity.

genetic resources**

Genetic material of actual or potential value.

habitat**

Place or type of site where an organism or population naturally occurs.

introduced species* – see species

low forest cover country (LFCC)

The term has not yet been formally defined, but commonly refers to countries with less than 10 percent forest cover. In 2000, 71 countries qualified as LFCCs, with a total land area of about 4 billion ha and forest cover of only 140 million ha (3.5 percent). In these countries natural forests accounted for 52 percent of forests, and planted forests for 48 percent.

managed forest/other wooded land*

Forest and other wooded land that is managed in accordance with a formal or informal plan applied regularly over a sufficiently long period (at least five years).

mangroves**

Characteristic littoral plant formations of tropical and subtropical sheltered coastlines. Various described as coastal woodland, tidal forest and mangrove forest.

multiple-purpose*

Forest/other wooded land designated to any combination of production of goods, protection of soil and water, conservation of biodiversity and provision of socio-cultural services, where none of these alone can be considered as being significantly more important than the others.

native species* – see species

natural forest*

Forest composed of indigenous trees, not planted and not classified as forest plantation.

modified natural forest/other wooded land*

Forest/other wooded land of naturally regenerated native species where there are clearly visible indications of human activities:

- Includes selectively logged-over areas, areas naturally regenerating following agricultural land use, areas recovering from human-induced fires, etc.
- Includes areas where it is not possible to distinguish whether the regeneration has been natural or assisted.

primary forest/other wooded land*

Forest/other wooded land of native species where there are no clear indications of human activities and the ecological processes are not significantly disturbed. Includes areas where collection of non-wood forest products occurs, provided the human impact is small. Some trees may have been removed.

semi-natural forest/other wooded land*

Forest/other wooded land of native species established through planting, seeding or assisted natural regeneration:

- Includes areas under intensive management where native species are used and deliberate efforts are made to increase/optimize the proportion of desirable species, thus leading to changes in the structure and composition of the forest.
- Naturally regenerated trees from other species than those planted/seeded may be present.
- May include areas with naturally regenerated trees of introduced species. Includes areas under intensive management where deliberate efforts such as thinning or fertilizing are made to improve or optimize desirable functions of the forest. These efforts may lead to changes in the structure and composition of the forest.

non-wood forest product (NWFP)*

Product of biological origin other than wood derived from forests, other wooded land and trees outside forests (www.fao.org/forestry/site/6388/en).

other wooded land*

Land not classified as forest, spanning more than 0.5 ha, with trees higher than 5 m and a canopy cover of 5 to 10 percent, or trees able to reach these thresholds *in situ*; or land with a combined cover of shrubs, bushes and trees above 10 percent. Does not include land that is predominantly under agricultural or urban land use.

plantation forest or forest plantation/other wooded land*

Forest/other wooded land of introduced species and sometimes native species, established through planting or seeding:

- Includes all stands of introduced species established through planting or seeding.
- May include areas of native species characterized by few species, even spacing and/or even-aged stands.
- Plantation forest is a subset of planted forest.
- Includes productive plantation* (in forest/other wooded land).
- Includes forest/other wooded land of introduced species and sometimes native species, established through planting or seeding mainly for production of wood or non-wood goods.
- Includes all stands of introduced species established for production of wood or non-wood goods.
- May include areas of native species characterized by few species, straight tree lines and/or even-aged stands.

protective plantation* (in forest/other wooded land)

Forest/other wooded land of native or introduced species, established through planting or seeding mainly for provision of services:

- Includes all stands of introduced species established for provision of environmental services, such as soil and water protection, pest control and conservation of habitats for biological diversity.
- Includes areas of native species characterized by few species, straight tree lines and even-aged stands.

planted forest/other wooded land*

Forest/other wooded land in which trees have been established through planting or seeding. Includes all stands established through planting or seeding of both native and introduced species.

production (in forest/other wooded land)*

Forest/other wooded land designated for production and extraction of forest goods, including both wood and non-wood forest products.

protection of soil and water (in forest/other wooded land)*

Forest/other wooded land designated for protection of soil and water.

reforestation*

Establishment of forest plantations on temporarily unstocked lands that are considered forest.

regeneration***artificial regeneration***

Forests established by artificial means on land that carried forest within the previous 50 years or within living memory, and involving the renewal of what was essentially the same crop as before.

natural regeneration (with assistance) or assisted regeneration

Forests established by natural regeneration with deliberate, human silvicultural assistance, including the provision of seed or vegetative reproductive material.

natural regeneration (without assistance)

Forests established by natural regeneration without deliberate, human assistance, including virgin forests and those regenerated by natural means.

secondary forest*

Forest regenerated largely through natural processes after significant human or natural disturbance of the original forest vegetation:

- The disturbance may have occurred at a single point in time or over an extended period.
- The forest may display significant differences in structure and/or canopy species composition in relation to nearby primary forest on similar sites.

social services (in forest/other wooded land)*

Forest/other wooded land designated for the provision of social services. These services may include recreation, tourism, education and/or conservation of cultural/spiritual and religious sites.

species***introduced species****

Species introduced outside its normal past and current distribution. Synonymous with “alien species” and “exotic species”.

Native species*

Species that naturally exists at a given location or in a particular ecosystem, i.e., has not been moved there by humans. Synonymous with “indigenous species”

(CBD website: www.biodiv.org/programmes/areas/forest/definitions.asp).

silviculture*

Art and science of controlling the establishment, growth, composition, health and quality of forest and woodlands to meet the targeted diverse needs and values of landowners and society on a sustainable basis (International Union of Forest Research Organizations website: www.iufro.org).

tree*

Woody perennial with a single main stem or, in the case of coppice, with several stems, and a more or less definite crown. Includes bamboos, palms and other woody plants meeting these criteria.

trees outside forests (TOFs)

All trees found outside forests and other wooded lands:

- stands smaller than 0.5 ha;
- tree cover on agricultural land, e.g., agroforestry systems, home gardens, orchards;
- trees in urban environments;
- trees along roads and scattered in the landscape.

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More than elsewhere, forests in the arid zones of sub-Saharan Africa have the potential, if well valued and sustainably managed, to contribute to biodiversity conservation, food security, sustainable livelihoods, preventing and combating desertification. Moreover, forests' role in addressing the challenges of climate change is crucial; the sustained provision of ecosystem goods and services can help people adapt to the local consequences of a changing climate, while the carbon stored in these ecosystems, if well managed, can contribute to climate change mitigation.

Following the request of sub-Saharan countries and partners, FAO has coordinated the preparation of *Guidelines on sustainable forest management in drylands of sub-Saharan Africa*, with the participation of a wide range of partners and experts. The guidelines' objective is to improve forest planning and management in the drylands of the region, so as to contribute to the well-being of local populations and enhance their social, cultural, environmental and economic benefits.

The guidelines are based on widely accepted international standards for sustainable forest management and are categorized under nine principles. They are intended to support those responsible for planning and managing forests and related resources in addressing the complex and inter-related issues and drivers behind forest degradation and desertification.

