

Patrick Vuilleumier/Silf Pictures

## PART D: FORESTS

### REGIONAL OVERVIEW

Forests and woodlands have played a critical role in the survival of human populations. They have been direct providers of shelter and food for people and their livestock, and of water, medicinal plants, building materials and fuel. But forests and woodlands also regulate our environment indirectly by slowing soil erosion, controlling run-off of rainwater and storing it, and regulating its release into our rivers and lakes. Globally, they help to regulate the climate and protect coastlines. Furthermore, forests and woodlands sustain many of our cultural, spiritual and religious values as well as playing an important role in the socio-economic development of industrial countries and being a vital resource for the socio-economic stability of developing ones. Loss of forests and woodlands therefore means loss of a vital resource and disruption of the socio-economic activities they support. The emphasis in recent years on sustainable development has meant that the use of forests and woodlands has come under greater scrutiny in order to preserve a healthy resource base and sustain social and economic benefits.

Tracking long term trends in forest cover involves the compilation and analysis of large quantities of data that are not always consistent or comparable and the task is further complicated by different definitions of what constitutes 'forest' (IPCC 2000, UNEP 2001, Matthews, Payne, Rohweder & Murray 2001). Forests may be defined in terms of administrative categories, land use or land cover (IPCC 2000). The United Nations

Food and Agriculture Organization (FAO), in collaboration with UNEP and the UN Economic Commission for Europe (UNECE) produces an assessment of the world's forests every 10 years. These are widely cited, and much of the information presented below is taken from the 2000 FAO Forest Resources Assessment. For the FAO report, the term 'forest' means land with a tree canopy cover of more than 10 per cent and area of more than 0.5 hectares, and a minimum tree height of 5 m. A canopy cover threshold of 10 per cent can include land that might be considered tundra, wooded grassland, savanna or scrubland (Matthews 2001). The discussion in this section will, therefore, include forests, woodlands and savannas. It should be noted that natural events and human activities can affect open and closed canopy forests in different ways.

Forests cover approximately 30 per cent of the world's surface, with tropical and subtropical forests (and woodlands) comprising 56 per cent, temperate and boreal forests accounting for 44 per cent. These are all natural forests with the exception of 5 per cent of forest plantations, (FAO 2001a). It has been estimated that, since pre-agricultural times, global forest cover has been reduced by at least 20 per cent, and perhaps by as much as 50 per cent (UNDP, UNEP, World Bank & WRI 2000).

The total forest cover in Africa was estimated to be just under 650 million hectares in 2000, equivalent to 17 per cent of the global forest cover, and approximately 22 per cent of Africa's land area (FAO

2001a). Africa has 14 different types of forest, in temperate and tropical climates, as shown in Figure 2d.1, although the extent of forest cover varies between sub-regions. Forests make up approximately 45 per cent of the land area of Central Africa, constituting 37 per cent of Africa's total forest cover. In contrast, only 8 per cent of the land area of countries in Northern Africa have forest cover and most of this is in Sudan (FAO 2001a).

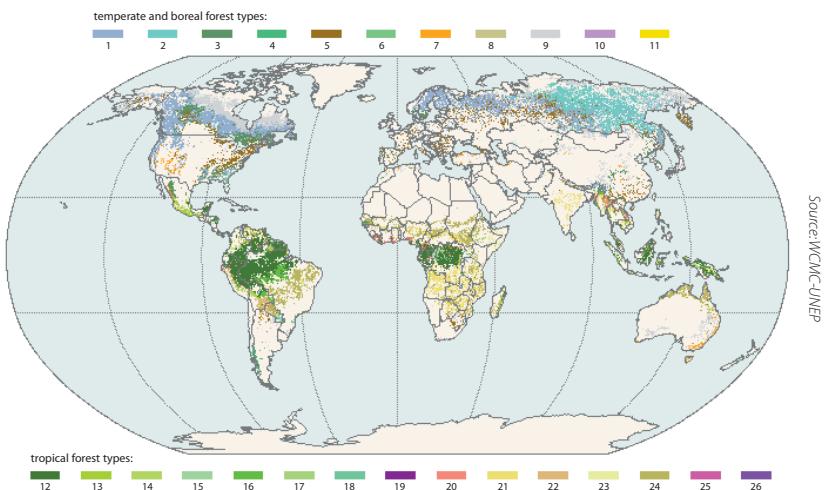
### ECOLOGICAL, ECONOMIC AND SOCIAL VALUE OF FORESTS AND WOODLANDS

Forests and woodlands are remarkable ecosystems. They have high productivity rates—over 800 gC/m<sup>2</sup>/yr in moist tropical forests (WCMC 2000)—and support rich and diverse animal and plant communities that, together, provide resources and opportunities sustaining livelihoods and commercial operations.

Forests and woodlands provide resources and environmental services at global, regional and local levels. At the global level, evapotranspiration and cloud cover over tropical rain forests play a role in maintaining a thermal balance in the earth's atmosphere. Forests also filter out pollution and are a sink for atmospheric carbon dioxide, thus helping to mitigate global climate change. Loss of forests and woodlands can contribute to local and perhaps regional climate variability (BSP 1992, Laurance 1998, IPCC 1998) because, when forest is cleared, both the albedo (proportion of solar radiation which is reflected by the earth's surface) and local temperatures rise.

Clearing of forests can affect evapotranspiration and hydrological cycles because trees (and especially trees in tropical rainforests) recycle much of the rainwater that falls over an area. It is estimated that about 50 per cent of the precipitation in the Amazon basin originates from evapotranspiration; the proportion of rainfall recycled in Central Africa may be as high as 75 to 95 per cent (BSP 1992, Laurance 1998). Clearing of tropical forests is implicated in reductions in local rainfall in many areas, including Côte d'Ivoire and the Gambia (Park 1992, WCMC 1992). Deforestation can also set off a chain of events that can result in intensified droughts affecting areas in other regions or sub-regions that might be more vulnerable to an increase in dry spells. For example, it has been argued that the prolonged

**Figure 2d.1 Map of African forest cover and types**



Source: WCMC-UNEP

droughts affecting the Sahelian areas of Northern Africa are caused, in part, by the destruction of forests in Western Africa (Park 1992).

Forests and woodlands also regulate soil and water quality, protecting the soil from erosion and contributing to its fertility, intercepting rainfall and channelling run-off, and maintaining the balance of elements and nutrients in the air, soil, water, and organisms. They prevent silting of water downstream, and control the drought-flood cycles in rivers. Major hydroelectric schemes can suffer if these phenomena are disrupted, resulting in a lower capacity for power generation that can affect industries and their ability to provide employment.

The destruction of forests upstream of mangrove forests can harm the mangroves by causing increased sediment loads in rivers, and by contributing to global warming (Wass 1995). In coastal areas, mangrove forests protect coastlines and riverbanks by stabilizing sediments and controlling erosion. They also absorb the impact of waves and of storm floods, regulate salt intrusion inland and trap sand preventing its moving onto the land behind beaches. In addition, mangrove forests protect coral reefs and beaches, absorb pollution from the ocean and provide a habitat for many species of commercial fish.

The value of all of these 'ecosystem functions' is not easy to estimate in monetary terms. Furthermore, the benefits accrue to the global community and not

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View of Gatamayu Forest, Kenya

Christian Lambrechts



only to local communities or users of forest resources. There is now increasing recognition of their importance and of these functions and of the need to harvest forest products on a sustainable basis in order to maintain them (FAO 1999). A recent study of forests in Madagascar has highlighted both the short-term and long-term values of different uses of forests, as detailed in Box 2d.1.

The moist tropical forests of Africa support an estimated 1.5 million species (WCMC 2000), which in turn support the local communities in terms of their food, shelter, utensils, clothing, and medicinal needs. By far the most dominant use of woodland resources is for domestic energy needs, mainly from wood and charcoal. In sub-Saharan Africa alone, traditional fuels accounted for 63.5 per cent of total energy use in 1997 (World Bank 1999). Other forest and woodland resources gathered and used by households or traded informally amongst villagers include meat, fruits and vegetables, construction and craft materials, medicinal products, and honey. In Western and Central Africa, more than 60 wildlife species are commonly consumed and bushmeat (mainly small animals and invertebrates) harvested from forests is a traditional protein supplement to the diets of local communities (FAO 1995). The Cross River State rainforest of Nigeria is home to over 700 species of plants and animals, over 430 of which are used by local residents (CRSFP 1994). For instance, bushmeat provides 70 per cent of the animal protein in Southern Ivory Coast; 80-90 per cent in Liberia and 55 per cent in Sierra Leone (FAO 1990). In the Western African savannas, from the Gambia to

Cameroon, local residents ferment wild beans (*Parkia sp.*) to make a nutritious traditional food that provides protein and fat. The pericarp (plant ovary wall) is a source of vitamin C to children who eat it raw (FAO 1995). In South Africa, communities in woodland areas are known to have regularly used between 18 and 27 wild products from up to 300 species of plants and animals (Shackleton, Netshiluvhi, Shackleton, Geach, Ballance & Fairbanks 1999), and in Namibia wild foods provided up to 50 per cent of household food requirements in rural villages (Ashley & LaFranchi 1997). Villagers also gain benefits by using forests and woodlands as grazing areas and as sources of animal fodder, and through agro-forestry and inter-cropping. An example of a comparative valuation of such woodland resources is shown in Figure 2d.2.

#### Box 2d.1 The value of forests in Madagascar

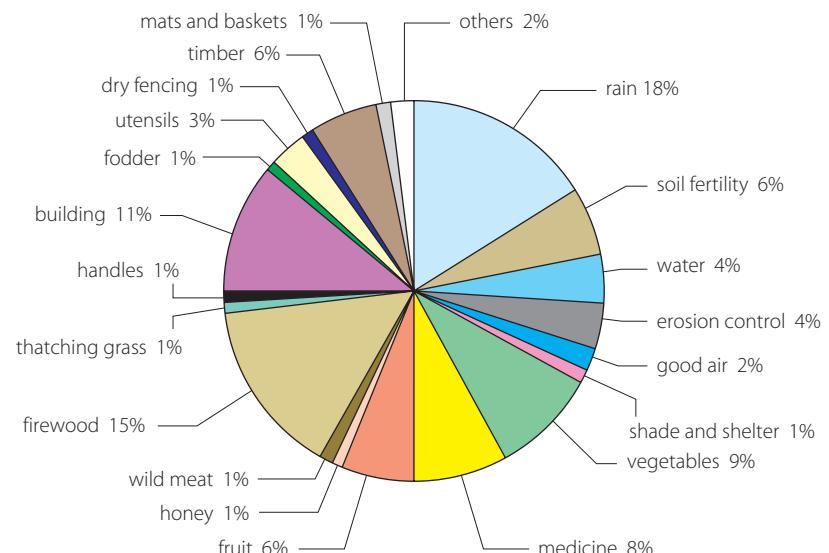
A study from Masoala National Park in Madagascar, showed that the value of forest products sustainably harvested by the local villagers could be as much as US\$200 000 over 10 years. By comparison, the income that could be earned over the same period through slash-and-burn agriculture was estimated at only US\$12 000. However, Madagascar could earn a total of US\$90 million in foreign trade by selling the timber from the forest. When the researchers included the value of the forest in terms of global climate regulation, preserving the forest could save twice this amount of money.

In addition to such tangible benefits, forests and woodlands have been important for cultural, spiritual or religious purposes. The Zigua ethnic group in Tanzania, for example, protect 748 forests, which they use for burial sites and ceremonies, worshipping, traditional practices and training, *Koluhombwa* (places where people with incurable diseases are left to die), meeting places and boundaries and for water protection (Mwihomeke, Msangi, Mabula, Ylhaisi & Mndeme 1998). Some of the forests have multiple uses. Conservation of resources and biodiversity may not have been the immediate goal in protection of these forests, but there are indications that those that remain are high in rare or previously unknown species and are highly valued by the adjoining communities (Mwihomeke and others 1998). Types of use of traditionally protected forests are shown in Figure 2d.3.

At a national level, the commercial exploitation of African forests and woodlands is an important source of income, foreign exchange, and employment. For example, Cameroon, one of Africa's leading producers and exporters of tropical logs and sawn timber, earned US\$436 million in 1998 from export of wood products, mainly sawnwood (FAO 2001a). South Africa is Africa's largest producer of industrial roundwood and an important producer and exporter of pulp and paper (almost exclusively from plantations). In 1998, exports of wood products totalled US\$837 million (FAO 2001a). Apart from tropical hardwoods, forests provide a wide array of products that have industrial value: oils, gum, latex, resins, tannins, steroids, waxes, edible oils, rattans, bamboo, flavourings, spices, pesticides and dyes (Park 1992). Many commercial crops originated from tropical forest plants including coffee and bananas, oranges, sugar, pineapples, rice, maize, cocoa. There is concern that, as forests are degraded, genetic resources needed for the development of new food plants may also be lost (Park 1992). For example, the role of forest crop in the provision of mother (shade) trees for the establishment of cacao and coffee plantations by local communities is significant.

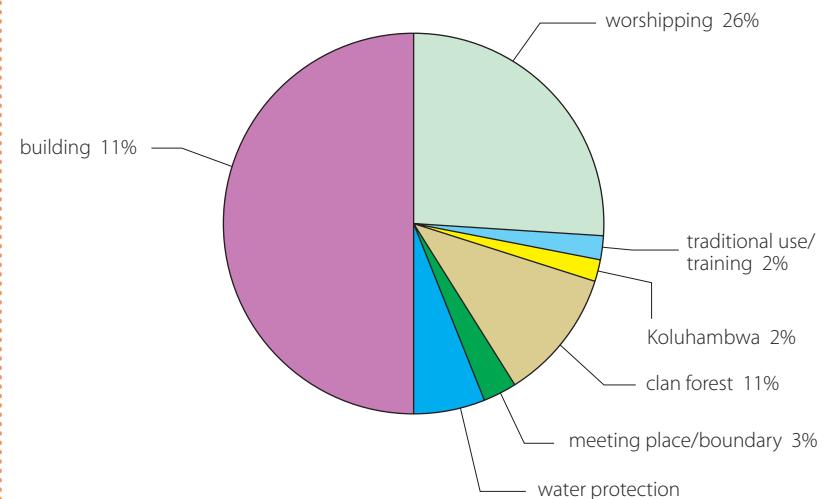
The enormous economic, social, cultural, and environmental value of forests means that the high rates of deforestation in Africa are cause for attention and require immediate remedial action. However, it is not just clear felling but loss of certain species and processes that causes damage to forests (both natural and human-induced).

**Figure 2d.2 Comparative woodland resource valuation in Iringa villages**



Rodgers et al. 2000

**Figure 2d.3 Types of use of the traditionally protected forests of Zigua ethnic group (by forests)**



Mwihomeke et al.

## FOREST COVER AND QUALITY

Deforestation is defined by the FAO as 'the conversion of forest to another land use or the long-term reduction of the tree canopy cover below the minimum 10 percent threshold.' Forest degradation is defined as 'changes within the forest that negatively affect the structure or function of the stand or site, and thereby lower its capacity to supply products and/or services' (FAO 2001a). In 1999, the FAO reported that 10.5 per cent of Africa's forests had been lost between 1980 and 1995,

the highest rate in the developing world and in sharp contrast to the net afforestation seen in developed countries. Forest loss between 1990 and 2000 was over 50 million hectares, representing an average deforestation rate of nearly 0.8 per cent per year over this period (FAO 2001a). As a consequence, availability of forest resources per capita declined from 1.22ha/person in 1980 to 0.74ha/person in 1995 (African Development Bank 2001). A regional comparison of changes in forest area is shown in Figure 2d.4. Deforestation can have a number of negative impacts on local agricultural production (see Figure 2d.5).

The pressures causing this decline are complex and operate at several different levels. They may be anthropogenic (caused by humans) or natural, and direct or indirect. Direct causes include commercial timber production, clearing of land for agriculture and urban expansion, and harvesting of wood for fuel and charcoal. These activities also open up forests by the construction of access roads to logging sites, fragmenting the forests and facilitating further clearance, resource extraction, and grazing by locals and commercial organizations. Forest fragmentation can lead to losses in biodiversity by cutting migratory routes for certain animal species, allowing invasion by alien species or changes in microclimate (UNDP and others). Indirect causes of deforestation include population growth, policies, agreements, legislation, lack of stakeholder participation and market factors that encourage the use

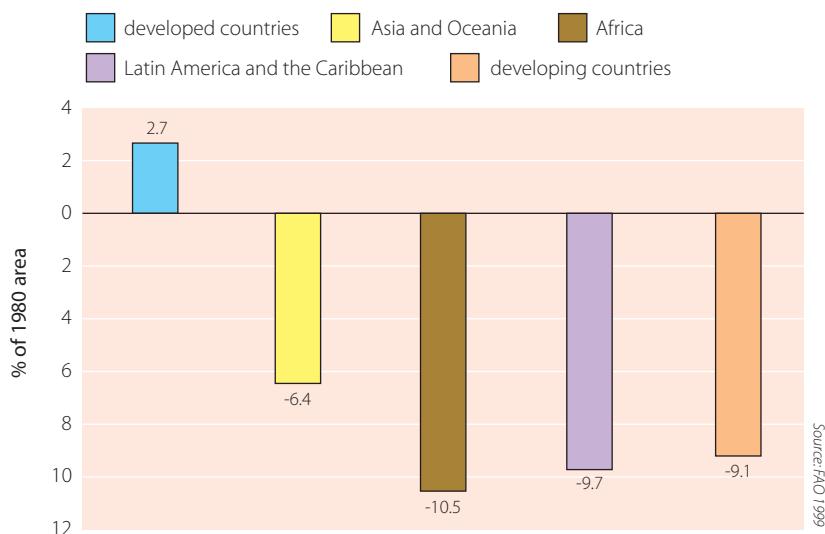
of forest products leading to loss, fragmentation or degradation (Rodgers, Salehe & Olson 2000). Other causes of forest loss include conflicts, civil wars and lack of good governance (Verolme & Moussa 1999).

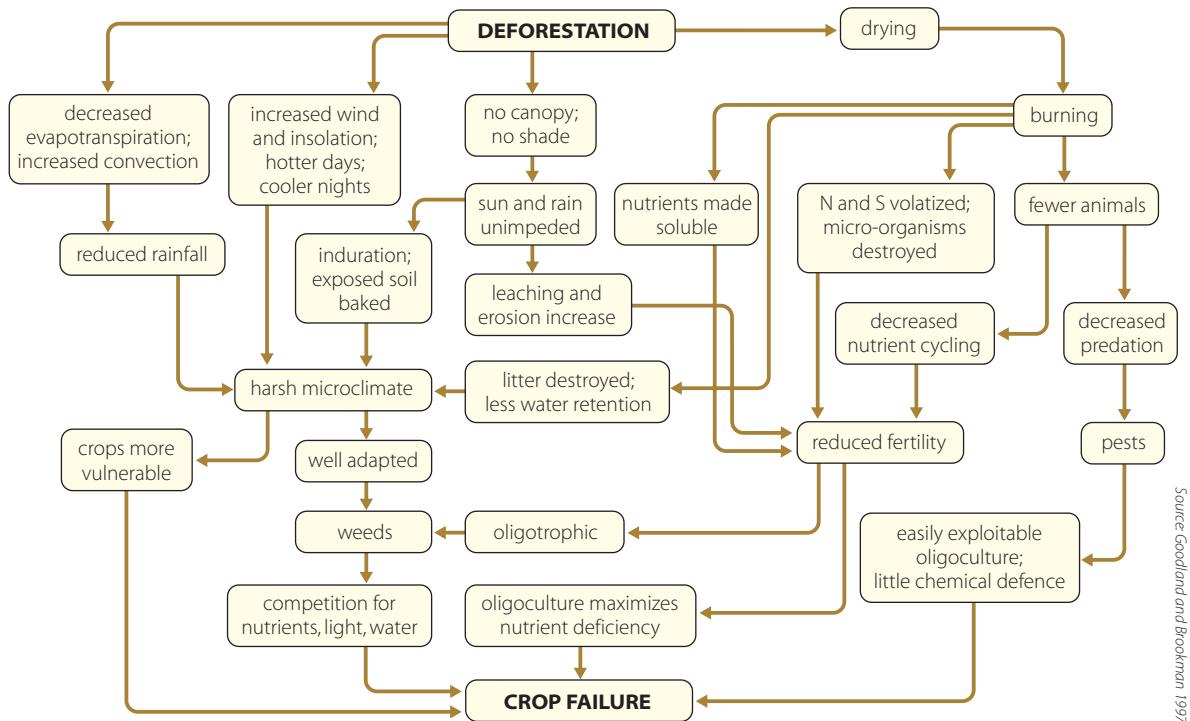
Commercial logging has caused the greatest rates of deforestation in Africa in the past 30 years or more, with governments hard-pressed to earn foreign currencies and stimulate their economies. The global demand for roundwood is set to increase by 1.7 per cent per year over the next decade and implementation of more sustainable harvesting methods is therefore a priority to prevent further deforestation (FAO 1999). Local processing and export of value-added products could raise export revenues and employment in timber-producing countries.

After commercial logging, consumption of wood as fuel is a major contributor to reduced forest cover and quality. Africa is the world's largest consumer of biomass energy (as a percentage of total energy consumption), which is largely wood and charcoal (see Figure 2d.6). Biomass consumption accounts for 5 per cent of total energy consumption in Northern Africa, 15 per cent in South Africa, and 86 per cent in sub-Saharan Africa excluding South Africa (EIA 1999). The demand for wood and charcoal in Africa is set to increase by over 45 per cent over the next 30 years, due to increases in population and demand for energy (FAO 2001b). Overharvesting of wood for fuel and charcoal production brings changes to the species composition of a forest or savanna. Local people are impacted by having to spend longer and search further to meet their daily fuel requirements. Development of alternative sources of energy is therefore a priority for the African region, and should be facilitated—for example, under the funding mechanisms of the Kyoto Protocol.

Slash and burn agriculture is another human activity contributing to declining forest cover and quality in Africa. This practice depletes the rich fertile forest soils of nutrients, and farming communities using this method have therefore traditionally shifted locations. However, the large and growing rural populations in Africa are making such shifts impossible and this breakdown in traditional management techniques is threatening the remaining forests with increasing rates of clearance and insufficient recovery time. Commercial agriculture, especially plantation agriculture, is also playing a significant part in this cycle of forest loss and soil depletion.

**Figure 2d.4 Regional comparison of change in forest area, 1980–95**

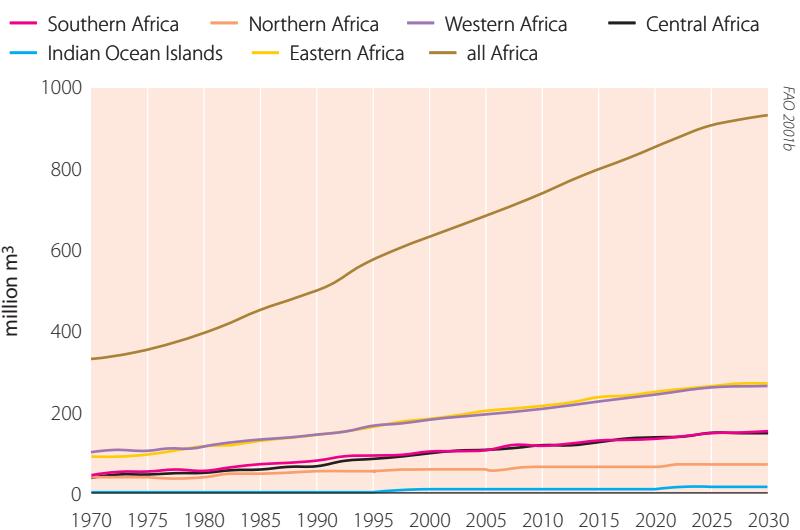


**Figure 2d.5 The relationship between forest clearance and crop failure**

Natural causes of forest and woodland loss, fragmentation or degradation include landslides, volcanism, fire, wind, pests and changes in water tables that change the salinity of soils (IPCC 2000, Medley & Hughes 1996). Other natural causes are river meanders cutting off areas of riverine forest from the river, after which they degrade, and large herbivores such as elephants and rhino which can change the understorey vegetation and the composition of the forest or woodland community (Medley & Hughes 1996, Western 1997). Mangrove forests can undergo change as a result of pests, sedimentation, newly formed sand dunes, high marine pollution levels, and rises in sea levels (Wass 1995).

These natural events can also be precipitated, aggravated or in some cases mitigated by human activity. For example, landslides can be caused by loss of ground cover through clearing for agriculture or cutting of timber for commercial purposes, roads or mining activities. Fires can start in other areas through human activity, and then spread to forests. On the other hand, burning can also improve regeneration of some tree species (Medley & Hughes 1996). Changes in water tables or in salinity can be caused by clearing of

trees, irrigation or interference with the hydrology of an area, including rivers flows. Large herbivores (such as elephant and rhino) may degrade their habitat if the size of continuous habitat is reduced. On the other hand, if these animals are excluded, seed dispersal and

**Figure 2d.6 Woodfuel use in Africa, 1970–2030**

propagation of certain species may be interrupted (Ganzhorn, Fietz, Rakotovao, Schwab & Zinner 1999). Pests can become a problem if alien species are introduced by human activities, or if the predator-prey balance is disrupted by agrochemicals or other agents. Interestingly, some traditional activities, such as livestock grazing have been shown to control a serious pest (the bruchid beetle) on *Acacia tortilis* trees (Medley & Hughes 1996).

Fragmentation of forests exposes species adapted to the sheltered, moist, dark forest interior to greater intensities of sunlight, greater wind speeds, or increased levels of predation, reducing the number of species available to local communities, both at present and in the future. The pace and duration of the decline in species richness in forest fragments has been difficult to establish, but fragments of tropical rainforest are high priority conservation areas as they could form the basis for the regeneration of larger areas of forest (Turner & Corlett 1996).

## TOWARDS SUSTAINABLE MANAGEMENT AND CONSERVATION OF FORESTS AND WOODLANDS

Since the 1992 'Rio Earth Summit' (UNCED), the issues facing the world's forests, particularly tropical forests in developing countries, have received greater international recognition and been the object of increased local action, as illustrated by Box 2d.2. Policies aimed at improving forest management and harvesting sustainability include removal of subsidies for commercial logging and privatization of state-owned forests. Greater stakeholder participation in forest management is also emerging and, in some countries, partnerships are being formed between the state or private companies and local communities, including previously dispossessed user groups. Legal frameworks controlling the ownership and use of forests are being reviewed in many African countries (Alden Wily 2000, Alden Wily & Mbaya 2001).

The value of timber as well as non-timber forest and woodland products and the value of ecosystem

### **Box 2d.2 The Global Workshop to Address the Underlying Causes of Deforestation and Forest Degradation (Costa Rica, January 1999)**

The Global Workshop was convened to support ongoing work of the Intergovernmental Forum on Forests and proposals for action on the underlying causes of deforestation and forest degradation.

In the African workshop it was agreed that direct causes of deforestation were logging and timber production; fuelwood consumption; forest fires; human settlements; and conversion to agricultural land. Factors hindering Sustainable Forest Management were identified as:

- poor governance and inappropriate and conflicting policies;
- inadequate macroeconomic policies and access to trade opportunities;
- inadequate institutional capacity and inappropriate technology;
- unsatisfactory tree and land tenure;
- improper valuation of forest resources;
- poverty;
- rapid population growth;
- low levels of awareness and inadequate stakeholder participation.

Overall recommendations of the workshop included the formulation of policies to address:

- 1) Trade and consumption patterns
- 2) Improving indigenous peoples, local communities and other stakeholder involvement (including issues of land tenure)
- 3) Resolving investment and aid policies and financial flows, issues of debt servicing, incentives and subsidies, role of the private sector, governance
- 4) Valuation of forest goods and services, including cultural values and ecosystem services

Specific steps identified to combat deforestation in Africa include:

- providing an enabling policy framework;
- creating awareness;
- ensuring stakeholder participation in forest management;
- provision of adequate resources;
- ensuring equitable distribution of benefits;
- educating the public on forest values;
- reviewing Structural Adjustment Programmes;
- assessing forest resources;
- reforming economic policies; and
- encouraging good cultural practices.

services provided by forests and woodlands are also receiving greater attention, and forest management is being reformed to include these aspects. Information on forests is becoming more accurate and widely available, with the use of technologies such as remote sensing and geographic information systems being used to document and present information. The African Timber Organization (ATO) was formed in 1976 by Angola, Cameroon, Central African Republic, Congo, Côte d'Ivoire, Democratic Republic of Congo (then Zaire), Equatorial Guinea, Gabon, Ghana, Liberia, Nigeria, São Tome & Príncipe, and Tanzania. Collectively, these countries have more than 80 per cent of the total African forest cover. At its first regional seminar (Libreville, Gabon in 1993), the ATO agreed to establish a regional sustainable forest management process with the ATO coordinating the programme and ensuring transparency and credibility. The ATO has developed principles, criteria and indicators for sustainable forest management, with assistance from the Forest Stewardship Council (FSC) and the International Tropical Timber Organization (ITTO). In May 1996, a preliminary version of criteria and indicators for sustainable forest management was approved and, by 2000, all but nine African countries had embarked on a programme of developing and implementing criteria and indicators, either through the ATO or alternative organizations active in other sub-regions. In Southern Africa, Namibia, South Africa, and Zimbabwe have criteria and indicator programmes set up through The Dry Zone Africa Process, and also have some forest areas certified by the FSC. Most countries have some forest in protected areas, although the amount varies (FAO 2001a). Seventy-seven per cent of Niger's forests are protected, 76 per cent are protected in Rwanda. Djibouti, Egypt, and Eritrea, on the other hand, have no protected forests (FAO 2001a).

To date, sustainable forestry development in Africa has been hampered by inadequate political commitment, weak or inappropriate institutions or policies, weak and poorly funded forestry departments, poor adoption and coordination of funding mechanisms, failure of the international community to translate forest conservation concerns into financial support, and national budgetary constraints (often worsened by Structural Adjustment Programmes). There is a need to encourage local efforts to mobilize resources for forest

management in order to reduce donor dependency and to provide support for post-project financing to firmly consolidate the gains made during the life of the project. The African Development Bank is now proposing a consortium approach to remove these barriers and improve funding for sustainable forestry development. The proposed consortium would provide a better channel for obtaining and allocating funding for policy development and sustainable development initiatives (Kufakwandi 2001).

The sub-regional analyses below highlight the priority issues in each area and give further details on the policy and management actions in place to improve the sustainability of use of resources from Africa's forests and woodlands.

## NORTHERN AFRICA

The Northern African sub-region has an arid climate and desert or semi-desert environments are dominant. Forests and woodlands are therefore not common in most of the six countries of the sub-region except along the coast of the western Mediterranean countries, the Atlas Mountains, and in the tropical zone which cuts through parts of Sudan. There are also some mangroves along the coast of the Red Sea. The total forest/woodland area in Northern Africa is estimated as 68 million hectares and constitutes 8 per cent of the total land area and about 10 per cent of Africa's forests (FAO 2001a). Although some countries have actually shown increases in forest cover in the past 30 years (owing to establishment of plantation forestry), the major concern in the region is still loss and degradation of natural forests and wooded areas.

## ECOLOGICAL, ECONOMIC AND SOCIAL VALUE OF FORESTS AND WOODLANDS IN NORTHERN AFRICA

Non-forest types of woody vegetation in Northern Africa include forest-like stands of trees, shrubs, and large bushes found in sandy *wadis* (wetlands) and depressions. The summits of coastal and inland high mountains support many wooded plants. Hydrophilous reeds occur in wetlands, and trees are cultivated as windbreaks or hedgerows around farms, along roads and canals constituting additional forest-like resources

in the region. All wooded areas, although not counted in the forest area figures, are important for forest products, grazing and control of desertification through soil stabilization and regulation of hydrological systems (AOAD 1998, Hegazy 1999). No significant commercial timber production is practised or planned in the sub-region, although small plantations do exist. Local people use over two-thirds of forest plants for food, medicinal purposes, construction, energy, and livestock rearing, and 35 per cent of plants are known to be multipurpose, that is to say useful for more than one application (FAO 1999, UNESCO/UCO 1998). In most countries in the sub-region, forestry's contribution to GDP is low. Sudan is the only country in the sub-region in which the forestry sector contributes significantly to GDP—as much as 13 per cent. Production of industrial wood is very limited with about two-thirds of the demand for industrial rounded wood and processed wood products in the sub-region being met by imports (FAO 1999).

### FOREST COVER AND QUALITY IN NORTHERN AFRICA

It is believed that much more of Northern Africa had forest cover originally, and that this has declined over several centuries because of climatic conditions and human intervention (CAMRE/UNEP/ACSAD 1996, Gilani 1997, Thirgood 1981 & AOAD 1998). However, only Sudan has experienced deforestation over the last decade, losing 10 million hectares of forest since 1990 (an average of 1.4 per cent of its forest per year) (FAO 2001a). By contrast, other countries have increased the extent of their forests and woodlands, mainly through establishment of plantations. Egypt has experienced the greatest increase—3.3 per cent per year (FAO 2001a).

The pressures resulting in loss of forest and wooded vegetation include extensive land clearing for human settlements and agricultural activities, overgrazing by livestock, overcollection of fuelwood and charcoal production. Frequent natural and man-made fires in the Mediterranean and tropical areas of the sub-region have also contributed to the reduction of natural forests, and degraded the soils that support them, enhancing the desertification process.

The growth in Northern Africa's population has also increased the demand for forest products for energy and various domestic uses in the sub-region, especially



Dried earth, Tunisia

*Yvette Tavernier/Still Pictures*

charcoal manufacture. Although the majority of the sub-region's energy needs are met through electricity generated by burning of fossil fuels, fuelwood and charcoal are still vital sources of energy, especially for the poor. Five per cent of all energy consumed in Northern Africa comes from biomass (compared to 86 per cent in sub-Saharan Africa), and total fuelwood use is currently 58 million m<sup>3</sup> per year, predicted to increase by 20 per cent over the next 30 years (EIA 1999, FAO 2001b).

In the Maghreb countries, forests and wooded vegetation in uplands and on slopes play an important role in land stabilization, erosion control and regulation of hydrological flow. However, deforestation in these areas has resulted in increased flooding, erosion, desertification, and siltation of dams (FAO 1997). Recently the construction of roads, quarrying and mining industries, and building of dams and irrigation canals have fragmented remaining forest cover, leading to losses of biodiversity. In addition, mass tourism has increased in forest areas over the last 10 years, contributing to opening of forest canopies and disturbing natural processes and wildlife.

Large areas of the sub-region have also become infested or replaced by exotic species, introduced intentionally or accidentally. Other factors contributing to the decline in forest area and quality in Northern Africa include: ambiguity as to ownership; lack of technical personnel for research, monitoring, and enforcement of protection regulations; and lack of financial resources and development techniques.

### Towards sustainable management and conservation of forests and woodlands in Northern Africa

Concerns about forest deterioration are reflected in the substantial afforestation and reforestation programmes and various local level measures that have been introduced recently to protect and increase forest areas (see Box 2d.3). The main method used by countries in extending their forests and wooded areas has been planting of forest plantations with the aims of stabilizing sand-dunes, rehabilitating range and steppe areas, managing water catchments, and protecting agricultural areas (FAO 1993). Morocco has large *eucalyptus* plantations (219 000 hectares), and coniferous (59 400 hectares) and dune fixing plantations (247 500 hectares). By 1990, the multipurpose green belt plantations in Algeria had mobilized a vast range of forest resources covering more than 150 000 hectares. Tunisia has reforested more than 312 000 hectares and has modernized its forest tree nurseries (Lamhamadi, Ammari, Fecteau, Fortin & Margolis 2000) and Egypt has planted about 34 000 hectares of trees. Forest plantation efforts in these countries have, however, not

been able to compensate for the loss of natural forests (FAO 1996 & 1997).

Forest reserves have been set up in some countries, ranging from 19 per cent in Libya to 4 per cent in Tunisia (Egypt does not have natural forests, only plantations) (FAO 2001a). Sustainable forest management has been adopted and is being implemented by all countries in the sub-region, through the Near East and Dry Zone Africa processes in the case of Sudan (FAO 2001a). Although forest legislation has been in place in most of the countries of Northern Africa since the nineteenth century, loopholes in the laws and lack of enforcement have limited its effectiveness in terms of protecting forests and wildlife resources (FAO 1999). The situation is made more complicated by ambiguity regarding ownership, lack of technical personnel and agricultural extension services, lack of financial resources and development techniques, poor forest management, underlying market and policy failures of forest resource pricing, and trade policies.

Reforestation and afforestation programmes are an essential part of environmental management in such an arid environment, and should be priorities for the next decade, as they will prevent or slow the rate of soil erosion, and will provide considerable benefits in terms of soil and water quality regulation.

#### Box 2d.3 Community-level forest conservation in Northern Africa

Commercial opportunities for cultivation of medicinal forest plants in nurseries are being realized in several countries. In Egypt three large nurseries and 20 small ones have been established in cooperation with local Bedouins, and have played a significant role in decreasing the collection of medicinal plants from the wild.

The Tree Lovers Association (TLA) in Cairo has been instrumental in raising awareness and protection of the Wadi Degla area, a desert valley of outstanding beauty and biological diversity. In collaboration with the governmental agencies, a local women's group has created a steering committee for managing the park, including measures to guard against further removal of woody vegetation. The Mediterranean coast countries are also expected to establish a policy of replanting, improving forestry management conditions, integrating trees in urban and tourism developments, and establishing conservation areas.

### EASTERN AFRICA

The climate of Eastern Africa supports a variety of forest and woodland cover from dense tropical forests, in the humid and mountainous regions of Uganda, Burundi and Rwanda, to the dry savannas of the Horn of Africa. Approximately 13 per cent of the total land area of Eastern Africa is covered in forests and woodlands, and this constitutes approximately 5 per cent of the total African forest cover. However, the percentage of forest and woodland ranges from 30 per cent in Kenya (although just 2 per cent of this is closed canopy forest), to less than 1 per cent in Djibouti (FAO 2001a, Wass 1995). There are also abundant mangrove and coastal forests in Eastern Africa. The major issue in this sub-region is conversion of natural forest to alternative land uses, predominantly cultivation and grazing, although urban encroachment is also a contributing factor.

View of Mt. Kenya National Reserve

Christian Lambrechts



### ECOLOGICAL, ECONOMIC AND SOCIAL VALUE OF FORESTS AND WOODLANDS IN EASTERN AFRICA

The forests of the Eastern Arc mountain chain, running through Kenya and Tanzania, and the Albertine Rift Montane Forests of the western border of Uganda are of particular biological importance (Rodgers 1998, Mittermeier, Myers, Gil & Mittermeier 2000, MUIENR 2000). The Eastern Arc Mountains are the oldest mountains in the sub-region and their climate, influenced by the Indian Ocean, has given rise to areas of forest which have evolved largely in isolation, given their high altitude and separation from one another. Isolation has resulted in large numbers of animals and plants being endemic to these forests and they have been identified as one of the 25 internationally recognized hotspots of biodiversity. They harbour 30-40 per cent of Tanzania's species (Iddi 1998, Mittermeier and others 2000). The Eastern Arc Mountains also form the catchment for rivers supplying the hydropower that represents 61.5 per cent of Tanzania's total electricity generation capacity (Iddi 1998).

There are few estimates of the indirect value of forests in the sub-region. From the few that exist, the water catchment protection value of the Mount Kenya Forest is reported to be around US\$55 million in terms of effects on production and replacement cost (Emerton 1997). The Albertine Rift Montane Forests occupy one of the most significant geological and biogeographic regions of Africa, and support a wealth of largely endemic biodiversity. The forests on these mountains play a vital role in intercepting precipitation and channelling run-off into Africa's two largest hydrological networks (The Nile and Congo basins). The forests are also important in terms of atmospheric exchanges and global and regional climate regulation, as well as

protecting and enhancing soil stability and fertility (ARCOS 2000).

Although commercial timber exploitation is limited in Eastern African countries, all forest and woodland areas are important in terms of the natural resources they provide to local communities. In Kenya, it is estimated that some 2.9 million people (more than one-tenth of the population of the country) live within 5 km of natural forests, (Emerton 1992). The value of forest resources to these communities has been estimated at US\$94 million per year, comprising fuelwood, grazing, polewood and timber (Emerton 1993). Fuelwood and charcoal supply the majority of the sub-region's energy, meeting 96 per cent of energy needs in Uganda and 75 per cent in Kenya (FAO 2001a).

Non-wood forest products are also used extensively in the sub-region. In Uganda, for example the combined value of medicines, bamboo shoots, wild foods, shea butter, oil, honey, gum arabic, curios, and weaving materials has been estimated at about US\$40 million per year (Emerton and Muramira 1999). The potential of medicinal plants in Eastern Africa is widely acknowledged and they are used by Maasai, Kipsigis, Turkana, and other tribes. The Maasai have a well-established pharmacopoeia for treating livestock diseases. The use of more than 60 species or subspecies of plants for ethnoveterinary purposes has been documented among the Olkonerei Maasai. These plants have been shown to act on a wide range of pathogens as well as regulating fertility, inflammation, and digestive disorders in livestock (Ole Lengisugi & Mziray 1996). Several of these species are now being documented and researched for potential commercial application, including the introduced tree species, *Azadirachta indica* which is being researched for anti-

malarial properties by the Kenya Medical Research Institute's Traditional Medicine and Drugs Research Centre, Nairobi. In Uganda, the National Chemotherapeutics Research Laboratory, in Kampala, is conducting research on many indigenous plant species (Cunningham 1997).

Weaving using wood products and wood carving are important traditional crafts that contribute substantially to household incomes and local economies in Eastern Africa. It has been estimated that there are 60 000 woodcarvers in Kenya alone, with each carver generating an additional five jobs in harvesting of the wood, and sanding and polishing of the finished carvings. The annual value of exported carvings has mushroomed from around US\$60 000 in the 1950s to US\$20 million today (Cunningham 2001).

### FOREST COVER AND QUALITY IN EASTERN AFRICA

Between 1990 and 2000 Eastern Africa lost 9 per cent of its total forest and woodland cover (FAO 2001a). The highest rates of deforestation were experienced in Burundi (9 per cent per year), Rwanda (4 per cent per year), and Uganda (2 per cent per year) (FAO 2001a). This is not, however, a recent problem as the forests of the sub-region have been under pressure from population growth and increasing demand for fuel and for agricultural land for decades. In Uganda, for example, it is estimated that forests 'originally' (i.e. around 1890) covered 45 per cent of the country but now account for only 21 per cent (MUIENR 2000, FAO 2001a). Similarly, Ethiopia's woodlands and bushland originally covered 30 per cent of the country but now represent around 4 per cent and some of the remaining forest areas are categorized as heavily disturbed and unable to produce at their full potential (EPA/MEDC 1997, FAO 2001a). A study of forest cover and quality in Ethiopia showed that up to 70 per cent of forest cover was cleared or severely degraded by human impacts between 1971 and 1997 (EIS News 1999).

Clearance of forests and woodlands for agricultural use, to feed the growing population, is perhaps the single most important cause of deforestation in Eastern Africa even though large areas of the sub-region are considered not suitable for agriculture. For example, only 29 per cent of the land area in Ethiopia is considered suitable (EPA/MEDC 1997). The percentage

is much smaller in Djibouti. To this pressure must be added the problem of declining soil fertility in cultivated areas, especially when production pressures do not allow adequate fallow periods. This causes further deforestation and encroachment by local communities and refugees, the impacts of which have been aggravated by weak policies (see Box 2d.4).

The people of Eastern Africa are largely dependent on wood for energy, with daily per capita consumption of around 1-2 kg (NEIC 1994, EPA/MEDC 1997). According to the FAO, the demand for fuelwood (including charcoal) in Eastern African countries will increase by over 40 per cent in the next 30 years, with total demand in 2030 exceeding 271 million m<sup>3</sup>/yr (FAO 2001b). Additional pressures on forests include extraction of timber for building materials, damage by forest fires and pests, and inappropriate forest policies or lack of their enforcement. Forestry departments in the sub-region have often been associated with those responsible for agriculture, water or environment and have been institutionally overshadowed. They have also often lacked the funding to implement regulations,

*The Maasai have a well-established pharmacopoeia for treating livestock diseases. The use of more than 60 species or subspecies of plants for ethnoveterinary purposes has been documented among the Olkonei Maasai*

#### Box 2d.4 Encroachment in forest reserves of Uganda

In 1975 a group of people called the Kanani Co-operative Farmers Society entered Compartment 173 of Mabira Forest Reserve. The district administration perceived them as a self-help agro-forestry project rather than as encroachers and hence supported their activities. The Forest Department consequently gave cultivation permits to 115 of its members. The permits specified the following:

- no more forested land would be cleared;
- valuable timber tree species would not be destroyed; and
- no buildings would be erected in the reserve.

However, confusion arose as to interpretation of Uganda's 1976 Land Reform Order, which stated that 'land which is not under lease or occupation by customary tenure... is hereby specified to be land that may be occupied by free temporary license.' People might have taken this to mean that any Ugandan is free to settle anywhere, provided such land is not already occupied. By the end of 1977, 200 more encroachers had entered the reserve and the number grew to over 1800 by 1981. They degraded over 7241 hectares of the reserve.

In Mt. Elgon National Park, agricultural encroachment from 1970 through the 1980s laid bare over 25,000 hectares of what was initially virgin forest. In Kibale National Park, over 10,000 hectares of forest were cleared by encroachers. Other forest reserves that have been affected include Luung, Mubuku and Kisangi Forest Reserves in Kasese district and Kasyoha-Kitomi Forest Reserve in Bushenyi District.

conservation activities, or development of trade in forest products. Several countries are now in the process of correcting these institutional weaknesses. Uganda, for example, is transforming its Forestry Department from a line ministry into a parastatal to be known as the National Forest Authority (UFSCS 2000). Forest policies are also being reviewed, revised or new ones drafted in Kenya, Uganda and Ethiopia.

The impacts of deforestation and degradation of wooded areas include increased potential soil erosion and loss of soil fertility, alteration of local climatic and hydrological conditions, and changes in biodiversity. Eastern Africa is home to the world's remaining population of mountain gorillas (*Gorilla beringei beringei*), in the Virunga Volcanoes. With a population of only about 320 individuals, mountain gorillas are one of two critically endangered subspecies of gorillas (the other subspecies is in Western Africa). The gorillas of the Bwindi Impenetrable National Park, previously thought to be mountain gorillas may, in fact, be a separate subspecies (Butynski 2001). The gorilla is under threat of extinction through habitat loss and disease brought about by the increasing proximity of humans resulting from the opening up of roads in forests, hunting and tourism. As a result of the conflicts in Rwanda, a massive increase in human traffic through the Virunga Volcanoes, and subsequent military presence are probably responsible for the presence of previously unidentified intestinal parasites found in the mountain gorillas (Butynski 2001). Loss of habitat combined with an increase in diseases is potentially disastrous for such a small population.

Excessive removal of wood for fuel removes vital nutrients from forests, as well as nesting material and shade for many species. Human demands on forest resources have resulted in wood deficiency leading to increased dependency on costly imports. Deficiency in fuelwood also forces people to walk further and spend longer in search of wood to meet their daily requirements and they are therefore turning to alternatives. There is, however, increasing concern over some of these. For example, agricultural crop residues and animal dung are meeting as much as 8 per cent of Ethiopia's energy requirements (EPA/MEDC 1997), but burning of these resources as fuel can give off noxious gases such as nitrogen and sulphur oxides which can cause respiratory disorders. Furthermore, these

materials are principal sources of organic nutrients and as such are traditionally used as fertilizers. Removing them from the agro-forest ecosystem has direct adverse impacts on agricultural productivity.

#### **Towards sustainable management and conservation of forests and woodlands in Eastern Africa**

In addition to national forestry policy and institutional reform, international, sub-regional and national efforts are being made to conserve forest resources and reduce the pressures on forest ecosystems. Reforestation programmes are being implemented through funding arrangements under the Kyoto Protocol, such as the rehabilitation of degraded areas of the forests of Mount Elgon National Park and Kibale National Park (Uganda), implemented jointly by the Ugandan government and a Dutch energy utility consortium (NEMA 1999). As a response to the rising demand for fuelwood, rural electrification is being promoted in some countries such as Uganda. However, the rural poor cannot afford the investments needed for electrical appliances or the electricity tariffs. Alternative means of meeting the energy requirements include promoting the establishment of woodlots. The success of these efforts will depend largely on improvements in land tenure arrangements together with the realization that available arable land is in short supply. Agroforestry techniques are being successfully introduced to help boost agricultural productivity and



Illegal logging in the Aberdares Forest Reserve, Kenya

economic gain. These have been taken up by many Kenyan farmers and multipurpose tree species are now providing plant nutrients, animal fodder, building poles, fuelwood and timber. Unfortunately, for a variety of reasons including inadequacy of institutional capacity and lack of funds, not all areas are being covered. Efforts are also underway to improve the sustainability of the wood carving industry, by discouraging use of endangered species while protecting the livelihoods of millions of entrepreneurs (see Box 2d.5).

In addition to reviewing policy, legal status and regulations, some countries in the sub-region have drawn up, or are currently drawing up, Forest Action Plans or Programmes as the main frameworks for rehabilitation and expansion of forest cover. Djibouti, Ethiopia, Eritrea, Kenya, Somalia, and Uganda have established criteria and indicators for sustainable forest management through the Dry Zone Africa process, and Ethiopia and Kenya now have some of their forested land under management plans. Burundi and Rwanda do not have such management measures in place as yet (because wars and civil unrest have presented barriers to these activities). However, both countries have large percentages of forest in protected areas (30 per cent and 76 per cent respectively) (FAO 2001a). The needs of some Kenyan communities for fuelwood, poles, sawnwood, wood-based panels, and pulp and paper have been met largely through afforestation and reforestation efforts at household and industrial/commercial levels. Rwanda has the largest network of forest plantations in the sub-region and these help to meet some of the timber needs of the local population.

## WESTERN INDIAN OCEAN ISLANDS

The humid, tropical climate in most parts of the Western Indian Ocean Islands is conducive to forest growth. However, frequent cyclones can cause extensive damage to forest cover, and Mauritius and Madagascar are also prone to droughts. This limits the extent of closed canopy forest but encourages savannas and thorn forests. In total, about 20 per cent of the land area of the Western Indian Ocean Islands has forest or woodland cover, less than 2 per cent of the African total (FAO 2001a). Madagascar has the most forest cover, at 20 per cent forest and 12 per cent woodland. Mauritius

### Box 2d.5 Kenya's wood carving —options for sustainability of livelihoods and environment

Kenya's extensive and successful wood carving industry is contributing to deforestation and degradation of wooded areas through selective harvesting. The four most commonly used species are *Dalbergia melanoxylon*, *Brachylaena huillensis*, *Combretum schumannii* and *Olea africana*. Carvers are aware of the threat this causes to the environment and their livelihoods and have identified fast-growing, widely grown tree species such as neem, jacaranda, grevillea and mango as alternatives. These species can be harvested without environmental damage, and their use for carving generates additional incomes to farmers who grow them for fruit or other purposes. However, these species require curing before carving, and carvers require some incentive to change their current practices. The WWF has launched a campaign to raise consumer awareness and encourage tourists and local residents to buy carvings from sustainably produced woods. Certification is being explored as an option to facilitate the switch, sustaining the livelihoods of the carvers and helping to conserve the environment.

and Seychelles each have about 7-8 per cent forest and significant woodland. Comoros, once heavily forested, now has only 4 per cent forest and 13 per cent woodland (FAO 2001a, UNEP 1999, UNDP 2000). Types of forest include lowland evergreen broadleaf rainforest, upper and lower montane forest, semi-evergreen moist forest, mangroves, and savanna.

The issue of greatest concern in this sub-region is the high rate of deforestation and its environmental consequences including soil erosion, desertification, and loss of ecosystem processes.

### ECOLOGICAL, ECONOMIC AND SOCIAL VALUE OF FORESTS AND WOODLANDS IN THE WESTERN INDIAN OCEAN ISLANDS

The Western Indian Ocean Islands constitute one of the 25 internationally recognized biodiversity 'hotspots' (Mittermeier and others 2000) and have relatively large areas of original forest habitat intact. Species diversity and endemism are extremely high for all major plant and animal groups throughout the islands, but this is especially the case for the forests and woodlands. There are also whole genera and families that are endemic to the region. For example, more than 80 per cent of the 10 000–12 000 species of flowering plants in Madagascar are endemic, as are 91 per cent of the 300

reptile species. Twelve per cent of all living primate species are found in Madagascar, and all 33 species of lemur are endemic. Praslin Island (Seychelles) is home to the endemic Coco-de-Mer palm (*Lodoicea maldivica*), and some of the larger islands also have dry palm forests unique to the Seychelles. Mangroves are widespread around most of the islands of the sub-region.

Commercial timber production is limited in most of the islands, although many wood and non-wood products are used locally. Madagascar, the largest commercial producer, produces modest volumes of sawn timber and small quantities of wood-based panels and paper. In 1998, the export value of these products was US\$8 million (FAO 2001a). Important non-wood forest products in the sub-region include medicinal plants, ornamental plants, fruits, honey, essential oils, meat, and animal fodder. Fuelwood is a vital resource for local communities, especially in the poorer nations of the sub-region. In Madagascar, for example, over 90 per cent of households depend on fuelwood and charcoal, driven by increasing poverty and price inflation. By contrast, only 8 per cent of people in the

Seychelles depend on fuelwood even as a supplementary source of energy (FAO 2001a).

### FOREST COVER AND QUALITY IN THE WESTERN INDIAN OCEAN ISLANDS

It has been estimated that up to 85 per cent of the original forest cover of the Western Indian Ocean Islands has been lost (WCMC 1994). There has been a steady decline over several decades with deforestation between 1990 and 2000 of less than 1 per cent per year for most islands. Comoros is an exception with deforestation rates exceeding 4 per cent per year (FAO 2001a). The major causes of deforestation are clearance to make way for shifting subsistence agriculture, for commercial plantations or for industry and residential areas. For example, there are now extensive coconut plantations in Seychelles as well as a relatively large planted forest estate of Casuarina and Albizia. Other introduced species are commercially exploited (sometimes illegally) for the distillation of ylang ylang perfume or for furniture making. Forest fires are a threat in some areas and burning of forests to create cattle pasture can also cause deforestation. The risk of fire and drought may be augmented by increasingly long dry seasons resulting from climate change. Causes of forest degradation include selective harvesting of wood for fuel and ornamental plant and animal collections.

Total fuelwood demand in the sub-region is currently estimated at 10 million m<sup>3</sup>, and is projected to rise to 18 million m<sup>3</sup> over the next 30 years (FAO 2001b). More sustainable production methods must be established and affordable alternative energy sources must be made available if further deforestation and forest degradation are to be prevented.

The loss of natural forest areas has precipitated the near extinction of tree species such as Tatamaca, Ebony and Baobab, common 50 years ago. Loss of forest has also depleted natural habitats for a wide variety of plants, insects, birds and wild animals (UNEP 1999). In Madagascar, the demise of a specific group of seed dispersers may have resulted in the decline of tree regeneration in an entire forest ecosystem—one study concluded that regeneration of the dry deciduous forest with all of the primary forest tree species in the western part of the country depends on the presence of a particular species of lemur (*Eulemur fulvus*) (Ganzhorn

Baobab forest,  
Madagascar

UNEP



and others 1999). The prolific invasion by shrubs, bushes and exotic species such as Chinese guava, privet, liane cerf and poivre marron is also evidence of habitat degradation throughout the sub-region's forests and woodlands. Soil erosion on steep slopes in areas that were previously mountainous forests is now causing siltation of fresh water ecosystems, lagoons and water reservoirs throughout the sub-region causing drying of watercourses. This is especially prevalent in Comoros. These changes in ecosystems are contributing to climate change and loss of cultural heritage, and are threatening local livelihoods (UNEP 1999).

#### **Towards sustainable management and conservation of forests and woodlands in the Western Indian Ocean Islands**

Madagascar has 4 per cent of the forest area in National Parks (FAO 2001a) and Seychelles has the best-preserved area of natural forest at the Morne Seychellois National Park. Some forest sites in Mauritius that are heavily infested with alien plants have been designated as Conservation Management Areas, and removal of exotic species has been attempted. This is a lengthy, resource-intensive process, requiring the continued commitment of resources to ensure that progress is not reversed. Mauritius and Seychelles have also joined the Dry Zone Africa process to establish criteria and indicators for sustainable forest management.

Other responses in the sub-region have included attempts at reforestation, but these have been inadequate (UNEP 1999). For example, only 500 hectares of cleared forest was reforested in the Comoros during the 1990s and many of the trees planted were utilized before maturity. In Madagascar, there were attempts at reforestation during the 1970s, to provide wood for fuel, crafts, and industry but efforts were not sustained, and these areas have also been depleted (UNEP 1999). Commercial forest plantations are also limited. Seychelles has the largest area of plantations, at 11 per cent of its land area; Madagascar's plantations cover just 2 per cent of its land (UNEP 1999).

In 1998, wood production in all Western Indian Ocean Island countries was insufficient to meet domestic demand and imports of wood products exceeded exports (FAO 2001a). More needs to be done to protect the little remaining natural endemic forest and to enforce the forest protection legislation available

in all the countries of the sub-region (UNEP 1999). Several international conservation organizations have been active in the region, conducting research, mapping, and making biological inventory studies, as well as providing baseline information for the establishment of new protected areas and assisting with policy development for sustainable natural resource use. These and other efforts to bring together social and economic development imperatives and environmental issues need further strengthening and development.

#### **SOUTHERN AFRICA**

Southern Africa has a range of forest and woodland types that follow the rainfall distribution of the sub-region. The wetter, more northern parts of the sub-region support more closed canopy forest, whilst drier countries in the south have predominantly woodlands and savannas. The total forest and woodland area of Southern Africa amounts to 32.7 per cent of the sub-region's total area, and constitutes 34 per cent of all of Africa's forests (FAO 2001a). Angola has the highest forest cover with 56 per cent of the land area under forests; Lesotho has the lowest with less than 1 per cent (FAO 2001a). There are four forest and woodland types, namely deciduous broadleaf forests (temperate forest types), lower montane forest, mangroves, deciduous/semi-deciduous broadleaf forest, and savannas (tropical forest types). Southern Africa also has six regions of exceptional plant species diversity, and forest species are abundant in many of these (White 1983).

The major issues of concern in the forests of Southern Africa are degradation of forests and woodlands, and overexploitation of certain species, resulting in loss of ecosystem goods and services.

#### **ECOLOGICAL, ECONOMIC AND SOCIAL VALUES OF FORESTS AND WOODLANDS IN SOUTHERN AFRICA**

Forest products are a valuable source of export earnings and revenue throughout the sub-region, and the communities living in forest or woodland areas are highly dependent on forest products for meeting everyday food and energy needs. For example, in 1998, South Africa's exports of forest products totalled US\$837 million, mainly from wood pulp and paper most

of which was produced in plantation forests. Zimbabwe's exports were US\$42 million, mainly from sawnwood (FAO 2001a). Forests and woodlands are important to local communities, mainly as a source of domestic fuel, either wood or charcoal. For example, about 80 per cent of Mozambique's population live in rural areas and depend on wood for cooking and for heating of water for domestic use, space heating and drying of foodstuffs. The charcoal industry generates about US\$30 million annually, and is the sole source of income for about 60 000 people (Kalumiana 1998). Important non-wood forest products include honey, beeswax, bamboo, reeds, mushrooms, caterpillars, fodder, wild edible plants and fruits, leaves and bark for weaving, and resins. The medicinal plant trade is extensive and profitable in Southern Africa with approximately 3 000 species (10 per cent) of Southern African plants used medicinally and around 350 species commonly and widely used (van Wyk, Van Oudtshoorn & Gericke 1997). Other species harvested from the wild contribute as much as 40 per cent to household incomes (Cavendish 1999) or between US\$200-1000 per year (Shackleton, Shackleton & Cousins 2000).

### FOREST COVER AND QUALITY IN SOUTHERN AFRICA

Southern Africa has one of the fastest growing populations in the world and faces the challenge of trying to increase food supplies by some 3 per cent per year. To date, this challenge has been addressed by improvements in agricultural production, and by bringing large areas of wooded land under cultivation. The sub-region is therefore witnessing an increasingly high rate of deforestation, mainly due to human activities. Rates of deforestation over the last 10 years have ranged from 2.4 per cent per year in Malawi to 0.1 per cent per year in South Africa, whilst Swaziland has experienced a 1.2 per cent per year net increase in its forest area (FAO 2001a). The other main pressure leading to deforestation in the sub-region is fuelwood harvesting and tree cutting for charcoal (Chenje 2000). Studies show that both rural and urban demands for wood energy have increased, and it is expected that these demands will almost double over the next 30 years due to growing populations and economic conditions (FAO 2001b). For example, worsening

poverty in some urban areas is forcing many people to turn to charcoal and fuelwood to meet their domestic energy requirements because these are cheap and fuelwood can be collected rather than purchased (World Bank 1996). In some countries, particularly those in which charcoal use is prevalent (Angola, Mozambique, Tanzania and Zambia), trading in charcoal is a major source of income for some households, contributing to the rate of wood collection and deforestation. In Zambia, for example, more than half the country's fuelwood is converted to charcoal, requiring the clearance of some 430 km<sup>2</sup> of woodland every year to produce more than 100 000 tonnes of charcoal (Chenje 2000). Commercial logging is a further cause of deforestation, and, in some cases, refugees from the wars in Angola and Mozambique have resettled in wooded areas, contributing to tree-clearance.

Selective harvesting of forest species is intensifying pressures on forest and woodland resources, and has the potential to degrade habitats, reduce biodiversity, and impair ecosystem functions such as water and soil quality regulation, even though clear felling does not occur. Commercial exploitation of medicinal plants from forests and woodland is an increasingly important component of selective deforestation, resulting in the localized disappearance of certain plant species. Commercialization of particular crafts, such as basket making, is also causing the disappearance of certain plant species. Another issue of concern is that species introduced for plantation forestry production are rapidly invading grassland ecosystems where they use vast amounts of water, disturb ecosystem functioning, and reduce biodiversity. Selective harvesting results in changes to the biodiversity and relative abundance of different species, as well as changing the microclimate, global climate, nutrient cycles and hydrological regimes.

Reduced forest cover and reduced forest quality accelerate soil erosion, sedimentation and siltation as well as siltation-induced flooding at points far away from the deforested areas. Soil erosion is probably the most important factor in the decline in agricultural productivity. This impacts most severely on rural communities that are most dependent on small-scale agriculture and natural resources for their livelihoods

Other impacts of forest and woodland loss or degradation include loss of resources for future exploitation, either local or commercial, for agriculture,

pharmaceuticals, or crafts. It is estimated that 300 000 to 400 000 hectares of natural grassland forests and plant species of medicinal value are destroyed in Tanzania each year. Tanzania has one of the largest ruminant livestock populations in Africa, many of them owned by pastoralists, and it is clear that the seriousness of this loss for the health and welfare of livestock (and therefore for that of their owners) will escalate in the near future (Ole Lengisugi and Mziray 1996).

### Towards sustainable management and conservation of forests and woodlands in Southern Africa

Most forests in Southern Africa are either state-owned or privatized with ownership by local communities being only weakly supported by laws (Alden Wiley 2000). The failure to involve local people and have tangible benefits accrue to them has disassociated people from forests and even made them co-exploiters and co-destroyers of their own forests. With growing democratic governance and rapid spread of environmental awareness, community participation in forest management and land tenure reform is being promoted and is gaining popularity as a sustainable means of natural resource management and income generation. In Tanzania, for example, a 'Land Act' clearly states that forest reserves may be owned by the state, private companies, or communities and legislation in South Africa also makes provision for community ownership of reserved forests. Local community actions have been encouraged in Malawi (see Box 2d.6) and recent legislation enacted in the country recognizes traditional ownership rights in the form of Village Forest Areas. Joint Management Committees in Zambia, Local Resource Management Councils in Mozambique, and Management Authorities in Namibia, have also been established to coordinate allocation of access rights and/or distribute benefits among the local population (Alden Wiley, 2000).

The Southern African countries of Angola and Tanzania are members of the ATO, and each has participated in developing criteria and indicators for sustainable forest management (FAO 2001a). Namibia, South Africa and Zimbabwe have some forest area certified by the FSC, and all countries of the sub-region have some of their forests in protected areas. Efforts to promote sustained regional self-sufficiency in forest and wood products, and to enhance the economic and



Illegal logging of Camphor trees, Kilimanjaro Forest Reserve, Tanzania

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environmental performance of the forestry sector are being pursued through the SADC Forestry Sector. The Forestry Sector coordinates programmes in forestry education and training, improved forest resource management, forest resources assessment and monitoring, forest research, utilization of forest products, marketing, and environmental protection. The Sector also developed the Forestry Policy and Development Strategy, approved in September 1997. The Strategy identifies priorities for cooperation in

#### Box 2d.6 Local community action in Malawi

In Malawi a recent project has successfully trained members of local communities in agro-forestry and extension work. Members of local communities working as extension officers for the Department of Forestry have until recently been excluded from most training programmes, and are thus not performing their duties optimally or achieving recognition. A local development organisation has worked with these people, training them in forestry and agro-forestry practices, the Forestry Policy Act, participatory rural appraisal tools, extension techniques, and community motivation. This has boosted both their morale and performance, and has improved communication among a wide range of stakeholders.

Source: COMPASS 2000.

building capacity in sustainable management, protection and conservation of forest resources, facilitating of trade in forest products, promoting sustained regional self-sufficiency in forest and wood products, improving public awareness of forestry, and enhancing forest research.

## CENTRAL AFRICA

Central Africa's high and reliable rainfall supports extensive forest cover throughout the sub-region, with the exceptions of the northern part of Cameroon, Chad and the Central African Republic. Forests and woodlands cover, in total, about 45 per cent of the land area of Central Africa, and constitute 37 per cent of Africa's total forest cover (FAO 2001a). Most countries in the sub-region are therefore well endowed with forests, with Gabon having the greatest cover (85 per cent), and Cameroon, Congo, Democratic Republic of Congo (DRC), and Equatorial Guinea having over 50 per cent. The exception is Chad, which, because of its northerly location and arid environment, has only 10 per cent forest cover (FAO 2001a). Tropical forests are the predominant type in the sub-region, namely lowland evergreen broadleaf rainforest, montane forests, freshwater swamp forests. Savanna cover is also significant in the northern parts of Cameroon, Central African Republic, and Chad and southern DRC.

Oil exploration in a rainforest, Gabon

*Arnaud Greth /Still Pictures*



The major issue of concern in Central Africa is rapid deforestation, mainly for commercial timber exports. The damage caused to remaining forest areas by timber extraction is an additional concern for the sub-region.

## ECOLOGICAL, ECONOMIC AND SOCIAL VALUES OF FORESTS AND WOODLANDS IN CENTRAL AFRICA

Dense, tropical forests provide essential ecosystem services such as nutrient cycling, water and soil protection, and exchange of atmospheric gases (absorbing carbon dioxide and releasing oxygen). The tropical, moist forest of Central Africa comprises the second largest contiguous area of tropical forest in the world, and thus plays a very important role in atmospheric carbon sequestration and mitigation of potential climate change. Other benefits of forests include the extremely high levels of biodiversity, which has enormous untapped potential for agricultural, pharmaceutical and nutritional applications. There are five regional hotspots in Cameroon, noted for their plant species richness and presence of endemic bird species.

Commercial logging is the primary source of revenue from Central Africa's forests. This is mainly carried out by foreign logging companies and thus ensures substantial amounts of foreign exchange for the countries of the sub-region. Cameroon, for example is one of Africa's leading producers and exporters of sawn timber and tropical logs, and ranks fifth in the world

(FAO 2001a, WRI 2001). In 1998, its exports exceeded US\$436 million, approximately 5 percent of GDP (FAO 2001a, World Bank 2001). In the same year, Equatorial Guinea exported US\$62 million of wood-based panels, representing 14 per cent of its GDP (FAO 2001a, World Bank 2001).

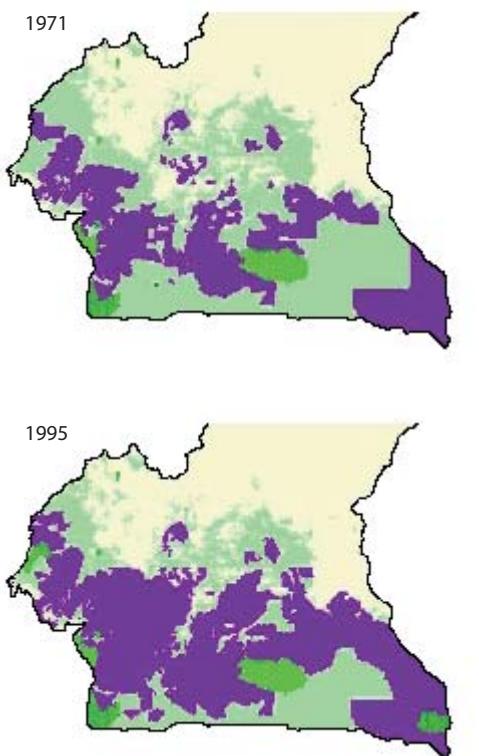
Central Africa's forest ecosystems are also home to a large number of communities from an estimated 250 ethnic groups (WRI 2001). These communities depend on wild and cultivated resources from forests, including bark, vegetables, fruits, flowers, honey, resins, fungi, medicinal plants and wildlife for local consumption as well as for export. Inter-cropping or agroforestry practised within these communities is a vital source of vegetables, grains and fruit, for use by households or for trade. The forests also offer opportunities for tourism, which would generate foreign exchange and stimulate rural development, although these are largely untapped at present because of low levels of infrastructure and/or conflict in Central African countries.

### FOREST COVER AND QUALITY IN CENTRAL AFRICA

With resources of such enormous potential value and countries with such low levels of economic and social development, it is not surprising that Central Africa is exploiting forest resources and experiencing large-scale deforestation. Between 1990 and 2000, a total of 9 million hectares of forest were cleared, 4 per cent of the total area. The highest annual rates of deforestation were recorded in Cameroon (0.9 per cent), Chad, and Equatorial Guinea (0.6 per cent each), while insignificant rates were recorded in Gabon and Sao Tome & Principe (FAO 2001a). The main causes of deforestation are commercial logging (including illegal activities), clearing for commercial and subsistence agriculture, and fuel wood harvesting. The improved access to forest areas, created by roads constructed for timber trucks, not only fragments the forests but also facilitates exploitation by local communities and resettlement by refugees, who eventually introduce wildfire through their various life-sustaining activities. Previously inaccessible areas are also opened up to poachers and hunters whose activities threaten wildlife.

By far the greatest threat to forests in the sub-region is commercial logging and the unsustainable rates of harvesting practised by many companies. In

**Figure 2d.7 Logging concessions in Cameroon 1971 and 1995**



Cameroon alone, the number of registered logging companies has more than quadrupled, increasing from 106 in 1980 to 479 in 1998 (see Figure 2d.7) (WRI 2001). In addition, weak protection regulations and lack of law enforcement have resulted in large numbers of logging violations, and logging concessions now encircle protected areas such as the Dja Forest Reserve, a World Heritage Site. Violations of forest regulations committed within concession areas include the felling of the wrong timber species, logging of protected species, and cutting of undersized trees. Unauthorized logging and logging within a protected area have also been recorded in Cameroon (WRI 2001). The need to encourage local milling and the recruitment of local skilled labour is vital in promoting joint conservation efforts.

Clearing of forests for agriculture and collection of fuelwood are other sources of forest loss and degradation in Central Africa. These pressures are set to increase over the next 20–30 years, driven by rapid population growth, poor social development, low employment opportunities, low-income levels, and lack of affordable alternative sources of energy.

The impacts of the various pressures on the sub-region's forests are both positive and negative. Positive impacts include the creation of employment in the forestry sector, tax and other sources of revenue. These activities lead to more monetary exchange, the development of a road infrastructure for easier transportation and marketing of local produce, and thus the improvement of conditions for the local populations. On the other hand, the logging methods used and the scale on which they are applied exceed the natural regeneration capacity of the forests. In addition, the negative impacts of soil compaction and chemical pollution on the speed of natural regeneration could be significant. Commercial logging leaves gaps in the canopy that change the microclimate and thus species composition. In closed canopy forest, the regeneration rates are sufficiently high to close gaps relatively quickly. However, in the drier areas of Central Africa, where savanna is the predominant form of wooded vegetation, trees take much longer to grow back, and their removal therefore has a greater impact on the ecosystem. Loss of forest habitat also leads to loss of biodiversity which, in turn, reduces opportunities for commercial agricultural or pharmaceutical exploitation. Other negative impacts of forest degradation include soil degradation and reductions in productivity from agroforestry, susceptibility to alien invasive organisms, and disruption of hydrological systems. Local communities suffer by having to search further and further afield to collect wild resources such as fuelwood.

#### **Towards sustainable management and conservation of forests and woodlands in Central Africa**

The importance of forests and forest resources in Central Africa has led stakeholders, especially governments, the international community and NGOs, to intensify measures for forest resource conservation and sustainable management. Countries in the sub-region have engaged in re-forestation programmes in places where deforestation has occurred, and in forest regeneration and rehabilitation where there has been degradation. Unfortunately, data are not available to show the extent of such actions. Further measures include the protection of forests through the establishment of protected areas, the extent of which varies from a total of 27 per cent of forest and woodland

#### **Box 2d.7 International cooperation in Central Africa**

The Yaoundé Forest Summit, held in Cameroon in March 1999, was a major event in cooperation between Central African countries towards tropical forest conservation. The Summit produced the Yaoundé Declaration, signed by Cameroon, Central African Republic, Chad, Congo, DRC, Equatorial Guinea, and Gabon. The Declaration is a 12-point plan of action for sustaining Central African forests, through commitments such as the creation and extension of protected forest areas, and plans to combat illegal logging and poaching. In December 2000, the heads of state of these nations met again, and plans were put in place to establish a transborder park, between Cameroon, Central African Republic, and Congo. The Sangha park, as it will be called, is the fusion of existing protected areas in the three countries, and the production forests and hunting zones that surround them, totalling one million hectares. This is the first park of its kind in Central Africa, and will help to effect harmonisation of national forest policies, policing, research, and monitoring.

Source: WWF 2000

area in Chad to 9 per cent in DRC (FAO 2001a). Regional cooperation in protection of forests has also been strengthened in recent years through the Yaounde Forest Summit and Yaounde Declaration (Box 2d.7).

With the exception of Chad, all of the countries of Central Africa are members of the ATO and have developed criteria and indicators for sustainable forest management under its auspices. Chad has developed criteria and indicators through the Dry Zone Africa process. Other sub-regional initiatives include the Central African Regional Environmental Programme (CARPE), a long-term initiative on the part of the USAID which aims to address the issues of deforestation and biodiversity loss in the Congo Basin forest zone. CARPE works with all governments in the sub-region, as well as American private voluntary organizations and appropriate federal agencies. Its 5-year pilot programme has been designed to gather and disseminate baseline information on forest resources, and to characterize and prioritize the threats to forests and opportunities for their sustainable management. It also aims to strengthen the capacity of decision makers in sustainable forest management.

Ecosystèmes Forestiers d'Afrique Centrale (ECOFAC) is another sub-regional programme that seeks to reconcile development and conservation of the natural environment by working closely with local communities and stakeholders. So far significant work has been channelled into developing botanical inventories and documenting information on forest dynamics (productivity, mortality, regeneration, and phenology). These data provide a baseline for understanding of how the ecosystem functions and for implementation of sustainable resource development. ECOFAC has also worked extensively with indigenous groups and studied their interactions with the environment, as well as pressures on the forest resources exerted by various groups and activities.

Many countries in the region have revised their forest policies, and/or developed National Environmental Action Plans or Biodiversity Conservation Strategies. However, their success is dependent on the commitment of political will, financial resources, trained staff, and equipment to enforce the new regulations and protection measures. Effects of these responses include an increase in the availability of information on sustainable forest management, raised awareness of forest issues, limited reforestation efforts, and the extension of protected areas.

## WESTERN AFRICA

Western Africa is characterized by a marked gradation of climate which is reflected in zones of vegetation cover. Dense rain forest and semi-deciduous forests dominate in the coastal belt. Moving northwards, there is a transition from forest to savanna which eventually gives way to sub-Saharan savanna in northern Mali, Mauritania, and Niger. In total, there were 72 million hectares of forest in 2000, equivalent to almost 12 per cent of the sub-region's land area, and representing 11 per cent of Africa's total forest cover (FAO 2001a).

The Upper Guinea Forest, a strip of tropical moist forest that runs parallel to the coast from Guinea to Cameroon (see Figure 2d.8) is one of the world's 25 biodiversity hotspots and ranks first in terms of mammalian species diversity (Conservation International 2001). It is estimated that only 20 per cent of the original extent still remains, and this is highly

**Figure 2d.8 Map of Upper Guinea Forest**



fragmented (Conservation International 1999). The rarest subspecies of gorilla, the Cross River Gorilla (*Gorilla gorilla diehli*) is found in fragments of this forest in Nigeria and Cameroon. With a remaining population of 200-250 individuals, this species is critically endangered (Butynski 2001). The largest continuous section of the Upper Guinean forest is in Liberia, where civil unrest threatens conservation activities. However, several initiatives are underway in Côte d'Ivoire, Equatorial Guinea, Ghana, Guinea, Liberia, Nigeria, Sierra Leone and Togo to manage the forest and protect endangered species. Forest loss and fragmentation are thus the most important issues in Western Africa.

## ECOLOGICAL, ECONOMIC AND SOCIAL VALUES OF FORESTS AND WOODLANDS IN WESTERN AFRICA

Commercial timber production is an extensive and lucrative occupation in Western Africa, contributing significant proportions of income and foreign exchange. For example, in 1998, Côte d'Ivoire exported US\$228 million worth of wood products (mostly sawnwood), Ghana exported US\$140 million worth (FAO 2001a). Forest and woodland products are also extremely important to local communities, and the people of Western Africa are highly dependent on forest and savanna resources for their energy needs, most of which are met from wood. In 2000, over 175 million m<sup>3</sup> of

wood were used in Western Africa for fuelwood and charcoal production (FAO 2001b). In Gambia, 85 per cent of energy needs are met from wood and charcoal, in Niger, biomass, mainly wood, meets 90 per cent of needs (FAO 2001a). Other resources heavily used by local communities are wildlife (bushmeat), medicinal plants, wood and rattan for construction, furniture and crafts, honey, nuts and fruits, and animal fodder, gums, dyes, teas, spices and aromatics. The most widely used wild food species is the wild yam, a staple in Western African diets. Palms, together with some 35 other species, are important resources for the wine and beer making that contributes significantly to the daily incomes of rural households in Western Africa (African Ethnobotany Network 2000). Palm cabbage, made into porridge, is an important 'hungry season' food during the rainy period immediately before the rice harvest.

### FOREST COVER AND QUALITY IN WESTERN AFRICA

Deforestation, forest degradation and the associated loss of forest products and environmental services are serious challenges facing Western African countries. Between 1990 and 2000, a total of 12 million hectares of forest were cleared, 15 per cent of the sub-regional total (FAO 2001a). These high rates of deforestation are largely attributable to governmental concessions on commercial logging. The timber and wood products are mostly exported to earn foreign currencies and contribute a considerable amount to GDP. Forests have also been cleared for agriculture, particularly during the 1970s and 1980s when high incomes could be earned from cash crops such as coffee, cotton, and sugar.

National policies for infrastructure development have also contributed to fragmentation of forests. The process starts with the construction of large access roads by logging companies which encourages the rural farming communities to settle deep inside the forest where the soils are most fertile. Other policies have played an indirect role in deforestation over the last 30 years. For example, governments have encouraged the conversion of forest reserves into agricultural lands in order to attract and resettle people from more densely populated and resource deficient areas. In addition, forest reserves have been converted into plantations to satisfy industrial demand for wood (Asibey 1990).

Collection of fuelwood contributes to forest

clearance and degradation through selective harvesting. The use of wood for fuel is likely to increase, according to predictions by the FAO (2001b), due to a rapidly increasing population and demands for energy which cannot be met by alternative sources in the short to medium term.

Current logging methods are destructive, and it has been estimated that to harvest 1m<sup>3</sup> of log, about 2m<sup>3</sup> of standing trees are destroyed (Serageldine 1990). This in turn significantly modifies the ecosystem by creating gaps in the canopy, exposing shade-adapted species to sunlight and allowing colonization by new species. Removal of vegetation has also increased the potential for soil erosion and run-off. This is especially problematic on steep slopes or in fragile ecosystems such as the mangroves and transitional marginal forests or derived savanna areas that have lower regeneration capacity than humid forests. Furthermore, it takes up to 700 years to restore a fully balanced, mature forest. Natural forests are therefore usually replaced by secondary forests which do not afford the same level of resources and services as primary forests. These secondary forest areas then typically become sources of local firewood collection, are converted to plantations, or used for grazing, activities which further degrade or destroy them.

Forest clearance and degradation are increasing in most countries in Western Africa because of increasing population pressures for agricultural land and for energy use. Population growth is linked directly to increased demand for food and occupancy of space. However, it is the local communities that often suffer most from forest degradation as they lose vital sources of firewood, construction materials, clothing, pharmaceutical products, food, hunting accessories, cultural and religious apparatus and grazing land for animals. Civil strife and its repercussions can fuel deforestation by creating needs for shelter and energy among refugees who will attempt to meet such needs from the forest.

Forests, especially dense tropical forests, play a vital role in carbon sequestration and therefore in global climate regulation, as well as in regulating local air quality and rainfall patterns. When forest cover is removed not only are these global functions lost but often—because the presence of forest reduces temperatures and evaporation, and limits the negative

impacts of wind—a microclimate conducive to the development of animal life and vegetation growth is also lost,. Clearing of the forest therefore limits the maintenance of a vibrant biological diversity.

### Towards sustainable management and conservation of forests and woodlands in Western Africa

European settlers built the foundation for modern management of forests in almost all of the countries of the sub-region. When these countries gained their independence (about 40 years ago), they inherited forest and wildlife resource management systems institutionalized in the form of state-owned protected areas. Forest in protected areas ranges from 77 per cent in Niger to 1 per cent in Guinea-Bissau and Liberia (FAO 2001a). Conservation International has been largely instrumental in developing and implementing management programmes aimed at conserving the fragmented Upper Guinea Forest hotspot. Activities have included environmental assessments and prioritization of conservation needs, building capacity in natural resources management agencies, employment creation for local communities in ranger activities, and tourism development (Conservation International 2001). Other responses include large-scale reforestation programmes, although these have encountered difficulties in implementation. New approaches built around ‘grass-roots projects’ have been introduced in some countries, putting more emphasis on community-level enterprises (Compaoré, Issaka & Yacouba 2000). Re-introduction and mainstreaming of indigenous forest conservation practices have also been successful in some parts of Western Africa (see Box 2d.8).

From the 1980s, the sub-region saw the appearance of projects related to the management of natural forests through the preparation and implementation of Forest Management Plans and Strategies. Also, in response to the Tropical Forest Action Plan, many Western African countries have initiated major forestry sector reviews in the past 10 years. Criteria and indicators for sustainable forest management are being developed and implemented in all Western African countries with the exceptions of Benin, Guinea, and Sierra Leone, coordinated by the ATO. Burkina Faso, Côte d'Ivoire, and Togo have some of

#### Box 2d.8 Indigenous forestry practices of farmers in Sierra Leone

In Sierra Leone, farmers normally leave tree cover at a distance of 3-5m from footpaths in order to maintain a continuum of shade for those using the paths during the peak of the hot season from March to April. Also, the clearing of a farm site normally excludes forest fringe vegetation in order to encourage wildlife and fish reproduction, and also to define a boundary between common property and farmers' fields. These practices could form the basis for the use of traditional knowledge in forestry in development modern strategies for conservation.

*Ministry of Agriculture, Forestry and Marine Resources, Sierra Leone*

Source:

E.K. Aieu, Director of Forests

their forests under management plans (FAO 2001a). In October 2000, the ATO announced its intentions to coordinate a common system of certification for timber and forest products, to ensure customers that the timber has come from sustainably managed forests.

Policy measures to reduce the pressures on forests and woodlands from fuelwood collection and charcoal production include the development and expansion of energy generation from renewable resources (such as hydropower and solar power), as well as through centralized power generation from fossil fuels using cleaner technologies. Under the Kyoto Protocol, developing countries in Africa will receive funds for development and adoption of cleaner technologies as well as for tree-planting and afforestation programmes.

### CONCLUSION

Approximately 22 per cent of the African continent is covered with forests, ranging from open savanna to closed tropical rainforest. Forests provide a great many goods and services which benefit local communities and national economies, as well as providing international environmental benefits. Commercial forest products include timber for construction and paper, but forest resources provide much more to local communities including food, construction materials, grazing areas for livestock, cultural and medicinal products, sites for religious practices and leisure activities, and fuel for cooking, heating and lighting. Forests protect and

- ... the true value of the variety of forest resources and services on which local communities and the global community depend needs to be made explicit and either incorporated into the price of forest products or traded on the open market. Economic and social development priorities need to be integrated into forest conservation measures, so that local communities can share in the management of the resource and in the benefits of trade in their products

stabilize the soil, recycle nutrients to maintain soil quality and regulate water quality and flow. Forests are also vast sinks for atmospheric carbon dioxide, and thus play a critical role in mitigating global climate change the impacts of which are predicted to be most severe for African countries and other developing nations. By protecting soils and by regulating temperatures, rainfall and hydrological systems, forests provide basic support systems for agriculture and industry, and, therefore, for the economies of African nations.

Natural forests and woodlands in Africa have been drastically reduced in size over the last century but particularly so since independence, as countries have struggled to improve their economies through exploitation of natural resources. Deforestation for commercial timber sales and clearance for agricultural and urban developments are the most intensive pressures, as well as overharvesting of wood for fuel, medicinal products, and construction materials. Remaining forests have also been degraded as a result of clear felling, fires, selective harvesting, and encroachment. Impacts of this degradation include losses of biodiversity, radically increased rates of soil erosion, reductions in water quality and increased risk of flooding in surrounding areas, and loss of livelihoods for local communities. The global community has also lost potential pharmaceutical and food products.

Pressures remain even though many countries in Africa have protected forest reserves, initiated reforestation and afforestation programmes, and have developed policies and programmes for sustainable forest management. And those pressures are set to increase with increasing populations and demand for forest resources. The developing countries are struggling to commit the necessary financial and human resources to their efforts in order to be able to turn away much needed foreign exchange proposed in return for further logging concessions. If they are to succeed, the true value of the variety of forest resources and services on which local communities and the global community depend needs to be made explicit and either incorporated into the price of forest products or traded on the open market. Economic and social development priorities need to be integrated into forest conservation measures, so that local communities can share in the management of the resource and in the benefits of trade in their products. This requires further

understanding of the types of forests, the complexity of the issues, and establishment of clear objectives and commitment of resources to implementation of sustainable development policies. Essential elements that must be taken into account include recognition of the intrinsic features of the local physical environment, impacts of climate change, deforestation factors, skills in forest management, scarcity of forest resources, deep-rooted traditions and human impacts, economic forces and political events. There must also be concerted efforts to provide alternative sources of energy, more efficient forms of energy utilization (such as mudstoves) and to provide income to people relying on natural forests. The major solutions for forest problems in the region include reforestation of the original and more prosperous areas and afforestation of multipurpose forests that can be used for grazing, wood production and other traditional uses. Establishment of multipurpose forests will diversify outputs, an important asset to avoid overuse of one-purpose forest.

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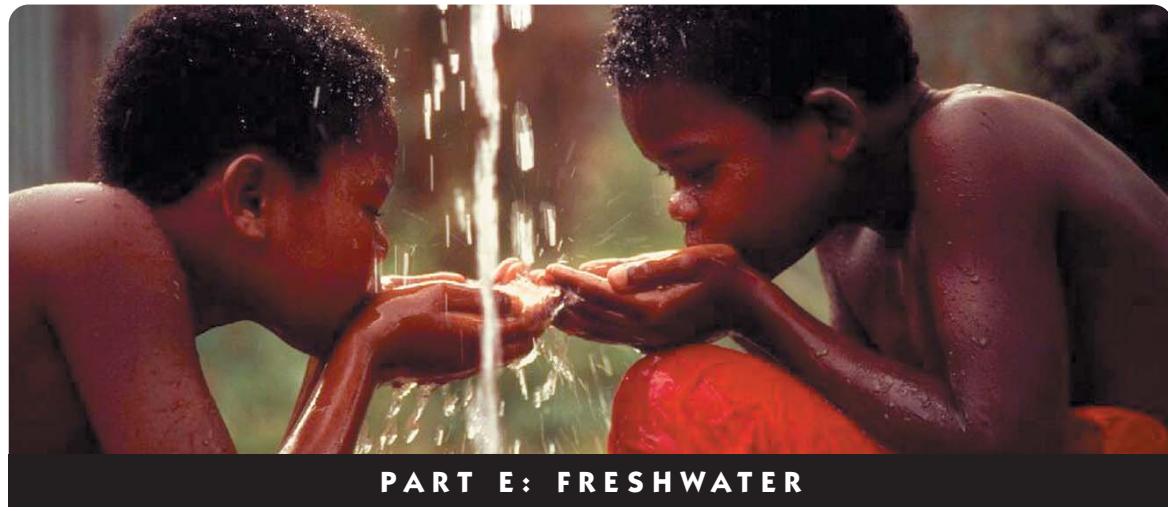
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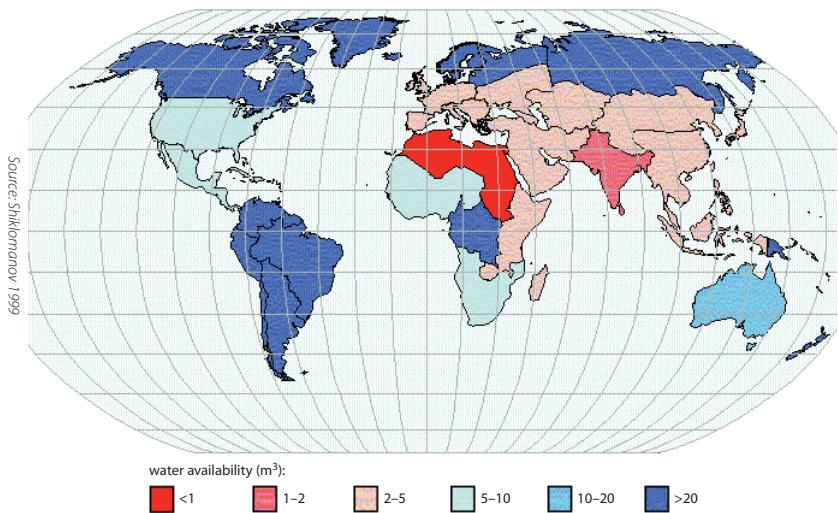
## REGIONAL OVERVIEW

### AVAILABILITY OF FRESHWATER

Freshwater availability is one of the most critical factors in development, particularly in Africa. Some 71 per cent of the earth's surface is water. However, less than 3 per cent is freshwater, and most of that is either in the form of ice and snow in the polar regions, or in underground aquifers.

Africa's share of global freshwater resources is about 9 per cent, or 4 050 km<sup>3</sup>/yr (Shiklomanov 1999, UNDP, UNEP, World Bank and WRI 2000). These freshwater resources are distributed unevenly across

Africa, with western Africa and central Africa having significantly greater precipitation than northern Africa, the Horn of Africa and southern Africa. The wettest country, the Democratic Republic of Congo (DRC), has nearly 25 per cent of average annual renewable water resources in Africa, with 935 km<sup>3</sup>/yr. By contrast, the driest country, Mauritania, has just 0.4 km<sup>3</sup>/yr, or 0.01 per cent of Africa's total (UNDP and others 2000). Average water availability per person in Africa is 5 720 m<sup>3</sup>/capita/year compared to a global average of 7 600 m<sup>3</sup>/capita/year, but there are large disparities between sub-regions, as shown in Figure 2e.1

**Figure 2e.1 Annual renewable water availability per capita (1995)**

Problems with freshwater availability in Africa are further complicated by highly variable levels of rainfall. As a result, large numbers of people are dependent on groundwater as their primary source of freshwater. In Algeria, for example, more than 60 per cent of all withdrawals are from groundwater and, in Libya, 95 per cent of all withdrawals are from groundwater (UNDP and others 2000). Some countries, including Algeria, Egypt, Libya, Mauritius, Morocco, South Africa and Tunisia, make use of desalinated water to assist in meeting their withdrawal requirements (UNDP and others 2000, GOM/ERM 1998).

Most African countries also experience extremes of rainfall (periodic flooding or drought). There is some evidence that both droughts and floods have increased in frequency and severity over the past 30 years (OFDA 2000). In particular, the Sahelian zone has experienced a continued decline in rainfall compared to pre-1960s averages, and Lake Chad has shrunk to 5 per cent of its size 35 years ago (NASA Global Earth Observing System 2001). Severe droughts were experienced in 1973 and 1984, when almost all African countries suffered reduced rainfall, and several million people in the Horn of Africa and the Sahelian zone, and in southern Africa, were affected.

The freshwater lakes of Africa have a total volume of 30 567 km<sup>3</sup>, covering a surface area of 165 581 km<sup>2</sup>. Not only are they important in water flow regulation,

flooding control and water storage, but they are also important for meeting human needs. Lake Tanganyika alone could supply water to 400 million people through the annual extraction of less than 1 per cent of its volume (Khruda 1996). With the exception of Lake Tana in Ethiopia, all African lakes are shared across international borders, which makes international cooperation a necessary condition for equitable use and development of lake resources. Wetlands cover about 1 per cent of Africa's total surface area, and are found in almost every country (WCMC 1992). The largest wetlands include: the Zaire swamps; the Sudd in the upper Nile River; the Lake Victoria basin; the Chad basin; the Okavango delta; the Bangweulu swamps; and the floodplains and deltas of the Niger and Zambezi rivers.

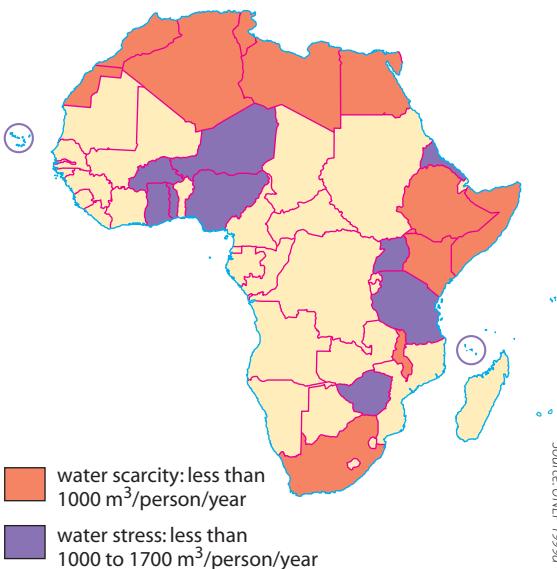
Africa has the highest rate of population growth in the world, and is also one of the regions that is most vulnerable to climate change. The Intergovernmental Panel on Climate Change (IPCC) predicts that average runoff and water availability will decline in the countries of northern and southern Africa, impacting on freshwater ecosystems, and advancing desertification in the Sahelian zone and in northern Africa (IPCC 2001). In addition, increased frequency of flooding and drought will also stress freshwater systems and pressurize water supply networks. As a result, 25 African countries are expected to experience water scarcity or water stress over the next 20–30 years, as shown in Figure 2e.2 (UNEP 1999a).

All the above factors combine to create enormous challenges for water storage, supply and distribution, as well as for water treatment (purification and wastewater treatment). Despite considerable efforts to develop water storage and infrastructure, particularly

### Box 2e.1 Africa's Water Vision

Water is a precious resource. In Africa, it can be a matter of life and death. It can also be a matter of economic survival. Yet it can be both an instrument and a limiting factor in poverty alleviation and economic recovery, lifting people out of the degradation of having to live without access to safe water and sanitation, while at the same time bringing prosperity to all on the continent. A radical change in approach is required if water is not to become a constraint, but an instrument, to socioeconomic development in Africa.

**Figure 2e.2 Countries expected to experience water stress or scarcity in 2025**



in the past 30 years, large numbers of people remain without access to water for domestic use, and many farmers do not have access to water for irrigation. By contrast, some industrial, agricultural and domestic users have access to subsidized water supplies, and have no incentive to use water carefully, or to reuse or recycle water. Access to water resources is thus a priority issue for the countries of Africa, together with rising concerns over water quality, due to excessive water withdrawal and declining availability, and pollution from a variety of sources.

### ACCESS TO FRESHWATER RESOURCES

Water stress (less than 1 700 m<sup>3</sup>/capita/yr) or water scarcity (less than 1 000m<sup>3</sup>/capita/yr) is already observed in 14 of the 53 African countries (WRI 2000). The high demand for water is driving unsustainable practices, and competition for water resources between sectors, communities, and nations. On occasion, it has been the cause of strained relations and hostility. For example, in Libya, annual withdrawals of groundwater are more than 500 times the rate of replenishment (UNDP and others 2000). In Egypt, 90 per cent of all freshwater resources are derived from the Nile River and, because this is a shared watercourse with nine

other nations, securing access and usage rights has been a contentious process.

With such limited, variable or unevenly distributed freshwater resources in Africa, it is not surprising that access to water is a major factor in social and economic development. Over the past 30 years, the response to this has been to dam or to modify large rivers in order to provide water for agricultural, domestic and industrial use, as well as to supply hydropower (see Box 2e.2). Low investment in water supply and infrastructure maintenance, increasing demand from all sectors and inequitable access policies have added further strain to the situation, resulting in highly skewed access to water resources.

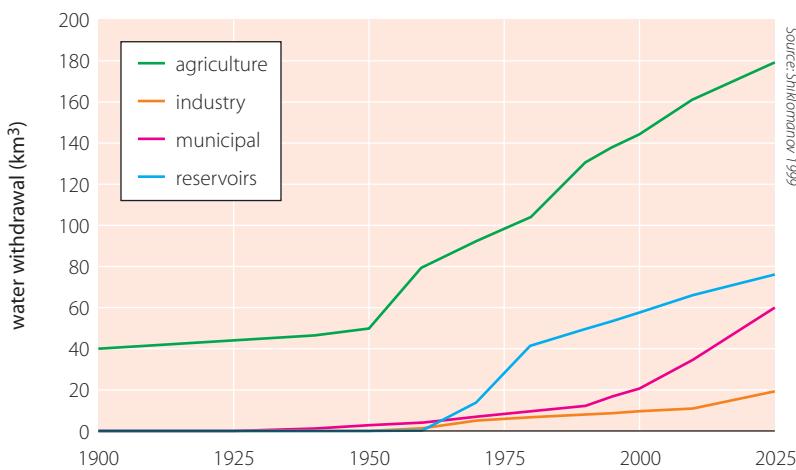
As shown in Figure 2e.3, the major user of freshwater resources is the agricultural sector, which accounted for 63 per cent of all withdrawals in Africa in 1995 (Shiklomanov 1999), and which irrigates more than 12 million hectares (ha) of farmland (FAOSTAT 2001). The more arid countries of northern and southern Africa are more dependent on irrigation than those in western and central Africa, however and, thus, securing water for irrigation is a high priority for economic

- *Low investment in water supply and infrastructure maintenance, increasing demand from all sectors and inequitable access policies have added further strain to the situation, resulting in highly skewed access to water resources*

### Box 2e.2 Large dams in Africa

There are more than 1 200 dams in Africa, more than 60 per cent of which are located in South Africa (539) and Zimbabwe (213). Most of these were constructed during the past 30 years, coincident with rising demands for water from growing populations. The overwhelming majority of dams in Africa have been constructed to facilitate irrigation (52 per cent) and to supply water to municipalities (20 per cent), although almost 20 per cent of dams are multipurpose. Although only 6 per cent of dams were built primarily for electricity generation, hydroelectric power accounts for more than 80 per cent of total power generation in 18 African countries, and for more than 50 per cent in 25 countries. Only 1 per cent of African dams have been constructed to provide flooding control.

Besides providing these benefits and services, however, dams have had several negative impacts, including: large-scale displacement of people; altered patterns of erosion and flooding; loss of land, due to flooding; loss of income from downstream fisheries; and changes to sedimentation rates. These ecological and social concerns – together with additional stresses on water resources, which are expected in many parts of Africa as a result of increasing population pressures and global climate change – are changing attitudes towards large dams. The construction of smaller dams and the development of micro-hydropower facilities are being investigated as more sustainable means of supplying water and power.

**Figure 2e.3 Water use by sector in Africa 1990–2025**

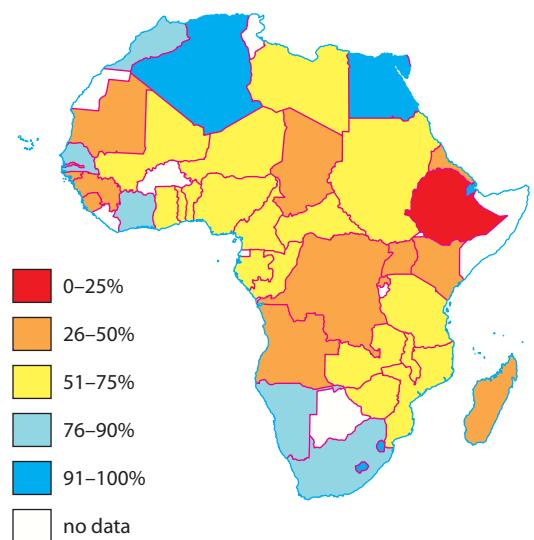
Africa (Hinrichsen, Robey and Upadhyay 1997). Per capita usage in Africa (on average 47 litres/person/day) is also far below that of other countries (85 litres/person/day in Asia, 334 litres/person/day in the UK and 578 litres/person/day in the US) (Hinrichsen and others 1997).

There are large differences in access to water between countries, between urban and rural areas, and between population groups. Inadequate water supply and sanitation, particularly in the cramped living conditions of urban informal settlements, increases the risk of waterborne diseases and infections. Diarrhoeal infections are particularly prevalent amongst children, and constitute a major cause of preventable deaths.

Consumption of water consumption also varies, as well as access to water. Typically, the greater the access to water, the greater the consumption. By contrast, people who spend a large proportion of their day fetching and carrying water are most conservative with its use. A study in eastern Africa, for example, showed that urban dwellers use more water than rural households, and households with piped water use more than three times the amount of water used by households without piped water (IIED 2000). In South Africa, extreme disparities exist in water consumption between different population groups, with residents of urban informal settlements using less than 50

development and stability. However, few countries can afford the financial investment in efficient irrigation systems, and water losses through leaking pipes and evaporation are as high as 50 per cent in South Africa alone (Global Water Partnership 2000). Notable exceptions are Mauritius and northern African countries, where drip irrigation systems are in place and faulty pipes are being replaced. With increasing population and consumption patterns, the demand for food is increasing across Africa, and freshwater withdrawals for agriculture are predicted to rise by more than 30 per cent over the next 20 years (Shiklomanov 1999).

Compared to the agricultural sector, the domestic sector in Africa uses little water. However, domestic use has also increased over the past 30 years and is set to continue this trend (see Figure 2e.3). In 1950, the domestic sector was responsible for less than 3 per cent of all water withdrawals, but this had risen to 4.4 per cent by 1995, and is predicted to account for 6 per cent of all withdrawals by 2025 (Shiklomanov 1999). It is important to note, however, that only 62 per cent of the African population received piped water from municipal sources in 2000 (WHO/UNICEF 2000). Therefore, actual withdrawals for domestic consumption are higher than the estimated percentage from municipal withdrawals. Compared to domestic consumption in other regions of the world, Africa's domestic sector is a moderate user of water. For example, in Europe, the domestic sector accounts for 13 per cent of all withdrawals, more than twice that in

**Figure 2e.4 Water supply coverage in Africa in 2000**

litres/person/day, and residents of middle-upper class suburbs consuming 750 litres/person/day—thirteen times more (Napier 2000). Losses from domestic water distribution systems also account for significant wastage, for example, up to 50 per cent of domestic consumption in the case of Mauritius (Government of Mauritius 1994).

### Improving access to freshwater resources in Africa

One of several international efforts to improve access to drinking water was the United Nations International Drinking Water Supply and Sanitation Decade (1981–90). This initiative was approved at the United Nations Water Conference in Argentina in 1977, following recommendations that governments 'develop national plans and programmes for community water supply and sanitation' and that 'national development policies and plans should give priority to the supply of drinking water for the entire population and to the final disposal of wastewater' (United Nations Mar del Plata Plan of Action 1977). However, population growth and the proliferation of unplanned settlements in Africa negated much of the progress and, by 1990, only marginal improvements had been made (WHO/UNICEF 2000). In the following decade (1991–2000), some of these gains had been lost (WHO/UNICEF 2000). The World Health Organization's (WHO) Africa Regional Office developed an Africa 2000 initiative in 1994. This is an international effort to expand water supply and sanitation services in Africa, through changing attitudes towards water and sanitation development. At the second regional consultation of African Health Ministers in 1998, recommendations were made for expanding the Africa 2000 initiative, on the strength of results achieved so far.

In the coming decades, major revisions to water policies and pricing in Africa are required. In the semi-arid countries of northern and southern Africa, these are immediate priorities, if the additional stresses of climate change and population growth are to be offset. Until recently, there have been few attempts at demand management. On the contrary, water sector policies have focused on meeting increasing demand, as a means of encouraging economic and social development. However, some countries have revised their water policies and pricing mechanisms, as



Village on the Nile River

Photodisc Inc.

measures to manage demand and to encourage more conservative water use. Recycling of wastewater as irrigation water, and upgrading of reticulation networks, are other vital measures which are in place in some countries. Africa's Water Vision—developed through consultative processes in 1999 and 2000, and presented at the 2nd World Water Forum in The Hague in 2000—stresses the need to change attitudes towards water supply and use, and proposes a framework for building on these achievements to date. The ten key elements of Africa's Water Vision are as follows:

- There is sustainable access to safe and adequate water supply and sanitation in order to meet the basic needs of all.
- There is sufficient water for food and energy security.
- Water for sustaining ecosystems and biodiversity is adequate in both quantity and quality.
- Water resources institutions have been reformed, in order to create an enabling environment for the effective and integrated management of water in national and transboundary water basins, including management at the lowest appropriate level.
- basins serve as a basis for regional cooperation and development, and are treated as natural assets for all within such basins.
- There is an adequate number of motivated and highly skilled water professionals.

- There is an effective and financially sustainable system for data collection, assessment and dissemination for national and transboundary water basins.
- There are effective and sustainable strategies for addressing natural and human-made water resources problems, including climate variability and change.
- Water is financed and priced to promote equity, efficiency, and sustainability.
- There is political will, public awareness and commitment among all for sustainable water resources management, including the mainstreaming of gender issues and youth concerns, and the use of participatory approaches (World Water Council 2000).

The proposed mechanism for attaining Africa's Water Vision is comprised of four key components, namely:

- strengthening governance of water resources;
- improving our understanding of water-related issues;

Bella nomad girls collect water in Burkina Faso

*Mark Edwards/Still Pictures*



- meeting urgent water needs; and
- providing financial resources for the development and management of water resources in the future.

Africa's Water Vision stresses the need for enhanced regional cooperation, and for a new model for water resources management (World Water Council 2000).

The significant movement towards Integrated Water Resources Management (IWRM) in several countries is, in part, a reflection of the thinking consolidated in Africa's Water Vision. The principles of IWRM include the management of water resources at the basin level, rather than within politically defined boundaries, and with all stakeholder groups having roles and responsibilities in managing the resource. This integrated approach also ensures that social, economic, environmental and technical considerations are taken into account in the management and development of water resources.

Public-private partnerships in water resources management and water supply programmes are also gaining popularity in many countries, as a means for ensuring a sustained supply and development of infrastructure. Such partnerships have been successful in providing services to large urban centres, as well as to districts and rural communities (Sharma 1996). International agreements and protocols have also been established, either as proactive measures or in response to escalating conflict over shared watercourses. The Nile Basin Initiative (NBI), the Regional Programme for the Sustainable Development of the Nubian Sandstone Aquifer (NSA), and the Southern African Development Community (SADC) Protocol on Shared Water Courses are successful examples of transboundary cooperation for the sustainable use and development of water resources.

Hydrological Cycle Observing Systems (HYCOS) projects are in operation in the Mediterranean zone, and in the southern Africa, western Africa and central Africa sub-regions. Similar systems are being established for the Inter-Governmental Authority on Development (IGAD), Congo basin and Nile basin areas. These systems have been established primarily as monitoring and assessment stations, building capacity in data collection and information dissemination. They monitor hydrological conditions, and have provided valuable information, such as early warning of rainfall fluctuations and extreme events (WMO 2001).

## WATER QUALITY

Not only is the availability of freshwater a major constraint to development but, in all sub-regions of Africa, the quality of freshwater is also raising concerns. Some of the manifestations of poor water quality are: eutrophication in lakes and dams; contamination of groundwater with nitrates and salts; and loss of aquatic habitats and biodiversity.

Eutrophication is the proliferation of algae due to raised levels of nutrients in the water body. Poor agricultural practices, and the unregulated discharge of untreated or partially treated sewage, are contributing factors. Algal blooms change the composition and functioning of the natural biota. They can be hazardous to human health, they make the environment less attractive for recreation and sport, and they increase the cost of water treatment. Raised levels of nutrients in water bodies can also encourage the spread of water weeds, and many lakes and wetlands—including the Caprivi wetland system (Namibia), Lake Victoria (East Africa) and Lake Kariba (Zambia/Zimbabwe)—are experiencing problems of infestation by the water hyacinth, *Eichornia crassipes*. This weed forms dense mats that block water channels, disrupting flow patterns and presenting a hazard for boat traffic. Decaying mats of the weed generate bad odours and lead to eutrophication of the water body. Affected countries have initiated biological and chemical control programmes, in addition to mechanical clearance, with some success to date (Global Water Partnership 2000).

Groundwater pollution is a particular concern in the more arid countries, which are highly dependent on underground aquifers for drinking water supplies. The main pollutants are nitrates and phosphates, together with chemical residues from seepage of agricultural runoff, and from inappropriate discharge of industrial and domestic wastewater. In low-lying areas, salinization of groundwater aquifers is a further concern, through the intrusion of saltwater and seepage of irrigation water. Expected sea level rise under climate change scenarios will cause further widespread contamination of aquifers. Therefore, it is critical that action is taken now, in order to ensure the sustained protection and sustainable use of underground water resources.

Freshwater lakes, wetlands and dams are also experiencing loss of biodiversity, as a result of industrial pollution and contamination of water sources by acid-

mine drainage. Lake Chivero in Zimbabwe, for example, experienced massive fish deaths in 1970, 1991 and 1996, due to high levels of ammonia and heavy metals, and low oxygen levels (Gumbo 1997). The Korle Lagoon in Ghana has been severely degraded, due to nearby development and associated effluents, dumping of solid waste, and run-off from surrounding areas, such that almost all wildlife has disappeared (Accra Sustainable Programme 2001). These threats to wetlands, and the requirements of the 1971 Ramsar Convention on Wetlands of International Importance have encouraged many countries to develop Wetlands Conservation Strategies, including Ghana, South Africa and Uganda.

Contamination of freshwater habitats, such as lagoons, wetlands, lakes and rivers, not only threatens ecological health, but the health of humans as well. Declining water quality results in an increased risk of water-related disease outbreaks. Diseases such as diarrhoea, ascariasis, dracunculosis, hookworm, schistosomiasis and trachoma are on the increase, particularly in urban informal settlements, where levels of water supply and sanitation provision are low. Lack of water of sufficient quality also reduces agricultural sustainability and potential output which, in turn, force increased importation of foodstuffs and agricultural products. Similarly, poor water quality limits economic development options, such as water-intensive industries and tourism.

## Improving water quality in Africa

Measures to control water quality have been implemented in many countries, including: establishment and enforcement of potable water and wastewater standards; and rehabilitation of existing wastewater treatment facilities. The Polluter Pays Principle has been adopted in many policies and legislation, but enforcement has been often hampered by a lack of resources for effective monitoring and prosecution. Other responses include: schemes for improving drainage; purification and decontamination of freshwater systems; and public awareness campaigns. Although only recently implemented, these responses have had localized success in improving access to potable water and raising awareness. Public-private partnerships have also been successful in implementing large urban sanitation projects (Sharma 1996).

•  
*Groundwater pollution is a particular concern in the more arid countries, which are highly dependent on underground aquifers for drinking water supplies. The main pollutants are nitrates and phosphates, together with chemical residues from seepage of agricultural runoff, and from inappropriate discharge of industrial and domestic wastewater.*



Increasing water shortages and declining water quality are compounding factors limiting Africa's development. As freshwater availability decreases, it increases the concentration of pollutants, lowering the water quality. And as water quality declines, water shortages are exacerbated, through increased costs of water treatment and increased time spent in collecting water. Therefore, the challenges are: to ensure equitable access to clean water; to manage the demand for water for domestic, industrial and agricultural purposes; and maintain healthy ecosystems, in order to ensure sustained supplies of good quality water.

The African Initiative on Land and Water, funded by the Global Environment Facility (GEF), was set up to address in an integrated manner complex environmental challenges impacting on land and water quality. It provides a framework for coordinating bilateral and multilateral funding mechanisms, as well as for harmonizing existing sustainable development initiatives. Thus, a consolidated national and sub-regional sustainable development framework is proposed, in order to control the direct and indirect impacts of land degradation and desertification, including: sedimentation; siltation; and pollution of national and international water bodies. In addition, the benefits accruing from sound environmental management will be equally distributed between stakeholders. A catchment- or watershed-based approach is considered appropriate, taking into account natural environmental variability, in terms of rainfall and biomass production, and linking closely to biodiversity conservation objectives. The initiative will use monitoring and assessment information to support the development of flexible and adaptive policies and management strategies at the catchment or watershed level (UNEP 2002).

The following sections provide further information on specific freshwater issues relating to each sub-region in Africa.

## NORTHERN AFRICA

The northern Africa sub-region is dominated by arid conditions and extensive deserts, with the exception of parts of southern Sudan and an intermittent narrow strip along the Mediterranean shoreline, where the climate is more humid. The major issue of concern is,

therefore, freshwater availability for domestic, agricultural and industrial consumption. Although most people have access to water resources, as a result of high levels of infrastructure development, demand management and integrated water resources management are priorities for improving adequacy and equity in supply. Water quality is an emerging issue, particularly with regard to salinization from poor irrigation methods, and pollution from industrial and domestic wastewater disposal.

### AVAILABILITY OF FRESHWATER IN NORTHERN AFRICA

The average total annual precipitation in northern Africa is estimated at  $1\ 503\text{ km}^3/\text{yr}$ , equivalent to 7 per cent of the total precipitation for Africa (FAO 1995). Distribution of this precipitation varies dramatically, with almost 75 per cent falling in Sudan (the average is 436 mm/yr, but it ranges from 20 mm/yr in the north to more than 1 600 mm/yr in the south) and just 3 per cent in Egypt (about 18 mm/yr) (FAO 1995). Only 5.6 per cent of the precipitation is available for renewing stream flows and for recharging shallow groundwater aquifers. The rest is mainly lost by evaporation, transpiration and seepage. Per capita water availability ranges from  $26\text{ m}^3/\text{yr}$  in Egypt to  $1\ 058\text{ m}^3/\text{yr}$  in Morocco (UNDP and others 2000).

Further disparity is evident when the countries of northern Africa are compared to those in sub-Saharan Africa. The total internal renewable water resources for northern Africa represent 2.5 per cent of the African total, but northern Africa's withdrawals represent 46 per cent of the total African withdrawals. This disparity partially reflects the harsh climatic conditions, and partially indicates an enhanced level of water resources development. It is the effectiveness of such management schemes, and heavy dependence on transboundary supplies, that has facilitated the growth of the sub-region's population and economies.

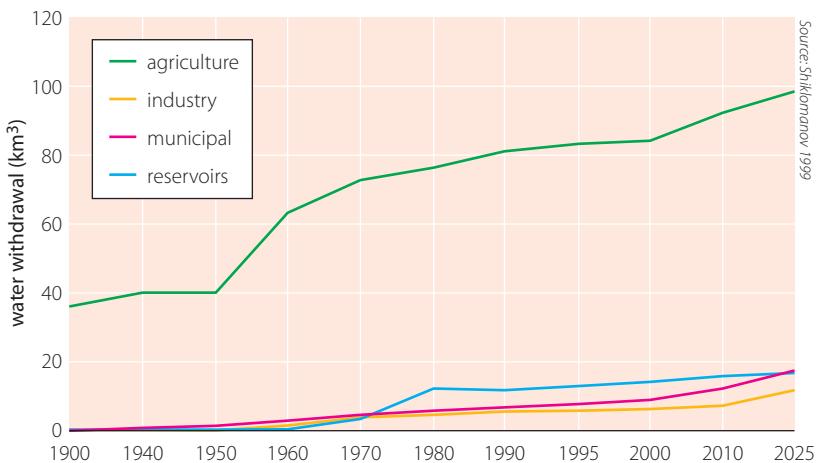
Renewable groundwater resources are in the form of shallow alluvial aquifers, recharged from the main rivers (for example, the alluvial aquifer beneath the Nile delta in Egypt) or from precipitation (along the north African Mediterranean coast). In the Sahara desert, the major water resources are the combined NSA and the Continental Intercalaire non-renewable aquifer, which

extend from Egypt to Mauritania. Current annual rates of groundwater withdrawal in the sub-region are 407 per cent of the recharge rate in Egypt, and 560 per cent in Libya (UNDP and others 2000). Exploitation of groundwater resources over the past ten years has led to a reduction in water pressure levels at the oasis of the western desert. Overextraction from the delta shallow aquifer has led to increased water salinization and a rapid inland advance of the saltwater interface.

The NSA is a huge fossil water resource, located in the eastern Sahara desert in northeastern Africa (see Figure 2e.5). It is shared among four countries—Chad, Egypt, Libya and Sudan—and contains an estimated 150 000 km<sup>3</sup> of groundwater (CEDARE 2000). The total current extraction from the NSA is estimated at 1 500 million m<sup>3</sup>/yr. The Centre for Environment and Development for the Arab Region and Europe (CEDARE) is developing a regional strategy for the sustainable utilization of the aquifer, to be adopted by the four sharing countries. This strategy will consider sustainability of the resource, as well as the development dimension in each country, based on current and future needs.

Global warming and regional climatic change impose an additional possible threat to the already scarce freshwater resources in northern Africa. The Nile basin

**Figure 2e.6 Water use by sector in Northern Africa 1900–2025**



Source: FAO (2000).

has a low run-off efficiency index and a high dryness index, rendering it highly susceptible to climate change (IPCC 1998). Run-off is likely to decrease with global warming, even if rainfall increases, because evaporation rates are so high. Scenarios for the future range from a 30 per cent increase in river flow to a 78 per cent decrease in river flow (IPCC 1998), presenting even greater challenges for international cooperation in water resources management. Northern Africa is already frequently affected by cycles of droughts and flooding and, with climate change, these are expected to increase. In the dry lands, which dominate most of the sub-region, population growth will push people onto marginal land, which is highly vulnerable to desertification, thus exacerbating the impacts of climate change.

### Access to freshwater in Northern Africa

The water supply coverage in the sub-region is generally high (ranging from 72 per cent in Libya to 95 per cent in Egypt), although urban areas are better supplied than rural areas. In rural areas, water supply coverage varies (from 58 per cent in Morocco to 94 per cent in Egypt) (WHO/UNICEF 2000). Access to sanitation is also generally good but, again, urban areas are better supplied than rural areas (WHO/UNICEF 2000). This is because of the high levels of water resources development, which have been implemented by the governments of northern African countries. However, the demand for water from all sectors is rapidly increasing, thus placing enormous pressure on the ecosystems which supply and regulate water availability and quality (see Figure 2e.6).

**Figure 2e.5 Map of the sandstone aquifer in the Nubian Basin**



Source: CEDARE

Agriculture, particularly the production of cash crops, is heavily dependent on irrigation, and consumes more than 80 per cent of withdrawals, while industry and the domestic sector consume 5.6 per cent and 10 per cent of withdrawals respectively (UNDP and others 2000). Irrigated areas represent 100 per cent of cultivated areas in Egypt, 26 per cent in Sudan and 9 per cent in Tunisia (FAOSTAT 1997). In response to the rising demand for water and increasing water scarcity, some countries supplement their water resources through desalination and the reuse of treated municipal wastewater. Tunisia, for example, supplements surface and groundwater extraction with 8.3 million m<sup>3</sup>/yr of desalinated seawater, and 20 million m<sup>3</sup>/yr of treated wastewater (FAOSTAT 1997). In Egypt, 8 per cent of the total water used comes from the reuse of agricultural or municipal wastewater, and less than 1 per cent comes from the desalination of seawater, although the flourishing tourism industry is pushing for the severalfold increase of the current desalination capacity by 2010 (FAOSTAT 1997).

#### **Improving freshwater availability and access in Northern Africa**

The interdisciplinary nature of water problems requires new methods to integrate the technical, hydrological, economic, environmental, social and legal aspects into a coherent framework of IWRM (McKinney and others 1999). Since the 1990s, most northern African countries have realized that the business-as-usual scenario of dealing with water management and water security issues is no longer suitable to cope with future challenges, and they are starting to implement IWRM strategies. Countries have created enabling environments for IWRM by developing legal and institutional frameworks for effective operation. For example Egypt, Morocco and Tunisia have developed national policies and master plans for water management, based on IWRM principles, and the Algerian government has created five Basin Authorities for IWRM. In Tunisia and Egypt, groundwater recharging schemes have been adopted, together with equitable models of water use between user groups. Water use associations have also been formally established in Morocco and Tunisia. Also under the banner of IWRM, a national drought management plan has been put in place in Morocco, and a national programme for the

#### **Box 2e.3 Overcoming conflicts associated with transboundary water resources**

Egypt's annual water consumption demands are met by the Blue Nile River (86 per cent), which flows from Lake Tana in Ethiopia, and by the White Nile River (14 per cent), which flows from Lake Victoria in Uganda. Egypt presently uses the majority of the River Nile's flows, and could potentially suffer crippling water reductions if other countries, such as Ethiopia, begin to utilize their share of the Nile's waters for hydroelectric power. Water rights to the Nile have thus become an important issue for the ten Nile riparian countries (Burundi, Democratic Republic of Congo, Egypt, Eritrea, Ethiopia, Kenya, Rwanda, Sudan, Tanzania and Uganda.).

The Nile Basin Initiative, launched in 1999, is joint programme of action between the ten Nile riparian countries, with the objectives of ensuring: sustainable resource development; security; cooperation; and economic integration. The first meeting of the International Consortium for Cooperation on the Nile (ICCON) took place in June 2001 in Geneva, where the Nile Council of Ministers put forward their Strategic Action Plan to the donor community. So far US\$140 million has been pledged in support of the region's commitment to peace and sustainable resource development.

Source: ElA 2000; ICCON 2001

abatement of wastewater discharge into the Nile River has been successfully instituted in Egypt. However, continued support for IWRM is required in terms of: ongoing capacity building; institutional coordination; improved information exchange and processing; and sustainable funding and political commitment.

The Nile Basin Initiative represents an excellent example of cooperation within the framework of IWRM between the ten Nile riparian countries (see Box 2e.3). The Joint Authority for the Nubian Sandstone Aquifer is another example of cooperation between Sudan, Libya, Egypt and Chad, in order to formulate and to monitor strategies for the rational utilization of the NSA.

#### **WATER QUALITY IN NORTHERN AFRICA**

Major water quality problems in northern Africa include: salinization; pollution; and eutrophication of

surface and/or groundwater. Increased salt content of surface and groundwater is mainly due to irrigation return flows and saltwater intrusion along the Mediterranean coast. Poorly sited or illegal waste dumping and seepage from landfills, together with localized sanitation problems, are the major causes of surface and groundwater pollution; and eutrophication of wetlands occurs as a result of high nitrate and phosphate levels in run-off from agricultural areas. Extensive algal blooms and mats of water hyacinth (*Eichornia crassipes*) in Sudan are also a result of raised nutrient levels in water bodies. These mats constitute problems for water quality, because they release toxins into the water, cause discolouration and reduce dissolved oxygen levels, thus creating an unsuitable habitat for many beneficial freshwater species, and increasing the costs of water treatment. Land erosion and dam reservoir sedimentation are also identified as major environmental problems in the sub-region. Reservoir sedimentation in Morocco was estimated at 50 million m<sup>3</sup>/yr in 1994, and was expected to reach 100 million m<sup>3</sup>/yr by the onset of the 21st century. The resulting annual loss of storage capacity is equivalent to the annual water requirements for irrigating 6 000 ha of cultivated land (FAO 1995).

Between the Aswan High Dam and Cairo, the Nile River receives domestic wastewater from 43 towns and 1 500 villages, and 35 major factories (with a combined wastewater discharge of 125 m<sup>3</sup>/yr), as well as 2 300 million m<sup>3</sup>/yr of irrigation return flows (containing chemical residues, sediments and nutrients) (Myllyla 1995). The health risks associated with such water quality problems are high, especially for children. In Morocco, the incidence of diarrhoea amongst children is highly correlated to lack of access to treated piped or treated well water (Kelly, Khanfir, David, Arata and Kleinau 1999). Tunisia's largest reservoir, the Sidi Salem, and Algeria's Mitidja and Saida aquifers, are showing deteriorating quality, in particular, elevated nitrate levels originating from industrial effluents and agricultural run-offs (World Bank 1996). This is of particular concern, because these are the main water supplies for the capital of Algeria, Algiers.

#### **Improving water quality in Northern Africa**

Special development programmes devoted to enhancing drinking water quality and sanitation services

are expected to be in place by 2010 in northern Africa. Implementation has already begun in some areas, such as Cairo, where the gigantic Greater Cairo Wastewater Project was implemented in the 1990s in order to convey and to treat the effluents from 7 million inhabitants of Cairo City. Industrial pollution abatement and pollution prevention programmes were prepared by the Egyptian Environmental Affairs Agency, and successful prevention of untreated industrial effluent discharge into the Nile River was confirmed by the Ministry of State for Environmental Affairs by 1998. National water monitoring programmes have also been launched by the National Research Centre and the Nile River Institute, but there is lack of coordination in their efforts, and insufficient technical and financial resources are additional barriers. The World Bank (WB) is investing more than US\$2 000 million through the GEF for water-related projects in Egypt, and the US Agency for International Development (USAID) is another sponsor, funding water supply and sanitation schemes in Cairo (Myllyla 1995). The Egyptian Environmental Affairs Agency has passed a new environmental protection law, and Environmental Impact Assessments (EIAs) will be required for new big industrial developments.

In Tunisia, wastewater management began in the 1970s with the launch of a national water policy, and the establishment of the National Wastewater Management Agency. In recent years, the focus of the National Wastewater Management Agency has been in providing services for rural areas, implementing the State Environmental and Public Health Policy, and maintaining infrastructure related to sewage in urban and industrial areas. Environmental water requirements are considered, and Tunisia is seeking to supplement domestic, industrial and agricultural demands through the reuse of treated wastewater (Citet 2001).

#### **EASTERN AFRICA**

Eastern Africa experiences high variability in rainfall over time and space, including frequent episodes of flooding or drought. There is also competition for access to water resources between user groups and between countries. Some of the countries are not only dependent on freshwater for domestic, agricultural and

- *Between the Aswan High Dam and Cairo, the Nile River receives domestic wastewater from 43 towns and 1 500 villages, and 35 major factories (with a combined wastewater discharge of 125 m<sup>3</sup>/yr), as well as 2 300 million m<sup>3</sup>/yr of irrigation return flows (containing chemical residues, sediments and nutrients)*

industrial consumption, but also for hydropower generation. Hence, freshwater availability and access is a priority issue for the sub-region. Concerns have been raised in recent years about declining water quality and, in particular, about the infestation of Lake Victoria with water hyacinth (*Eichornia crassipes*).

### AVAILABILITY OF FRESHWATER IN EASTERN AFRICA

Eastern Africa, on the whole, is fairly well endowed with freshwater, with total average renewable freshwater resources amounting to 187 km<sup>3</sup>/yr (UNDP and others 2000). Uganda has the largest share of this, with 39 km<sup>3</sup>/yr (1 791 m<sup>3</sup>/capita/yr), whilst Eritrea has the least, with 2.8 km<sup>3</sup>/yr (data on per capita resources are not available) (UNDP and others 2000). The amount and distribution of rainfall varies across Eastern Africa, with annual averages ranging from 147 mm for Djibouti to more than 1 000 mm for Uganda, Rwanda and Burundi (FAOSTAT 2000). Intra-annual variations are also high, ranging from: 50–300 mm for Djibouti; 250–700 mm for Somalia; 750–2000 mm for Uganda; and 100–2 400 mm for Ethiopia (FAOSTAT 2000). These intra-annual variations determine, to some extent, water availability. For example, more than 75

per cent of Ethiopia's rainfall occurs in intense downpours over a period of 3–4 months, whilst conditions are relatively dry for the rest of the year (Ministry of Water Resources 1998). The intensity of these rains and the lack of vegetative cover cause most rainfall to be lost as run-off or evaporation, with only a small percentage available to recharge underground aquifers. Surface water, therefore, dominates freshwater resources in eastern Africa (the groundwater resources of Ethiopia and Eritrea, for example, are just 2.6 km<sup>3</sup> of the total resources for these countries) (FAOSTAT 1996). Surface water resources are also important in power generation (see Box 2e.4).

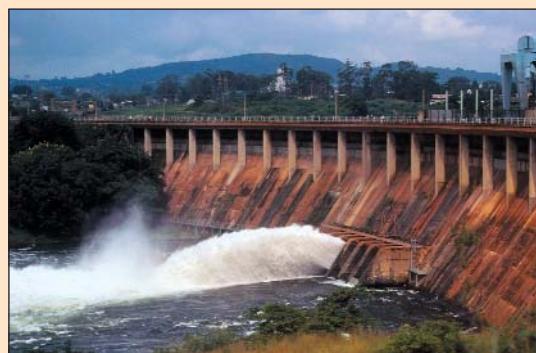
The drier countries in the Horn of Africa (Ethiopia, Eritrea and Somalia) frequently experience drought, and have been devastated by drought-induced famine on several occasions over the past 30 years. The largest freshwater source in eastern Africa is Lake Victoria, the second largest lake in the world. Lake Victoria provides freshwater to the populations of Uganda, Kenya and Tanzania directly and, through the Nile River, to Sudan and Egypt. It is also the life and livelihood support of millions of people living around the lake, providing: fish; irrigation water; tourism and recreation; communications; and transport. Other major freshwater lakes in eastern Africa include: Lake

- *Annual freshwater withdrawals are a small percentage of the total available, ranging from less than 3 per cent of the total resources available in Burundi to 12 per cent in Rwanda*
- 

#### Box 2e.4 Hydropower development in Eastern Africa

The world's largest storage dam is the Owen Falls Dam on the River Nile in Uganda. The 162-megawatt (MW) capacity hydroelectric station at the dam supplies most of Uganda's electricity requirements, and exports 30 MW each year to Kenya. In 1999, however, increased domestic demand in Uganda resulted in a drop in supply to Kenya. Kenya's own hydropower stations supply 78 per cent of the country's electricity (670 MW in 1999). Ethiopia's hydropower potential has been estimated at 15 000–30 000 MW, although less than 2 per cent of this had been exploited by 1993, and 90 per cent of all energy consumed is derived from biomass. With such dependency on hydroelectric power, the eastern African countries are vulnerable to power shortages during times of low rainfall, as experienced during 1999 and 2000 by Kenya and Ethiopia. This, in turn, adversely impacts on the economy, as a result of losses in industrial

productivity, commercial activities, and transport and communication networks. The government of Kenya is subsequently promoting the development of diesel and geothermal power plants.



T. de Salis/Still Pictures

Tanganyika in Tanzania; Lake Edward, Lake George, Lake Kyoga and Lake Albert in Uganda; Lake Turkana in Kenya; and eleven freshwater lakes in Ethiopia.

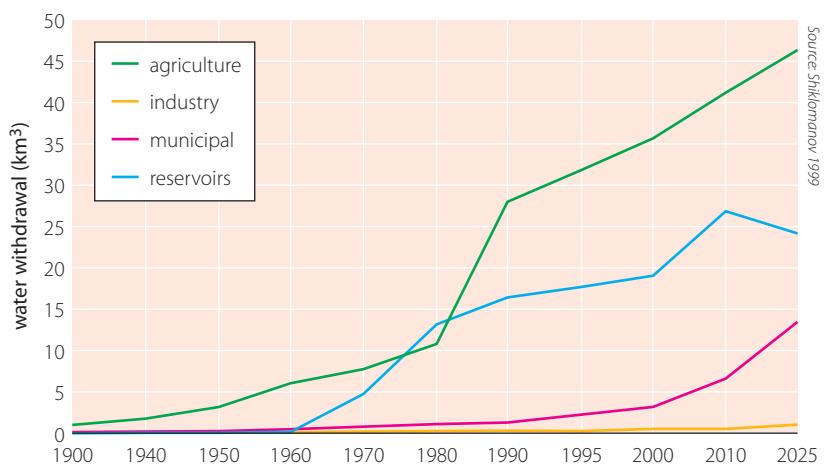
Annual freshwater withdrawals are a small percentage of the total available, ranging from less than 3 per cent of the total resources available in Burundi to 12 per cent in Rwanda (UNDP 2000). However, variability in rainfall results in frequent bouts of water scarcity and, during these times, demand exceeds supply. Human settlement patterns also influence, and are influenced by, freshwater availability. For example, in Kenya only 33 per cent of the land area has adequate and dependable water, but this area is home to 70 per cent of the population.

With Eastern Africa's population growing rapidly, demand for freshwater is already becoming a problem. Figure 2e.7 shows the current and expected sectoral water use for eastern Africa. Demand for freshwater in the domestic sector is also rising because of increasing per capita water usage. In 1980, per capita urban water usage in Uganda was 90 litres/day; and this was expected to almost double by the year 2000 (NEMA 1999).

Eastern Africa is home to a sizeable population of pastoralists. One of the main environmental problems associated with pastoralism is overstocking of animals, leading to depletion of drinking water sources and degradation of vegetation. Currently, Uganda's livestock freshwater demand is reported to be 81 million m<sup>3</sup>/yr, and is projected to increase to 233 million m<sup>3</sup>/yr by 2010 (NEMA 1999). Compounded by increasing demand from the domestic sector, this will present huge challenges to water resources management and water supply services. In addition, more land is being brought under cultivation in many countries, as part of strategies to increase food production and security. Ethiopia's potentially irrigable land area is 3.7 million ha, of which only 160,000 ha have been developed (Ministry of Water Resources 1998). Ethiopia is considering expanding irrigation activities into the Shebelle and Genale river valleys, with some of the irrigation plans also calling for diversion of streams. This could have adverse effects on downstream water users, and could potentially disrupt hydrological systems and aquatic ecosystem health.

IPCC predicts that rainfall will decrease in the already arid areas of the Horn of Africa, and that

**Figure 2e.7 Water use by sector in Eastern Africa, 1900–2025**



Source: Shiklomanov 1999

drought and desertification will become more widespread (IPCC 2001). As a result of the increasing scarcity of surface freshwater, groundwater aquifers are being mined. Wetlands areas are also being used to obtain water for humans and livestock, and as additional cultivation and grazing land. This alters hydrological cycles, leaving the surrounding area more prone to flooding.



View of the southern end of Lake Turkana in Kenya

### Box 2e.5 Water resources management in Ethiopia

Until the early 1990s, there were eight public agencies involved in the development and provision of water resources in Ethiopia. The National Water Resources Commission was responsible for irrigation. The Water Resource Development Agency was responsible for the design, implementation and operation of large- and medium-scale irrigation projects. The Irrigation Development Department within the Ministry of Agriculture was entrusted with the planning and construction of small-scale irrigation. Feasibility studies and planning of irrigation schemes was undertaken by the Ethiopian Valleys Development Studies Authority and the Water Well Drilling Agency, which took over from the Valleys Development Agency and the Development Projects Studies Authority. The Ethiopian Water Works Construction Agency constructed all water project infrastructure, and the Water Supply and Sewerage Authority supplied water services and sanitation for urban and rural settlements. Not surprisingly, there was often a great deal of duplication of effort and wastage of resources among these myriad, autonomous and semi-autonomous agencies. There was also incomplete geographical coverage of water service provision. In 1994, the Ministry of Water Resources was established as a single, unified public agency responsible for water development in Ethiopia.

Source: Rahmato 1999

Environmental Management Programme (LVEMP) and the Nile Basin Initiative. The LVEMP was established in 1995, with funding from GEF. The focus was primarily on: fisheries management; pollution control; control of invasive weeds; and catchment land use management. The achievements to date include: bio-control of water hyacinth (*Eichornia crassipes*); involvement of local communities in fisheries research and management; and afforestation in the surrounding catchment.

At the national level, policy responses include: revision of water resources development policies; improved reticulation and treatment; and greater involvement of stakeholders in water management and supply. In Kenya, water and sanitation schemes have been commercialized in pilot areas in Kericho, Eldoret and Nyeri. These pilot studies will test whether privatization contributes to meeting the goals of the Kenyan Water Act (Cap. 372), namely, to enhance the provision, conservation, control, apportionment and use of water in Kenya. The international donor organization, SIDA, is also providing support to the government of Kenya to produce a new water policy that will support the rights of villages to own and run their own water systems (SIDA 2000).

Uganda's long-term goal for the water sector is a system of full cost-recovery for services provided, but with the provision of cross-subsidized safe water services for low-income groups. The responsibility for water supply in urban areas has been decentralized away from the national Water Development Department, to local authorities. Safe water and sanitation facilities in Uganda have been improved, although rural supply rates (less than 50 per cent of the population) lag behind urban supply rates (60–75 per cent) (NEMA 2001). A National Wetlands Policy was formulated and passed by the Ugandan government in 1994, calling for, amongst other things: capacity building for wetlands management; public awareness; and wetlands resource assessment. Where housing construction design permits, rainwater is also being harvested.

In 2001, Ethiopia initiated a process to develop a sectoral strategic action plan for the realization of the objectives of the national water policy. The strategy prioritizes the interest and roles of different stakeholders, who are invited to make inputs to the strategy development.

### Access to freshwater in Eastern Africa

Even where freshwater is potentially available, it is not always accessible. In Ethiopia, for example, despite an extensive network of lakes and rivers, only 24 per cent of the country's population has access to clean water, and only 13 per cent in the rural areas (WHO/UNICEF 2000). In Djibouti, by contrast, water supply and sanitation coverage is 100 per cent in both urban and rural areas (WHO/UNICEF 2000). A significant barrier to the effective development of water storage, treatment and supply has been the fragmentation of responsibilities amongst government departments, as illustrated by the Ethiopian example (see Box 2e.5).

### Improving availability and access to freshwater in Eastern Africa

The major international programmes for water resources management in the sub-region are the Lake Victoria



Ostrich and flamingos, Lake Nakuru, Kenya

M&amp;C Denis-Huot/Still Pictures

### WATER QUALITY IN EASTERN AFRICA

A further environmental issue concerning the freshwater resources of eastern Africa is pollution from domestic, agricultural and industrial sources. Low levels of water supply and sanitation, and overburdening of municipal services, create situations where untreated sewage is discharged directly into watercourses, particularly in areas surrounding informal settlements. For example, in Mombasa, the domestic sewerage system was designed to serve about 17 per cent of the current population. The outfalls for both domestic sewage and stormwater run-off are located in the Kilindini and Tudor Creeks, and sludges from septic tanks and pit latrines are usually disposed of at the Kibarani dumpsite on the shores of Makupa Creek (UNEP 1998).

Poor agricultural practices contribute to the pollution of freshwater sources in two ways. Firstly, the increasing use of agrochemicals contributes to the pollution of both surface water and groundwater, through run-off. These chemicals either cause eutrophication (by increasing the nitrogen and phosphorous loads in water bodies), or are toxic to flora and fauna. Unsustainable farming practices and overgrazing increase the susceptibility of the soil to erosion. Increased sediment loads in rivers, in turn, contribute to siltation in dams and lakes, and the smothering of habitats, flora and fauna. Lake Victoria, for example, has become the recipient of increased concentrations of nitrogen and phosphorous, washed

down from the surrounding plantations of tea and coffee. This has led to the invasion and rapid domination of the water hyacinth, *Eichornia crassipes*, which has formed dense mats, blocking navigation channels and choking boat engines. Other adverse impacts of the weed include modification of aquatic and wetland environments, through changing the concentrations of nutrients and dissolved oxygen, as well as reducing the light penetrating below the surface of the lake and releasing toxins. It also reduces the quality of water for drinking and domestic use, and provides an ideal habitat for disease carriers, such as mosquitoes. The Lake Victoria Environmental Management Programme is implementing biological, chemical and mechanical means of controlling the spread of the weed, and the Kisumu Innovation Centre-Kenya (KICK) has initiated marketing a number of crafts made from the weed (Olal, Muchilwa and Woomer 2001).

In 2001 Lake Nakuru and Lake Bogoria in Kenya experienced large numbers of deaths among the flamingos for which the lakes are famous. Pollution by heavy metals is suspected to be the primary cause of these deaths, resulting from contamination of the lakes by sewage, industrial effluent and organochlorines, which are present in agricultural run off (Environment News Service 2001). Industrial developments, particularly in urban centres and along the coast, have inadequate or expensive wastewater treatment facilities and, therefore, discharge of effluents directly into rivers and estuaries is common. The growing level of industrialization in greater Mombasa, for example, is causing considerable concern as a result of effluent discharge. Complex organic compounds and heavy metals may be contained in effluents and spillages from commercial industries and textile mills, which are located along the coast and banks of the Mombasa, Kilindini, and Port Reitz creeks (Mwangi and Munga 1997). A decline in the quality of freshwater creates even greater stress for water supply schemes. It can also limit industrial, domestic and agricultural water use, and it contributes to the prevalence of waterborne diseases.

### Improving water quality in Eastern Africa

Responses aimed at improving water quality and at mitigating the environmental impacts of poor quality water include the promulgation by several countries in East Africa of water quality standards and effluent

- *In 2001 Lake Nakuru and Lake Bogoria in Kenya experienced large numbers of deaths among the flamingos for which the lakes are famous. Pollution by heavy metals is suspected to be the primary cause of these deaths, resulting from contamination of the lakes by sewage, industrial effluent and organochlorines, which are present in agricultural run off*

### Box 2e.6 Wetland rehabilitation in Uganda

Wetlands in Kampala are used by the city council as dumping sites for municipal waste. The associated pollution has rendered these areas unsuitable for wildlife or human settlement. Resultant flooding in the city has led to: the interruption of transport and communications services; loss of property; and outbreaks of waterborne diseases. Kampala is also experiencing increasing numbers of problematic Marabou storks. These birds are wetland species, which have been forced into the city as scavengers, due to the loss of their natural habitat. The storks live on the top of buildings, and constantly dirty the city's streets and roads.

Education and improved town planning are recommended as solutions to the growing problems of wetland destruction and its consequences, together with improved wetland protection and management. Additional measures include the 1971 Ramsar Convention on Wetlands of International Importance, and cooperation in environmental pollution control under the auspices of IGAD.

Source: NEMA 1999

controls. A Water Action Plan, providing a framework for the protection and development of Uganda's water resources, was prepared in 1994, based on the guiding principles of IWRM established at the United Nations Conference on Environment and Development (UNCED) in 1992. Uganda's Water Statute, incorporating many of the recommendations from the Water Action Plan, was promulgated in 1995, and regulations for the control of Water Resources, Water and Sewerage and Wastewater Discharges were issued in 1998. A draft National Water Policy is currently being reviewed prior to submission to The Ugandan government for approval (NEMA 1999). Wetland rehabilitation is also underway, in order to improve water quality and ecological functionality (See Box 2e.6).

Ethiopia's water supply and sanitation sector shows an encouraging participation of communities, for example, through the contribution of beneficiary communities in the development and construction of water supply schemes and sanitation facilities (WHO/UNICEF 2000). Under the Africa 2000 initiative, launched in 1996, a study on low-cost latrine technology options was carried out in 1997, and a study on the impact of water and sanitation-related diseases on development is also nearly complete. Several health education trainers have completed their training and are being deployed.

Kenya's government has formulated a comprehensive water supply, demand and management policy, which was approved by the government in 2001. The policy outlines methods to improve water supply, methods for regulation, pricing and ways to enlist the participation of other stakeholders.

### WESTERN INDIAN OCEAN ISLANDS

Availability of freshwater in the Western Indian Ocean islands is a priority issue, as a result of: variable rainfall and high run-off; increasing domestic, agricultural and industrial consumption; and a lack of storage capacity. Pollution from a variety of sources is contributing to restricted availability of water for human use, and is contributing to environmental degradation. Therefore, implementation of integrated water resource management strategies is a priority in the sub-region.

### AVAILABILITY OF FRESHWATER IN THE WESTERN INDIAN OCEAN ISLANDS

Access to freshwater in the islands of the Western Indian Ocean Islands is complicated not only by variability in rainfall, but also by disparities between the abundance of water and the distribution of the population. Only Madagascar has abundant internal freshwater resources: a total of 337 km<sup>3</sup>/yr (UNDP and others 2000). However, these resources are unevenly distributed across the country due to the terrain, and poor infrastructure development means that large sectors of the population, especially in rural and coastal areas, lack access to water. Mauritius has just 2.21 km<sup>3</sup>/yr, or 1 970m<sup>3</sup>/capita/yr, of freshwater, which is close to the water stress threshold of 1 700 m<sup>3</sup>/capita/yr (UNDP 1998). This poses a challenge for the supply of water to urban centres.

Although the climate in the Western Indian Ocean is humid maritime, most of the rainfall occurs during a few months—December to April. Therefore, many islands experience periods of water shortages. The southwest region of Madagascar is the driest part of the Western Indian Ocean Islands, and experiences periodic drought (UNEP 1999b). In addition, monsoon rainfall and cyclones are common, and much of the water is lost through run-off. Comoros has an almost complete

absence of surface water, because of the high permeability of its soil (UNEP 1999b). Deforestation and the clearing of land has occurred in all the islands, and has contributed to high rates of run-off.

There are many rivers (92 in Mauritius alone), natural and human-made lakes, and considerable groundwater resources in Madagascar and Mauritius, although these have not been evaluated or exploited thoroughly (UNDP and others 2000, UNEP 1999b). Wetlands are also important habitats on all of the islands in the sub-region, providing breeding grounds for large numbers of waterfowl. However, these are coming under pressure for land development, especially in the smaller islands, where tourism and population growth are driving the demand for housing and industry. To date, Madagascar has declared two wetlands as Wetlands of International Importance under the Ramsar Convention, and Mauritius and Comoros have each designated one Ramsar site.

### **Access to freshwater in the Western Indian Ocean Islands**

Data for total annual withdrawals are not available for Comoros or Seychelles but, in Madagascar and Mauritius, withdrawals by all sectors represent a small percentage of annual renewable resources (6 per cent and 16 per cent respectively) (UNDP and others 2000, UNEP 1999b). The agricultural sector is by far the greatest water user, accounting for 99 per cent of all withdrawals in Madagascar and 77 per cent in Mauritius (UNDP and others 2000, UNEP 1999b). This reflects the importance of agriculture in economic development and livelihood subsistence and, in Mauritius, particularly the production of sugar cane, yields of which are among the highest in the world (FAOSTAT 1995). The area under irrigation grew from 12 000 ha in 1970 to 17 500 ha in 1995, most of which was sugar cane (FAOSTAT 1995). In Seychelles, water is used to irrigate orchid farms, as well as food crops, in times of water shortages. Groundwater is largely used for this purpose, as it was on Mauritius until the costs of pumping became prohibitively high (FAOSTAT 1995).

Details of water consumption are not available for the sub-region. However, in Mauritius, the second largest user of freshwater is the domestic sector which accounts for 16 per cent of all withdrawals (UNEP

1999b). This is largely to support the other economic mainstay of Mauritius, namely, the tourism industry, and it has been supported by significant investment in water supply infrastructure. Consequently, 100 per cent of the population, in both rural and urban areas, has access to piped water and improved sanitation (WHO/UNICEF 2000). By comparison, only 47 per cent of the population in Madagascar has access to piped water (although, in urban areas, rates are as high as 85 per cent), and 70 per cent of urban populations and 30 per cent of rural populations have access to improved sanitation (WHO/UNICEF 2000). In Comoros, only 33 per cent of people have safe sanitation (UNEP/COI 1997).

With growing populations, and expansions in tourism and other industrial sectors, the demand for freshwater is expected to increase over the next 25 years in all the Western Indian Ocean states. Supplies per capita in Mauritius are falling, and are predicted to be within water stress levels by 2025 (Johns Hopkins 1998). In Comoros, per capita annual water resources are expected to fall to 760 m<sup>3</sup>, creating a situation of water scarcity (UNDP 1998). In Seychelles, water shortages were so severe during 1998 (due in part to the El Niño Southern Oscillation phenomenon) that brewing and fish canning industries were temporarily closed (UNEP 1999b). This had such an impact on the local economy that the government has since commissioned a water desalination plant, in order to augment supplies. Losses from old water pipes further compound problems of current and future supply, accounting for up to 50 per cent of domestic withdrawals in Mauritius alone (Government of Mauritius 1994). Low storage capacity by households and in the public system aggravates the situation (Government of Mauritius 1994). The dry spells and periodic droughts which are common in Mauritius force water rationing in the north of the island, and increase the risk of contamination through the infiltration of untreated surface water.

The islands of the Western Indian Ocean are extremely vulnerable to climate change, not only in terms of sea level rise and associated loss of land and infrastructure, but also in terms of reduced availability of freshwater. Potential inundation of groundwater aquifers could foreclose options to exploit these resources, and alterations in rainfall quantities and

Sugar cane plantation:  
young crop with  
mature crop behind.

Duncan Smith/Holt Studios



distribution patterns, together with temperature and evaporation changes, may also reduce surface water availability (IPCC 2001).

#### **Improving availability and access to freshwater in the Western Indian Ocean Islands**

These conditions of water scarcity and stress will continue to restrict economic and social development in the sub-region through curtailment of industry, agriculture, tourism and subsistence, unless a dramatic shift in policy is made towards IWRM. Major challenges include: the shortage of freshwater; improvement in freshwater management; and balancing the competing demands of population, agriculture and tourism. At present, an adequate framework of integrated policy is lacking. Water pricing does not reflect the true cost of production and distribution, and the capital cost of increasing supply. Lack of sensitivity to water conservation by industrialists, tourists and local residents exacerbates the problem (UNEP 1999b). Therefore, the priority is demand management, through public awareness and education, as well as through economic incentives. Reforms to date in Mauritius

include: the diversification of crops, away from the heavily irrigation-dependent sugar cane; and conversion to more efficient drip, pivot, guns and sprinklers. Localized irrigation from small impoundments is being encouraged, instead of reliance on large dams that incur higher evaporative losses (FAOSTAT 1995).

Seychelles is looking to increase its crop production through improved irrigation, but also through the use of hydroponics, a technique that is currently under development (FAOSTAT 1995).

#### **WATER QUALITY IN THE WESTERN INDIAN OCEAN ISLANDS**

Problems of water availability are worsened by the contamination of existing supplies by pollution from various sources. Sugar cane production for example, as well as consuming a high proportion of local water, is also a major polluter of water aquifers, as a result of heavy use of chemical fertilizers. Irrigation of other crops also contributes to the contamination of surface water and groundwater resources, through chemical residues, increased silt loads and higher salt concentrations. As rivers and estuaries are drying up, and as nitrate and phosphate levels increase, so they are engulfed by algal blooms and dense mats of water hyacinth (*Eichornia crassipes*). Sewage, wastewater and solid waste dumping are significant contributors to pollution of groundwater, especially in Mauritius (Institute for Environmental & Legal Studies 1998). Some aquifers have nitrate levels of 50 milligrams/litre (mg/l), a level considered a risk to health (Jootun, Bhikajee, Prayag and Soyfoo 1997). This is ecologically detrimental, removing nutrients and dissolved oxygen from the water, and elevating the level of toxins in the water so that it becomes unfit for consumption.

Saline intrusion from the sea is also contaminating underground freshwater supplies in various parts of the sub-region. Sources of industrial pollution include: textile factories; fish processing plants; breweries; and tanneries. In Port Louis in Mauritius, industrial effluent is only pretreated before it is discharged into the sea at only 800 metres (m) from the shore (Institute for Environmental & Legal Studies 1998). Just along the coast, at the Coromandel industrial zone, untreated effluent is discharged only 600 m out to sea, and has

caused the death of the coral reef opposite Pointe aux Sables (Institute for Environmental & Legal Studies 1998). In Madagascar, industrial wastewater receives little treatment, and pollution control legislation does not exist (ONE and INSTAT 1994, ONE 1997). There is no wastewater treatment system in Comoros, and most effluent eventually ends up in the sea (UNEP 1999b).

### **Improving water quality in the Western Indian Ocean Islands**

Improving water availability and quality is now a priority for the sub-region. Water desalination is practised in Seychelles and Mauritius, and Mauritius has a series of projects geared to increasing the volume and quality of water supply in its National Environmental Action Plan (GOM/ERM 1998). Projects for increasing reservoirs and sewage treatment works, and the rehabilitation of old, leaking water systems, are in hand. Metering and charging for water use by volume is being introduced in the region. Legislation for environmental and water protection is in place in most countries. Recycling domestic wastewater for commercial users is projected. Education and sensitization programmes with schools and the media have been introduced (UNEP 1999b). It has yet to be seen whether these separate efforts will be effective in the absence of an integrated sub-regionwide policy framework. The extent of the worsening situation appears to have been underestimated.

## **SOUTHERN AFRICA**

Southern Africa is mostly semi-arid, and experiences variation in rainfall, both over time and between countries. This sub-region is also expected to experience further variability in rainfall, reduced precipitation and increased evaporation, as a result of climate change. With a rapidly growing population, and demands from the domestic, agricultural and industrial sectors for water, freshwater availability is a priority concern for the sub-region. Discriminatory access policies and pricing systems have also skewed the distribution of access to water resources across population groups. An additional concern in the sub-region is declining water quality due to domestic and industrial pollution, and eutrophication and salinization due to agricultural pollution.

### **AVAILABILITY OF FRESHWATER IN SOUTHERN AFRICA**

Southern Africa's annual average surface water resources are approximately 534 km<sup>3</sup>/yr, but they are distributed unevenly due to: frequently low and variable rainfall; terrain; evaporation rates; and vegetation and soil cover. For example, Angola, the wettest country in the sub-region, has average annual internal water resources of 184 km<sup>3</sup>/yr (14 000 m<sup>3</sup>/capita/yr), and Mozambique and Zambia have 100 km<sup>3</sup>/yr and 80 km<sup>3</sup>/yr respectively (5 000 m<sup>3</sup>/capita/yr and 8 700m<sup>3</sup>/capita/yr). By contrast, the driest countries, Botswana and Namibia, have just 2.9 km<sup>3</sup>/yr and 6.2 km<sup>3</sup>/yr respectively (1 700m<sup>3</sup>/capita/yr and 3 500m<sup>3</sup>/capita/yr respectively) (UNDP and others 2000).

The areas of low rainfall are in many cases also coincidental with areas of highest evaporation potential, and variability in rainfall can result in periodic episodes of severe and prolonged droughts, particularly in the southwest. In these areas, groundwater resources are particularly important (see Box 2e.7). By contrast, the northern and eastern areas are subject to occasional floods, the most recent example being in 1999–2000. The excessive rains of this season affected Mozambique, Botswana, Zambia, Zimbabwe and South Africa. Some 200 000 ha of cropland were flooded and more than 150 000 families were affected. The estimated cost of recovery is millions of US dollars (Mpfou 2000). Although the SADC Early Warning

#### **Box 2e.7 Importance of groundwater in Southern Africa**

Groundwater is the main source of water for about 60 per cent of both rural and urban residents throughout southern Africa. A large part of the sub-region is characterized by small towns, villages and dispersed rural settlements. Thus, access to reticulated surface water resources has been limited because of the high costs and long distances that need to be covered in order to establish infrastructure for formal water services. The sustainable management of groundwater is, therefore, important for rural livelihoods in the sub-region, even though the proportion of water coming from groundwater sources is relatively small.

System was able to predict the heavy rains, most countries were ill-prepared for the magnitude and duration of the floods, stimulating investigations and revisions of response strategies.

The sub-region's largest freshwater lake, and the third largest lake in Africa, is Lake Malawi, with a surface area of 31 000 km<sup>2</sup>. The lake is important in terms of fishing activities and the tourist industry which it supports. Lake Malawi has the largest number of fish species of any lake in the world, estimated at more than 500 species, of which 90 per cent are thought to be unique to the lake. The most important species biologically, and in terms of local livelihoods, are the 400 or more cichlid species, of which all but five are endemic to Lake Malawi (Ribbink, Marsh, Ribbink and Sharp 1983). Because of this extraordinary biodiversity, the southern part of the lake is registered as a national park, and was established as a Natural World Heritage Site in 1984. Major rivers include the Zambezi River, whose basin is shared by eight southern African countries and is home to 40 million people. The Zambezi basin also supports many local communities, as well as commercial agriculture and forestry, manufacturing and mining, conservation and tourism (Chenje 2000).

A study of the potential impacts of climate change on freshwater resources in southern Africa predicts an overall reduction in rainfall, by as much as 10 per cent across the whole sub-region, and up to 20 per cent in parts of South Africa (WWF 2000). Evaporation rates will increase by 5–20 per cent, as a result of raised temperatures, which will reduce run-off, and decrease water security and agricultural potential. Coincident with this will be increases

in the frequency and intensity of flooding and drought (WWF 2000). In addition to variability and long-term decline in precipitation, water resources development is further complicated by the uneven distribution of population—particularly, high population densities in arid areas. Per capita average annual water resources in Angola, for example, exceeds 14 000 m<sup>3</sup>/capita/yr whereas, in South Africa, each person has only slightly more than 1 000 m<sup>3</sup> per year (UNDP and others 2000).

Environmental degradation is a further contributor to decline in water availability, through loss of vegetation, and the disruption of microclimates and hydrological cycles. Dense stands of alien vegetation in southern Africa are particularly disruptive in this regard, because they use much larger amounts of water than indigenous species (see Box 2e.8). In some areas of southern Africa, up to 50 per cent of wetlands have been transformed, and the Caprivi wetland system (Namibia) has been reduced to almost 25 per cent of its original size. This has been due to: draining of wetlands, for agricultural or infrastructure development; reduced flows; aquatic weeds choking water courses; increasing use of pesticides; and overextraction of reeds, wood and other materials for construction, weaving and crafts (Chenje 2000). Wetlands act as sponges, absorbing excess water in times of heavy rainfall and, thus, buffering the effects of flooding. To prevent further degradation of these important habitats, two countries of the sub-region, South Africa and Zambia, are parties to the 1971 Ramsar Convention, and have designated certain areas as Wetlands of International Importance.

- *Lake Malawi has the largest number of fish species of any lake in the world, estimated at more than 500 species, of which 90 per cent are thought to be unique to the lake. The most important species biologically, and in terms of local livelihoods, are the 400 or more cichlid species, of which all but five are endemic to Lake Malawi.*

#### **Box 2e.8 Alien invasive vegetation and water use in southern Africa**

Alien invasive vegetation is a significant and growing problem in many areas of southern Africa, especially in riparian zones. The water hyacinth (*Eichornia crassipes*) is choking many water bodies in South Africa, Swaziland, Malawi and Zimbabwe, and exotic timber species, such as pines (*Pinus* sp.) wattles (*Acacia* sp.) and eucalypts (*Eucalyptus* sp) take up more water than indigenous species, thereby reducing mean annual run-off. Zimbabwe and South Africa have initiated biological and chemical control programmes for the water hyacinth,

with some success to date. South Africa's Working for Water Programme, launched in 1995, is a nationwide alien plant control programme, building capacity, and generating employment and incomes among some of the country's poorest communities. The programme uses mechanical, chemical and biological control methods and, during 2000, the teams cleared 238 000 ha and rehabilitated 51 000 ha of land which was infested with alien vegetation. The activities of that year employed 21 000 people.

### Access to freshwater in Southern Africa

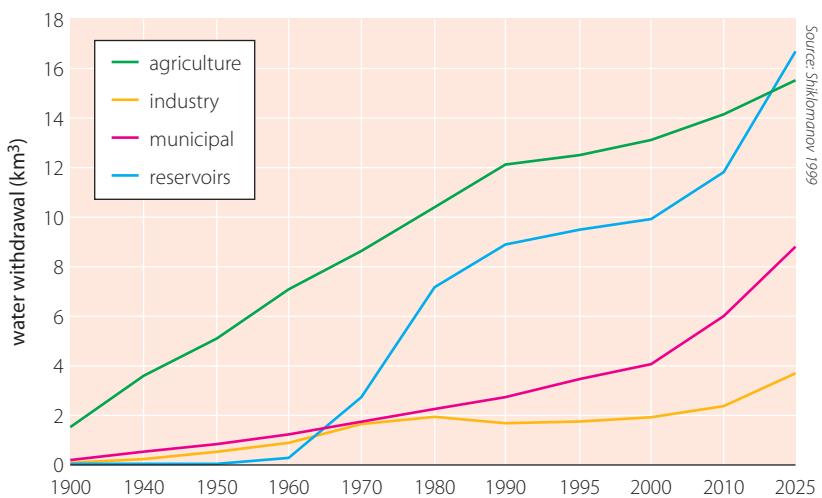
With such intense and varied pressures on freshwater ecosystems, southern Africa faces a serious water supply challenge. This is exacerbated by rapid population growth, high rates of urbanization, and imperatives of economic development and social equity, causing an increase in demand for agricultural, industrial and domestic water uses. At present, agriculture accounts for 74 per cent of southern Africa's total water use, domestic users account for 17 per cent and industry accounts for 9 per cent (UNDP and others 2000). The rapid rise in demand for water is best illustrated in South Africa where, although 4.3 million households do not have water services, the increase in domestic demand over the past four decades has been four times greater than that of the agricultural sector. The domestic demand in South Africa is projected to increase to 23 per cent of the total by 2030, an increase of more than 200 per cent since 1996 (DEA&T 1999). Current projections estimate that serious shortfalls in water provision will occur within the next 10–20 years. Figure 2e.8 shows the current and predicted trends in water use by all sectors in southern Africa.

Some urban water distribution networks in southern Africa are poorly maintained and highly inefficient. In South Africa, for example, the supplier Rand Water estimates that up to 70 per cent of water is lost every year from the Soweto supply, due to leakages, costing US\$100 800 per day (UNCHS/UNEP 2001). Similarly, irrigation is said to be less than 50 per cent efficient, with the majority of farms being irrigated by wasteful flooding and overhead sprinkler systems, while only 10 per cent use the more efficient microjet and drip irrigation systems (Chenje 2000). Mozambique has larger water resources than other countries in the sub-region, yet access to potable and irrigation water is more limited than in the drier countries, mainly due to infrastructure damage from the long civil war (IUCN 2000).

### Improving availability and access to freshwater in Southern Africa

The response to this situation over the past 30 years has been to dam or to modify nearly all the water courses in the sub-region, in order to meet demand. Southern Africa has the highest concentration of dams and interbasin transfer schemes anywhere in Africa

**Figure 2e.8 Water use by sector in Southern Africa, 1900–2025**



(World Commission on Dams 2001). The Kariba Dam, for example, located on the Zambezi River, and shared between Zambia and Zimbabwe, has a capacity of 180 km<sup>3</sup>. With a surface area of some 5 500 km<sup>2</sup>, it is one of the largest dams in the world. It was constructed primarily to provide hydropower to the two countries, and has a generation capacity of 1 320 MW (Soils Incorporated (Pty) Ltd and Chalo Environmental and Sustainable Development Consultants 2000).

Significant strides have been made towards the development of infrastructure for water supply and sanitation services. Access to safe drinking water improved from an average figure of 52.6 per cent in 1990 (WRI, UNEP and UNDP 1990) to 58 per cent in 1998 (WRI, UNEP, UNDP and World Bank 1998). Such access, however, varies between rural and urban areas, with the latter enjoying better access. There are also disparities between countries, with the greatest access to water in Botswana (95 per cent) and the least access in Angola (38 per cent) (WHO/UNICEF 2000). Water policies need revising to redress this issue, combining demand management (using economic incentives to control usage) with meeting basic needs (through improved equity in access and supply). South Africa has enacted such legislation, in the form of the National Water Act, Act 36 of 1998. In Windhoek, Namibia, water tariffs were increased in 1996 by 30 per cent, and household water consumption exceeding 60 m<sup>3</sup>/month was penalized with even higher rates, with the effect of reducing average water consumption by 25 per cent (Eales, Forster and Du Mhang 1996).

- Some urban water distribution networks in southern Africa are poorly maintained and highly inefficient. In South Africa, for example, the supplier Rand Water estimates that up to 70 per cent of water is lost every year from the Soweto supply, due to leakages

In addition, countries of southern Africa have made considerable efforts to cooperate in the management of shared water resources (see Box 2e.9). At the national level, countries have also made a shift towards IWRM and true cost pricing, in order to control demand. Instruments invoked to effect this include the removal of subsidies, and cost recovery from consumers. In Namibia, for example, subsidies—including those on water—accounted for 1 per cent of GDP in 1993 (IUCN 2000), but have gradually been lifted, while, in Zimbabwe, most large-scale and smallholder farmers used not to pay for irrigation water at all. The reuse of wastewater is being increasingly considered as a step towards IWRM in the region. The city of Windhoek already treats and reuses water to supply 19 per cent of the 42 510 m<sup>3</sup> that the city uses every day (IUCN 2000).

### WATER QUALITY IN SOUTHERN AFRICA

Freshwater resources in southern Africa are also under pressure from pollution, and water quality is a growing problem, particularly in urban areas and close to industrial centres. Inadequate sewage treatment and disposal facilities are the main causes of urban water pollution, resulting in localized incidences of high faecal coliform counts. In the Victoria Falls town in Zimbabwe,

for example, faecal coliform counts were found to be 350 times the level in unpolluted water (Feresu and van Sickle 1990). Khami Dam, near the city of Bulawayo, receives a daily discharge of up to 700 m<sup>3</sup> of effluent (Chenje 2000). These bacteria cause intestinal infections and diarrhoeal epidemics, if allowed into drinking water supplies. Diarrhoea is one of the main causes of death in Africa, particularly among children, and the main causes of diarrhoea are poor water quality and sanitation. Contamination of water supplies also creates problems for irrigation and industrial uses, requiring additional processing, which is expensive.

Agricultural run-off is causing accumulation of excess nutrients, such as phosphates and nitrates, in water bodies (eutrophication), as well as sedimentation. This changes the composition and functioning of the natural biota; makes the environment less attractive for recreation and sport; releases toxic metabolites, and taste and odour-causing compounds; and complicates water treatment. In 1996, Lake Chivero, near Harare, experienced algal blooms, infestations of water hyacinth and fish deaths, as a result of high levels of ammonia and low levels of oxygen in the lake (Gumbo 1997). The most likely sources of contaminants are: sewage from nearby settlements; agricultural run-off; and industrial discharges (Gumbo 1997). The Kafue River in Zambia is the recipient of almost all of the 93 000 tonnes (t) of waste from mining, chemical, fertilizer and textile industries (Chenje 2000). Mining activities also contribute to declining water quality and degradation of freshwater habitats. The rivers in Greater Soweto, for example, are heavily polluted by mining drainage water, and show evidence of low pH values, high electrical conductivity and high sulphate values (GJMC 1999). A further source of pollution is from solid waste which has not been properly disposed of, from which pollutants are leached into surface and groundwater. Metals and batteries were found to be prevalent in solid wastes from the town of Kariba, constituting a major input of metals and heavy metals into the Zambezi River (Chenje 2000).

#### Box 2e.9 Mechanisms for international cooperation over shared water resources in Southern Africa

Rising demand for water resources has the potential for conflict between user groups and between countries where water resources are shared. To ensure close cooperation for the judicious, sustainable and coordinated use of shared watercourses, the SADC Protocol on Shared Watercourse Systems was developed and came into force in 1998. In addition to the protocol, there are also several bilateral agreements to facilitate sharing of water resources. These include:

- the Zambezi River Action Plan, between Zambia and Zimbabwe;
- the Permanent Okavango River Basin Water Commission;
- the Joint Permanent Technical Commission Over the Lesotho Highlands Water Project; and
- the Permanent Joint Technical Commission on the Cunene River.

Cooperation has also been developed in the areas of research and hydro-meteorological data, through SADC-HYCOS. Whilst there is commitment and cooperation at the sub-regional political level, further capacity needs to be built, in order to effectively implement the tenet of shared water management at grassroots level.

### Improving water quality in Southern Africa

The heads of state of the southern African countries recently made a decision to bring forces together, in order to develop a holistic regional strategic approach to IWRM and development in the region. This resulted in the formulation of the Regional Strategic Action Plan

in 1997, and represents a significant commitment towards meeting the challenge of providing adequate water service and supply in the sub-region, as well as protection of the environment. The Regional Strategic Action Plan reaffirms the importance of the sub-region's water resources, and its influences on all aspects of the region's economic and social performance. Other initiatives that have occurred in the sub-region in the water sector, in a bid to achieve regional integration, include the Water Weeks, instituted by SADC. The Water Weeks comprise a series of national workshops aimed at informing key stakeholders about SADC-wide water initiatives, and to involve them in discussions about the implementation of these initiatives.

Effluent water standards have been established and implemented in South Africa and Namibia, as measures to control water quality. In South Africa, in addition to a General Effluent Standard, there is a Special Effluent Standard, designed to protect mountain streams that can support trout (Water Act 54 of 1956). A National River Health Programme has also been implemented, in order to provide regularly updated information on the biological health of river systems in South Africa, and to provide recommendations for IWRM at the catchment level. The National River Health Programme is also responsible for a series of 'State of the Rivers' reports, which present the information in a user-friendly manner.

## CENTRAL AFRICA

Central Africa rarely experiences problems of water availability, because rainfall is high and generally predictable. However, there is growing competition between user groups, and access to water, particularly in rural areas, is seen as a priority for development. Localized problems of water quality are being raised, especially in coastal areas, where industrial, agricultural and domestic wastewater discharges are high, and where there is an additional threat of saltwater intrusion.

### AVAILABILITY OF FRESHWATER IN CENTRAL AFRICA

With the exceptions of the deserts of northern Chad and the Sahelian parts of northern Cameroon and central Chad, the central Africa region is well-endowed with

water resources. The total annual renewable resources for the region in 2000 were estimated at 1 775 km<sup>3</sup>/yr (UNDP and others 2000). There were significant variations between countries however, with the DRC having the greatest water resources (935 km<sup>3</sup>/yr or 18 000 m<sup>3</sup>/capita/yr), and Chad being the driest country (15 km<sup>3</sup>/yr or 1961 m<sup>3</sup>/capita/yr) (UNDP and others 2000). Although water use has been on the increase, water deficit is generally unknown in the region. The Congo River basin is the largest in Africa, covering 12 per cent of the region, and is shared by nine countries. The water resources of this area are vital to support livelihoods and economic development, in particular, by providing irrigation water for the cultivation of cash crops. There is some inter-annual variation in rainfall in Central Africa, where flooding is more common in the humid zone. Only in Chad and northern Cameroon is drought a serious threat, and drought frequency has increased over the past 30 years (IPCC 1998). In 1973, drought killed 100 000 people in the Sahel, and even countries in the humid zone suffered lowered rainfall and reduced crop yields (Gommes and Petrossi 1996).

The Lake Chad basin is a depression of the seven countries grouped around it, forming a freshwater lake (the Conventional Basin), which is shared by Cameroon (9 per cent), Chad (42 per cent), Niger (28 per cent) and Nigeria (21 per cent). Lake Chad is an important source of water and economic activities, including agriculture and fisheries. Satellite images show that the lake has shrunk considerably over the past 30 years, and is now 5 per cent of its former size, due to persistent low rainfall in the region. IPCC predicts reduced rainfall and run-off, and increased desertification, risks in the Sahelian belt (IPCC 2001), which could mean further reductions in the size of the lake. This would threaten the livelihoods of fishermen and farmers in the region, and poses a challenge for IWRM and international cooperation to ensure sustainability of the resource.

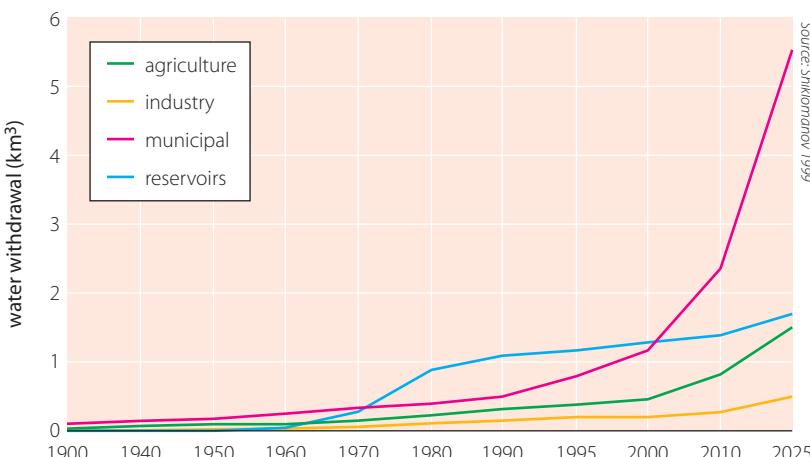
### Access to freshwater resources in Central Africa

In 1998, the annual withdrawal of freshwater for central Africa was estimated to have been less than 1 per cent of the total available. However, the uneven distribution of water resources, with respect to time and population distribution, has created challenges for water supply. The traditional response to this challenge has been to dam rivers and to distribute water to the people, rather

than resettling people closer to water resources. The DRC has 14 dams, Cameroon has nine, and Gabon and Congo each have two. Their main functions are to provide water for domestic consumption, and to provide hydroelectric power, although it is estimated that only half the potential for hydroelectric power is exploited (WRI, UNEP and UNDP 1992). Because of the relatively high reliability of rainfall in this sub-region, irrigation is not always required, and the agricultural sector only consumes 33 per cent of all withdrawals, whereas the domestic sector accounts for more than 50 per cent of all withdrawals (UNDP and others 2000, Shiklomanov 1999). Despite these efforts to provide water to municipalities in central Africa, there are significant shortfalls, for example, in Chad, where only 27 per cent of the population has access to improved water sources (WHO/UNICEF 2000).

The reasons for the relatively low access to water in the sub-region include poor economic growth and, thus, low investment in infrastructure development and maintenance, as well as rapid population growth and migration to urban centres. The demand for water for domestic use is predicted to increase fivefold over the next 25 years, due to population growth and increases in per capita consumption (see Figure 2e.9). Significant improvements to the existing infrastructure and supply networks are thus required, in order to improve access to potable water over the next 20–30 years. Increasing demand from other sectors is also expected, as agricultural and industrial developments expand to meet economic growth imperatives.

**Figure 2e.9 Water use by sector in Central Africa, 1900–2025**



### Improving availability and access to freshwater resources in Central Africa

The increases in demand for water in central Africa are unlikely to lead to conditions of water stress or water scarcity, because the estimated withdrawals are still small compared to the available resources. However, reductions in rainfall related to climate change are expected in parts of northern Cameroon and Chad, and this will exacerbate already inadequate water supply systems. Therefore, localized problems of water supply may be exacerbated. In addition, further studies are required to investigate the ecological consequences of damming rivers, diverting flows and abstracting water, before ecologically and socially acceptable standards can be established.

Cameroon, Chad, Niger and Nigeria formed the Lake Chad Basin Commission in 1964, and were later joined by Central African Republic in 1999. The objective of the Lake Chad Basin Commission is to ensure the most rational use of water, land and other natural resources, and to coordinate regional development. In March 1994, the commission approved the Master Plan for the Development and Environmentally Sound Management of the Natural Resources of the Lake Chad Conventional Basin. This document consisted of 36 projects relating to: water resources; agriculture; forestry; biodiversity management livestock; and fishery developments. Funding was made available through the GEF, in order to coordinate these projects by means of: the establishment of joint regulations on the development and use of resources; information collection and sharing; and joint actions and research programmes. An international campaign to save Lake Chad was also launched. In July 2000, the Lake Chad Basin Commission states met, and agreed on a proposal to establish the whole of Lake Chad as a transnational Ramsar site. Other projects agreed to include the development of an Inter-basin Water Transfer Scheme, and strengthening of Joint Patrol Teams (Lake Chad Basin Commission 2000).

### WATER QUALITY IN CENTRAL AFRICA

Freshwater quality in parts of central Africa is declining, as a result of: pollution from industrial and sewage outflows; agricultural run-off; and saltwater intrusion.



The Kouiloo River, Congo—one of many rivers in the coastal area of Central Africa facing contamination by industry and siltation from excessive soil erosion.

*Michel Gunther/Still Pictures*

The Congo River has been recognized as one of the cleanest in the world, due to the absence of industry, large urban settlements and agriculture along its banks (Johnson 1999). However, coastal areas are experiencing run-off and effluent from neighbouring agro-plantations and industries, which contaminate rivers, marshes and groundwater reserves. Clear felling in the hinterland also contributes to high rates of soil erosion, and to the siltation of rivers and estuaries. In particular, the Lobe and Kienke rivers (Cameroon) are especially high in sediment, which is deposited in the coastal zone and prevents the development of reef-building coral (World Bank 2000). Salinization occurs where freshwater sources come into contact with brackish or saltwater. The coastal industrial town of Douala in Cameroon has problems with the salinization of drinking water from aquifer resources, because rising sea levels facilitate permeation of underground aquifers by seawater. There is also inadequate provision of sanitation for the city's 1.4 million inhabitants, and raised nutrient levels are recorded in the estuary, as result of sewage discharge (Gabche and Smith 2001).

Coastal freshwater resources are further threatened by sea level rise, which the IPCC predicts could be as much as one metre by 2100 (IPCC 2001).

The impacts of declining water quality are both ecological and social, with the contamination of freshwater habitat resulting in: losses of biodiversity; regulation of water flow; and reduced availability of exploitable water for domestic, industrial, agricultural and recreational functions. There are also heightened risks of waterborne diseases associated with lack of potable water and sanitation, and costs of water treatment are increasing at a time when investment in this sector is already inadequate. For example, the drinking water supply in Yaounde, Cameroon, experiences occasional shortages and interruptions, driving many people to fetch water from alternative sources, such as springs and wells. A recent study of the bacteriological status of fifteen of these wells and springs revealed high densities of faecal bacteria and, thus, high risk of disease (Nola, Njine, Monkiedje, Sikati, Foko, Djuikom and Tailliez 1998). Several wetlands in the region have been degraded, due to the construction of dams and irrigation schemes, which divert water, and thus alter hydrological regimes. The reduction in water flow, and the increased silt and nutrient levels from agricultural return flows, have resulted in loss of favourable habitat and breeding grounds, and several wetland species have been lost.

### Improving water quality in Central Africa

In response to pressures affecting water quality, many programmes and actions are under way in central Africa. These include: schemes for the drainage, purification and decontamination of freshwater systems; water management programmes; public awareness campaigns; ratification of relevant regional and transfrontier conventions for water resources protection and management; and efforts to implement water quality standards and control. National and international organizations have been instrumental in water supply and sanitation projects at the local level, and vehicles for international cooperation have been established for management of shared water resources. The Gulf of Guinea Large Ecosystem Project, for example, includes the management of land-based activities which contribute to declining water quality. The GEF-funded Reversal of Land and Water

### Box 2e.10 Wetland rehabilitation in Cameroon

Each year, the Logone River (Cameroon) floods an area of about 6 000 km<sup>2</sup>. This wetland supports large herds of giraffe, elephant, lions and various ungulates (including topi, antelope, reedbuck, gazelle and kob). Part of the floodplain has been designated as the Waza National Park, which attracts thousands of tourists per year, and which serves as a fish nursery in the flood season. Livestock grazing is also an important activity, supporting the livelihoods of many local communities. However, the wetland has been significantly reduced in size since the construction of a barrage across the floodplain in 1979.

This barrage created Lake Maga, which supplies water for the irrigation of nearby farmland. Fish stocks fell by 90 per cent, and grazing potential has decreased, impacting on local livelihoods. Plans to rehabilitate the wetland were established in 1993, and the embankments along the river were modified at an estimated cost of US\$5 million over eight years. Stakeholders and local community members were involved in the planning and design of the project, which reinundated several thousand hectares of land. Small-scale fishing activities have recommenced, and clean water has been supplied to 33 villages from 37 wells. Together with training in health and sanitation, this has succeeded in lowering the incidence of diarrhoea by 70 per cent.

Degradation project has been initiated through the WB, in order to improve the management of resources in the Lake Chad basin. Gabon now has three Ramsar sites, following ratification of the Ramsar Convention in 1987 (Ramsar 2001), and Cameroon is undertaking the rehabilitation of wetlands that were compromised due to inappropriate development policies (see Box 2e.10).

Between 1990 and 2000, the percentage of the population with access to potable water supply increased from 52 per cent to 62 per cent in Cameroon, and from 59 per cent to 60 per cent in Central African Republic (WHO/UNICEF 2000). Access to sanitation has shown very slight increases, and rates are still far below other countries in Africa. Continued increased investment in this area is required, in order to mitigate pollution and the outbreak of diseases arising from inadequate sanitation and wastewater treatment.

## WESTERN AFRICA

Most Western African countries are well-endowed with freshwater, except for those bordering on the Sahel, which frequently experience drought. Accessibility to freshwater and its integrated management nonetheless

remain major concerns in western Africa. Inappropriate management of freshwater, and competition between user groups, limit efforts by governments and the international community to encourage economic development and to improve the standard of living in western Africa. There are also rising concerns over freshwater quality, in terms of pollution from domestic effluents and industrial wastewater, particularly in the coastal zone.

### AVAILABILITY OF FRESHWATER IN WESTERN AFRICA

With the exception of Cape Verde, all the countries in the sub-region share surface water resources with one or more other countries. The sub-region is drained by three major basin systems. The Niger basin drains an area of 2 million km<sup>2</sup> (33 per cent of the total surface area of the sub-region), and involves 9 of the 16 sub-regional countries, including Cameroon and Chad. Other important basins are: the Senegal basin, shared by four countries; the Gambia basin, shared by three countries; the Bandama basin in Côte d'Ivoire; the Comoe basin, shared by four countries; and the Volta basin, shared by five countries. The sub-region's freshwater resources are unevenly distributed between countries. Liberia, for example, has internal renewable water resources of more than 63 000 m<sup>3</sup>/capita/yr, and Mauritania has only 150 m<sup>3</sup>/capita/yr (UNDP and others 2000). Temporal variation in rainfall is common throughout the sub-region, but only those countries in the northern Sahelian zone (Mali, Mauritania, and Niger) regularly experience drought, whilst countries in the wetter coastal belt are periodically affected by floods.

Three major types of groundwater aquifers are observed in the region, namely: basement aquifers; deep coastal sedimentary aquifers; and superficial aquifers. The availability of groundwater varies considerably from one type of substrate to another, and according to the local levels of precipitation and infiltration, which determine the actual recharge. In Mauritania, for example, internal renewable groundwater resources are estimated at 0.3 km<sup>3</sup>/yr (FAOSTAT 1997), and these are important sources of water for domestic use, irrigation and livestock watering. About 400 000 people live in the 218 oases, and are dependent on 31 400 wells,

extracting the water manually (FAOSTAT 1997). The water is used to irrigate 4 751 ha of palm trees, with 244 ha of annual crops under them (FAOSTAT 1997).

Six Western African countries are expected to experience water scarcity by 2025, namely: Benin; Burkina Faso; Ghana; Mauritania; Niger; and Nigeria (Johns Hopkins 1998). Climate change is predicted to bring about reduced rainfall and increased evaporation in the areas to the north, advancing the rate of desertification in the Sahel (IPCC 2001). Countries in the coastal zone may experience more intense rainfall and increased run-off. Combined with existing high rates of deforestation and degradation of vegetation cover, this could have serious consequences for soil erosion and agricultural productivity.

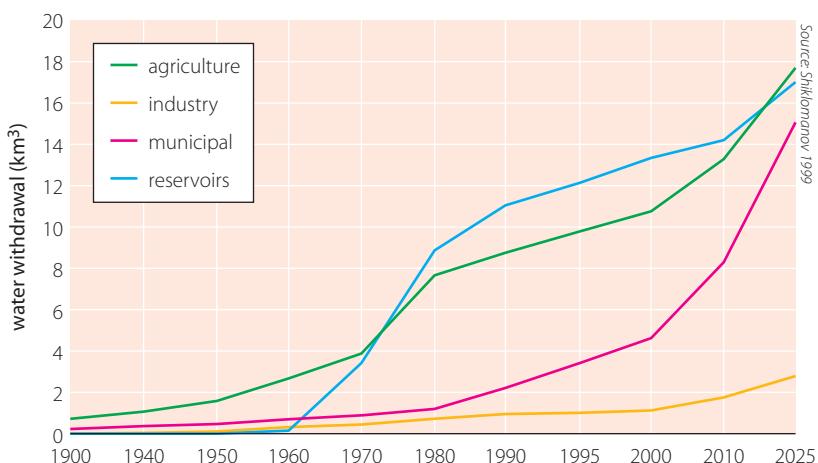
### **Access to freshwater resources in Western Africa**

Demand for water has been steadily increasing in all sectors, as a result of population growth; commercial agricultural expansion; and industrial development. Current total withdrawal of water for domestic, industrial and agricultural consumption is 11 km<sup>3</sup>/yr, and demand for water from all sectors is expected to increase to some 36 km<sup>3</sup>/yr by 2025, as shown in Figure 2e.10 (UNDP and others 2000, Shiklomanov 1999).

The Volta and Niger rivers have been dammed to supply water for irrigation and domestic consumption, as well as to generate hydroelectric power. However, this has created problems of accelerated erosion in the coastal zone, as well as marginalization of pastoralists, who are dependent on seasonal floods (for example, Acreman 1999). Despite agriculture being the largest water user, accounting for 70 per cent of all withdrawals in the sub-region in 1995 (Shiklomanov 1999), irrigation potential remains largely untapped, especially in the Sudano-Sahelian zone, where only 16 per cent (5.3 million ha) of potentially irrigated lands have been developed (Falloux and Kukendi 1988).

Access to piped water and sanitation also remains low, despite considerable improvements during the International Drinking Water Supply and Sanitation Decade (1981–1990). In 2000, total water supply coverage was highest in Senegal (78 per cent) and lowest in Sierra Leone (23 per cent), with most urban areas in the sub-region better supplied than rural areas (WHO/UNICEF 2000).

**Figure 2e.10 Water use by sector in Western Africa, 1900–2025**



### **Improving availability and access to freshwater resources in Western Africa**

IWRM is recognized as a priority for western Africa. However, its implementation has been constrained by a number of factors. The main obstacles are limited technical skills in the sub-region, coupled with the complexity of the integrated approach. In addition, the increasing demand for water, freshwater pollution and disruptions to the hydrological cycle have complicated water resources management. The deterioration of most of the infrastructure for hydrometeorological and hydrogeological data collection, compilation, analysis and dissemination, as well as lack of funding, have led to poor maintenance. This situation is aggravated by political instability, due largely to armed conflicts, ethnic strife and inadequate grassroots participation in decision making. However some countries have adopted strategies on IWRM and development, or have enacted water laws and established institutions to enforce the laws. Economic incentives for water demand management have been successfully implemented in some areas, for example, Conakry, Guinea (see Box 2e.11).

A recent project to improve water supply to 90 villages in Mauritania has demonstrated the importance of the involvement of community members in the design, establishment and maintenance of facilities. This UNDP-funded programme created a private network for the construction and maintenance of water

**Box 2e.11 Private sector involvement in water services in Western Africa**

In 1998, 50 per cent of all the water pumped in Conakry (Guinea), was unaccounted for, and only 10 per cent of water bills were collected. Since a private company took over the management of water services in the city in 1989, water losses have been halved, and 85 per cent of bills are now paid. In Lomé (Togo), the public water utility has recently undergone improvements. Losses are now only 20 per cent, almost all water bills are paid and water subsidies are not required.

Source: Ménard and Clarke, 1996

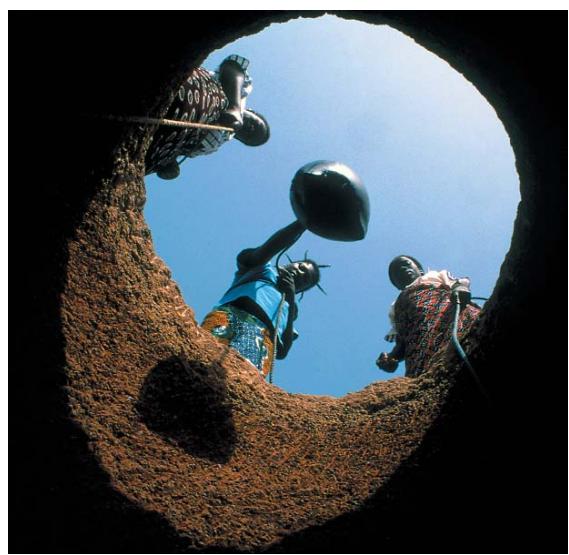
supply equipment, providing employment to the community, and ensuring back-up supplies of spare parts. A water-point committee was also established in each village, in order to take responsibility for management and maintenance costs, and local people were trained to repair the equipment. On completion of the project, more than 90 per cent of the villages were independently funding the maintenance of their pumps, with help from the people trained during the project (UNDESA 2000).

There is also a growing tendency in the countries of Western Africa to intensify monitoring, assessment and policy reform for the water resources sector. New measures are being introduced for water conservation and the development of infrastructure, in order to improve the integration of water and land management. Furthermore, during the past three decades, numerous intergovernmental organizations responsible for the development and management of shared rivers in the region have emerged (in particular, for the management of the Senegal, Gambia and Niger rivers), although their actual performance remains far below their potential.

### WATER QUALITY IN WESTERN AFRICA

Rising levels of pollution of surface and groundwater resources in the sub-region compounds inadequate access to freshwater. The primary sources of pollution are sewage and industrial effluents. Agricultural run-off is an additional burden, through contamination with chemical residues and silt, and increased nutrient levels. This is particularly noticeable in the coastal areas of western Africa, where most industries and commercial agricultural plantations are located. Coastal wetlands, which are particularly sensitive to pollutants, are experiencing severe degradation. The Korle lagoon in Accra, Ghana, for example, is one of the most heavily polluted wetlands in western Africa, receiving effluents from solid waste dumps, industries, sewage outfalls, and agricultural run-off. Effluents washed out to sea are also having a negative impact on coastal and marine habitats, and are posing a health risk to humans (IDRC 1996). In recent years, 36 wetlands in western Africa have been designated as Wetlands of International Importance under the 1971 Ramsar Convention, including six sites in Ghana and six in Guinea (Ramsar 2001).

Degradation of water quality inland also creates problems for domestic, industrial and agricultural users. In Yeumbeul, Senegal, 7 000 households are dependent on a groundwater source that was recently found to harbour nitrate concentrations well above WHO's guideline of 50 mg/l. Two sources of contamination were identified, namely: shallow nearby latrines; and waste organic matter carried in groundwater (Tandia, Diop and Gaye 1999). Diarrhoea, ascariasis (roundworm), dracunculiasis



Women collecting water from a village well in Burkina Faso

Glen Christian/Still Pictures

(guinea worm) and schistosomiasis (bilharzia) are among the most prevalent waterborne diseases, and are associated with standing water, and lack of safe drinking water and sanitation.

### **Improving water quality in Western Africa**

The Africa 2000 initiative of the WHO Africa Regional Office has seen considerable gains in water supply and sanitation in western Africa. For example, in Ghana, Drinking Water Quality Guidelines are the same as WHO guidelines, and disinfection of drinking water has 100 per cent coverage in Accra. A new policy on water and sanitation provision, introduced in 1993, encourages user communities to become more self-reliant, especially in rural areas, where the provision of services is through community ownership and management of the facilities. In Mauritania, gains under the Africa 2000 initiative include: a research programme to optimize water treatment with the use of appropriate technology; and training of water treatment plant operation and maintenance technicians. Training of hygiene workers in water quality analysis, and the promotion of a hygiene education programme in villages, schools and urban areas, has resulted in several latrines being built in schools and individual households.

A number of Western African countries are members of the African Union of Water Distributors, namely: Benin; Burkina Faso; Côte d'Ivoire; Ghana; Guinea; Liberia; Mali; Mauritania; Niger; Senegal; and Togo. The African Union of Water Distributors has been instrumental in improving water exploitation, distribution and pricing among member states. Western African states have also formed a water research organization, the Inter-African Committee for Hydrology Studies, based in Ouagadougou. This committee deals with extension work to spread new technologies and information concerning water in Africa (Biémi 1996).

Countries of western Africa would benefit from developing and enforcing effective water pollution prevention and control programmes which combine strategies for reducing pollution at source, prior to EIAs of new developments. Criteria for monitoring the biological, physical and chemical quality of water bodies need to be established, and mechanisms need to be put in place to address deviations from standards. Above all, water resources require integrated

management, with the participation of all stakeholders in decision making and management, and with the inclusion of the environment as a legitimate water user. International water-quality monitoring and management programmes—such as the Global Water Quality Monitoring Programme, the UNEP Environmentally Sound Management of Inland Waters and the Food and Agriculture (FAO) Regional Inland Fishery Bodies—provide support and coordination for such activities.

### **CONCLUSION**

Africa's water resources are characterized by extreme variability, both over time and space. Rainfall varies from less than 20 mm/yr in the arid countries encompassing the Sahara desert to more than 1 000 mm/yr in the humid tropical belt of western, eastern and central Africa. Inter-annual variations can be extremely high, and drought and/or flooding is common in most African countries. The cost of such extreme events runs to millions of dollars every year, a price that many African countries cannot afford either to incur or to prevent.

Natural climatic variations, and the location of major urban and industrial centres in dry or water-stressed areas, presents a formidable challenge for water service providers. With anticipated increases in unpredictability and variation in precipitation due to global climate change, and increases in demand from a rapidly growing population and economic developments, the way in which water resources are managed in Africa needs to be radically reformed in order to meet the goal of equitable access to sufficient water of acceptable quality, and to facilitate agricultural and industrial development. (See Box 2e.12.)

Increases in demand for freshwater are anticipated in all African countries, in all sectors (domestic, agricultural and industrial), over the next 10 years. In some countries, demand is projected to double within the next 30 years. This arises not just from an increase in the number of people requiring water, but also from increasing consumption patterns, especially among the wealthier communities. Likewise, industries rarely pay the true price of water and are, therefore, not encouraged to recycle or to reduce their consumption. Surface and groundwater

- *Increases in demand for freshwater are anticipated in all African countries, in all sectors (domestic, agricultural and industrial), over the next 10 years. In some countries, demand is projected to double within the next 30 years*

### Box 2e.12 Attaining Africa's water vision

In order to achieve Africa's water vision of sustainable access to clean, safe water for all, various reforms to water policies and management strategies are required. The most important of these, which will be monitored according to a series of milestones over the next 25 years, are: political commitment and support at the grassroots level, together with openness and accountability in decision making; enhanced information gathering and dissemination; regional cooperation and decisive action; and sustainable financing and cost recovery methods.

Source: World Water Council 2000

- *Most African countries cite declining water quality as a priority issue for the environmental and developmental agenda. The most common sources of freshwater pollution are sewage, industrial effluents and agricultural run-off. They are due, in large part, to inadequate wastewater treatment facilities, as well as to ineffective pollution control*

supplies have been exploited, and some countries have turned to alternative sources of water, in order to attempt to meet this increasing demand, including desalination of seawater and recycling of wastewater.

Most African countries cite declining water quality as a priority issue for the environmental and developmental agenda. The most common sources of freshwater pollution are sewage, industrial effluents and agricultural run-off. They are due, in large part, to inadequate wastewater treatment facilities, as well as to ineffective pollution control.

The principles of IWRM have been widely adopted in Africa, as a systematic approach for tackling the technical, hydrological, economic, environmental, social and legal aspects of water quality and supply problems. A central tenet of IWRM is to move away from supply management methods, such as the construction of dams, towards demand management methods, such as removal of water subsidies and the enforcement of polluter payments. IWRM also requires the joint management of water resources by all users, from local communities to water service providers, municipalities, industries and agricultural organizations. Although adopted in principle in the region, implementation of IWRM has, to date, been impeded by: capacity constraints; lack of financial resources; institutional fragmentation; poor availability of information; and lack of commitment by various partners.

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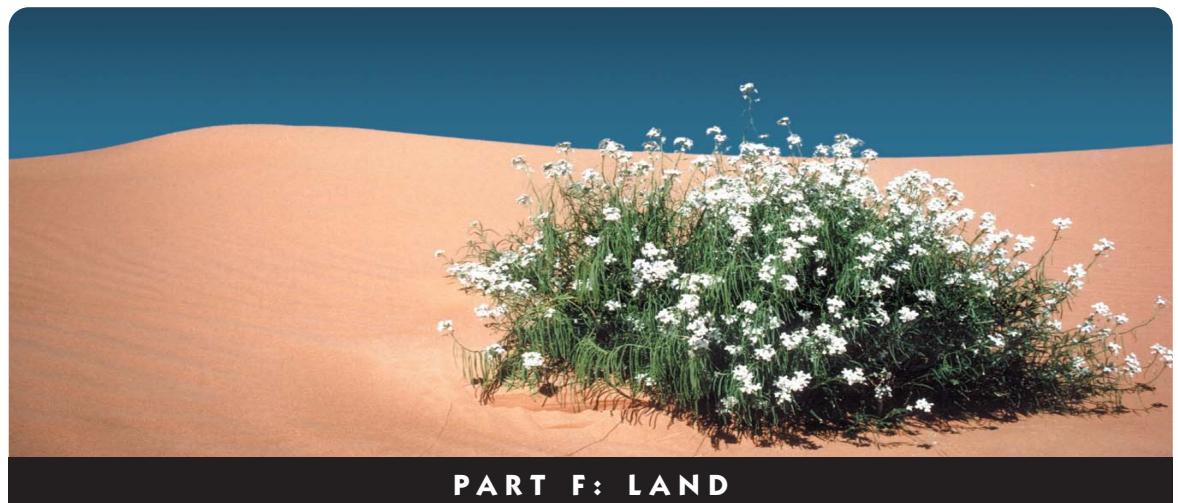
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PART F: LAND

UNEP

## REGIONAL OVERVIEW

Stretching 7 680 km north to south and 7 200 km from east to west, Africa is the second largest region in the world, accounting for 20 per cent of the world's land mass (2 963 313 000 hectares (ha)) (FAOSTAT 2001). Some 66 per cent of Africa is classified as arid or semi-arid, and the region experiences extreme variability in rainfall (UNEP 1999a). Climatic regimes are roughly symmetrical around the equator, and are mirrored in the pattern of vegetation. Thus, dense tropical forests are found in the high-rainfall equatorial belt, with a gradient to both north and south, through savannas, grasslands and deserts. Approximately 22 per cent of Africa's land area is under forest (650 million ha), 43

per cent is characterized as extreme deserts (1 274 million ha), and 21 per cent (630 million ha) is suitable for cultivation (FAO 2001a, Reich, Numbem, Almaraz and Eswaran 2001, UNEP 1999a). By 1999, it was estimated that about 200 million ha (32 per cent of the suitable area) had actually been cultivated (FAOSTAT 2001). At the same time, it was estimated that 30 per cent of the total land area (892 million ha) were being used as permanent pasture (FAOSTAT 2001).

Africa has abundant natural terrestrial resources and potential for economic, social and environmental development. Patterns of land use in Africa are equally diverse and complex, extending beyond agriculture (which, in this context, refers to both cultivation of crops and rearing of livestock). However, many of these have

- The contribution of agriculture to the formal economy and to employment in many African countries, although substantial, does not take account of the significant contribution of small-scale cultivation and livestock production to livelihoods*

been discussed in other sections of this chapter, and the key issues identified for this section are land quality and productivity, and land tenure, as they relate to food production systems and food security. Figure 2f.1 shows the different types of land cover and patterns of land use in Africa.

The people of Africa are largely rural, and they traditionally practice small-scale cultivation, or pastoralism, which is more common in the more arid areas of northern, eastern and southern Africa. Pastoralists herd cattle, camels, sheep and goats, and migrate according to the seasonal abundance of fodder for the livestock. Although men and women both play important roles in agriculture, the production and preparation of food for the household is the main activity for most rural women (FAO 2001b). Cultivation is also an important means of supplementing diets and incomes in urban areas, and urban agriculture is growing faster in Africa than in any other region of the world (Asomanigbo and Boateng 1999, Mougeot 1998). Other land resources are also widely used, both at the household level and commercially. These include: medicinal products; raw materials for construction and crafts; bushmeat; and wood for fuel. Together, they contribute up to 50 per cent of household food requirements and up to 40 per cent of household incomes (for example, Ashley and LaFranchi 1997, Cavendish 1999). This direct dependency of most Africans on land, and the heavy economic dependence of many African countries

on agricultural (as well as mineral) resources, create a unique regard for land in Africa, as well as unique production pressures and competition for resources.

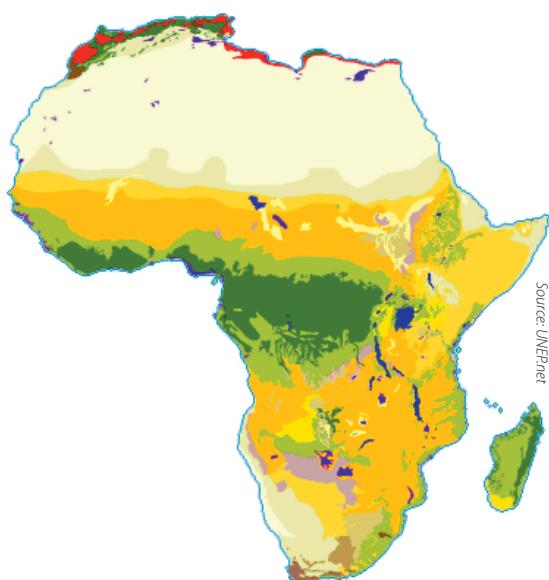
## THE REGIONAL IMPORTANCE OF CULTIVATION AND LIVESTOCK PRODUCTION

The contribution of agriculture to the formal economy and to employment in many African countries, although substantial, does not take account of the significant contribution of small-scale cultivation and livestock production to livelihoods. Nor does it represent the cultural value of terrestrial resources (particularly livestock), or the ways in which traditional practices have shaped the environment. In many countries, for example, cattle provide the primary source of dietary protein, are traded for cereals, and contribute to the ploughing and fertilization of cultivated areas (FAO 1997a). Thus, the total value of terrestrial resources is much greater than reflected in the figures that follow below.

Agriculture employs the largest number of workers, and generates a significant share of gross domestic product (GDP) in many African countries. In 1990, the agricultural sector accounted for 68 per cent of the workforce in sub-Saharan Africa, and 37 per cent of the workforce in northern Africa. This compared with industry, which accounted for 9 per cent and 25 per cent of the workforce respectively (World Bank 2001). In 1999, agriculture contributed more than US\$64 484 million to the economy of sub-Saharan Africa (18 per cent of GDP for 1999), and US\$26 188 million to northern Africa (13 per cent of GDP in 1999) (World Bank 2001).

The main commercial crops grown in the region are: cereals; cocoa; coffee; cotton; fruit; nuts and seeds; oils; rubber; spices; sugar; tea; tobacco; and vegetables. These contribute significantly (alongside minerals and metals) to exports and foreign exchange earnings. In 2001, for example, Africa produced 67 per cent of the world's cocoa, 16 per cent of the world's coffee, and 5 per cent of world's cereal production (FAOSTAT 2001). Livestock and livestock products contribute about 19 per cent to the total production value from agriculture, forestry and fisheries in sub-Saharan Africa (FAO 1997a). Animal production is highly skewed towards the drier regions, with Ethiopia, Kenya, Nigeria, Sudan and Tanzania accounting for 50 per cent of Africa's animal production (FAO 1997a).

**Figure 2f.1 Map of land cover and use in Africa**



This dependency on agriculture was highlighted by a World Bank (WB) study in 1993, which found that a 1 per cent growth in agricultural production in Africa can stimulate 1.5 per cent overall economic growth, due to positive impacts on industry, transport and other services (World Bank 1993a). Agriculture has, therefore, been the focus of strategies and hopes for economic development over the past three decades (for example, African Development Bank 1998). However, the full potential for development in agriculture has not been realized.

Most agriculture in Africa is rain-fed (except in northern African countries and the Western Indian Ocean Island states, where irrigation potential has been well developed), and most African countries experience large inter-annual and intra-annual variations in rainfall, with frequent extremes of flooding or drought. Thus, vulnerability to crop failure translates into economic insecurity. In addition, African farmers have been heavily taxed through price-fixing, export taxes and taxes on agricultural inputs, whilst countries outside the region have enjoyed massive subsidization (Wolfensohn 2001, World Bank 1994, Oyejide 1993). Furthermore, many African economies are dependent on a narrow range of agricultural commodities, creating greater vulnerability to failure (resulting from outbreaks of pests, climatic variations, price fluctuations and so on). For example, the same nine commodities (banana, cocoa, coffee, cotton, groundnut, rubber, sugar, tea and tobacco) accounted for 70 per cent of the region's agricultural exports over the period 1970–1995 (Oyejide 1999). Between the 1960s and the mid-1990s, a number of economic shocks hit Africa's agricultural base, with the result that market share for a number of commodities declined sharply, including: cocoa (for which market share declined by 50 per cent); coffee (42 per cent); and cotton (35 per cent). Groundnuts suffered the most dramatic decline in market share, from 70 per cent to just 2 per cent over this period (Oyejide 1999).

However, over the past decade and, in particular, over the last half of the past decade, there have been signs of an economic recovery in several African countries (World Bank 2001), and agricultural value added in Africa grew by 4 per cent between 1990 and 1997 (Oyejide 1999). Continued agricultural development and global competitiveness requires the liberalization of domestic pricing, and improved export

market access and, therefore, participation in world trade negotiations is critical for the region.

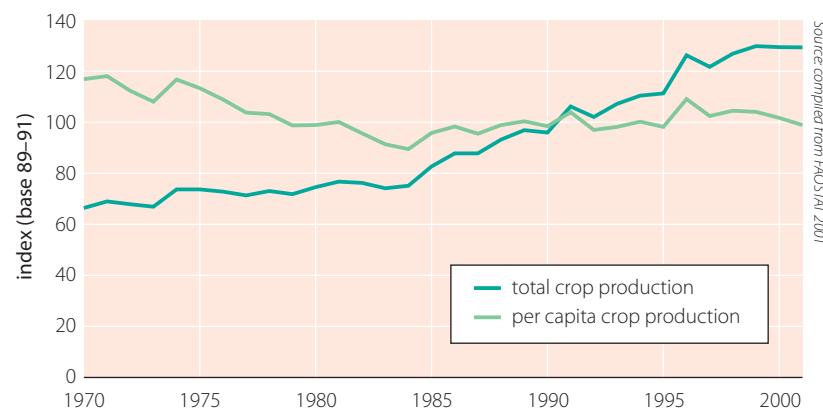
## EXTENT AND PRODUCTIVITY OF CULTIVATION AND LIVESTOCK PRODUCTION SYSTEMS

In response to growing domestic populations in Africa, and to policies directed at economic growth through agricultural export, the extent of land under cultivation has risen steadily from 166 million ha in 1970 to 202 million ha in 1999. The area of land under permanent pasture increased rapidly during the latter half of the 1980s, and then declined sharply to 892 million hectares in 1999 (approximately the same as in 1970) (FAOSTAT 2001).

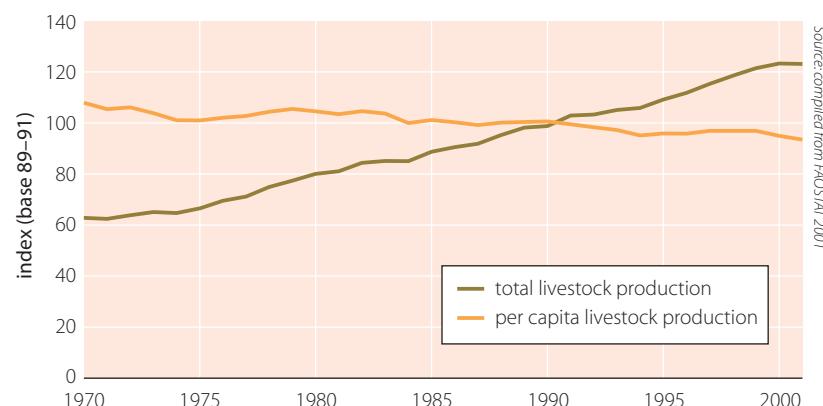
Absolute productivity over the past 30 years has also increased for both crops and livestock (see Figure 2f.2 and Figure 2f.3). However, the gains in cultivated area and productivity have been outweighed by rapid population growth and, hence, increased demands on

- Absolute productivity over the past 30 years has increased for both crops and livestock; however, the gains in cultivated area and productivity have been outweighed by rapid population growth and, hence, increased demands on food supply*

**Figure 2f.2 Crop production indices for Africa, 1970–2000 (total and per capita)**



**Figure 2f.3 Livestock production indices for Africa, 1970–2000 (total and per capita)**



food supply. For example, despite increases in crop production of 2.3 per cent in 1998 and 2.1 per cent in 1999, population growth averaged 2.5 per cent and, therefore, per capita crop production declined (FAO 2001c). Average per capita arable land which is actually cultivated has also fallen, as a result of population growth, from 0.5 ha/capita in 1965 to 0.3 ha/capita in 1990 (Cleaver and Schreiber 1994).

Limited economic growth, and myriad land tenure policies and management practices (including the increasingly widespread poverty and marginalization of subsistence farmers) have also contributed to limited gains in nutritional status, and to increasing dependence on food aid. Although average per capita daily calorie consumption has increased slightly, the number of undernourished people in Africa has doubled since 1970 (FAO 2000a). The region is a net importer of cereal crops for domestic consumption, and the ratio of imports to exports is escalating. Recurrent drought has resulted in crop failures and an inability to accumulate food reserves, and civil wars have restricted food distribution. Consequently, over the past 30 years, millions of people have faced food shortages. In 2000, these totalled 28 million in sub-Saharan Africa, in at least 16 countries (FAO 2001d).

### LAND QUALITY AND PRODUCTIVITY

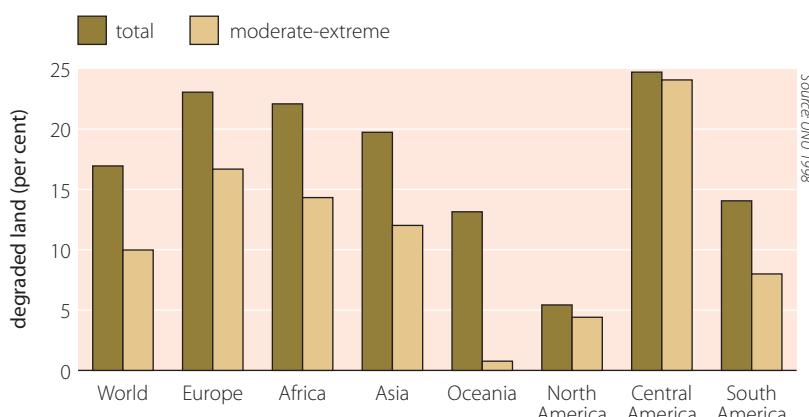
As a result of pressures to increase production: marginal land is being brought under cultivation or grazing; fertilizers and pesticides are widely used by commercial operations (although applications of

organic matter in small-scale practices is declining); and fallow periods are being reduced. These activities, although designed to increase productivity, can result in exhaustion of the production capacity of the land, manifested as: declining yields; vegetation and soil degradation and loss; and, in extreme cases, desertification. Climatic variability and change, and inappropriate land use or land tenure policies, add to the pressures and magnify the impacts. The current situation is that approximately 22 per cent of vegetated land in the region (494 million ha) has been classified as degraded, and 66 per cent of this are classified as moderately, severely or extremely degraded (UNU 1998). Africa is not unique in experiencing this problem, as shown in Figure 2f.4, but the effects on food security and the anticipated impacts of climate change make land degradation a priority issue for African leaders.

Land degradation and reduced productivity can be categorized as: hydrological and chemical degradation; physical degradation; or biological degradation. Hydrological and chemical degradation encompasses: waterlogging; salinization; sodication; and chemical pollution. It is caused by the use of low quality water for irrigation, and environmental pollution. Chemical degradation—resulting from pollution from industrial, household and medical refuse, and mining wastes—also occurs in selected sites. Physical degradation includes deterioration of soil structure and the occurrence of compacted layers, and can be due to: overstocking; inappropriate use of machinery; mining and quarrying activities; frequent waterlogging; and exposure to erosion. Biological degradation refers to the loss of nutrients and micro-organisms vital for maintaining healthy productive crops, and is due to the exhaustion of soil fertility, as a result of: intensive cropping; removal of crop residues; nutrient deficiencies; and insufficient organic matter.

The causes of land degradation in Africa are climatic variability and management practices, in addition to physical factors, such as the slope of the land and soil structure. Although most often associated with cultivation or grazing areas, degradation can also affect: forests, woodlands and savannas; urban and peri-urban areas; and protected areas. For example, clearance of forest vegetation (by fire, drought or overgrazing, or for alternative land uses) leaves soils

**Figure 2f.4 Regional comparison of land degradation**



more susceptible to erosion by wind and rain, especially when on steep slopes, in high rainfall zones or when combined with poor management, such as over-grazing. Draining of wetlands (for cultivation or urban development) disrupts the hydrological cycle and renders the surrounding areas more prone to flooding, and may no longer provide suitable habitat for wildlife, or raw materials for construction and crafts. Conversion of natural habitats to cultivation or grazing in unsuitable areas can also set off negative feedback systems of degradation, as detailed in Box 2f.1.

Over the past 30 years, soil structure has been damaged, nutrients have been depleted and susceptibility to erosion has been increased, as a result of: increasing application of chemicals; use of inappropriate equipment and technologies; and commercial mono-specific plantations. Irrigation in areas of high evaporation, and by inappropriate technologies, for example, increases the rate of salinization of the soil, because the water is rapidly lost, leaving behind a crust of once-dissolved salts. Likewise, intense grazing, especially in marginal areas and by a single species of livestock, can degrade vegetation, and can lead to soil compaction and accelerated erosion. One study found that most soil degradation in Africa was attributable to overgrazing (50 per cent), followed by: poor agricultural management practices (24 per cent); vegetation removal (14 per cent); and overexploitation (13 per cent) (WRI 1992). Between 1980 and 1995, Africa's permanent pasture declined slightly, indicating either conversion to cultivation, or abandonment due to extreme degradation, or a combination of both (UNU 1998).

A visible impact of land degradation is soil loss. Information regarding rates of soil loss in Africa are fragmented and country-specific, with estimates ranging from 900 t/km<sup>2</sup>/yr to 7 000 t/km<sup>2</sup>/yr (Rattan 1988). Likewise, studies of the economic impacts of soil loss are localized and varied, but are estimated to reach up to 9 per cent of GDP (UNU 1998). Loss of soil not only impairs productivity for future cultivation, but also causes: sedimentation in dams and rivers; smothering of aquatic and coastal habitats; and eutrophication. This, in turn, leads to reduced biodiversity in, and productivity of, these systems. Ultimately, these effects are felt in the lowered economic and nutritional status of African people.

### Box 2f.1 Demographic change and land quality

In traditional agro-pastoral systems, when land productivity declined through overcultivation or overgrazing, the farmers shifted to a new area whilst the former area recovered. However, with increasing population and economic pressures, production systems have changed, and the rate of conversion of natural habitat is faster. The rate of degradation is also faster, because inputs are minimized and fallow periods are reduced, in order to maximize production over the short term. The overall result is that more land is brought under grazing or cultivation, in order to counteract losses due to degradation. This impacts on natural habitats, biodiversity and ecological functioning, and means that food production requirements are not met.

Certain techniques have all been used successfully to improve productivity and over the long term, whilst maintaining a health resource base. These techniques include: crop rotation; increasing crop diversity; using livestock manure and crop residues as fertilizers; the construction of windbreaks; and agroforestry

With appropriate agricultural practices, rates of soil loss can be reduced, and soil fertility and productivity can be restored, as recently shown in Ethiopia, Kenya, Malawi, Senegal, Somalia and South Africa (Nana-Sinkam 1995, Hoffman and Todd 2000). A Soil Fertility Initiative for sub-Saharan Africa was established in the 1990s, and launched at the 1996 World Food Summit, in response to growing concerns over soil degradation and loss. This is a participatory initiative, with technical partners including: the International Fertilizer Industry Association; the International Food Policy Research Institute (IFPRI); the International Centre for Research in Agroforestry (ICRAF); the International Fertilizer Development Centre; the Food and Agriculture Organization (FAO); and the WB. The approach combines policy reform and technology adaptation, aimed at conserving natural resources and improving farmer's livelihoods through the design and implementation of integrated plant nutrient management programmes, which use a combination of available organic sources of nutrients, supplemented by mineral fertilizers. Many countries are currently preparing National Soil Fertility Action Plans as part of this programme (Maene 2001).

Desertification describes an extreme form of degradation in dryland areas, caused by climatic and management factors, where the land is no longer productive. Some 66 per cent of Africa is classified as desert or drylands and, currently, 46 per cent of

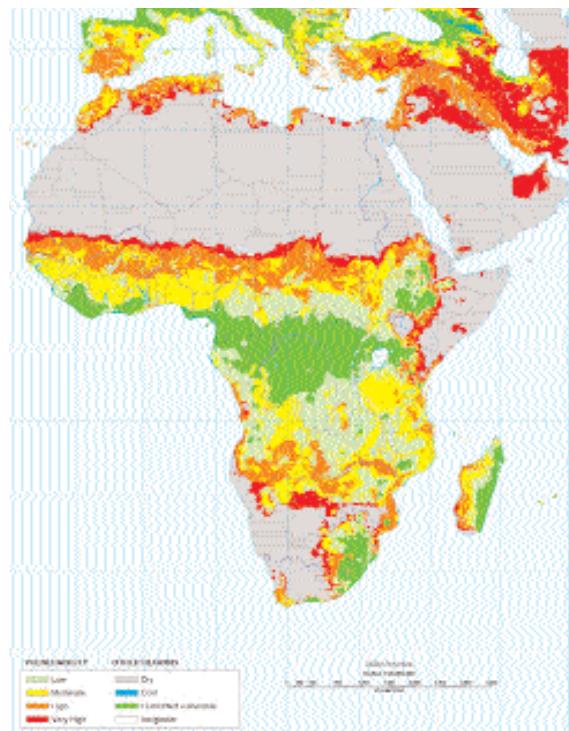
- *Over the past 30 years, soil structure has been damaged, nutrients have been depleted and susceptibility to erosion has been increased, as a result of: increasing application of chemicals; use of inappropriate equipment and technologies; and commercial mono-specific plantations*

Africa's land area is vulnerable to desertification, with more than 50 per cent of that under high or very high risk (Reich and others 2001). The most vulnerable areas are along desert margins, as shown in Figure 2f.5. These areas account for 5 per cent of the land area, and are home to an estimated 22 million people (Reich and others 2001). Climate change is predicted to reduce rainfall, to increase evaporation, and to increase the variability and unpredictability in rainfall for many areas of Africa (IPCC 1998, IPCC 2001). This, in turn, will lead to greater vulnerability to drought and desertification. In combination with continuing pressure for economic growth, and the rapid population growth rates, across the region, this will further threaten food security, unless coherent land tenure and management policies are established and enforced.

### Improving land quality and productivity

In recognition of their vulnerability to declining land quality and desertification, African countries were largely instrumental in establishing the United Nations Convention to Combat Drought and Desertification in Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa (UNCCD) in 1992 (UNCCD 2000). Since then, most African countries have embarked on National Action Plans, together with awareness-raising campaigns and, by 2001, 17 countries had completed and formally adopted their programmes (UNCCD 2001). Action plans have also been developed at the sub-regional level: in northern Africa by the Arab Maghreb Union (AMU); in western Africa by the Permanent Inter-State Committee for Drought Control in the Sahel (CILSS); in eastern Africa by the Intergovernmental Authority on Development (IGAD); and for southern Africa by the Southern African Development Community (SADC) (UNCCD 2001). A Regional Action Programme is also being developed, and will be coordinated by the African Development Bank (ADB) in Abidjan. Desertification, poverty, development pressures and climatic factors interact in a complex manner to influence food security. It is, therefore, essential that desertification be tackled within a development framework, and in a participatory manner. The approach must combine: political and legal reform; economic and social development strategies; land tenure reform; international partnerships; capacity building; and financial sustainability.

**Figure 2f.5 Vulnerability to desertification in Africa**



Source: Reich and others 2001

### LAND RIGHTS

The issue of land rights in Africa is a highly complex and sensitive social and political issue, closely linked with poverty and land degradation issues. The following terminology is applied throughout this review to avoid ambiguity or confusion:

- 'land rights' include rights over access to land and resources;
- 'land tenure' refers to the conditions and institutional arrangements under which land is held;
- 'land reform' encompasses reform of land rights and policies, as well as land redistribution or the physical reallocation of land; and
- 'land restitution' refers to the restoration of land to indigenous people, following alienation under colonialism or apartheid.

Traditional land tenure systems in Africa were developed in accordance with variations in physical conditions and cultures, although they were largely centred on communal access to resources and sharing of benefits. Tenure was rarely recorded or registered, and land rights were largely allocated through

### Box 2f.2 Women and land tenure

In most parts of Africa, both modern and traditional laws favour patriarchal ownership of land and control of resources. Women may be granted access to resources through their fathers or husbands on a temporary basis but, if they become widowed, they may be forced to leave their land. There is also a financial bias towards male ownership, as women tend to have lower incomes than men and, therefore, may not be able to afford to purchase land, or to acquire access to credit schemes. Women are also discriminated against in the quality of land they have access to, and often have marginal and remote land.

However, with land reform efforts progressing in many African countries, access to land, ownership and registration systems are helping to shift the balance of equity in recognition of the rights of vulnerable groups, including women and minority, ethnic or nomadic groups.

inheritance or other regulatory and distributive mechanisms. Traditional systems offer more security of tenure than is often recognized by supporters of individual tenure systems, although women generally have lower status than men (Cleaver and Schreiber 1994). The insecurity of women in this regard is illustrated in Box 2f.2. In pastoral communities, land may be under tenure or may be open access. Here, access is regulated according to seasonal abundance of resources, and is determined by traditional governance systems. The mobility of pastoral communities buffers against climatic variability and provides them with greater food security.

However, colonial regimes and newly independent governments perceived traditional tenure and access systems to be insecure and poorly suited to commercial, settled agricultural development and conventional economic growth (Cleaver and Schreiber 1994, Toulmin and Longbottom 1997). Thus, land largely became the property of the state, and was then redistributed with discrimination along lines of wealth, race or gender (Cleaver and Schreiber 1994). Resulting conflicts between traditional and contemporary tenure and access policies have frequently led to the mismanagement of resources and to conflicts between

user groups. In the Western Indian Ocean state of Comoros, for example, there are three types of land tenure system in place: traditional, colonial and Islamic (RFIC 1998). The best land is reserved for commercial crops which are mainly for export, whilst small-scale and subsistence farmers are left with less productive, even marginal areas, such as steep slopes. Without proper terracing, these areas are prone to soil erosion (COMESA 2001). Extreme inequity in land distribution is seen in South Africa, where access to land averages just over 1 ha/capita for black farmers and 1 570 ha/capita for white farmers (SARIPS 2000). A further complication affecting access rights and food security across Africa is that of population growth, resulting in greater and greater land fragmentation under the traditional system of inheritance and sub-division. As each successive generation inherits a smaller and smaller parcel of land, average farm size per household is declining, thus contributing to food insecurity.

Over the past few decades, governments have realized that centralized management of land resources is also inappropriate, and processes of land reform are underway in many countries. Individual land titling may be appropriate, for example, in urban areas but, in pastoral areas, communal ownership may be a more viable alternative. Legal recognition of traditional land-use practices could be a means of avoiding the overexploitation of resources associated with lack of ownership and accrual of benefits (the 'tragedy of the commons'). Mozambique is one of the countries where demarcation of community lands is being undertaken and, in Tanzania, the Village Land Act provides for collective land ownership for pastoralists (DFID 1999). Protection of sacred forests through community ownership and management is also emerging as a successful model of forest conservation (Alden Wiley 2000). Uganda's 1998 Land Act attempts to integrate traditional and contemporary tenure and access policies, allowing: legal registration of traditional land rights; representation of traditional authorities in dispute resolution; and the formation of communal land associations. However, there is still confusion among the public over their rights, and implementation has been restricted through lack of resources (DFID 1999).

Another key element in the discussion of land reform processes is the effect of different tenure systems on investment in resource management and on

*Legal recognition of traditional land-use practices could be a means of avoiding the overexploitation of resources associated with lack of ownership and accrual of benefits*

productivity. Evidence of subsistence level production being less efficient is still inconclusive, and comparisons are complicated by existing market failures and by inequities in market access. The role of the private sector needs to be explored further, and a clear strategy of land use and production needs to be developed and understood by all participants before implementation. Otherwise, there is a risk of collapse in production during a transition period (DFID 1999).

Other issues for concern and for continued discussion include: the means for developing effective, legitimate institutions for the management of land rights; the implementation of market-based instruments for the redistribution of land; the question of land restitution; and the continuing marginalization of women, indigenous peoples, and pastoralists or hunter-gatherers (DFID 1999). The role of the state in facilitating or administrating land reform is also under the spotlight, particularly in Zimbabwe, where the land issue has become the central campaign issue between political parties (Moyo 2002).

Delays in reform have been considerable, and governments continue to hold legally defined *de jure* ownership rights over much of rural Africa. By contrast, and often as a consequence, rural communities and individuals exert *de facto* rights to land and resources, based on claims to traditional land rights, and in protestation over slow reforms (Cousins 2000). In some countries, most notably, southern African countries, where there was extreme inequity in access to and ownership of land and resources, the process of reform has been catalysed by demonstrative and, in some cases, violent action. In Zimbabwe, for example, there have been several violent clashes over illegal land occupation (for example, Drimie and Mbaya 2001).

Land reform is a highly contested and sensitive issue, requiring an appropriately sensitive approach. Policies must consider country-specific situations and objectives, within an overall development context. Policies will necessarily be developed through several iterations, with the involvement of all stakeholders, particularly those most marginalized (Drimie and Mbaya 2001).

The following sections give further details of specific issues and policies relating to land resources in each of the African sub-regions.

## NORTHERN AFRICA

Due to the extreme aridity, a major issue in northern Africa is scarcity of arable land (or land that is suitable for cultivation). Average annual precipitation is just 7 per cent of Africa's total, and there are large inter-annual and intra-annual variations (FAO 1995b). Distribution of rainfall between the countries is also varied, with more than 70 per cent falling in Sudan, and just 3 per cent in Egypt, where more than 90 per cent of precipitation is lost through evaporation or transpiration (FAO 1995b). These harsh climatic conditions, and the predominance of shallow, highly erodible soils, make cultivation a precarious occupation. Arable land represents 26.4 per cent of the total land area, and 18.7 per cent is currently cultivated, although the extent of cultivated area ranges from 2.6 per cent in Egypt to 77.4 per cent in Morocco (FAOSTAT 2001). Rangelands currently occupy about 13 per cent of the total land area (mostly in Algeria and Sudan) although, over the past 50 years, half of these have been reclaimed for cultivation (AOAD 1998, Le Houerou 1997).

Despite severe physical limitations, agricultural and pastoral activities contribute significantly to national economies and traditional lifestyles. Thus, land cultivation in the sub-region is becoming increasingly dualistic in nature, with a high technology agribusiness sector developing alongside traditional smallholder agriculture. In almost all countries, some farmers still harvest their crops by hand, whilst commercial agriculture is heavily mechanized, employing highly efficient irrigation systems, tractors, multi-furrow ploughs and combine-harvesters. There is a pressing need to integrate the two sectors, and to combine the wisdom from each (Lycett 1987).

## IMPORTANCE OF CULTIVATION AND LIVESTOCK PRODUCTION IN NORTHERN AFRICA

In 1990, agriculture employed about 37 per cent of the workforce in the Arab countries, and 69 per cent in Sudan. This was a steep decline for the Arab countries, from 51 per cent in the previous two decades (World Bank 2001). The major crops produced in the sub-region include: cereals (wheat, barley, rice and sorghum); fruit (citrus, dates and olives); vegetables (beans); sugar (beet and cane); and nuts and seeds



A Bedouin nomad diverts water to his crops in a small-scale irrigation project.

*Nigel Dickinson/Still Pictures*

(sesame and groundnuts). Total agricultural exports for northern Africa (excluding Sudan) were US\$2 451 million in 1997, and value added in agriculture was 13 per cent of GDP in 1999 (World Bank 2001). Commercial farming is heavily dependent on irrigation and fertilizer use. For example, in Egypt, all cultivated land is irrigated although, in other countries, the percentage is lower (FAO 1995b). Over the past decade, northern African countries have used between 1 million t and 1.5 million t of fertilizer per year, approximately 45 per cent of Africa's total (World Bank 2001).

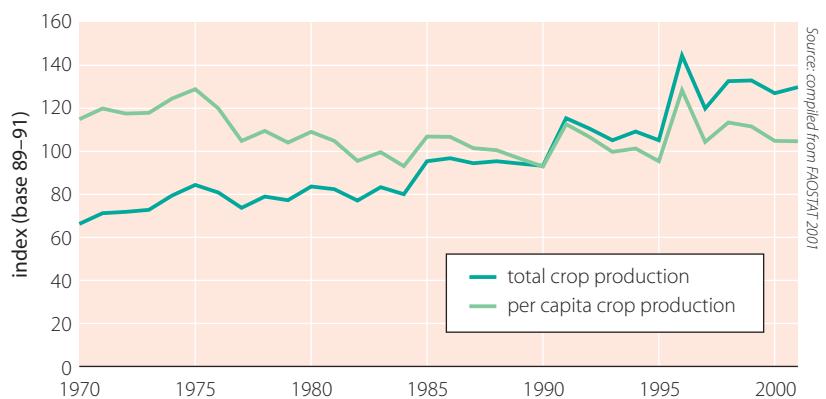
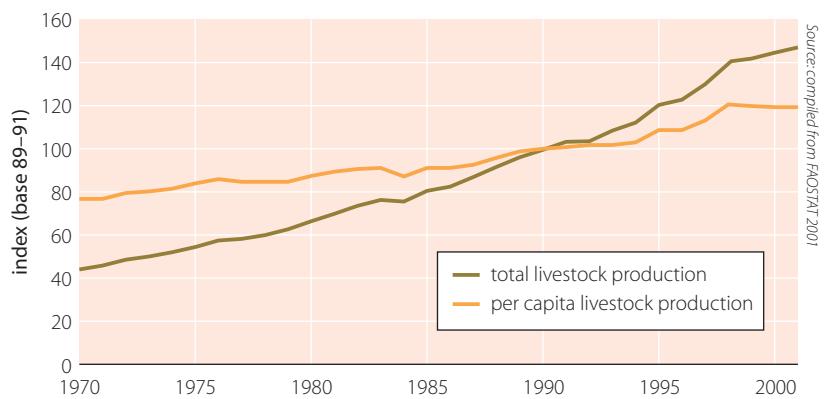
The population of Northern Africa doubled between 1970 and 2000 (from 85 million to 174 million people), and is continuing to grow at an average of 2 per cent per annum (UNPD 1996, World Bank 2001). This, together with increasing consumption and demand for luxury foods (Miladi 1999), has been responsible for rising demands on agricultural production and for pressures on the land resources. Responses to meet this rising demand have included: enhancing cropping intensity; extending the area of land under cultivation; and intensive irrigation and use of chemicals and other inputs (FAOSTAT 2001).

## EXTENT AND PRODUCTIVITY OF CULTIVATION AND LIVESTOCK PRODUCTION SYSTEMS IN NORTHERN AFRICA

The total area under cultivation in the sub-region has grown from approximately 35 million ha in 1970 to more than 45 million ha in 1999 (FAOSTAT 2001). Sudan has witnessed the most dramatic expansion (from 11 million ha in 1970 to 17 million ha in 2000), although there are still large areas of land with potential for cultivation, which have not yet been exploited (FAOSTAT 2001). For other countries, most or all arable land is under cultivation, due to significant technological and engineering developments. These include: the construction of the Aswan High Dam on the Nile River in Egypt; the Al-Salam canal development, which diverts water from the Nile River to Sinai, Egypt; and the great covered human-made river in Libya (Hegazy 1999). In other countries, the potential for expansion has been limited by: availability of water resources; inequity of land resource distribution; availability of capital investment; human resources; supply of energy; and prevailing soil characteristics.

The percentage of cultivated land that is irrigated has also expanded considerably over the past 30 years, from 6 million ha in 1970 to nearly 8 million ha in 1999 (FAOSTAT 2001). Irrigated area as a percentage of agricultural area varies from 100 per cent in Egypt to about 15 per cent in Morocco and Sudan, where rain-fed agriculture is more reliable (FAOSTAT 2001). This expansion has been outstripped by population growth, however, as shown by declining area of cultivated land per capita, which fell from 0.59 ha/capita in 1970 to 0.33 ha/capita in 1990 (calculated from FAOSTAT 2001). Total crop and livestock production has also increased over the past decade but, again, the rapid increase in population has resulted in a net decline in per capita production, as shown in Figure 2f.6 and Figure 2f.7 (FAOSTAT 2001).

Intensification and expansion of food production have contributed to food self-sufficiency and food security in the sub-region. However, imports far exceed exports, and the gap between imports and exports is growing (Miladi 1999). Northern Africa has high self-sufficiency in vegetables, fruits and tuber crops (more than 97 per cent) but, for sugar, cereals and plant oils, self-sufficiency rates are 33.2 per cent, 57.3 per cent and 62.7 per cent respectively (Arab League 1999).

**Figure 2f.6 Crop production indices for Northern Africa, 1970–2000 (total and per capita)****Figure 2f.7 Livestock production indices for Northern Africa, 1970–2000 (total and per capita)**

### LAND QUALITY AND PRODUCTIVITY IN NORTHERN AFRICA

Land quality and productivity are declining in cultivated areas, rangelands and forests, as a result of a number of pressures. These include: rapid population growth; climatic stresses and drought; overgrazing; clearing of forests and woody vegetation; cultivation of marginal lands; unfavourable land tenure; irrational agricultural production; and trade policies (El Bagouri 2000).

Forests and wooded areas are rapidly being degraded as wood is cut for fuel, and to bring more land under cultivation. Not only does this result in reduced natural habitat and natural resources available from forests, but loss of soil cover and protection increases the risk of erosion by wind and rain, as well as increasing the risk of flooding and landslides in these areas. In Egypt, cultivation occupies a narrow strip along the Nile River (3.5 per cent of the total land area of the country), surrounded by desert on either side. In these desert margins, wind erosion is a threat, and may

affect agriculture production on the edges of cultivated areas. To slow down the effect of wind erosion, the government of Egypt has a long-term plan to establish a protective belt of perennial green vegetation cover (FAO/AGL 2000).

Rain-fed areas suffer particularly from prolonged and/or frequent dry spells and droughts, and from inappropriate farming systems which, in turn, have been encouraged by macroeconomic policies and pressures. In Sudan, for example, the so-called 'suitcase farmers' have caused widespread loss of productivity, through uncontrolled, low-input sorghum farming (Lusk 1987). High prices for this cereal encouraged extensive monoculture, with inadequate fallow or rest periods for the soil to recover, or alternative cropping to return nutrients removed from the soil by sorghum. This has caused: serious losses of soil, through wind and water erosion; loss of soil fertility; and loss of biodiversity, through degradation of natural plant cover and deforestation. Fertility decline in Egypt is managed by using mineral fertilizer—mainly nitrogen and phosphorous fertilizers—at quite high rates in comparison with other countries in Africa. The use of organic matter and crop residues is not common in Egypt (FAO/AGL 2000).

Areas under irrigated cultivation are showing signs of chemical degradation, such as: increased soil salinity; water-logging; and pollution. Irrigation in areas with naturally high evaporation rates and inadequate drainage, for example, leads to the accumulation of high levels of soluble salts in the topsoil. Salt-affected or salinized soils have become widespread over the past 30 years, as a result of the use of saline drainage water and brackish water in irrigation (Goossens, Ghabour, Ongena and Gad 1994, FAO 1994, Framji 1974). In Egypt, 30–40 per cent of the cultivated irrigated land is now salt-affected (mostly in the northern part of the country, along the Nile delta), and this accounts for 15 per cent of total production losses (FAO/AGL 2000). This region is now considered a global 'hot spot' of land salinization, together with the most fertile river basins of Asia and Latin America (Scherr and Yadav 1996 in FAO 2000b).

Responses to curb salinization and the hydrological degradation of soils include: improvements to leaching and drainage of irrigation water; land levelling (to avoid collection of irrigation water in pools); applications of

gypsum, organic matter and farm manure; and the selection of salt-tolerant crops during the reclamation programmes (FAO/AGL 2000).

Rangelands are subject to: overstocking and overgrazing; mismanagement of land, often associated with poorly defined or inappropriate tenure policies; and the conversion of rangelands to cultivation. The environmental impacts of land degradation include: reduced water quality from sedimentation and pollution, thus leaving water unsuitable for human use or irrigation; impaired navigation of watercourses; and increased costs for flood control and dam maintenance. Ultimately, productivity is reduced, affecting food security in the long term and the short term. According to the FAO (FAO/AGL 2000), only 5 per cent of Egypt's cultivated lands are in excellent condition, 40 per cent are classified as good, and the remaining 55 per cent are classified as either medium or poor. Furthermore, the FAO estimates that soil degradation in Egypt results in an overall production loss of 53 per cent (FAO/AGL 2000).

According to Reich and others (2001), the areas most vulnerable to desertification are along the desert margins and, within these areas, where population densities are high, and where land management practices are insensitive to climatic or physical restraints. Thus, large areas of northern Africa are highly vulnerable to desertification, along the borders of the Sahara desert and the arid Sahelian region. In Algeria, for example, 85 per cent of the land area is desert and, of the remaining 15 per cent, 14 per cent is moderately, highly or very highly vulnerable to desertification (Reich and others 2001). In Morocco, 52 per cent of the land area is vulnerable to desertification, and 45 per cent is either moderately, highly or very highly vulnerable (Reich and others 2001).

### **Improving land quality and productivity in Northern Africa**

The consequences of declining productivity could include: reduction in return from capital investment and labour inputs; lower incomes, especially for small-scale farmers; and increasing rural-urban migration, in search of more secure livelihoods. Therefore, combating degradation is of paramount importance for sustainable development. Northern African countries are carrying out varied activities in order to assess and to monitor degradation, and to test techniques to mitigate desertification.



Steppe and alpha grass, Mergueb Reserve, Algeria

Arnaud Greth/Still Pictures

All the countries of the northern African sub-region have ratified the UNCCD. Tunisia has produced a National Action Plan, Morocco has established a website for information dissemination, and most countries have produced national reports. In 2000, the Union du Maghreb Arabe (AMU) produced a sub-regional action plan for the Arab countries of northern Africa (UNCCD 2001). Greater efforts are also being exerted to reduce the rate of population increase, especially in Tunisia and Egypt. In Morocco, a decentralization process is underway, in order to encourage rural development and to improve food and economic security in rural areas and in agricultural lifestyles. Participatory implementation tools have been piloted, alongside a new legal framework for the development of rain-fed agriculture. In Sudan, the government passed a decentralization law in 1998, transferring responsibility for revenue generation and expenditure to local authorities.

### **LAND RIGHTS IN NORTHERN AFRICA**

Current land tenure policies in northern Africa have been derived from pre-colonial and colonial tenure systems, largely influenced by the type of land use most appropriate for various areas, and economic pressures of different periods. Although they may have once been optimal for enhancing productivity under the prevailing social and demographic situations, tenure policies have not always kept pace with changing demographic patterns, demand for resources or national priorities. Thus, resource overexploitation is apparent in some areas, contrasting with inefficient use of resources in

other areas. Lack of tenurial security has been reported as a major constraint to land development (FAO 1992) and, throughout the sub-region, much land remains under poorly defined ownership. Much of it is 'open access', although sometimes called 'common property', and large proportions are state-owned. Until recently, 20 per cent of Tunisia's total land area (3 million ha) was under communal ownership, and 6 per cent was state-owned. However, in 1991, the government privatized 1.2 million ha of agricultural land and 600 000 ha of rangelands (World Bank 2000a). This reflects a change in economic and social thinking towards more commercial production. Access to land resources is a primary determinant for development, and is considered a major factor responsible for the failure of some governments to engage the people in land development programmes. In some countries, such as Libya, the state assumes ownership of any land which is not assigned to sedentary populations, that is, they have nationalized lands held in some sense collectively by local communities (Harbeson 1990).

Land tenure reform processes in the sub-region attempt to optimize land use, minimize degradation and stem the rapid rates of urbanization. Many of the governments in the sub-region have also adopted liberalization and structural reform policies, that is, marketing, pricing and trading produced food and agricultural commodities with the removal or minimization of subsidies for inputs. Policies have been adopted to enhance exports and foreign trade. Measures have been taken to encourage intra-regional trade, through bilateral trade agreements among the countries of northern Africa, and the establishment of free trade zones. Research efforts to enhance sustainable development have also been encouraged. Greater participation of stakeholders through farmers and users associations is receiving greater attention, and gender issues are being discussed.

In Tunisia, for example, land reform has focused on the settlement of land claims through the registration and certification of ownership, and through a dual plan for promoting economic stability and environmental protection (World Bank 2000a). However, despite the government's attempts to encourage registration, half of all eligible lands have not been registered and, even amongst registered lands, successive land transfers often go unrecorded. The process of privatizing state

and collectively owned lands has also been slow, as has the emergence of land markets. Fragmentation of land and resources remains a principal concern, which the government is attempting to redress by means of: legislative modifications; extension programmes; and improved administrative procedures (Gharbi 1998). In Morocco, until recently, land was owned by the state, by religious orders or by communities. The government has encouraged land reform through incentives for: streamlining registration; limiting fragmentation; the standardization of tenant contracts; and the privatization of state-owned and church-owned lands. A recent report concludes that private tenureship provides greater security and greater incentives for investment in land improvements, such as access to financing (Taleb 1998).

## EASTERN AFRICA

The eastern African sub-region is characterized by two fragile ecosystems, namely: mountainous and hilly areas (predominantly in Burundi, Rwanda, Uganda, Kenya and Ethiopia); and semi-arid or arid (dryland) areas (predominantly in Djibouti, Eritrea, Ethiopia and Somalia). These areas support most of the sub-region's population (with densities of more than 200 people/km<sup>2</sup>), and are the centres of crop cultivation. For example, the highlands of Ethiopia (above 1 500 masl) constitute about 45 per cent of the total land area, and are inhabited by 80 per cent of the population and by 75 per cent of the country's livestock (EPA/MEDC 1997). The dryland areas have low rainfall, and are extremely vulnerable to drought and desertification, especially in the Horn of Africa (rainfall in Djibouti, for example, is only 147 mm/yr). The Horn of Africa experienced severe droughts in 1972–73 and 1984–85, in which millions of people lost their lives, their homes, their livestock or their livelihoods (FAO 2000a). In Djibouti, Eritrea and Somalia, less than 5 per cent of the land area is under cultivation (FAOSTAT 2001). Ethiopia and Kenya have 10 per cent and 8 per cent respectively of land under cultivation. In Burundi, Rwanda and Uganda, higher and more predictable rainfall facilitates relatively extensive cultivation (42 per cent, 35 per cent and 45 per cent respectively) (FAOSTAT 2001). All countries in the sub-region, except



Coffee picking: worker harvesting ripe cherries in Tanzania

Nigel Cattlin/Holt Studios

Uganda, have extensive pastures (FAOSTAT 2001). In the drier regions, these are used by nomadic herders, because livestock production is preferable to the risks of cultivation.

Most of the population in Eastern Africa (more than 70 per cent) is rural, practising subsistence agriculture (WHO/UNICEF 2000). More than 95 per cent of Ethiopia's agricultural output is generated by small-scale farmers, who use traditional farming practices (FAO 2000a). Rapid population growth and increasing demand for food, combined with high variability in rainfall and frequent drought, is putting pressure on farmers to clear more natural vegetation, and to cultivate more and more marginal land. Shortening of fallow periods and high intensity of rainfall contribute to creating conditions which are conducive to land degradation, soil erosion and desertification (NEMA 2000). Thus, the main issues of concern are population growth, agricultural practices and food security.

### IMPORTANCE OF CULTIVATION AND LIVESTOCK PRODUCTION IN EASTERN AFRICA

Although most people in the sub-region are involved in subsistence agriculture, commercial agriculture is also an economic mainstay, contributing significantly to employment, GDP and exports. In Burundi and Rwanda, for example, more than 90 per cent of the workforce

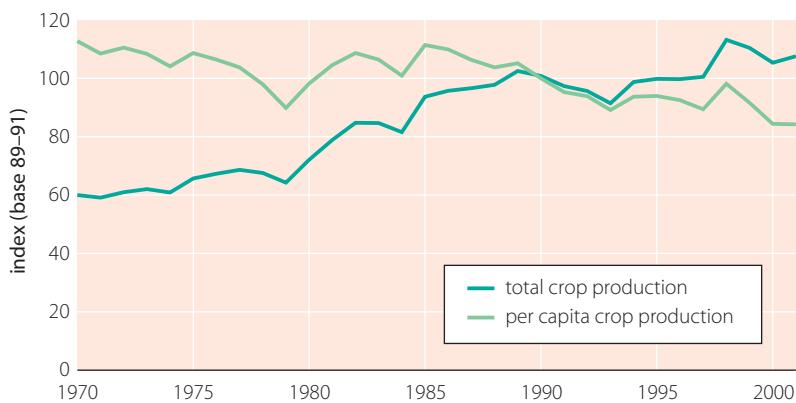
have been employed in agriculture for the past three decades (World Bank 2001). In Ethiopia, Kenya, Somalia and Uganda, rates of employment in this sector have been between 80 and 95 per cent (World Bank 2001). The main crops are: bananas; beans; cassava; coffee; cotton; maize; millet; rice; sesame; sisal; sorghum; sugar; tea; and wheat. Economic contributions from agriculture have been significant over the past 30 years, including an average of 45 per cent of GDP in Burundi, Ethiopia and Uganda, and 21 per cent of GDP in Kenya (World Bank 2001). The value of agricultural exports from the sub-region is also substantial, reaching US\$526 million in Ethiopia and US\$1157 million in Kenya during 1997 (World Bank 2001). Considering that these are among the poorest countries in the world, the value of agriculture, and the precariousness of depending on so few rain-fed crops, cannot be underestimated.

### EXTENT AND PRODUCTIVITY OF CULTIVATION AND LIVESTOCK PRODUCTION SYSTEMS IN EASTERN AFRICA

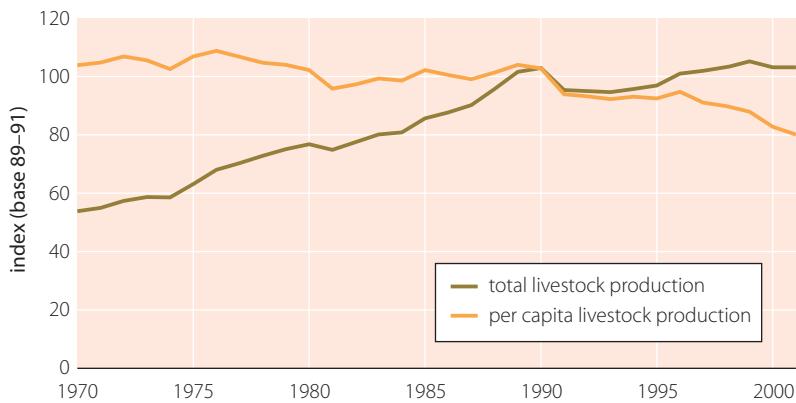
The total area under cultivation has increased over the past three decades for all countries, except for Burundi, which has experienced a slight decline (FAOSTAT 2001). Food production has also climbed over the past 30 years, although with considerable inter-annual variation. However, population growth has exceeded increases in production. The drier countries in the Horn of Africa, where climatic variation and drought are more common, show the greatest overall decline in per capita food production, and the greatest variation between years, as shown in Figure 2f.8 and Figure 2f.9.

This has resulted in declining food security, and decreased per capita food intake. Daily per capita calorie intake in Kenya, Uganda, Rwanda and Burundi was less in 1997 than in 1970 and, in Ethiopia, almost 50 per cent of the population is undernourished (UNDP 2000, FAO 2001c). Over the same period, there were declines in per capita supply of protein and fats in the same countries (UNDP 2000). Malnutrition is also of serious concern, and deficiencies in iodine and vitamin A are common among children below the age of six years in Ethiopia (FAO 2001c).

Declining per capita food production and per capita food intake is causing the countries of eastern Africa to

**Figure 2f.8 Crop production indices for Eastern Africa, 1970–2000 (total and per capita)**

Madagascar; Malawi; Mauritius; Mozambique; Rwanda; Seychelles; Somalia; Sudan; Swaziland; Tanzania; Uganda; Zambia; and Zimbabwe. The second phase of the project included Eritrea, Namibia and South Africa (DMC 2002). Other responses include the United Nations Inter-Agency Task Force strategy for improving food security, which focuses on the underlying causes of chronic food insecurity in the seven countries. It proposes diversification of livelihoods away from the traditional dependence on agriculture, as well as means of enhancing resilience to climatic variation within agricultural practices. Macro issues, such as market reforms, improving access to trade and information, and environmental protection, are also central to the strategy (UN 2000).

**Figure 2f.9 Livestock production indices for Eastern Africa, 1970–2000 (total and per capita)**

become more and more dependent on food imports and food aid. For example, Ethiopia has been a food-deficit country for several decades, and average cereal food aid during the period 1984–99 was 14 per cent of total cereal production (FAO/AGL 2000). These severe droughts and food shortages catalysed the need for a drought monitoring facility for eastern and southern Africa. In March 1985, the leaders of the meteorological centres of the region met in Nairobi, and agreed to establish the present Drought Monitoring Centres (DMCs) in Nairobi (Kenya) and Harare (Zimbabwe), within the respective meteorological departments. The main objective of the Drought Monitoring Centres is to provide early warning of drought, based on meteorological information, thus preparing countries and alleviating the devastating impacts of drought. A regional project, 'Drought Monitoring for Eastern and Southern Africa', was set up in January 1989, with 21 participating countries, namely: Angola; Botswana; Burundi; Comoros; Djibouti; Ethiopia; Kenya; Lesotho;

## LAND QUALITY AND PRODUCTIVITY IN EASTERN AFRICA

Population and climatic pressures have taken their toll on land and resources in Eastern Africa, and the sub-region is experiencing some of the most rapid degradation rates in Africa (Henao and Baanante 1999). It has been estimated that 2 million ha of Ethiopia's highlands have been degraded beyond rehabilitation, and an additional 14 million ha severely degraded (EPA/MEDC 1997). The same study estimated that more than 25 per cent of the country is experiencing desertification, and the annual rate of topsoil loss is reported to be 1 900 million tonnes (EPA/MEDC 1997). As farms have been sub-divided over the years, decreasing farm size has led to shorter fallow periods and, in some places, to continuous cropping, in order to sustain productivity levels. Crop residues are rarely ploughed into the soil, and applications of other organic matter have been low, resulting in higher requirements for inorganic fertilizers, with consequent problems of salinization and pollution (FAO 2001c). In the early 1990s, Rwanda and Burundi experienced nutrient depletion rates of more than 100 kg ha/yr of nitrogen, phosphorous and potassium (NPK) (Henao and Baanante 1999). Almost 80 per cent of Kenya's total land area is classified as arid or semi-arid and, in these areas, removal of vegetation cover (through overgrazing and for charcoal production) exposes the soil to wind and water erosion. Soil compaction occurs in areas where there is excessive

### Box 2f.3 Extent and quality of grazing areas

Quality of grazing lands refers not only to the quantity of vegetation cover, but also to the quality of the grazing available, as well as other factors, such as water availability, mineral content and parasite load. A good illustration of this is provided by the interactions of Maasai cattle with wildlife in the pastoral areas of Kenya. It has been suggested that, when the Maasai were excluded from their traditional grazing areas under British colonial administration, wildebeest moved in to graze these high-quality short grass plains and, consequently, their numbers increased. Exclusion of the Maasai means that their cattle are now restricted to lower quality areas, which the herdsmen would traditionally have avoided due to their high parasite load.

Source: Homewood and Rodgers 1991

trampling by animals and, in cultivated areas, soil fertility is declining, as a result of the exhaustion of soils by mono-specific cropping and reduction of fallow periods (FAO/AGL 2000). Colonial land policies have also contributed to degradation through the marginalization of pastoralists, as shown by the example in Box 2f.3. In irrigated areas of Kenya, approximately 50 per cent of the soils are affected by salt, as a result of the poor management of irrigation (FAO/AGL 2000). In Uganda, the estimated proportion of degraded land ranges from 20 per cent to 90 per cent, with soil degradation, resulting from overgrazing and soil compaction, a common feature in the major cattle-rearing areas (FAO/AGL 2000).

In Djibouti, where 85 per cent of the land area is dryland or desert, the remaining 15 per cent of the land has been classified as moderately, severely or extremely vulnerable to desertification. In Eritrea, 42 per cent of the area not already classified as desert is vulnerable. In Ethiopia, this is 26 per cent and, in Kenya, it is 35 per cent (Reich and others 2001). Soil fertility has also declined under cultivation with little organic inputs and short fallow periods. Other causes of land degradation are: inappropriate crop production practices; overgrazing; land fragmentation; deforestation; uncontrolled bushfires; and inefficient mineral exploration techniques. According to Slade and Weitz (1991), the annual cost of soil erosion in Uganda

is in the order of US\$132–396 million. Soil loss estimates in Ethiopia range from US\$15 million (FAO 1986) to US\$155 million (Sutcliffe 1993), equivalent to between 1 per cent and 5 per cent of GDP. Cumulative economic losses, as a result of lowered productivity, could reach US\$3 000 million for Ethiopia (Bojo 1996).

The impacts of soil degradation include: increased risk of flooding; sedimentation in rivers, lakes and dams; smothering of coastal habitats; and eutrophication. For example, in Uganda, uncontrolled flooding was experienced in 1997–98, as a result of the El Niño rains, and because of extensive vegetation removal, landslides were experienced (NEMA 1999). In April 1999, thousands of fish deaths were observed in the Albert Nile River, most likely caused by eutrophication, resulting from soil erosion and increased levels of fertilizers in the river. Soil degradation also contributes to rising rural poverty and food insecurity, because productivity is reduced, and subsistence farmers are less and less able to accumulate reserves of grain. Ultimately, rural-to-urban migration and encroachment into gazetted natural reserves occur, as are now extensively experienced in Uganda (NEMA 1999).

### Improving land quality and productivity in Eastern Africa

Responses to control and to reduce land degradation, erosion and desertification in the sub-region include: the ratification of international agreements; the development and implementation of regional action plans; reform and development of national policies; and effecting local level soil conservation practices. All governments in eastern Africa, except Somalia, have signed and ratified the UNCCD. Uganda, Djibouti and Ethiopia have produced national reports and National Action Plans, and have held awareness-raising meetings. Rwanda, Burundi and Kenya have produced national reports. The Intergovernmental Authority on Development (IGAD) has also produced a sub-regional action plan for the countries in the Horn of Africa (UNCCD 2001).

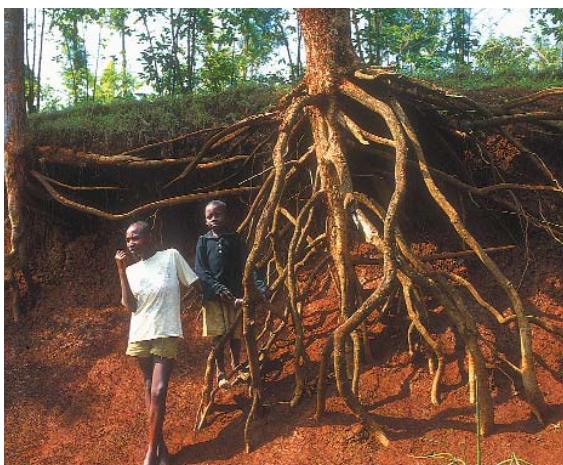
IGAD was created in 1986 by Djibouti, Ethiopia, Kenya, Somalia, Sudan and Uganda (and later joined by Eritrea), in order to coordinate development in the Horn of Africa. The IGAD policy on food security and environment aims to establish, amongst other activities: a regional integrated information system for drought

•  
*The annual cost of soil erosion in Uganda is in the order of US\$132–396 million. Soil loss estimates in Ethiopia range from US\$15 million to US\$155 million, equivalent to between 1 per cent and 5 per cent of GDP*



## Erosion, Kenya

*Charlotte These/Still Pictures.*



monitoring and early warning; diversification of household energy sources; and implementation of the UNCCD. Research activities are also focusing on the promotion of the sustainable production of drought-tolerant, high-yielding crop varieties, and capacity building programmes have been established to improve integrated water resources management (IWRM). Efforts to remove barriers to trade and economic growth include the coordination and harmonization of policies in trade, industry, tourism, communications infrastructure and telecommunications.

The Ethiopian government has made it a priority to improve food insecurity following the tragic famine of 1983–84, and has been successful in avoiding famine, despite droughts in 1991–92 and 1993–94. This success has been facilitated by: early warning of drought by IGAD; the establishment of an Emergency Food Security Reserve; and substantial assistance from international agencies and donors (FAO 2001c). Vulnerability analysis and mapping by the United Nations (UN) World Food Programme (WFP) has also helped in providing advance information on crop yields. The Ethiopian government is also implementing a Sectoral Investment Programme, focusing on: crop diversification; strengthening early warning; improving access to facilities for the very poor (such as extension services and financial resources); and small-scale irrigation development (FAO 2001c). The capacity of soil and water conservation training institutions is being increased at the various universities and agricultural colleges. The programme is accompanied by a population policy aimed at reducing fertility, in an

attempt to address one of the major pressures in land management—population growth (FAO 2001c).

In Uganda, a national land use policy has recently been formulated, although a new law, the Land Act 1998, was enacted two years ago (Moyini 2000). Additionally, the Ugandan government is approaching the population-agriculture issue in three ways. First, in a direct approach, a National Population Policy was formulated in 1995. Second, in an indirect approach, universal primary education was established, in the expectation that a literate population will better appreciate the benefits of family planning (NEMA 1999). Third, the government's Plan for Modernization of Agriculture is expected ultimately to shift the rural population away from subsistence agriculture into agroprocessing industries, leaving few and more efficient farmers (MoFPED/MAAIF 2000).

At the community level, soil management practices in semi-arid eastern Kenya include: strip cropping; intercropping; cover cropping; agroforestry; crop rotation; ridging; mulching and application of manure; terracing; and cutting of drains. National afforestation programmes are also being established as long-term measures to conserve land and soil resources (FAO/AGL 2000).

### LAND RIGHTS IN EASTERN AFRICA

Land tenure in eastern Africa is a sensitive and complex issue. At independence, the countries in the sub-region established quite different tenure reforms, all aimed at improving productivity. For example, in Ethiopia, all land became public land, with leasing or sale of land being forbidden (FAO 2001c) whereas, in Kenya, the government pursued private ownership (Bruce, Subramanian, Knox, Bohrer and Leisz 1997). In both Kenya and Ethiopia, fragmentation of land parcels through subdivision has reduced the average farm size to less than 1 ha in many areas. This has the result that fallow periods have been reduced or are omitted altogether, in order to produce sufficient quantities to meet the needs of the family. In spite of these policies, the countries of the sub-region have all suffered impediments to large-scale agricultural development, and the majority of the population are small-scale farmers (Bruce and others 1997).

The nomadic herdsmen of the Horn of Africa have suffered extreme marginalization and reduced food

security since the colonial governments seized control of all central rangelands and, later, reallocated them for mechanized farming, expansion of irrigated agriculture and declaration of wildlife reserves (see Box 2f.4). Thus, the herdsman have greatly reduced access to fodder, and are frequently also denied access to crop residues in farming areas, except in return for a fee. Cropping has extended steadily, woodcutting in former pasture areas has been sanctioned, nomadic routes have been disturbed and watersources have not been maintained (DFID 1999). The lack of institutional support for nomadic pastoralists has further excluded their participation in decision making or land use planning (DFID 1999).

Governments are recognizing that central control of land and agricultural resources is limited by capacities and resources, and that land policy reform is needed to encourage the formation of farms of viable size, for sustainability and growth of agricultural output (FAO 2001c). In addition, just as state ownership has not yielded the anticipated growth in agricultural production, private ownership has also shown little benefit to increasing production, largely as a result of market failures. Therefore, market reform must go hand in hand with tenure reform (Bruce and others 1997). Policy-makers are also reforming attitudes towards communal land tenure and access, and realizing that, under certain conditions, communal systems provide security of tenure, environmental and production sustainability, and conflict avoidance (Bruce and others 1997). However, this transformation has been slow, and is still experiencing opposition in some countries. In Kenya, for example, individual titling is still regarded as the political and social ideal and, therefore, claims to communally owned land are often thrown out of court. This has led to land grabbing, or illegal occupancy in some areas, notably in urban areas and state forests (DFID 1999). Means for strengthening the voice of community groups include the decentralization of political power and the formation of natural resource use councils, comprised of community members (DFID 1999). In Uganda, the new Land Act (1998) combines objectives of agricultural productivity and equity by promoting democratization and good governance with some redistribution of land rights. Implementation of the Land Act (1998) has been hindered by lack of an overall land policy, and by insufficient strategic

#### **Box 2f.4 Conflicts in land use due to land policy failures**

Many of Kenya's major wildlife reserves are in traditional pastoral areas (for example, Maasailand and Samburu). The livestock belonging to the indigenous pastoralists (the Maasai and Samburu tribes) are excluded from the parks, because conservation areas were established under colonial rule, and the prevailing philosophy was to preserve and to protect the land from human activities. However, this results in restrictions on important grazing areas (including springs and other water sources) and disrupts traditional management practices. At the same time, the parks are not fenced and the wild animals are not herded. Therefore, they are able to leave the reserves at certain times of the year and to graze in the same areas as livestock. This means that the areas outside of the reserves incur additional pressure – from the livestock that can no longer migrate into the neighbouring reserves, and from the game that migrates out of the reserve. The impact of the wildlife is also greater than that of the cattle, as they have 'extended grazing hours', feeding throughout the night, whereas cattle are kept in enclosures

planning, limited resources and capacity, and widespread corruption (DFID 1999).

A further consideration in land reform is the issue of gender. Although women are responsible for most household and commercial agricultural production (FAO 2001b), their rights to own land are severely diminished, being largely through husbands or fathers (Bruce and others 1997). Governments' recognition of women's rights, and the issue of gender reform, have not progressed as far in eastern Africa as in southern Africa, although Burundi, Eritrea and Ethiopia are starting to encourage the inheritance of land by women, and the allocation of land to couples to create household holdings (Bruce and others 1997).

#### **WESTERN INDIAN OCEAN ISLANDS**

Madagascar dominates the sub-region in terms of land mass, occupying nearly 600 000 km<sup>2</sup>, the fourth largest island in the world. The remaining countries are made up of archipelagos of between 3 and 115 islands, with a combined size of 2 000 km<sup>2</sup>. Large parts of the western Indian Ocean Islands are mountainous, rugged and dry, and unsuitable for cultivation. Only Madagascar is large enough to support a significant amount of permanent pasture (41 per cent of the land area) and livestock production (UNEP 1999b). The

dominant land use in the sub-region is cultivated crops in Comoros and Mauritius (40 and 48 per cent of the land area respectively), whilst all countries have significant cover of forests and woodlands, which are widely used for grazing and gathering of wild resources (UNEP 1999b). Most of the islands experience monsoon rains from November to April, and total rainfall varies from island to island, within the range 700 mm/yr to more than 2 000 mm/yr. Cyclones are also common in some of the islands, and this can be highly erosive to exposed soils. By contrast, dry spells and droughts are not uncommon, especially in southern Madagascar.

### **IMPORTANCE OF CULTIVATION AND LIVESTOCK PRODUCTION IN THE WESTERN INDIAN OCEAN ISLANDS**

Agriculture is an important activity in the Western Indian Ocean islands, both at the subsistence level and at the commercial level. The major commercial crops are: bananas; cassava; cloves; coffee; copra; onions; potatoes; rice; sugar; sweet potatoes; tea; vanilla; and ylang ylang, a perfume which is unique to Comoros. In 1970, agriculture employed 83 per cent of the workforce in Comoros, 84 per cent in Madagascar and 34 per cent in Mauritius. This fell slightly in all countries over the following two decades, with Mauritius showing the greatest decline, to 17 per cent by 1990 (World Bank 2001). Over the past 30 years, the agricultural sector has also contributed significantly to the economies of the sub-region's countries, with the result that the best land has been reserved for the commercial production of luxury commodities, and the countries are net importers of cereals and staples.

In Comoros, the contribution of agriculture to the economy has ranged from 35 per cent to 38 per cent of GDP between 1980 and 1999 (World Bank 2001). In Madagascar, the contribution to GDP has been slightly lower, at between 24 and 28 per cent (World Bank 2001). In the Seychelles, agriculture's contribution to GDP has fallen from nearly 10 per cent in 1980 to less than 5 per cent in 1999, as tourism has grown in income contribution and foreign exchange earnings (World Bank 2001). Exports from agriculture in 1999 were estimated at US\$92 million from Madagascar, and US\$405 million from Mauritius (World Bank 2001).

### **EXTENT AND PRODUCTIVITY OF CULTIVATION AND LIVESTOCK PRODUCTION SYSTEMS IN THE WESTERN INDIAN OCEAN ISLANDS**

Subsistence agriculture is practised on all islands in the sub-region, especially in Madagascar and Comoros, where slash-and-burn agriculture is a common means of supplementing household food requirements and incomes. However, due to economic pressures for agricultural exports and foreign exchange earnings, the best land is often reserved for commercial crop production (especially sugar, copra, vanilla, coffee and ylang ylang) (UNEP 1999b). As a result of rising population pressure and of increasing demand for land for subsistence farming, more natural habitat is being converted to cultivation, and the soils are becoming degraded, especially in the marginal areas, where low-input subsistence agriculture is practised. As a result, there are signs of reduced productivity compared to levels 50 years ago (UNEP 1999b).

These same pressures have resulted in increased area of land under cultivation in Comoros (from 90 000 ha in 1970 to 120 000 ha in 1999) and in Madagascar (from 2 300 ha in 1970 to 3 100 ha in 1999). In Mauritius and Seychelles, the area of land under cultivation has remained fairly constant (at 100 000 ha and 5 000 ha respectively) and, in Reunion, the area of cultivated land has actually declined slightly, from almost 60 000 ha to less than 40 000 ha (FAOSTAT 2001).

Although absolute food production indices have also climbed over the past 30 years, as a result of population growth and largely export-driven markets, food production per capita has declined in all countries, as shown in Figure 2f.10 and Figure 2f.11 (FAOSTAT 2001). In Madagascar, where there is significant rearing of livestock, production indices have also risen, by almost 50 per cent of the output in 1970 but, again, this has been outstripped by population growth, and per capita production rates have fallen by almost 40 per cent (FAOSTAT 2001). In Mauritius, livestock rearing and processing, principally chicken farming and fish farming, has produced an increase in food production (UNDP 2000).

The gap between food production and population growth, and the emphasis on commercial agriculture rather than production for domestic consumption, have resulted in a food deficit, particularly in cereals and

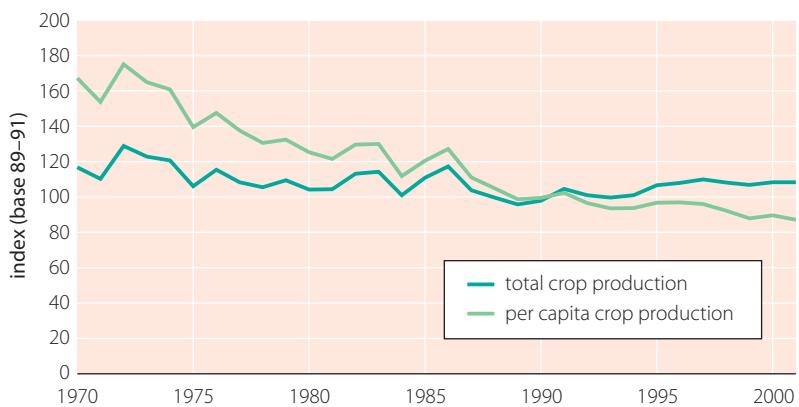
other staples (FAO/GIEWS 1998). As a result, some countries, such as Mauritius and Seychelles, import significant quantities of cereals, whereas Comoros and Madagascar are poorer countries, which cannot afford expensive imports and, therefore, are often dependent on food aid to make up some of the deficit. In 1998, both food imports and aid were high for Comoros and Madagascar, due to an outbreak of brown locusts, which caused crop damage. The locust outbreak may have been linked to the El Niño event, which caused hot, dry conditions (FAO/GIEWS 1998).

### LAND QUALITY AND PRODUCTIVITY IN THE WESTERN INDIAN OCEAN ISLANDS

The heavy pressures on land in the sub-region have resulted in: the degradation of, or the conversion of, natural vegetation; clearing of forests; loss of productivity; and soil erosion. Deforestation rates are high, because land is cleared for commercial cultivation, as well as for urban and industrial developments. This exposes the soil to wind and water erosion, and alters the capacity to regulate soil and water quality, flow regulation and flooding control. The rainforest area of Madagascar, for example, is experiencing escalating rates of clearance for cultivation and cattle rearing. Intense grazing pressures are, in turn, affecting areas of grassland and permanent pastures, leading to: loss of vegetation cover; soil compaction; and erosion.

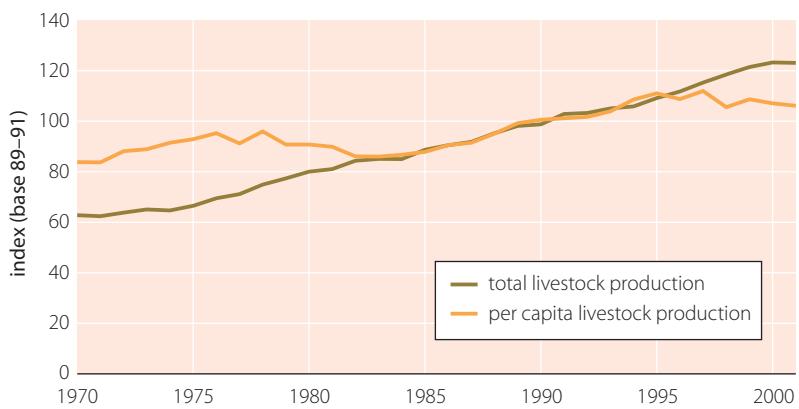
Lack of erosion control techniques, exacerbated by frequent, severe tropical cyclones, leaves the soils exposed and vulnerable to extensive erosion (World Bank 1995). The central highlands of Madagascar have been classified as 'hotspots' of soil erosion, due to intense pressures from low-input agriculture and, in the southwest of the country, shortening of fallow periods has caused nutrient depletion of the soils, rendering them more vulnerable to the impacts of drought (UNEP 1999b). In Comoros, soil fertility has declined and soil structure has deteriorated, such that enormous soil losses are experienced with each monsoon (UNEP 1998). In Reunion, the steep sides of the volcano have been cleared of vegetation, and they experience highly erosive rainfall, resulting in landslides, which are effective barriers to sustainable agriculture. In these small islands, the coastal zone is greatly threatened by soil losses of this magnitude, because sediments which are washed

**Figure 2f.10 Crop production indices for the Western Indian Ocean Islands, 1970–2000 (total and per capita)**



Source: compiled from FAOSTAT 2001

**Figure 2f.11 Livestock production indices for the Western Indian Ocean Islands, 1970–2000 (total and per capita)**



Source: compiled from FAOSTAT 2001

out to sea smother fragile and economically important habitats, such as coral reefs and mangroves. This is a serious problem in the Seychelles (Shah 1997), where additional coastal erosion occurs due to wave action and sea level rise. Land reclamation projects in Seychelles have produced 200 ha, with a further 395 ha under development, despite damage to the coral (Shah 1997).

Rates of soil loss, and the economic impacts of this, have not been quantified for this sub-region, but it has been estimated that, in Madagascar, approximately 45 per cent of the land is under moderate, high or very high risk of desertification. This follows the general pattern seen in Africa of highest vulnerability in areas of low-input agriculture combined with high population, or along desert margins (Reich and others 2001). Madagascar's National Environmental Action Plan (NEAP) places the costs of land degradation at 15 per cent of GDP, or US\$290 million (USAID 1988). This was



Satellite image showing soil erosion and deposition in the ocean off Madagascar

*Jacques Desclolettes, MODIS Land Rapid Response Team, NASA/GSFC*

mostly attributed to deforestation, although soil erosion was estimated to cost between US\$4.9 million and US\$7.6 million in any particular year. The costs included: reductions in agricultural productivity; raised infrastructure maintenance and investment costs; and damage to coastal ecosystems (USAID 1988). Whilst this was a small fraction of agricultural GDP that year, the cumulative costs of soil degradation over time could be significantly higher, as shown by estimates from other countries (UNU 1998).

A further issue of concern, particularly in Mauritius, is the extensive use of inorganic fertilizers, herbicides and pesticides in commercial sugar plantations. Average annual fertilizer applications have been estimated at 600 kg/ha, more than five times the world average of 113 kg/ha (Government of Mauritius 1991, WRI, UNDP, UNEP and World Bank 1998). This excessive exposure to agrochemicals poses a health risk for farmworkers, and run-off reaching rivers and coastal waters is poisoning wildlife and contributing to eutrophication (UNEP 1999b).

#### **Improving land quality and productivity in the Western Indian Ocean Islands**

Climate change and increasing populations (both resident and tourist) are likely to increase the pressures on land resources, in order to meet the growing demand

for food amid more variable climatic conditions. In response, all countries in the sub-region have ratified the UNCCD, although none of the countries have yet produced National Action Plans. Madagascar, the country most affected by drought, organized a National Awareness Seminar in 1997, and has established a national focal point for coordinating the National Action Plan (UNCCD 2001).

All countries have also produced NEAPs, in addition to a Regional Environment Programme coordinated by the Indian Ocean Commission, Mauritius (IOC). Each of these contains action programmes to combat degradation, and implementation is well underway in Madagascar and Mauritius. In Madagascar, environmental awareness has increased since adoption of a national conservation strategy in 1984, and several successful conservation schemes have been completed. The NEAP complements these activities by focusing on: biodiversity protection and management; the creation of a national environmental fund for environmental improvement projects; additional research, including land mapping and management; environmental education and training; and institutional support.

#### **LAND RIGHTS IN THE WESTERN INDIAN OCEAN ISLANDS**

Land tenure arrangements vary within and between countries, which often creates conflicts over land ownership, access to resources, land use and distribution of benefits. These, in turn, influence investment patterns and land management practices, and can lead to land degradation. The richer parts of the region have established more equitable distribution of land between their differing communities, with effective protection of land rights. In the poorer islands, however, much needs to be done, and the lack of equitable land policies and practices present direct threats to sustainable land quality. In Mauritius, 90 per cent of land is privately owned, and more than 80 per cent of families own their own homes with government-registered deeds. By contrast, in Madagascar, land is generally owned through inheritance without title deeds, resulting in conflicts over land rights, and in short-term exploitation of soil (FAO 1997b). In Comoros, three types of land tenure laws apply:

colonial law, customary law and Islamic law. As in Madagascar, lack of registration in Comoros creates confusion over ownership and access rights (RFIC 1998). In Seychelles, 70 per cent of the land is state-owned and is then leased to smallholders (Republic of Seychelles 1997, UNDP 1997). Since 1993, however, land reform processes are underway in Seychelles, in order to transfer land back to original owners (UNEP 1999b). In Madagascar, a land reform study was started in 1993 to improve understanding of the relationship between land tenure and degradation, and the likely future consequences of rising population and demand for land and resources. Additional studies are required to determine the role of traditional property rights in sustainable land use and to make recommendations for short-term local action programmes, coupled with reforms in land tenure and land use, as well as development policies (World Bank 1993b).

## SOUTHERN AFRICA

Southern Africa has a total land area of 6.8 million km<sup>2</sup>, of which almost 33 per cent is covered by forest, 21 per cent is desert, and the remaining natural habitat is largely savannas and grasslands. Rainfall in the sub-region ranges from 50mm/yr in the arid deserts of Botswana, Namibia and South Africa, to more than 1000mm/yr in the equatorial forests of Angola, Malawi, Mozambique and northern Zambia. In most areas, rainfall is largely seasonal, falling over a period of just a few months, often in the form of intense thunderstorms or showers. Where vegetation cover is reduced, this can lead to higher rates of soil erosion. Likewise, most of the sub-region experiences high variability in rainfall, and frequent or prolonged periods of flooding and drought. Grazing lands currently cover 49 per cent of the area, predominantly in savannas and grasslands and, especially, in the drier countries where forest cover is lower (FAOSTAT 2001). Permanent crops and arable lands cover slightly less than 6 per cent of the land area, and are predominantly rain-fed, except in South Africa, where irrigation potential is relatively well developed.

## THE IMPORTANCE OF CULTIVATION AND LIVESTOCK PRODUCTION IN SOUTHERN AFRICA

The proportion of the southern African population employed in agriculture in 1970 was 71 per cent. In 1980, it was 64 per cent and, by 1990, it was 60 per cent (World Bank 2001). Proportions varied, however, from 87 per cent in Malawi to 14 per cent in South Africa (World Bank 2001). The major crops include maize, wheat, tobacco, tea, cashew nuts, sugar cane, coffee and cotton, and these contribute significantly to GDP and to exports. In Tanzania, agriculture contributes up to 50 per cent of GDP and 50 per cent of export earnings (Government of Tanzania 2001). Livestock production is particularly important, accounting for approximately 30 per cent of agricultural earnings. South Africa's agricultural exports totalled US\$2 464 million in 1997, and Zimbabwe's reached US\$1 157 million (World Bank 2001). In Malawi and Mozambique, agriculture accounts for approximately 35 per cent of GDP, but less than 10 per cent in mineral-rich countries, such as Botswana and South Africa (World Bank 2001).

Small-scale agriculture and pastoralism are widely practised in southern Africa, although the value of these practices is not reflected in national accounts. For example, in Tanzania, approximately 3.8 million households practise small-scale farming, and roughly 10 per cent of these practise pastoralism or agro-pastoralism (Government of Tanzania 2001). Although cattle dominate, sheep and goats are extremely important sources of protein, accounting for about 12 per cent of the national meat supplies (Government of Tanzania 2001). In Botswana, approximately 70 per cent of the population lives in rural areas and is dependent on agricultural activities—both rain-fed cultivation of crops and livestock rearing—for their livelihoods (Botswana Agricultural Census Report 1993).

## EXTENT AND PRODUCTIVITY OF CULTIVATION AND LIVESTOCK PRODUCTION SYSTEMS IN SOUTHERN AFRICA

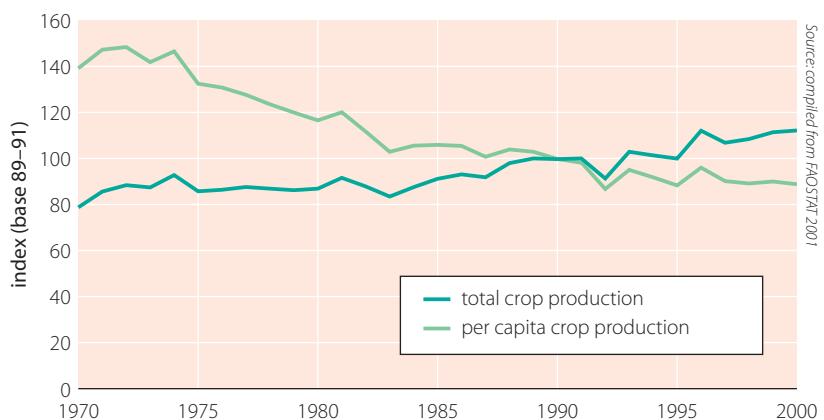
Over the years, the sub-region has seen some expansion in both cropland and permanent pastures, as a response to rising population and demand for food, as well as to policies aimed at increasing exports. The total cultivated area has grown from 32 million ha in 1970 to 39 million ha in 1999, whereas the extent of

permanent pastures has remained almost constant, at 332 million ha (FAOSTAT 2001). In some instances, these areas are inappropriate for cultivation or grazing, as a result of low or variable rainfall, or unsuitable topography and soil quality.

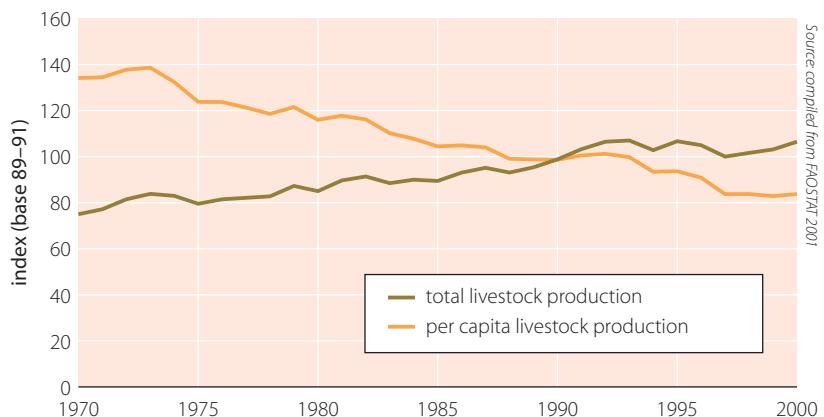
Absolute production of crops and livestock has increased since 1970, but has lagged behind population growth and, therefore, the per capita production indices show a decline (see Figure 2f.12 and Figure 2f.13). Countries have been dependent on imports of grain over the past three decades and, on occasion, have required food aid, particularly during times of flooding or drought. In addition, per capita calorie intake in many countries is now lower than it was in 1970, and protein intake has declined quite considerably in Malawi, Zambia and Zimbabwe (FAOSTAT 2001).

Current levels of nutrition in the sub-region are, on average, 2 231 calories/capita/day. However, they vary from 1 782 calories/capita/day in Mozambique (which is recovering from civil war) to 2 956 calories/capita/day in South Africa, one of the wealthiest countries in the sub-region (Trueblood, Shapouri and Henneberry 2001). Climate variability contributes significantly to fluctuations in production, and food supplies tend to be in surplus or in deficit. Mozambique and Angola have also been most heavily dependent on imports and food aid, especially since 1980. For example, between 1963 and 1965, Angola imported 9.5 kg/capita of grain but, between 1993 and 1995, the figure had increased to nearly 50 kg/capita (Trueblood and others 2001). In Lesotho, imports grew even more dramatically, from 19 kg/capita to 98 kg/capita, whereas, in Botswana, food imports remained constant, and exports grew from nothing to 3 kg/capita (Trueblood and others 2001).

**Figure 2f.12 Crop production indices for Southern Africa, 1970–2000**



**Figure 2f.13 Livestock production indices for Southern Africa, 1970–2000**



## LAND QUALITY AND PRODUCTIVITY IN SOUTHERN AFRICA

One of the challenges facing southern Africa is to feed the growing population through increased agricultural production. Such production pressures have led to resources being overexploited, and vegetation and soil degradation is a major concern. Studies indicate that more than 50 per cent of southern Africa's land degradation is caused by overgrazing from cattle, sheep and goats, some of which are bred in unsuitable areas (UNEP 1999a). The timing and density of stocking affect the productivity of grazing land, particularly in areas where rainfall is limited or variable (Erskine 1987). Drought is a further contributing factor, as is the land tenure type, because traditional communal access grazing systems have conflicted with commercial production pressures, population growth, and colonial and post-colonial tenure systems, resulting in less willingness to share input costs, and greater incentives to exploit land for individual gains. Because the extent of suitable land is limited, there is increasing pressure to open up forests for grazing land and irrigation, and to cultivate marginal lands—a situation which exacerbates land degradation. Deforestation rates in the region average 0.5 per cent per year (equivalent to the loss of 13 000 km<sup>2</sup> per year), mainly due to the expansion in agricultural land (World Bank 2000b). Removal of

vegetation cover, poor agricultural practices, loss of wetlands and overgrazing are mainly responsible for increasingly dramatic impacts of flooding in southern Africa in recent years (UNDHA 1994).

Some of the visible manifestations of land degradation in southern Africa include: rapid soil erosion; declining crop yields; siltation of rivers and reservoirs; and deterioration of grazing lands. In Zambia, for example, it is estimated that the country loses 3 million tonnes per year (t/yr) of topsoil from cultivated land while, in Swaziland, the rate of soil loss is 50 000 (t/yr) and, in South Africa, it is between 300–400 million (t/yr) (Chenje and Johnson 1994). Knock-on effects of vegetation and soil loss include: changes in the abundance and diversity of species; and impaired water quality and air quality regulation.

Declining soil fertility is largely brought about by continuous cultivation without the application of fertilizer or manure. Fertilizer use in the sub-region has increased for some countries whilst, for others, the removal of government subsidies has lead to increasing costs of fertilizers and, thus, their use is declining. Many farmers can no longer afford them, or apply sub-optimal amounts and, therefore, soil fertility further declines.

### **Improving land quality and productivity in Southern Africa**

There have been a number of responses in southern Africa to combat loss of vegetation cover and soil fertility, and to rehabilitate land resources. Some of the programmes are in the form of community-based natural resources management projects (CBNRM), or of district and national environmental action plans or biodiversity strategy action plans, under the auspices of regional and international conventions. For example, the SADC has established an erosion hazard mapping programme, aimed at defining seriously affected areas, as well as assisting in the design of appropriate conservation strategies, by providing guidance in regional planning, environmental monitoring and land utilization programmes. The SADC also produced a Sub-Regional Action Programme to Combat Desertification in southern Africa, in line with UNCCD. All the countries of southern Africa are party to this convention, and Lesotho, Malawi, Swaziland, Tanzania and Zimbabwe have also produced National Action Plans (UNCCD



Drought-stricken maize crop, Tanzania

*Nigel Cattlin/holt studios*

2001). The sub-regional action plan also identifies priority issues to be dealt with in curbing desertification, including strengthening of early warning systems and the development of alternative sources of energy (Chenje 2000). An environment education programme aimed at establishing an SADC network for environmental education is also being implemented, with support from international donors. The Regional Environmental Education Centre coordinates the activities, which include the development of environmental education policy, and training of trainers.

Following the Inter-African Conference on Soil Conservation and Land Utilization in Goma (Democratic Republic of Congo) in 1948, several regional committees for the conservation and utilization of soil have been established, including the Southern African Regional Commission for the Conservation and Utilisation of the Soil (SARCCUS). Through the Subcommittee for Land-use Planning and Erosion Control, SARCCUS drew the attention of its member countries to negligible levels of soil conservation in the region. In 1974, soil erosion surveys were undertaken throughout southern Africa. However, owing to a lack of a standard procedure meeting the specific needs of the region, no overall assessment of the soil erosion situation was carried out. Following several attempts over a long period, a classification system eventually materialized, with several countries participating, culminating in a meeting in Gaborone in 1981 (SARCCUS 1981).

### LAND RIGHTS IN SOUTHERN AFRICA

Access to land and resources in southern Africa is perhaps the most socially and politically sensitive issue, now being entangled in environmental and political agendas. Minority individual tenure and state-based conservation practices were imposed on land which was traditionally owned by indigenous people, and most of the black populations were removed and confined to areas insufficient in extent or quality to meet production requirements, as detailed in Box 2f.5. Although colonial and post-colonial apartheid policies have largely been replaced, or are in the process of transformation, ownership and access to resources is now largely determined by economic status, with commercial farmers occupying the best farmland and contributing most visibly to the economies. For example, in Zimbabwe, a minority of 4 500 mainly white commercial farmers control more than 33 per cent of the country's prime agricultural land.

Land inequities were, until recently, most extreme in South Africa, where some 70 000 white farmers owned 87 per cent of the arable land, and 2 million black subsistence farmers were restricted to 13 per cent of the land (Moyo 1998). The imposition of state-controlled institutions significantly undermined the traditional and cultural institutional structure for resource management, thereby alienating the indigenous people from their cultural and governance aspirations. Traditional tenure security was effectively eroded, and CBNRM came under threat. Inequitable access to land underlies the food and agricultural problems facing southern Africa today, and their impact on poverty. Botswana's Tribal Land Act (1968) facilitated the conversion of tribal land to individual lease for residential, arable or grazing purposes (DFID 1999). This has led to the expansion of commercial cattle ranching, which contributes to vegetation and soil degradation, and to the marginalization of traditional hunter-gatherer communities, such as the Bushmen. The traditional authority of the chiefs has been replaced by a Land Board and its Board Secretariat, a Technical Committee and Land Officers (DFID 1999). Land Rights issues in southern Africa are manifest in increasing pressure on resources, land-based conflict, and pressure for rural development and land reform. In Zimbabwe, the conflict over land encompasses ancestral claims, claims by veterans of the independence war and gender imbalances.

#### Box 2f.5 Colonial influences on land rights in Southern Africa

Colonial policies on land tenure and access influenced patterns of land use and management in several ways in southern Africa. Shifting cultivation was seen as destructive to forests, for example, and legislation creating forest reserves was passed, leaving farmers with little option but to intensify production from existing cultivated or grazing areas. The traditional communal land tenure system was perceived to be insecure and a further cause of environmental degradation and, therefore, land was either leased from the state or privatized. It has since been acknowledged that state or private ownership can be just as harmful to the natural resource base, and extensive land tenure reforms are underway, with a greater recognition of indigenous rights and practices, as well as a greater appreciation of the role of women in agriculture.

Source:Annenstein 1989

In response, most countries of southern Africa are developing new policies, through reorganization and transformation, in order to address the needs of previously disadvantaged masses. A number of strategies were adopted, in order to achieve the objectives of land reform, including land redistribution and resettlement programmes. For example, in Zimbabwe, the government plans to acquire 5 million ha of the total 11.3 million ha of land belonging to the commercial sector, in order to complete its resettlement programme. Following land identification and planning, selected groups are to be resettled according to six different models, covering mixed farming, specialized farming and ranching (Government of Zimbabwe 1998). However, there have been significant delays and, of the targeted 160 000 families aimed for resettlement, only 60 000 had been resettled by 1988 (African Development Bank 1993). Other policy instruments that have been used include five-year national development plans to reorganize communal areas by agricultural potential. These plans presented options for sustainable and viable agricultural production, in an attempt to alleviate fears of falling agricultural productivity levels and economic recession.

In South Africa, the land reform process has attempted to provide for tenure, use and access rights that are either individual or group-based, with existing or new community organizations qualifying for such rights on the basis of demonstrable public support. Land Rights Officers are proposed, in order to ensure the participation of all stakeholders in decision making, and Land Rights Boards will arbitrate in the event of disputes and will make recommendations to the Minister (DFID 1999). Implementation is in the early stages, however, and assessments of effectiveness would currently be premature. In Mozambique, the 1998 Land Law is beginning to be implemented, following an extensive public awareness and discussion programme. Surveys to register land rights have commenced in certain areas, and verbal testimony to tenure under customary law is sufficient to register tenure rights under the new law (DFID 1999).

In many countries, land reform processes have been strengthened by the creation of central agencies, such as government departments for land, agriculture, local government and resource development. These institutions provide land, credit facilities, and a range of technical and professional services.

The current mixture of land tenure systems allows varying degrees of access to resources by women. Under the private freehold system, women have rights to access land, but very few of them have the resources to purchase such land on the open market. On the other hand, communal land held under the traditional or customary system allows women secondary access through marriage but, as soon as the marriage breaks, they lose the right to cultivate lineage land (SARDC-WIDSAA 2000). However, through processes of land reform, liberalization and improved status of women, women are slowly beginning to control a sizeable proportion of rented, purchased and allocated land.

### CENTRAL AFRICA

Central Africa is predominantly covered in forest and savanna. The coastal humid belt, with high and relatively constant rainfall, supports dense tropical forests, whereas the northern parts of Cameroon, Central African Republic and Chad are drier, with more variable rainfall, and the dominant vegetation is

savanna. Land use in the sub-region is sensitive to climatic and vegetation characteristics, with forestry and commercial plantation agriculture largely found in the humid zones (where rainfall reaches up to 4000 mm/yr), and livestock rearing, with some subsistence cultivation, in the semi-arid zones (where rainfall averages 500 mm/yr). The semi-arid zone is also highly vulnerable to climatic variations and drought, which limit agricultural expansion. Soils are highly vulnerable to erosion, because most of the rainfall occurs in intense heavy storms, and because the clay and silt content makes the soils prone to crusting when exposed (Njinyam 1998).

Approximately 8 per cent of the total area is currently used for arable and permanent crops (with Cameroon having the largest share, at 15 per cent of its land area), and 16.5 per cent is used as permanent pasture (FAOSTAT 2001). Irrigated agriculture is limited, partly because the fertile soils and the high, reliable rainfall in the humid zone are conducive to rain-fed agriculture, and partly because the infrastructure development required to establish irrigated cultivation in the semi-arid zone has so far been prohibitively expensive. Despite these favourable conditions in central Africa, large-scale agricultural development has been limited by national market failures and international trade barriers. Shifting cultivation (or slash-and-burn agriculture) was a traditional means of coping with variability, but this practice is no longer sustainable, because there are much larger populations now requiring land. The priority issues in central Africa are, therefore: improving food security, through enhanced production and distribution of resources; and reducing the pressures that shifting cultivation has on forests and woodlands.

### IMPORTANCE OF CULTIVATION AND LIVESTOCK PRODUCTION IN CENTRAL AFRICA

In 1970, 81 per cent of Central Africa's labour force was employed in agriculture, with Chad having the highest at 92 per cent. By 1980, the percentage had fallen to 74 and, in 1990, the average was 68 per cent (World Bank 2001). The reasons for this decline include population growth exceeding agricultural expansion, and industrial development. Pastures account for much of the agriculturally productive land in the Sahel, and

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- Through processes of land reform, liberalization and improved status of women, women are slowly beginning to control a sizeable proportion of rented, purchased and allocated land*
-

pastoralists and agropastoralists are integral parts of local and regional economies. It was estimated in 1995 that there were more than 404 000 pastoralists in Chad (about 15 per cent of the country's population), with pasture areas covering about 55 percent of the national territory (FEWS 1995).

The major crops in the sub-region include: cassava; cocoa; coffee; cotton; groundnuts; maize; millet; palm oil; rubber; and sorghum. In 1980, the total value of agricultural exports for the region was US\$1 148 million, although Cameroon took the lion's share at US\$699 million. In 1990, exports fell to just US\$909 million, mainly as a result of commodity price fluctuations (World Bank 2001). By 1997, however, markets had recovered in most countries, although the war in Democratic Republic of Congo had an enormous impact on its agricultural exports and, as a result, totals

for the sub-region were just US\$796 million (World Bank 2001). Value added in agriculture in 1980 ranged from 40 per cent of GDP in Chad to just 12 per cent in Gabon (World Bank 2001). In 1990, the percentage for Chad fell to 24 whilst, in Democratic Republic of Congo, the percentage contribution of agriculture to GDP has climbed from 27 in 1980 to 58 in 1999, mainly due to other economic activities having been disrupted due to the war (World Bank 2001).

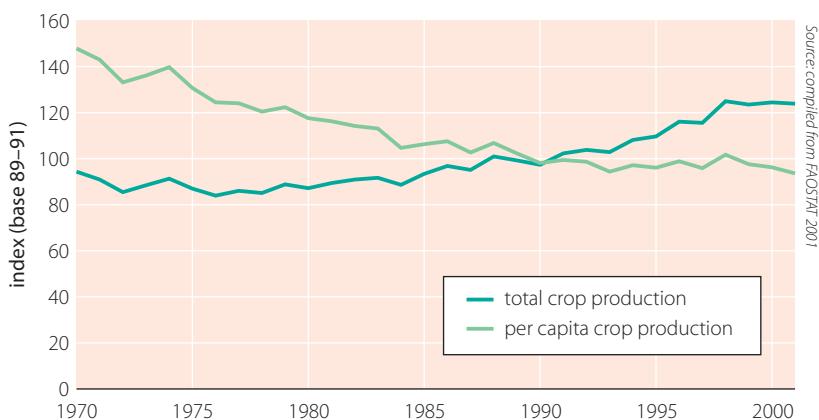
### EXTENT AND PRODUCTIVITY OF CULTIVATION AND LIVESTOCK PRODUCTION SYSTEMS IN CENTRAL AFRICA

Land development for crop cultivation increased rapidly between 1970 and 1985 (from 18 million ha to 21 million ha), but then the rate of expansion slowed, until 1999, when the total cultivated area was 21.5 million ha (FAOSTAT 2001). The period of rapid increase must have come as a result of the boom in export crop prices, especially from coffee and cocoa sales, followed by the economic crises of the 1990s, during which land use for export cash crops decreased. Over the same period, the extent of permanent pasture has shown little change, and it stands at approximately 80 million ha (FAOSTAT 2001).

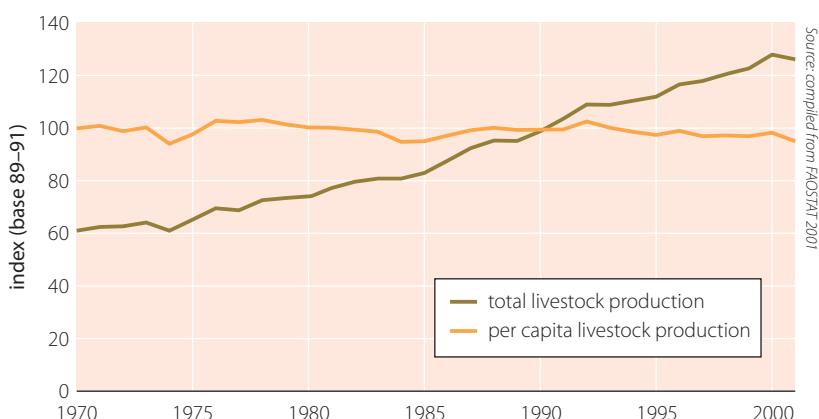
Absolute production for crops has increased steadily over the past 30 years, but crop production per capita has declined, due to population growth rates exceeding food production capacity (see Figure 2f.14) (FAOSTAT 2001). Interestingly, absolute livestock production indices for the sub-region have increased quite significantly, but livestock production per capita has remained relatively constant (see Figure 2f.15) (FAOSTAT 2001).

As a result of declining yields and civil wars, calorie intake in Cameroon, Central African Republic and Democratic Republic of Congo in 1999 was lower than in 1970. For the other countries, it had improved, but was still, on average, just 2 292 cal/capita/day (FAOSTAT 2001). To compensate for this, many countries have imported large amounts of cereals and, during times of drought, Cameroon, Democratic Republic of Congo and Chad have requested food aid. The Democratic Republic of Congo is normally an importer of cereals but, in 1998, livestock production suffered from the civil strife (more so than crop

**Figure 2f.14 Crop production indices for Central Africa, 1970–2000 (total and per capita)**



**Figure 2f.15 Livestock production indices for Central Africa, 1970–2000 (total and per capita)**



production), and food production shortfalls were estimated at 118 000 tonnes. Due to the disruption of trading activities, particularly in Brazzaville, commercial food imports were reduced, and 46 000 tonnes of cereal were required to meet the population's needs. A variety of coping mechanisms were enacted, including increasing effort in alternative food production areas (fishing and hunting, and short-cycle crops), as well as food aid for vulnerable groups (FAO/GIEWS 1998).

### LAND QUALITY AND PRODUCTIVITY IN CENTRAL AFRICA

Land degradation, defined as the deterioration in the quality and productive capacity of land (Benneh, Agyepong and Allotey 1990), has been identified as one of the major environmental challenges facing the central Africa sub-region. The main contributors to land degradation in this sub-region are erosion and soil compacting, as a result of extensive removal of vegetation, and exposure of the soils to heavy rainfall, increased evaporation and wind action. The main reasons for vegetation removal are commercial logging and tree cutting to provide domestic fuel, as well as clearance of forests for commercial or subsistence cultivation.

The rate of forest loss in central Africa is a cause for concern in terms of its impacts on biodiversity, atmospheric change and hydrological cycles, in addition to the concerns regarding soil erosion (UNU 1998). Chemical degradation also occurs, because of: intensive cultivation of marginal areas without sufficient fallowing; use of chemical rather than organic fertilizers; and salinization, through inundation with saltwater or irrigation with poor quality water. For example, the Congo basin has lost more than 1 million ha of original forest cover, contributing to soil erosion and the sedimentation of waterbodies (WRI 2001). The Lake Chad basin has also suffered severe vegetation loss, and potential for soil loss and desertification is high (WRI 2001).

Declining productivity and soil structure in the Sahelian zones of Chad and Cameroon are exacerbated by unpredictable rainfall and drought, resulting in extreme degradation and desertification. Chad is currently experiencing the greatest vulnerability to desertification, with 58 per cent of the area already



Goat herd overgrazing fragile pasture, Chad

*Vincent Dede/Still Pictures*

classified as desert, and 30 per cent classified as highly or extremely vulnerable (Reich and others 2001). There is a large area in Democratic Republic of Congo (64 per cent), which is classified as hyper-arid, and sands of the Kalahari desert have encroached on the savanna vegetation (Reich and others 2001). Central African Republic and northern Cameroon have also been experiencing desertification since the severe drought of 1972–73 (Njinyam 1998).

In the coming decades, the threat of desertification will increase, as a result of climatic changes, such as: increased evaporation; reduced rainfall and run-off; and increased frequency and severity of drought (IPCC 2001). In addition, civil unrest or conflict can result in vast movements of refugees, many of whom are settled in marginal or fragile areas. Such social and environmental pressures were clearly demonstrated in 1997, when Central African Republic (having to cope with internal disputes) received more than 50 000 refugees from Sudan, Chad, Democratic Republic of Congo, Congo Brazzaville and Rwanda. The arrival of these displaced persons put a visible strain on the already stressed food security situation (Njinyam 1998).

The consequences of land degradation, and of soil erosion and compaction, are manifest as a result of the declining ability to support natural or domesticated plant and animal production. Ultimately, this translates to reduced nutritional status of the population and to reduced export revenues. In addition, communities which are dependent on wild produce—such as fruits, nuts, animals and mushrooms, and wood for fuel—have to search further and further afield to meet their needs,

and may experience food shortages or even famine during drought years. Extreme reductions in productivity may result in people abandoning their farms and migrating to urban centres, in search of improved security.

### **Improving land quality and productivity in Central Africa**

Political and economic development policies, as well as conflicts and civil unrest, have also played a role in declining food security in parts of the sub-region, as shown by the example of Cameroon in Box 2f.6. A comprehensive, integrated approach to improving food security and land quality is, therefore, a current environmental and developmental priority for central Africa. To this end, countries of the sub-region have ratified UNCCD. Chad and Cameroon are the only countries to have so far produced national reports,

however, and Chad has also produced a National Action Plan. The CILSS, which encompasses Chad, has developed a sub-regional action plan to combat desertification (UNCCD 2001).

Cameroon and Chad have also developed NEAPs, which provide an overall framework for: improvement of land use; harmonization of land use policies; and environmental management. Implementation of these plans needs strengthening through additional resources and institutional arrangements. In Cameroon, the government has also embarked on a tree-planting programme, aimed at stopping the advancing desert.

### **LAND RIGHTS IN CENTRAL AFRICA**

One of the most important issues related to land and natural resources management in central Africa is the form of land tenure and the system of access rights. These policies have a direct effect on people's security and on their investment in land and resources management which, in turn, affect productivity and land quality. The procedures and conditions of land attribution are cumbersome and complex, and there are a number of disparities between traditional and modern rights to land ownership. Whereas traditional land rights are granted through inheritance, and are centred on communal access to resources, statutory laws encourage state and private ownership, with the emphasis on commercial production rather than on household production. Differences between customary and statutory law produce conflicting situations on the ground, and can lead to disputes over access to resources. As elsewhere in Africa, the interests of certain population groups with lower levels of political recognition (including pastoralists, women and certain castes) are often marginalized (IIED 1999). Rapid population growth and migration in the sub-region have added to the pressures on land resources, especially on commercial production in the more fertile coastal zones. The influence of Islamic law in some areas, and interventions by development projects, add further complexity to the allocation of resource distribution and access rights (IIED 1999).

Where there is insecurity in land tenure, or competing interests for land use, incentives to invest in adequate land management are reduced, thereby increasing vulnerability to degradation and conflict. An

#### **Box 2f.6 Agricultural development in Cameroon**

In 1972, the government of Cameroon embarked on a 'Green Revolution', whereby agricultural production and export was promoted, in order to boost the economy. Monocropping was encouraged, in order to increase the production of cacao, coffee, cotton and rubber, which were fetching high prices on the international markets. Fertilizers and pesticides were subsidized (by up to 65 per cent and 100 per cent respectively), which attracted many farmers to this style of input-dependent agriculture.

However, in 1986, the value of cacao and coffee fell drastically, plunging the country into economic crisis. Subsidies were completely removed, and the use of agrochemicals declined, together with soil fertility. Not only did farmers suffer from lost revenue for their products but, because they had been encouraged to grow crops for export, there was a national deficit of cereal staples. The country had to import food and to request food aid, which has subsequently disrupted local production and food security. For example, imported rice was sold at a lower price than local farmers could produce it, making rice farming unviable.

Consequently, many farmers abandoned their land and migrated to urban centres, seeking greater income and food security. In 1990, the government embarked on a comprehensive research and development programme to improve food security and land management. The approach was for agricultural extension workers to engage with local farmers, and to develop affordable means of improving productivity, food security and soil fertility. A number of local level projects have been successfully implemented, encouraging farmers to use organic matter, such as animal dung, instead of expensive inorganic fertilizers, and to encourage crop diversification and rotation, and agroforestry. Some farmers have been able to produce sufficient quantities to sell in local markets, and assistance in marketing is provided through the non-governmental organization (NGO) network.

example of this is the large area around Lake Chad (northern Cameroon, Chad and Central African Republic), which is used primarily by migratory herdsmen. Their livestock often compete with settled cultivators for land and water, sometimes resulting in violent clashes (Njinyam 1998). The wetter areas in the coastal zone of central Africa are not suitable, due to the widespread occurrence of tsetse flies (which carry trypanosomiasis) and other diseases. Thus, the arid savannas of the north are vital resources, and assured access to dry-season grazing reserves and crop residues in villages is necessary, in order to ensure the continued significant contribution of livestock production to local communities and national economies (IIED 1999).

In Cameroon, the declaration of conservation areas under the colonial administration has alienated local communities from land and resources which they owned under customary laws. Their claims to the land are not recognized, and any occupation or use of such areas must be negotiated with the relevant responsible state department (Vabi and Sikod 2000). This situation has resulted in the communities exercising de facto user rights in a manner of open access, and these activities are rarely incorporated into conservation areas management plans. Better communication and planning between conservation authorities and local communities is required, in order to meet the objectives of both parties in a sustainable way (Vabi and Sikod 2000).

In response to the various impacts at national level, most countries have elaborated land-zoning plans which indicate the boundaries for various land uses. Registration and titling have also been used in some countries, as a means of improving tenure security, in order to encourage investment in agricultural inputs. However, this has been hampered by the enormous administrative burden of reclassification and recording, and it has not been able to effectively promote access rights for women or pastoralists (IIED 1999). Land reform is also challenged by the existing overlaps and contradictions between traditional customary laws, land use practices and statutory laws. These need to be resolved as a first step in delivering a more equitable and workable system of land rights.

In Chad, the government passed a Forest Code in 1989, confirming the dominant role of the state in ownership of forest land. However, this code simply

replaced the customary laws, and placed sole responsibility for administration with the central government. Decentralization of government to local authorities may relieve the administrative burden of central ministries, thus improving the effectiveness of the system and speeding up the process of reform (IIED 1999). To improve effectiveness, stakeholder dialogue and voluntary participation need to be encouraged, and policy reform needs to be complemented with initiatives that target the underlying causes of land degradation, and promote food self-sufficiency and economic development (IIED 1999). In addition, the lessons learned from the implementation of CBNRMs could be incorporated into law reform, such as: options for the co-management of forest and wildlife resources; and improving conflict resolution mechanisms (IIED 1999). CILSS, the sub-regional resource management organization, provides a useful structure for encouraging such debate and sharing of experiences between countries with similar challenges.

## WESTERN AFRICA

Land cover and land use in western Africa are largely determined by climate, and a dramatic gradation is seen from north to south in rainfall and vegetation cover. In the north, average annual rainfall is 350–850 mm/yr and savannas are the dominant ecosystems along the southern border of the Sahel (Mali, Mauritania, Niger and northern Senegal). Here, climate variability is greatest, and drought is common, and often severe. Cultivation is limited, and the dominant agricultural activity is pastoral livestock rearing. For example, in Mali and Niger, cultivation represents just 4 per cent of the land area and, in Mauritania, it is less than 1 per cent (FAOSTAT 2001). By contrast, permanent pasture accounts for 25 per cent of the land area in Mali, and nearly 40 per cent in Mauritania (FAOSTAT 2001). In the equatorial and coastal zone, rainfall is higher, with greater inter-annual and intra-annual reliability, ranging from 1 000 mm/yr to 4 000 mm/yr, although periodic flooding occurs (FAOSTAT 2001). In 2000, forest cover totalled 72 million ha (almost 12 percent of the land area), although it is highly fragmented, and under increasing threat from charcoal production and collection of wood for fuel,

commercial logging, and plantation and slash-and-burn agriculture (FAO 2001a). Nearly 11 per cent of the total area of western Africa is currently cultivated. Most of it is rain-fed agriculture, and cultivation mostly occurs in the equatorial belt. Togo and Nigeria have the largest percentage of land under cultivation (42 per cent and 33 per cent respectively), followed by Côte d'Ivoire and Ghana (23 per cent each) (FAOSTAT 2001).

Most of western Africa's population depends on the land for their subsistence, as well as for the production of cash crops. However, this dependency, rising economic pressure and population growth have resulted in increased demands on productivity of the land over the past 30 years. As a result, forest and agricultural lands have undergone rapid degradation and reductions in productivity.

### **IMPORTANCE OF CULTIVATION AND LIVESTOCK PRODUCTION IN WESTERN AFRICA**

Although subsistence agriculture is widespread, commercial agriculture also contributes significantly to the economy of the sub-region with, on average, 65 per cent of the workforce employed in this sector over the past three decades. Burkina Faso, Mali and Niger had the highest rates of employment in agriculture—more than 90 per cent—in 1990 whereas, in Cape Verde and Nigeria, employment in agriculture reached only 31 and 42 per cent respectively (World Bank 2001).

There is a wider variety of crops grown in western Africa than in some other sub-regions, although the

most important are: cotton; coffee; cocoa; cassava; groundnuts; maize; millet; palm oil; rubber; sorghum; and yams. International price fluctuations have heavily influenced income from agricultural produce over the past 30 years, but it has remained one of the mainstays of GDP. For example, in Benin and Burkina Faso, the value of agricultural exports grew steadily between 1980 and 1997 (from US\$55 million to US\$198 million and from US\$80 million to US\$119 million respectively) (World Bank 2001). Côte D'Ivoire, Ghana and Nigeria experienced declines in export values between 1980 and the mid-1990s, but have seen gains since then, whereas Gambia, Liberia, Senegal and Sierra Leone have not recovered so well. Mali, Mauritania and Guinea have seen fairly constant export values (World Bank 2001). In Mauritania, value added in agriculture was US\$306 million (compared to GDP of US\$1 252 million) in 1999, up from US\$160 million in 1980 (when GDP was US\$753 million).

### **EXTENT AND PRODUCTIVITY OF CULTIVATION AND LIVESTOCK PRODUCTION SYSTEMS IN WESTERN AFRICA**

Total land area under crop cultivation in the sub-region has grown from 51 million ha in 1970 to 66 million ha in 2000 (FAOSTAT 2001). Absolute crop production has also increased, whereas per capita production was the same in 2000 as it was in 1970, having declined until 1985, and then recovered, as shown in Figure 2f.16. Livestock production has also increased in absolute terms, although per capita production increased between 1975 and 1985, and then declined to below 1970 levels (see Figure 2f.17).

Whilst there has been an overall increase in the daily per capita calorie supply in western Africa (from an average of 2 252 calories/capita/day in 1970 to 2 612 calories/capita/day in 1999), Liberia and Sierra Leone have seen declines (FAOSTAT 2001). This is probably due to supply and distribution disruptions, as a result of the civil wars in these countries. Conflicts and climatic variability have also been the cause of western African countries being food-deficit countries, and among the most food insecure in the world (Staatz, Diskin and Estes 1999). These countries have been dependent on food imports and aid, and are likely to continue to be so for the foreseeable future. For

Harvesting cocoa pods,  
Ghana

Ron Giling/Still Pictures



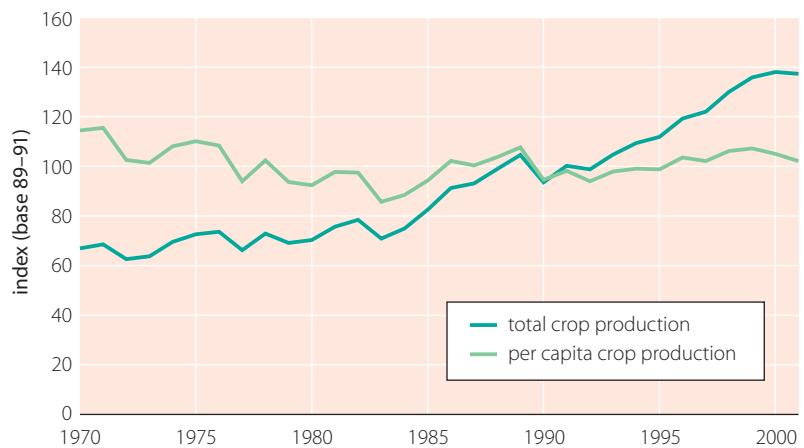
example, Sierra Leone was a net exporter of rice in the 1960s but, by 2001, was importing it at an approximate cost of US\$22 million a year (Verheyen 2001). The food situation in 2001 was also particularly severe in Burkina Faso, Liberia and Niger, where the FAO was warning of the need for food aid (FAO 2001d).

Efforts to improve food security have been instigated at the sub-regional and national levels. For example, the US Agency for International Development (USAID) is currently developing a Western Africa Strategy, in order to determine priority needs and areas of assistance (Staatz and others 1999). A further sub-regional response has come from the CILSS and the Club du Sahel. The Club du Sahel is a donor group of the Organization for Economic Cooperation and Development (OECD), which interfaces with CILSS. It was established after the 1972–73 drought, in order to ensure that the disaster was not repeated. Together, these institutions developed a Charter for Food Aid to the Sahel in 1990. The charter, the first of its kind, provided guidelines for improving food aid practices, and integrating foreign assistance into long-term food security objectives. The three main focus areas are: enhancing understanding of the food situation; coordination of donations; and provision of food aid (OECD/ Club du Sahel 2001). Mali and Niger have established well-functioning early warning systems (EWS), whereas other countries are experiencing start-up problems. Lack of coordination between donors, and confusion over requests for aid, have also been experienced in some countries (OECD/ Club du Sahel 2001).

### LAND QUALITY AND PRODUCTIVITY IN WESTERN AFRICA

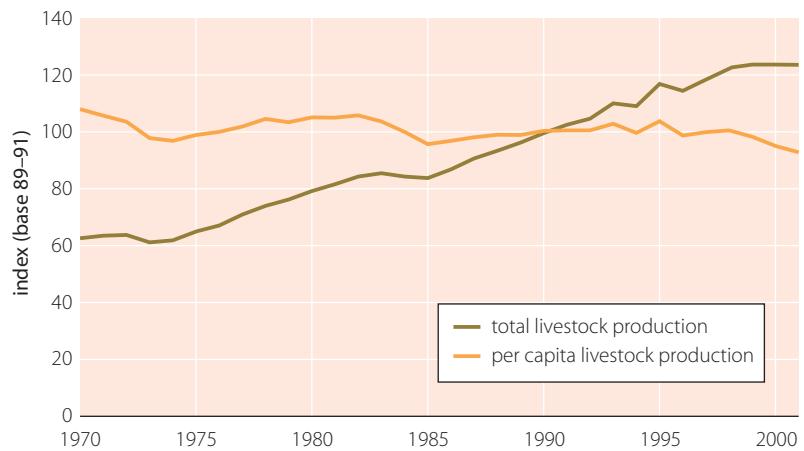
Land degradation is identified as a major issue in many western African countries, specifically with regard to: the degradation of forest cover; intensive cultivation practices; and natural disasters, such as droughts and desertification. The current state is a reflection of increasing pressures on land resources over the past 30 years, due to: population growth; rising demand for production and energy; and worsening poverty. Policies in support of foreign exchange earnings are additional pressures, which have intensified land degradation in both the dry savanna and the wet forest zones of the sub-region.

**Figure 2f.16 Crop production indices for Western Africa 1970–2000**



Source: FAOSTAT 2001

**Figure 2f.17 Livestock production indices for western Africa 1970–2000**



Source: FAOSTAT 2001

Loss of soil fertility and soil erosion are the obvious manifestations of land degradation in western Africa. In the northern Sahelian zone, where animal husbandry is the dominant agricultural practice, the main agent of soil erosion is the wind, which is supported by dry climatic conditions. Overgrazing and trampling reduces the vegetative cover and causes compacting of the soil, which is then vulnerable to erosion. In the wet forest zones of the sub-region, sheet and gully erosions are predominant, due to loss of vegetative cover. In commercial plantations and subsistence farms alike, soil fertility is declining, as a result of the prohibitive costs of inorganic fertilizers. In Ghana, for example, water erosion is the major problem, with more than 220 000 km<sup>2</sup> of land affected by sheet and gully erosion, of which 50 000 km<sup>2</sup> is severely affected (FAO/AGL 2000). Nutrient depletion is widespread in

Ghana, especially in the coastal areas, due to high losses of organic matter caused by: reduction of fallow; intensive cropping; and inadequate applications of fertilizers (FAO/AGL 2000). The long term on-site consequence of erosion and nutrient depletion is the reduction in crop yield, and annual productivity losses of 2.9 per cent in all crops and livestock have been recorded in Ghana (FAO/AGL 2000). The impacts of this on Ghana's economy have been estimated at 2–5 per cent of agricultural GDP. Furthermore, additional losses and costs may be incurred, for example, through eutrophication of water bodies, resulting from sedimentation and accumulation of fertilizer residues. Soil degradation also has consequences at the household level, affecting incomes and food intake, as well as encouraging rural-to-urban migration.

In the Sahelian belt of western Africa, there is an increasing risk of erosion and desertification (FAO 2000b, Reich and others 2001). In Niger, for example, only 19 per cent of the country is non-desert, and most of this is highly or very highly vulnerable to desertification (Reich and others 2001). Mauritania is similarly affected, with 93 per cent of the country classified as hyper-arid, and the remaining 7 per cent at moderate to very high risk of desertification (Reich and others 2001). The IPCC predicts that rainfall and run-off will decline, and that evaporation will increase, in this zone, further contributing to desertification pressures in future (IPCC 2001).

### **Improving land quality and productivity in Western Africa**

All the countries of western Africa have ratified the UNCCD, and Benin, Burkina Faso, Cape Verde, Gambia, Mali, Niger and Senegal have produced National Action Plans. The Economic Community of Western African States (ECOWAS) and the CILSS have jointly produced a Sub-regional Action Plan (UNCCD 2001).

Following an upsurge of general environmental awareness as a result of the Stockholm Conference on the Human Environment in 1972, many countries in western Africa have formulated environmental and land use policies aimed at stopping land degradation. NEAPs, National Conservation Strategies (NCSs) and other such strategy frameworks have been adopted to address these land issues. In most instances, these policy responses have been initiated or sponsored by

external agencies and institutions, which provided the bulk of the funding. National and sub-regional institutions have also been created to address specific issues, including: the development of drought-resistant crop varieties; collation of reliable climatic data; and soil conservation measures. Population policies have also been adopted in most of the countries, and relevant institutions are in place to implement these policies and related programmes. However, family planning programmes adopted in countries in the sub-region since the 1970s have not reduced the population growth rate, which still averages 3 per cent (ECOWAS 2000).

Local programmes to improve land management include: stone bunding, in order to control erosion on slopes in the northern savanna region; and applying organic matter to cultivated areas, in order to replace nutrients. Composting, agroforestry and the establishment of woodlots are additional land and water conservation measures in operation in Ghana (FAO/AGL 2000). In Niger, the Keita Integrated Development Project was launched in 1984, in order to address declines in agricultural production caused by drought, desertification and population growth. Women have been the main participants in the project, and have been involved in: dune stabilization; land reclamation; soil and water conservation; reforestation; crop production; rural engineering; training; and setting up credit and alternative incomes (Carucci 2000).

### **LAND RIGHTS IN WESTERN AFRICA**

Countries of western Africa, as in other sub-regions, are bound by a complex interaction of land tenure policies, which often create insecurity of tenure and exploitation of production in the short-term, and which lay the foundations for conflict over resources (Toulmin and Longbottom 1997). Under customary law, chiefs are the dominant land owners, through whom members of the community obtain access to resources via ownership, sharecropping, tenancy and pledging. The countries inherited tenure laws from the colonial government and, at independence, state-ownership became the norm, and land was then either sold or leased privately. Thus, customary land tenure practices have been weakened, and are no longer recognized by the state or rural communities (DFID 1999). Attempts to reconcile



Agricultural plots, shaded by trees, in the Dogon region, Mali

J.P.Delobelle/Still Pictures

differences in land tenure policies, and the influence of Islamic laws and development ideals have, in many cases, created greater confusion and conflicts between land users (Toulmin and Longbottom 1997).

Conflicts over land and resource access rights have most frequently been between farmers and herders, migrant farmers and governments (see Box L2.7). An example is the establishment of cultivation in areas used by seasonal herders, such as the northern savanna areas and seasonal floodplains (Toulmin and Longbottom 1997, Maltby 1986). The impacts of inappropriate land tenure are economic, environmental and social (Ouedraogo and Toulmin 1999). Economic impacts are loss of livelihoods and increasing poverty, as well as unrealized potential of commercial agriculture. Environmental impacts include disincentives for investment in land care or land improvement, and social consequences include deterioration of community cohesion and rising levels of conflict.

Many western African countries are undergoing land policy reform, either in the preparatory discussion phase, or in the pilot phase, testing different legislative approaches. The main objectives of these reforms are: clarification of rights and access; harmonization of existing legislation; creation of incentives for enhanced land management; raising productivity and economic development; improving dialogue between

stakeholders; and diffusing potential conflicts (Ouedraogo and Toulmin 1999). The main type of reform has been to convert greater areas of land to private ownership, particularly in favour of large-scale agricultural developers (Ouedraogo and Toulmin 1999). Côte d'Ivoire's Rural Land Plan, which was implemented in 1988, is a programme of mapping and recording the boundaries of landholdings and existing rights of individuals and groups. This is done through consultation with local inhabitants and validation by village committees, thereby integrating customary laws into a new rural land tenure code (DFID 1999).

## CONCLUSION

Land and terrestrial resources in Africa have unparalleled economic, social and environmental value. Traditionally, African societies are agrarian or pastoral, depending directly on subsistence farming to meet their daily needs. Commercial agriculture holds an equally important position, employing the largest share of the workforce in most countries, and contributing significantly to national economic growth, export earnings and foreign exchange. However, national and household dependency on agricultural output has been a significant factor in limited economic growth over the past three decades. Climatic instability has caused significant and frequent variability in production, and narrow crop diversity, and national and international market failures, have facilitated recurrent economic losses.

Rapid population growth, and policy pressures to increase production, have forced the cultivation of greater and greater areas of land in all sub-regions, and the extension of cultivation and grazing to marginal areas. Combined with limited application of organic or inorganic fertilizers, reductions in fallow periods, restrictions on crop diversity, inappropriate irrigation, and an increasing use of herbicides and pesticides, this has resulted in the physical, chemical and biological degradation of vegetation and soil. Soil erosion and desertification rates are increasing as a result, and declines in productivity have been noted.

More than 20 per cent of Africa's vegetated lands are classified as degraded, and 66 per cent of this is moderately to severely degraded. The worst affected areas are along desert margins, and the problem is

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- Rapid population growth, and policy pressures to increase production, have forced the cultivation of greater and greater areas of land in all sub-regions, and the extension of cultivation and grazing to marginal areas*
-

likely to intensify over the next 30 years, as a result of population growth and increasing climate variability. Land degradation impacts are felt most keenly by the poor, because they are forced to cultivate marginal lands, such as desert margins, which get degraded more rapidly. Hence, productivity losses are more rapid, and affected households become increasingly food insecure.

Environmental consequences of erosion include: sedimentation; pollution; eutrophication of waterbodies; smothering of aquatic habitats; and changes to biodiversity.

Responses have included: ratification of international conventions; and implementation of awareness raising and action planning at national level. Sub-regional cooperation has also been initiated, through national and sub-regional organizations, such as CILSS, ECOWAS, IGAD and SADC, which have developed food security strategies, and strategies for improving the condition and management of resources.

NEAPs have provided overall frameworks for enhancing planning and development of land resources, and EIAs have facilitated the implementation of the tenets held in the NEAPs. Local level responses have perhaps seen the most rapid and dramatic results, because they have not experienced the institutional and logistical constraints of actions attempted at national and sub-regional levels. Local level measures have included: diversification of cropping; increased fallow; crop rotation; creation of wind breaks; application of manure and other organic wastes; and responsible and conservative irrigation schemes.

Land tenure and access to land resources are complex issues in Africa, impacting on food security, environmental sustainability and social security. Colonial legislation often conflicted with traditional tenurial systems, and was aimed at increasing commercial production, often at the expense of household production. With independence, African countries attempted to redress the issue of traditional access rights, whilst maintaining control of resources, especially economically important ones. Realizing the inadequacies, overlaps and contradictions in existing land policies, governments embarked on further processes of land reform. However, these are fraught with tensions between user groups and different land uses. Women, generally, have fewer ownership rights although, in many countries, women are involved in

most food production activities. Political and environmental refugees frequently place additional burdens on issues of tenure, and on the resources themselves. Refugees who are settled in marginal or sensitive areas cause extensive degradation, whilst further potential conflicts exist with neighbouring communities.

Improved security of tenure can greatly improve land management practices, and rural development programmes should focus on greater inputs to farming, freer trade and higher value addition. This will ensure that: greater income is earned from production; greater food security is awarded to the household producer; and expansion of agriculture into marginal areas is controlled. Poverty alleviation schemes are also required, in order to keep people from abandoning their farms, and to ensure that they are able to afford inputs, such as fertilizers and efficient irrigation systems (UNU 1998).

Policy reforms are another essential component of resolving conflicts over resources and of ensuring greater investment in sound resource management activities. However, these reforms have to be made carefully, with the full participation of all stakeholder groups. This is a process which will take time, but which will avoid further conflicts in rights or their administration. Legislation is also only a part of what governments can contribute towards land reforms. Other actions include: decentralization of administrative power; more comprehensive land use planning and management frameworks; more effective participation by stakeholders; and economic diversification, in order to relieve some of the dependence on commercial agriculture and forestry. The involvement of women and children is particularly important, because the spread of HIV/AIDS will mean that, in future, more households are headed by these groups. Pastoralists must be involved in management plans for grazing areas, in order to maintain livestock production at the household level and to maintain its contribution to national economies.

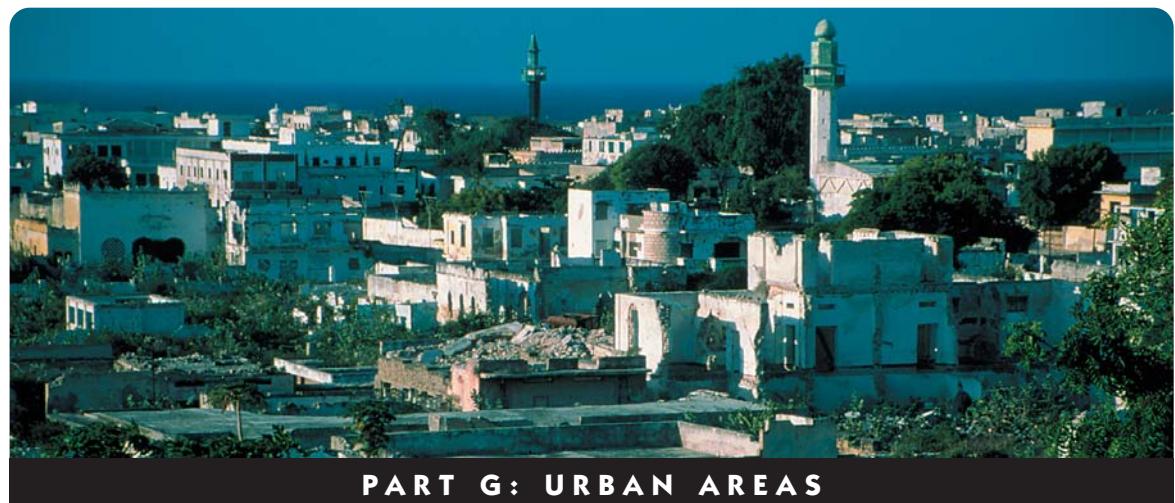
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## REGIONAL OVERVIEW

Thirty-eight per cent of Africa's population, that is to say 297 million people, live in urban areas. By 2030, this is expected to grow to approximately 54 per cent of Africa's projected population of around 1405 million (UNCHS 2001a). The level of urbanization in Africa is on a par with that in Asia, but lower than the global figure of 47 per cent, and well below the European and North American levels of over 70 per cent (UNCHS 2001a).

However, it must be borne in mind that the definition of what constitutes an urban area differs from one African country to another. For example, in Uganda a settlement with a population of more than 100 is classified as urban, whereas in Nigeria and Mauritius an urban area has a population of more than 20 000 (UNCHS 2001b). There are also difficulties in defining a city, as cities are not only defined on the basis of population size but also of administrative or legislative functions. Large cities, however, are generally those with

populations over a million, and mega-cities have populations of more than 10 million (UNCHS 2001b).

Africa's rate of urbanization of 3.5 per cent per year is the highest in the world, resulting in more urban areas with bigger populations, as well as the expansion of existing urban areas (UNCHS 2001a). There are currently 40 cities in Africa with populations of more than a million and it is expected that by 2015 seventy cities will have populations of one million or more. Lagos, with its current population of 13.4 million is the largest city in Africa, and the 6th largest in the world. Cairo, Africa's second largest city, has a population of 10.6 million and ranks 19th in the world (UNCHS 2001b). The growth of Africa's urban population is shown in Figure 2g.1.

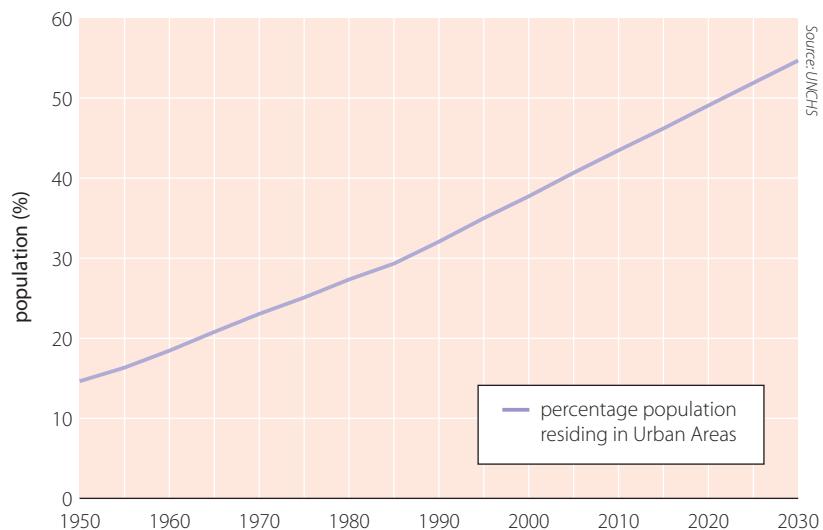
Northern Africa is Africa's most urbanized sub-region with, on average, 64 per cent of its population living in urban centres. Libya is the most urbanized country with 87.6 per cent of the population living in urban areas (UNCHS 2001a). Central Africa and the Western Indian Ocean Islands are also considerably urbanized, with average urban populations of 48 per cent each, followed by Western Africa (38 per cent) and Southern Africa (36 per cent). The least urbanized sub-region is Eastern Africa (26 per cent), and Rwanda is the least urbanized country, with an urban population of just 6.2 per cent (UNCHS 2001a). However, Eastern Africa has the highest average rate of urbanization for any of Africa's sub-regions, averaging 4.5 per cent per year. Malawi has the highest rate of all African countries (6.3 per cent per year).

### THE SIGNIFICANCE OF URBAN AREAS

The reasons for rapid growth of urban populations include overall high population growth rates, and 'pull factors' such as opportunities for employment, education, and improved access to health care which attract people from urban areas. African cities account for 60 per cent of the region's GDP and are important centres for education, employment, and trade (UNCHS 2001b).

The colonial influence on development resulted in many of Africa's urban centres and national capitals being located on the coast, maximizing access to trade, international travel, and development. However, there are also many social challenges associated with urbanization, such as the influx into urban areas of people forced out of rural areas by declining agricultural

**Figure 2g.1 Urban population growth in Africa, 1950–2030**



yields and who come to the urban areas in the hope of employment and greater income security. In many urban areas rates of economic growth and infrastructure development have lagged urbanization rates, resulting in high levels of unemployment, inadequate standards of housing and services, and impacts on human health and development. Environmental disasters and conflicts have also caused many people to flee rural areas and to seek refuge in urban centres. In Mozambique about 4.5 million rural people were displaced to urban areas because of civil strife in the 1980s (Chenje 2000) and the third largest settlement in Sierra Leone is a displaced persons camp (UNCHS 2001b).

### URBAN AREAS AND THE ENVIRONMENT

Urban centres, and cities in particular, have developed from administrative and transport centres to commercial hubs, and centres of education and technology, manufacturing and processing, trade, and employment. Urban dwellers have lifestyles that contrast starkly with those of their rural forebears or contemporaries, not least in their interactions with the environment. In the majority of nations, cities generate the lion's share of economic activity, ultimately consume most of the natural resources, and produce most of the pollution and waste. These problems are usually associated with unplanned or unserviced settlements (slums) where predominantly poor

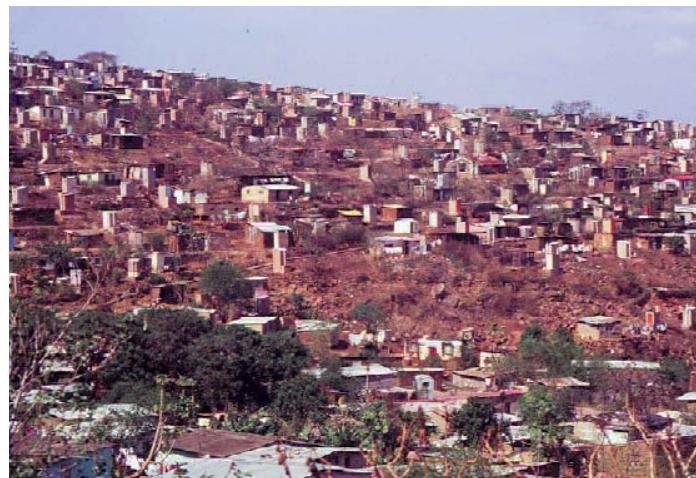
- African cities account for 60 per cent of the region's GDP and are important centres for education, employment, and trade

inhabitants do not have access to adequate housing, water supply, sanitation, waste disposal, or electricity. These are also highly visible impacts and affect the health and well-being of many millions of people. However, environmental degradation is caused as much by the excessive consumption of resources (especially water) and generation of non-biodegradable wastes prevalent in affluent urban areas as it is by illegal dumping and burning of sewage and solid wastes in informal settlements (e.g. Napier 2000). The key requirements for sustainable urban growth are:

- coherent, integrated planning;
- development that is environmentally and socially sensitive;
- security of tenure and financing;
- sufficient investment in infrastructure to keep pace with the rate of growth of urban populations and their demands for adequate shelter, services, and security;
- integrated and innovative demand management with respect to resources and services; and
- rural development programmes to assist in slowing the rate of urban population growth.

#### Unplanned settlements

The high rate of growth of urban populations in Africa has resulted partially from an increase in the number of urban households, brought about by changes in standards of living and attitudes towards familial dependence. The rate of growth in number of households across Africa averaged 3.1 per cent between 1985 and 2000, and is set to continue at this rate until 2030 (UNCHS 2001a). The consequent increase in demand for basic housing and services for urban populations, as well as skewed distribution of investment towards affluent suburban developments, has resulted in the rapid expansion of illegal or unplanned and unserviced settlements, with unhealthy living conditions and extreme overcrowding. For example, in 1993, about 55 per cent of Nairobi's population lived in informal settlements (USAID 1993), and in South Africa, nearly half the population did not have adequate housing in the late 1990s (DEA&T 1999). In Monrovia, Liberia, 42 per cent of households were reportedly living as squatters in 1998 (UNCHS 2001c). Furthermore, only 60 per cent of urban dwellings in Africa are considered permanent, and almost half fall short of compliance with regulations



Unplanned settlements often lack basic services.

*Mark Napier*

(UNCHS 2001b). In African cities the average person has just 8 square metres of floor space, indicating conditions of extreme overcrowding. By comparison, residents of Asian cities have 9.5 m<sup>2</sup>, in industrialized countries the average is 34.5 m<sup>2</sup>, and the global average is 13.6 m<sup>2</sup> (UNCHS 2001b). Overcrowding exacerbates rates of transmission of infectious diseases, such as gastro-intestinal infections, and respiratory diseases such as tuberculosis, commonly associated with poor ventilation and air pollution.

Low revenue in African municipalities, and consequently low spending, has led to development and maintenance of infrastructure being severely curtailed. In spite of their contribution to national economies, African municipalities receive only 14 per cent of GDP in revenue—an average of US\$14 per capita per year and two hundred times less than the revenue of municipalities of high income countries (UNCHS 2001b). They spend only US\$12 per capita per year. This situation has been further compounded by slow economic growth over the past three decades and a bias amongst donor organizations in favour of development projects in rural areas.

An additional concern is that the poor often pay higher prices for housing and associated services. In African cities, people spend approximately 40 per cent of their incomes on rent, with the Arab nations paying the most at 45 per cent. This is over twice the amount

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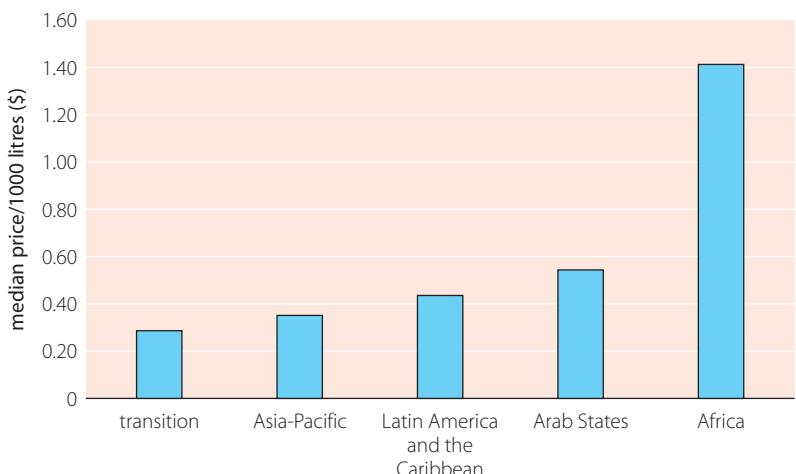
•

paid by residents of higher income countries and indicates the high demand for housing and slow rates of provision of rented accommodation in Africa (UNCHS 2001b). Local governments are attempting to address this issue by increasing the production of low-cost housing stocks, and introducing housing subsidies for low-income groups (Department of Housing 2000, UNCHS 2000). However, tremendous backlogs still exist, as housing development falls short of population growth and urbanization rates. The residents of informal urban settlements often pay more for access to water (see Figure 2g.2), whereas water rates to planned suburban developments and industrial and agricultural users can be heavily subsidized (UNCHS 2001b).

Access to water supply, sewerage, electricity and telephone in African cities ranks the lowest in the world (UNCHS 2001b). Overall access to improved water sources in urban areas in Africa has increased marginally, from 84 per cent in 1990 to 85 per cent in 2000. However, 'improved water' includes household connection, public standpipes, boreholes, protected dug wells or springs, and rainwater collection (WHO/UNICEF 2000). Similarly 'improved sanitation' includes connection to a public sewer or septic system, a pour-flush toilet, a simple pit latrine, or a ventilated pit latrine (WHO/UNICEF 2000). The overall figure for access to sanitation in African towns and cities declined marginally from 85 to 84 per cent in the same period (WHO/UNICEF 2000). Poor water supply and sanitation create conditions conducive to high rates of water-related diseases such as cholera, dysentery, scabies, and eye infections. Diarrhoea and dysentery are among the most prevalent childhood diseases and a significant cause of under-five mortality. They correlate strongly with lack of availability of clean water (UNCHS 2001b). In addition, health and education facilities in unplanned settlements are often under-resourced or unaffordable, and unemployment and poverty are rife.

Unplanned settlements can, however, also be important economic centres, contributing to the informal economy through provision of services such as food provision and sale, domestic services, car and household maintenance, hairdressing, and childminding, as well as trade and recycling (e.g. Napier, Ballance & Macozoma 2000). A good example of the contribution of the informal sector is the 'Zaballeen', a group of informal waste collectors in Egypt who

**Figure 2g.2 Regional cost of water**



Source: UNCHS 2001b (p.41) *State of World Cities Report*

separate and recycle different types of waste, thereby providing a valuable service to the urban environment whilst also making a living (UNCHS 1999).

Environmental impacts of rapid, unplanned, urban growth include loss of natural habitats, changes in and sometimes loss of biodiversity, as well as alterations to ecological functions such as hydrological cycles and atmospheric exchange. Fragile environments such as delicate slopes, natural drainage waterways, and flood-prone areas, are at risk from rapid urbanization. In unplanned settlements—where space is at a premium and shelters are erected on steep slopes, on wetlands, or in flood zones—not only are residents at risk from flooding and subsidence, but the ecosystems are also vulnerable to pollution and physical degradation. Residents of Johannesburg's Alexandra Township were devastated by flooding and suffered loss of property and outbreaks of cholera in early 2000. In Cairo, the risk of earthquake puts millions of people in dense and insufficiently stable urban settlements in danger of loss of life and property. Improved planning, reductions in the backlog of low-cost housing, and improved disaster early warning and preparedness schemes are required to reduce this threat.

#### Management of pollution and waste

Pollution and wastes are often concentrated in urban centres due to the high population densities and generally higher consumption patterns relative to rural areas. This presents a visible challenge for urban planners and managers in selecting landfill sites so as to

minimize impacts on the environment and human health. Solid waste production and management and air pollution are the issues of greatest concern in African towns and cities.

Urban centres in developing countries are experiencing high and growing levels of air pollution due to their rapid rates of growth and to industrial development. The major sources of air pollution are vehicle exhausts, industrial emissions, and domestic use of wood, coal, paraffin or refuse for heating and cooking. Lead pollution from vehicles is also causing great concern and, in some cities, it combines with dust and sand or gets trapped near the ground due to temperature inversions. Some cities have introduced incentives for conversion to non-leaded fuels, or have encouraged the sale of newer, cleaner vehicles. In dense, informal settlements, the use of traditional fuel sources contributes to rising ambient levels of sulphur dioxide, nitrogen oxides, carbon monoxide, ozone and suspended particulate matter. Exposure to these pollutants is associated with increased risk of acute respiratory infections (ARIs), particularly among children. These conditions are compounded by inadequate affordable health care for poorer urban residents. Electrification of households, promotion of low-smoke fuels, and improved ventilation of houses are some of the measures that have been adopted to reduce health risks.

In the late 1990s, each person in the developing countries was generating, on average, 200 kg of solid waste per year (UNCHS 2001b), but this is increasing with increasingly affluent lifestyles, as well as (to a lesser extent) population growth. The amount of waste generated far exceeds the capacities for waste collection, treatment and disposal of most municipalities and only one-third of the waste generated in African cities is disposed of via formal disposal routes (UNCHS 2001b). Lack of suitable landfill sites, and rapid filling of existing ones is a problem experienced by many municipalities. As a result solid waste is often dumped or burned formally by the municipality. In Comoros, for example, domestic waste is dumped directly on the beaches (UNEP 1998), and in Kampala (Uganda) the municipality has designated several wetlands as dumping grounds (NEMA 1999). Inappropriate dumping of solid waste poses a threat to human health through contamination



An old quarry is used as a municipal rubbish dump in Zanzibar town.

*Andy Crump/Still Pictures*

of water supplies by harmful leachates; causes blockages in drainage channels exacerbating the effects of flooding; and is hazardous to wildlife. Burning of solid waste contributes to ambient air pollution by emission of toxic fumes.

Lack of integrated waste management policies, inadequate funds and low access to appropriate, affordable technologies, and lack of incentives for alternative waste treatment and disposal have all contributed to this situation. For example, in 1999, only seven of the 90 garbage trucks in the city of Harare, Zimbabwe, were operating, because there were insufficient funds for training of personnel and equipment maintenance (UNCHS 2001b).

Waste recovery and recycling in Africa is limited to 2 per cent of all waste generated in the region (UNCHS 2001b) due to lack of economic incentives and markets for recycled materials. The most commonly recycled materials are paper, textiles, glass, plastic, and metal. However, opportunities for income generation through recycling in the informal sector are gaining recognition, and several African cities have

projects underway for waste collection, sorting, and sale to commercial composting and recycling operations. Some cities have piloted industrial waste recycling by, for example, using wastes and effluents for electricity production. Furthermore, a large percentage of urban waste is organic matter that can be used as compost for urban agricultural development (Asomani-Boateng & Haight 1999).

### Towards sustainable urban settlements

The two most influential movements over the last 30 years for improving conditions in urban settlements have been the creation of the United Nations Commission for Human Settlements (Habitat) (UNCHS) and Local Agenda 21.

Habitat was established in October 1978 to provide leadership and coordination for the activities of the United Nations in the field of human settlements. Habitat's mission is to promote socially and environmentally sustainable development of human settlements and the achievement of adequate shelter for all. The Habitat Agenda was adopted as the global plan of action for achieving this mission at the Habitat II Conference, held in Istanbul, Turkey, in June 1996. In the lead up to the Conference, African Ministers responsible for housing and urban development met in Kampala, Uganda. They recognized the need for urbanization in relation to economic development, but stressed the need to improve rural facilities and rural-urban linkages to slow the rate of urbanization. They also endorsed the decisions of the Dakar Declaration to involve stakeholders, build capacity in urban authorities, establish enhanced urban environmental management, and develop and implement national environmental action plans.

The other framework for action, the Local Agenda 21 programme, is expressly called for in Agenda 21 (Chapter 28) which encourages local authorities to enter into dialogue and to develop a process that is specifically designed to help achieve sustainable development at the local level, in the same way as Agenda 21 promotes this at the national and global level.

Although implementation of the Habitat Agenda and of Agenda 21 has been constrained, largely by lack of funding, many African cities have made remarkable achievements (see Box 2g.1). These include the revision or formulation of constitutions and national legislation to promote the right to adequate shelter—

almost 80 per cent of African countries now legally recognize this right (UNCHS 2001b). Thirteen out of 29 African countries recently studied recognize women's rights to own property, and more are revising or developing policies to this effect (UNCHS 2001b). Environmental policies are also being overhauled, and many African countries now require environmental impact assessments to be conducted prior to new developments such as housing, commercial development or road construction. Integrated water policies and waste management strategies are being developed, and municipal services are also being privatized in many urban centres, in an effort to improve coverage and maintenance. Effluent standards and tighter controls on waste management are also being developed and implemented to encourage responsible waste disposal. Housing programmes, subsidies for low-income families, poverty alleviation programmes, and decentralization strategies are additional measures being used to relieve the social, economic, and environmental burden currently concentrated on urban areas.

In 1995, officials from concerned African cities met and formed the African Sustainable Cities Network (ASCN), to build capacity in participatory environmental planning within local authorities. The members started the process with an environmental management needs assessment, followed by a phased programme of

#### Box 2g.1 African best practices in urban development

African cities have been setting standards internationally for their progress in achieving sustainable growth and improving living conditions. The 1998 Global 100 Best Practices List, drawn up by the United Nations Centre for Human Settlements to recognise various elements of urban development, contained eight African projects, and two award winning projects, one from Angola and one from Sudan. These best practices encompassed environmental management, children and youth centres, infrastructure development, sustainable community design and architecture, and poverty eradication.

education and training, establishing a framework for implementing new national environmental policies, and creating local sustainable development strategies. By June 2000, 31 African cities had joined the network and had embarked on activities (ICLEI 2001).

### NORTHERN AFRICA

With 64 per cent of its population living in towns and cities, Northern Africa is the most urbanized sub-region in Africa (UNCHS 2001a). Within the sub-region, urbanization rates vary between countries—36 per cent in Sudan to 95 per cent in Western Sahara (UNCHS 2001a). Most of this growth has occurred in the last two decades, although urban populations have increased steadily since the colonial phase. In 1990–1998, the average rate of urbanization reached 2 per cent per annum (World Bank 2001a), and it is predicted that this will continue over the next 15 years, which means that by 2015, 70 per cent of Northern Africa's population will live in cities (UNCHS 2001a).

Urban growth in Northern Africa is partially the result of rural-urban migration, but natural urban growth and reclassification account for more than 70 per cent of urban development (World Bank 1995). Furthermore, the new structural adjustment programmes adopted by most countries in the sub-region have brought new frontiers in industrial development in the last 10 years. By 1990, Alexandria (Egypt), Algiers (Algeria), Cairo (Egypt), Casablanca and Rabat (Morocco), Tunis (Tunisia), Tripoli (Libya), and Khartoum (Sudan) had populations of more than one million (UNCHS 2001a).

### THE SIGNIFICANCE OF URBAN AREAS IN NORTHERN AFRICA

Old and well-established urban centres such as Cairo, Casablanca, Alexandria, and Tripoli continue to thrive and have retained their character despite various economic, social, cultural and political changes. However, urban agglomerations and 'mega-cities' are important features of recent urbanization trends, as well as heavy industrialization. Most infrastructure, and societal services are centred in these cities and they make the greatest contribution to national products. As a consequence, they play a vital part in economic development by providing

opportunities for investment and employment. They have also gained a key political and administrative role.

### URBAN AREAS AND THE ENVIRONMENT IN NORTHERN AFRICA

Despite the gains outlined above, rapid urbanization in Northern Africa has also given rise to significant environmental and social problems, and is characterized by increasing urban poverty, emergence of informal settlements and slums, shortage in basic urban services, and encroachment on agricultural land. Between 15 and 50 per cent of city residents in the sub-region are urban poor living in squatter settlements, illegal subdivisions, sub-standard inner-city housing, custom-built slums, and boarding houses (World Bank 2000). It has also been indicated that cultural heritage sites are especially at risk from uncontrolled development and environmental degradation in urban areas. While there have been national and international efforts to conserve this heritage, greater efforts are required to ensure its protection.

Water supply and sanitation rates are higher in Northern Africa than in some other sub-regions, but they are nonetheless variable and many of the poorer residents of urban centres are without reliable services. In 2000, most urban residents had access to improved water supply (ranging from 72 per cent in Libya to 98 per cent in Algeria) and sanitation (87 per cent in Sudan and 100 per cent in Morocco) (WHO/UNICEF 2000). Casablanca's wastewater network, however, cannot cope with the volume of wastewater produced, despite recent upgrading by the municipality. As a consequence, large quantities of wastewater are discharged into the sea (WHO/UNICEF 2000).

### Unplanned settlements in Northern Africa

Cairo has several large informal settlements on the city periphery and these accounted for 84 per cent of urban growth between 1970 and 1981 (ABT 1983). In 1992, there were 400 shantytowns in Casablanca, housing more than 53 000 families, and in Algiers, 6 per cent of the population are reportedly squatters (UNCHS 2001c). These settlements suffer from a shortage in basic infrastructure and hence have major health problems. Their illegal status compounds the problem, and residents often have to be moved to more appropriate sites where local authorities or municipalities can provide

them with basic urban services including water supply, transport or health care (CEDARE 1997, Hamza 1994). More investment is required to provide these services to the whole urban population (Larsen 1995).

There has been land use planning and zoning in most of the cities in the sub-region. However, this has not, in some cases, prevented chaotic expansion and densification of cities. It is now the norm to find residential zones next to industrial sites or industries enveloped by housing estates, with all of the potential risks to the environment and to health which that entails.

In 1979, the Egyptian government implemented a strategy for improving the living conditions of urban slum dwellers in Cairo, by moving them to alternative locations. Residents of Eshash El-Torgman and Arab El-Mohamady were moved to El-Zawia El-Hamra, Ain Shams, or Madinat El-Salam. Their original residences were close to the city centre and thus to the job market, whereas the resettled areas were far out of town. Reports of the negative social impact of this move prompted the government to change its approach to informal settlement upgrading, and to adopt a new twofold strategy: clearance for state land (squatter settlements), and upgrading for private land (informal settlements). As a result of social pressure, however, no areas have been cleared, but provision of infrastructure to informal settlements has made significant strides (Manal El-Batran from UNCHS 2001c). In Morocco, settlements have been upgraded in Agadir (see Box 2g.2) and, in Casablanca, the state issued a plan, in 1992, to build 200 000 houses for low-income people. Progress has been slow however, as the extent of state-owned land has declined sharply, and privately owned land is very expensive, making subsidized housing unviable (UNCHS 2001c). Over the last three decades the government of Libya has made housing provision a priority and general housing, investment housing, agricultural housing and low-income housing projects have been implemented. Nearly 400 000 units were constructed in various locations, and efforts are well under way to deliver a further 60 000 (UNCHS 2001c).

#### **Management of pollution and waste in Northern Africa**

Cities tend to be areas of high population concentration, high economic status and high levels of activity and therefore also consume natural resources from their vicinity and from distant sources. In doing so

#### **Box 2g.2 Settlement upgrading in Agadir**

The Moroccan National Shelter Upgrading Agency's project in Agadir has been recognised as one of Habitat's Best Practices for Human Settlements. Agadir was devastated by an earthquake in 1960 and housing for lower-income families has been insufficient ever since. In 1992, there were 77 separate shanty areas with 12 500 households (13 per cent of Agadir's population). The Upgrading Agency's project has provided approximately 13 000 serviced housing lots, housing units, apartment units, or lots for apartment units, has provided utilities connections for an additional 3 600 families, and created 25 000 jobs per year in construction. Reasons for the project's success include active participation of the clients in project design, implementation and monitoring, recognition of the clients' rights to adequate shelter by local authorities, open dialogue between the parties, and integration of former squatter into cosmopolitan neighbourhoods.

Source: UNCHS 2000.

they generate large amounts of waste that are disposed of within and outside the urban areas. In Egypt, Morocco, and Tunisia, solid waste generation in 1993 averaged 0.5–0.6 kg/capita/day (UNCHS quoted in WRI, UNDP, UNEP & World Bank 1998).

The effectiveness of management of municipal waste in the sub-region varies from country to country and, in some places, large amounts of wastes are not deposited in sanitary landfill sites but are dumped in the open. In Tripoli, for instance, 65 per cent of waste is dumped in the open, in Ismailia (Egypt) 80 per cent is dumped, and in Casablanca, 90 per cent (UNCHS 2001c). With extremely warm temperatures, such waste tends to decompose rapidly, causing serious health risks and nuisance (Kanbour 1997). Open burning of waste is an informal disposal method used where waste collection services are inadequate, and it contributes to the problem of urban air pollution. Unmanaged disposal of waste affects human health, causes economic losses, and damages the physical and biological environments. For example, it has led to problems such as pollution of water sources and offensive odours, as well as an increase in disease vectors, pests, and scavengers. Health risks also

translate into economic losses with sick employees staying away from their jobs and increasing the burden on public health care.

There are, however, successful examples of hygienic dumping and recycling of waste in many countries in the sub-region. For example, Tripoli recycles 20 per cent of its solid waste, Tunis 5 per cent (UNCHS 2001c). In Egypt, waste is also recycled through the informal sector, by the 'Zaballeen'—informal sector garbage collectors who have been providing a door-to-door waste collection service since the 1960's covering wide areas, especially in Cairo. They collect mainly domestic waste and recycle up to 80 per cent of what they collect. Their activity has recently been somewhat formalized by the government (UNCHS 1999). In rural Egypt, there are organizations that promote environmental awareness among women, distributing plastic bags so they could collect their garbage, while youths are given the task of taking them to a designated collection point. Such schemes can have equal success in urban areas.

The high content of organic matter in waste has also created interest among some municipal governments in the sub-region, and several composting plants are already in operation producing compost fertilizers and soil conditioners (Kanbour 1997). Whilst there are still no effective legal and institutional frameworks for implementation of solid waste management at national level, the issue has been given national priority in most countries in the sub-region. Privatization of solid waste management has recently been introduced in the sub-region as a way of overcoming the lack of finance and capabilities of local governments and, in many areas, this has been more efficient and cost effective in delivering services, especially in Tunisia, Egypt and Morocco.

Crowded cities in Northern Africa have also seen a significant increase in the number of motor vehicles and traffic congestion, creating additional problems of air pollution. In large cities, the situation is compounded by the presence of heavy industries surrounding residential areas and adding to the types and quantities of pollutants. In Tunis, many factories responsible for the worst air pollution were transferred to the outskirts of the city and air quality has improved, although at peak traffic times smog is still a problem (UNCHS 2001c). In Egypt, environmental legislation introduced in 1994

imposed strict regulations and penalties for polluting industries. Conversion to unleaded fuel for vehicles was also initiated. Within one year, the level of airborne lead in some of Cairo's most polluted areas had decreased by up to 88 per cent (USAID 2001). Urban transport reform is still a priority in the region, however, not only in terms of promoting more fuel efficient and cleaner-fuelled vehicles, but also of upgrading roads and public transport systems to reduce congestion.

### **Towards sustainable urban development in Northern Africa**

Meeting the challenges raised by the urban environment requires concerted government action at all levels, in partnership with non-governmental organizations (NGOs), private enterprises, communities, and citizens. Institutional structures, together with policies and frameworks, have been established in Northern African countries. For example, the high population growth and urbanization rates experienced by Libya in the 1970s and 1980s prompted the establishment of a Public Authority for Environment, a centralized agency with presence in all major centres for protection and cleansing of the environment. Solid waste disposal sites have been established and are managed by the Public Authority, and some waste is now recycled and used as inputs to industrial processes. Attention is also focused on the provision of drinking



Aerial view over Cairo, Egypt

water and maintenance of air quality (UNCHS 2001c). In Tunis a department dealing with environmental issues has been created within the municipal administration. It is critical that such efforts be maintained, in order to continue to improve the social and environmental conditions in urban areas, in the face of rapid population growth, urbanization, and development.

### EASTERN AFRICA

Eastern Africa is the least urbanized sub-region in Africa, with 26 per cent of its population living in towns and cities (UNCHS 2001a). Within the sub-region, Djibouti is the most urbanized country with 83 per cent of the population in urban areas; Rwanda is the least urbanized at 6 per cent, although the recent violent conflicts in Rwanda and Burundi are likely to have impacted enormously on demographic patterns (UNCHS 2001a). Eastern Africa does, however, have the highest rate of urbanization of Africa's sub-regions (expected to average 4.5 per cent over the next 15 years), so the pattern is changing rapidly (UNCHS 2001a). Only a few cities in the sub-region currently have populations in excess of one million, namely Addis Ababa (Ethiopia) with 2.6 million, Kampala (Uganda) with 1.2 million, Mogadishu (Somalia) with 1.2 million, and Nairobi (Kenya) with 2.3 million (UNCHS 2001a).

### THE SIGNIFICANCE OF URBAN AREAS IN EASTERN AFRICA

Rapid urban growth since the 1960s has resulted from growth of existing urban populations and from migration to urban centres of people either seeking refuge from poverty-stricken rural areas and declining agricultural productivity, or coming in search of employment, and improved security of income and housing tenure. This pattern has created a high demand for housing and urban services. However, economic growth has lagged growth of population and urbanization, recording on average a slight negative trend in the 1990–98 period, although with wide differences between countries. Uganda, for example, reported net economic growth of 3.5 per cent in the period, whereas Burundi reported a net loss of 4.2 per cent (UNDP 2000). Negative economic growth has

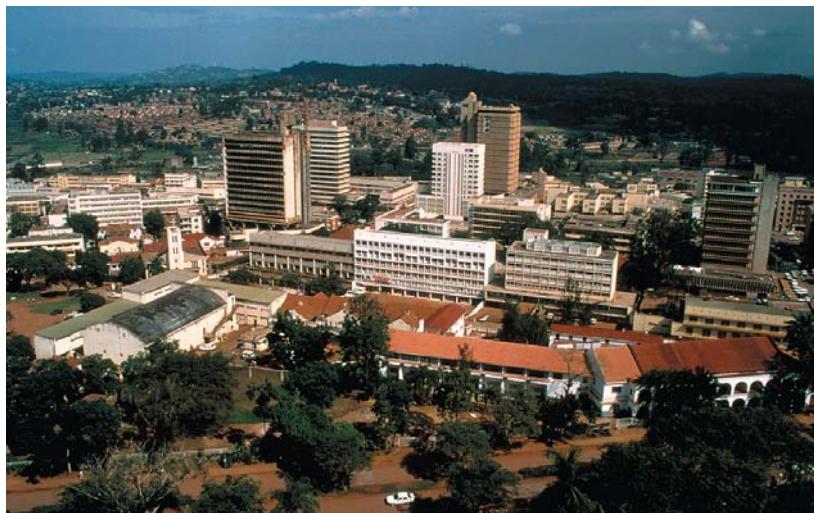
resulted in fewer funds being available for development and maintenance of infrastructure, in increased unemployment, and in people being less able to afford basic housing and services.

### URBAN AREAS AND THE ENVIRONMENT IN EASTERN AFRICA

Proliferation of slums and unplanned settlements in urban areas of Eastern Africa has been accompanied by inadequate provision of water supply and sanitation. Water supply is not only insufficient, but is also intermittent in unplanned and low-income residential areas. On average, access to clean water in the sub-region's urban areas is 80 per cent, ranging from 100 per cent in Djibouti to 60 per cent in Eritrea (WHO/UNICEF 2000<sup>1</sup>). Access to sanitation in urban areas ranges from 99 per cent in Djibouti to 12 per cent in Rwanda, with an average of 72 per cent (WHO/UNICEF 2000). In both cases, this represents a slight improvement on the situation in 1990 (WHO/UNICEF 2000). Residents in unplanned settlements also tend to pay more for water consumed. For instance, in Nairobi, residents of unplanned settlements paid between 30 cents and 70 cents for a 20 litre container of water, compared to 17 cents per 20 litre container paid by consumers with water meters (USAID 1993). Inadequate water for cleansing and for sanitation creates opportunities for disease and pests to breed and spread.

Discharges of raw sewage into rivers and lakes have also increased, creating a toxic environment for plant and animal communities, as well as for humans. Lake Victoria and the Indian Ocean coast are particularly affected (as evidenced by frequent episodes of eutrophication) owing to the concentration of towns and cities in these areas. Governments in the sub-region have yet to put in place effective policy measures and regulations to arrest the situation. However, a programme to privatize municipal services in Eastern Africa was launched by the United Nations Centre for Human Settlements in the second half of the 1990s (UNCHS 1998). Improvements in water supply and sanitation have been made in Kenya and Uganda, although collection of payments is a serious limitation to maintenance of infrastructure and viability of continued operations (UNCHS 1998).

Residents in unplanned settlements tend to pay more for water consumed. For instance, in Nairobi, residents of unplanned settlements paid between 30 cents and 70 cents for a 20-litre container of water, compared to 17 cents per 20-litre container paid by consumers with water meters



View over the city of Kampala, Uganda

Ron Giling/Still Pictures

### **Unplanned settlements in Eastern Africa**

Unplanned settlements have mushroomed in Eastern Africa, with negative impacts on the social and biophysical environment. In Nairobi, for instance, about 55 per cent of the population were living in unplanned settlements in 1993 (USAID 1993) and approximately 5 per cent of residents in Entebbe and 16 per cent in Jinja (Uganda) are squatters (UNCHS 2001c). Balbala, an unplanned settlement of 240 000 residents in the city of Djibouti, accounted for the largest share of the city's growth during the last decade (UNCDF 1998). Population densities in these settlements are usually very high, which encourages the transmission of diseases such as parasites and respiratory diseases.

In response to this situation, governments have taken measures to enact housing policies that will support an environmentally sustainable housing sector. For example, Uganda formulated a Housing Policy in 1978 that influenced the upgrading of Namuwongo low-cost housing and Masese Women's Self-Help housing projects. The National Housing Strategy was completed in 1992, a Land Tenure Policy was prepared, and services and planning have been decentralized. Capacity building for land use planning is still urgently required. In Kenya the government drafted a new housing policy in

1999 giving priority to upgrading of slum areas with minimal displacement, to allow for proper planning and provision of necessary infrastructure and related services. Between 1971 and 1991, the City of Nairobi received World Bank funding to provide urban housing and water supply and sanitation. An evaluation of the projects revealed that water supply had kept pace with the urban population growth and tariff restructuring had helped in keeping water affordable (World Bank 1996). About 65 per cent of the urban population now has water-borne sewerage, and significant environmental improvements have been noticed. A development project in the Balbala quarter of Djibouti brought improvements to living conditions for 1 164 families and established a development model setting standards for future infrastructure, equipment, and housing development (UNCDF 1998). Additional responses in Eastern African cities include the development and/or implementation of local environmental plans in Bujumbura (Burundi), Addis Ababa, Mombasa (Kenya), Kigali (Rwanda), and Entebbe (UNCHS 2001c).

### **Management of pollution and waste in Eastern Africa**

The volume of solid wastes generated by urban centres in Eastern Africa has been increasing, mainly as a result of growing urban population, concentration of industries in the urban areas, consumption patterns of residents, and inadequate finances and facilities to manage waste collection and disposal. There is thus a wide variation in solid waste generation. Recent data were not available for all cities in the sub-region but, in 1993, solid waste generation ranged from 6 kg/capita/day in Kampala to 1.4 kg/capita/day in Bujumbura and 0.6 kg/capita/day in Kigali (UNCHS quoted in WRI, UNDP, UNEP & World Bank 1998). Percentages of households benefiting from garbage collection services also varied, from 47 per cent in Nairobi to 20 per cent in Kampala, and just 2 per cent in Addis Ababa (UNCHS quoted in WRI, UNDP, UNEP & World Bank 1998).

Proper collection and disposal of solid waste is necessary in order to avoid environmental pollution problems such as pollution of surface water bodies and of the ambient atmosphere, through burning or decomposition. In Kenya, an increasing amount of plastic materials has been observed among solid wastes. This is a problem, as plastics block the drainage

systems leading to frequent flooding in urban areas. In Bujumbura, 33 per cent of solid wastes are deposited in open dumps, 27 per cent is burned openly, and only 15 per cent finds its way to sanitary landfill (UNCHS 2001c). A similar pattern is observed in Addis Ababa where 10 per cent is deposited in sanitary landfill, 21 per cent is dumped openly, and the remainder is unaccounted for (UNCHS 2001c). In Kigali a staggering 84 per cent of solid waste is burned openly, giving rise to unpleasant and sometimes toxic fumes (UNCHS 2001c). On the outskirts of Kampala, large volumes of wastes are dumped at Lweza and Lubigi, which were originally wetlands, and Uganda's only recognized landfill, at Mpererwe, is actually managed as a dumpsite rather than as a designated sanitary landfill (Ngatetegize and others 2000).

Policy failures in the past have contributed to poor waste collection and management because most urban authorities would not allow private sector involvement in waste management. There are also inadequate facilities for recycling materials such as paper, aluminium, and glass, and inadequate measures in the re-use of recycled containers that may have contained harmful substances. Moreover, there is an overall lack of awareness and limited community participation in the management of solid wastes (Ngatetegize and others 2000). In response to this, the government of Uganda enacted the Environment Statute (1995) and regulations (1999) to address solid waste management. However, there is still no national waste management policy in Uganda, although a draft action plan for municipal solid waste management was developed in 1999 (NEMA 2001). The City of Kampala privatized its solid waste management functions recently and, in June 2000, eleven companies were operating and their contribution to waste management was increasing steadily (Ngatetegize and others 2000). Nairobi City Council opted to privatize its solid waste management in 1997 when it was recognized that solid waste generation was outstripping capacity to collect and treat the waste (UNCHS 1998). By 1998 improvements to waste management had been noted, although some areas were still inadequately serviced or unserviced (UNCHS 1998).

Long-term data on levels of air pollution in urban centres in Eastern Africa are not available. However, emissions from vehicles, industries, and domestic consumption of coal, wood, charcoal, and other fuels

cause localized smog and pose risks to human health. Additional sources of air pollutants include waste dumps which emit methane, sulphur oxides, and carbon dioxide. There are growing numbers of motorized vehicles in the major urban centres, and many of the vehicles on the roads are old and inefficient (MoWTC 2000). In addition, leaded petrol is still widely used and traffic congestion is a common occurrence because transport networks have not been upgraded to keep pace with the increasing numbers of vehicles (NEMA 2001). Vehicular emissions account for 95 per cent of atmospheric lead concentrations in Kampala, and residents of urban areas have higher levels of lead in their blood than those exposed to less traffic (NEMA 2001). Air quality standards for all major pollutants have been established for most countries in Eastern Africa, but lack of resources renders enforcement below optimum levels.

### **Towards sustainable urban development in Eastern Africa**

Entebbe, Gulu, Iganga, Jinja, Kampala, Masindi District, and Njeru in Uganda, and Nakuru and Thika in Kenya, are members of the African Sustainable Cities Network, and have been working towards capacity building for improved environmental planning and management, and implementation of sustainable urban development strategies in partnership with stakeholder groups.

Jinja, Uganda, is a highly industrialized and agricultural centre on the shores of Lake Victoria. As a result of these developments, and the attraction of the source of the Nile, Jinja has experienced rapid population growth, with consequent pressure on the environment. Inadequate housing, waste collection and disposal and electricity supply result in pollution of air, water and soil, excessive vegetation removal, and eutrophication and siltation of waterways. The local environmental action plan, developed through the ASCN programme, has encouraged greater public participation in local issues and programmes. Through the system of decentralization, considerable power and decision making has been devolved to local communities, who now have the right to be involved in planning and managing their own affairs (ICLEI 2001).

The town of Nakuru in Kenya has developed a Local Agenda 21 framework to build a long-term vision in partnership with stakeholders, and to combine urban development with sustainable environmental

practice. Nakuru is situated between two environmentally sensitive areas, the Menengai crater and Lake Nakuru National Park and is a rapidly growing town with growth based on agricultural development and services, tourism, and administration. There are also plans to strengthen the functions of the Municipal Council and to stimulate innovative partnerships. Plans are to be implemented on the basis of partnerships between local communities and the municipality (ICLEI 2001).

In Addis Ababa, a programme is underway to build capacity in urban planning and management and to reduce urban poverty. The programme is jointly implemented by the Ethiopian Ministry of Works and Urban Development, Addis Ababa City authorities, Ethiopian Civil Service College, UNDP, and UNCHS. The objective is to develop an urban development strategy and operational guidelines for municipalities, focusing on urban management, housing development, integrated infrastructure development, municipal finance management and upgrading of institutional capacity (UNCHS/ROAAS 2001).

### **WESTERN INDIAN OCEAN ISLANDS**

Forty-eight per cent of the population of the Western Indian Ocean Islands lives in urban areas. The least urbanized countries are Madagascar (30 per cent) and Comoros (33 per cent) (UNCHS 2001a). Seychelles is the most urbanized, at 63 per cent, followed by Mauritius at 41 per cent (UNCHS 2001a). Annual urban population growth rates in the sub-region in the past thirty years have ranged from one per cent in Mauritius to over five per cent in Comoros and Madagascar (UNDP 2000). Urban growth rates over the next 15 years are expected to average 2.8 per cent per year, ranging from 4.5 per cent in Madagascar and 4.1 per cent in Comoros to under 2 per cent in Mauritius and Seychelles (UNCHS 2001a).

### **THE SIGNIFICANCE OF URBAN AREAS IN THE WESTERN INDIAN OCEAN ISLANDS**

The major factors encouraging rural-urban migration are the search for improved standards of living, employment and educational opportunities, and for

access to communications and trade. In Mauritius, for example, economic growth averaged 7.7 per cent per year between 1985 and 1989 and 5.2 per cent per year between 1990 and 1999, with yearly growth in exports of 15.5 per cent and 6.4 per cent over the same periods (World Bank 2001a). The port and capital city, Port Louis, has facilitated this development through harbour operations, and, as a consequence, has attracted numerous industries. In Seychelles, 90 per cent of the population lives on the principle island of Mahe, with the majority (71 000 people) living in the capital Victoria where the country's main economic activity, tourism, is based.

### **URBAN AREAS AND THE ENVIRONMENT IN THE WESTERN INDIAN OCEAN ISLANDS**

The high rate of urbanization means that urban environments and infrastructure providers are under extreme pressure to deliver goods and services. In addition, many urban centres are located on the coast, where there are risks of environmental disturbance, erosion, and pollution. The large and growing number of tourists coming to the islands is also pushing up the demand for housing and infrastructure, and land is being reclaimed and coastal wetlands drained. In Seychelles, for example, coastal sand dunes are now being used for construction and land is being reclaimed from the sea with irreparable damage to the reefs, wetlands, marine and land eco-systems (UNEP 1999).

### **Unplanned settlements in the Western Indian Ocean Islands**

Data on adequacy of shelter are only available for Mauritius, where most residents are owners of their properties, and dwellings are of conventional type (UNCHS 2001c). The majority of towns and cities in the sub-region are growing faster than the provision of infrastructure and there are shortfalls in water supply, sanitation, waste disposal, roads and communications infrastructure, as well as in health and educational facilities. However, the Western Indian Ocean Islands fare better than many African countries, with all urban residents in Mauritius and nearly all in Comoros enjoying access to improved water and sanitation (WHO/UNICEF 2000). In Madagascar 85 per cent of the urban population has access to water supply and 70

per cent has access to some form of improved sanitation (WHO/UNICEF 2000).

Where these services are lacking, the urban population relies on septic tanks, and pit latrines. If not properly managed (especially in informal settlements) these can contaminate groundwater, and untreated domestic sewage—together with storm water run-off from impermeable surfaces in urban areas—can threaten drinking water supplies and the quality and safety of coastal waters. The result is a risk to biodiversity and human health from enhanced breeding and transmission of intestinal parasites, pests, and bacteria. Many of the urban developments—grown from villages and concentrated along the coastlines—discharge their liquid and solid wastes directly into the sea. For example, there are no waste management facilities in Comoros (UNEP 1998).

### **Management of pollution and waste in the Western Indian Ocean Islands**

The growing populations in urban centres in the Western Indian Ocean Islands, together with the growing number of visitors and patterns of increased consumption, are producing greater and greater volumes of solid waste. In Mauritius more than 1 000 tonnes of solid waste are generated every day, mostly in the capital, Port Louis, and other urban centres (UNEP 1998). However, solid waste collection and disposal services in urban areas in the sub-region are somewhat dysfunctional. For example, in Antananarivo, Madagascar, it is estimated that only 25 per cent of solid waste is collected. Lack of waste collection encourages illegal dumping of wastes by households and municipalities, and uncontrolled roadside dumping, or dumping on the beaches, as in Comoros (UNEP 1999, UNEP 1998). Lack of suitable landfill sites, especially on the smaller islands complicates the problem, and burning in the open is common. Burning presents a threat to public health and air quality. Water quality is also threatened when solid waste is dumped in or near surface and groundwater resources (UNEP 1998). Some of the waste generated in the sub-region is recycled. For example, Madagascar and Mauritius recycle paper, textiles, and metal. In Mauritius glass, precious metals, and plastics are also recycled (UNEP 1998).

Intensive animal rearing, especially the pasturing of goats around urban areas creates pressures on the

environment and human health if the waste is not disposed of properly. Contamination and eutrophication of water courses lower the ability of the natural systems to provide vital functions such as water quality regulation and nutrient cycling, as well as impacting on biodiversity and providing breeding sites for parasites and bacteria.

### **Towards sustainable urban development in the Western Indian Ocean Islands**

The establishment of urban planning regulations, waste management and raising of public awareness are improving the situation in some parts of the Islands. But more needs to be done, especially in islands where urbanization and population are growing rapidly and where residential and industrial developments combine their pressures on the urban environment. In old towns and cities, the road, water, sanitation and traffic management infrastructure is in urgent need of radical renewal and attention is being given to decentralizing the population through better spatial planning for industry, government and residential population areas.

The Cities Alliance, to which Antananarivo, Madagascar, is a partner, held a special session in February 2001, at which Madagascar's Minister for Regional and Urban Development reported that significantly more investment is required to keep pace with a rapidly urbanizing population. The Government of Madagascar has conducted extensive consultations with local authorities, civil society and international partners, and has formulated a Poverty Reduction Strategic Programme, focused at the local level and, in particular, on provision of infrastructure and creation of employment. Activities include the development of planning and monitoring tools and a campaign to develop municipal awareness and capacities.

Also in Madagascar, the World Bank has funded a slum upgrading and city development strategy for Antsirabe, Antsiranana, Mahajanga, and Toamasina, as well as an integrated municipal programme for poverty reduction in Fianarantsoa and Tulear. Community participation has been a significant component of both projects, and replicable methodologies have been established (UNCHS/ROAAS 2001).

## SOUTHERN AFRICA

Southern Africa's urbanization levels are currently just under the average for the Africa region, with 36 per cent of the sub-region's population living in urban areas (UNCHS 2001a). South Africa and Botswana are the most urbanized countries, with urban populations of 50 per cent each, and Malawi is the least urbanized with just 24 per cent of its population living in urban centres (UNCHS 2001a). This is considerably different from the situation 30 years ago, when just 11.2 per cent of the Southern African population lived in towns and cities (WRI, UNEP & UNDP 1992).

The current rate of urbanization is also high, and is predicted to average around 3.5 per cent over the next 15 years, although there are wide differences between countries. For example, South Africa, one of the most urbanized countries in the sub-region, has the lowest rate of urbanization, at 1.2 per cent per year, whereas Malawi, currently the least urbanized, has estimated urban growth rates of over 6 per cent per year (UNCHS 2001a). South Africa has the biggest and most numerous urban areas in the sub-region, including Southern Africa's largest urban agglomeration, Johannesburg (population approximately 4 million, 791 000 households, area 1384 km<sup>2</sup>, 720 suburbs) (UNCHS & UNEP 1997, GJMC 1999).

### THE SIGNIFICANCE OF URBAN AREAS IN SOUTHERN AFRICA

The high urbanization rates in Southern Africa are due to rural-urban migration and high population growth rates. Migration is a result of the pull factors of urban settlements—such as perceived job opportunities, and better infrastructure and housing—in addition to ‘push factors’ from rural areas such as shortage of land and declining returns from agriculture. In Angola and Mozambique, urbanization has been driven largely by civil conflict which forced many rural residents to flee to relatively safer urban areas. About 4.5 million Mozambicans were displaced to urban areas during the 1980s (Chenje 2000).

Despite considerable economic development and employment opportunities in Southern Africa's urban centres, the rate of population growth and urban migration has exceeded the ability to create jobs and

raise standards of living for urban residents. However, the informal sector has grown rapidly in urban areas, and many cities now have considerable hidden economies. One such informal activity is urban agriculture. Mainly instituted at the subsistence level to counteract low levels of employment and income, urban agriculture has become an integral part of the urban economy for the poor. Up to 37 per cent of urban households in Mozambique were engaged in subsistence agriculture in 1996, and 45 per cent of low-income urban households in Zambia grew crops or raised livestock (UNDP 1996).

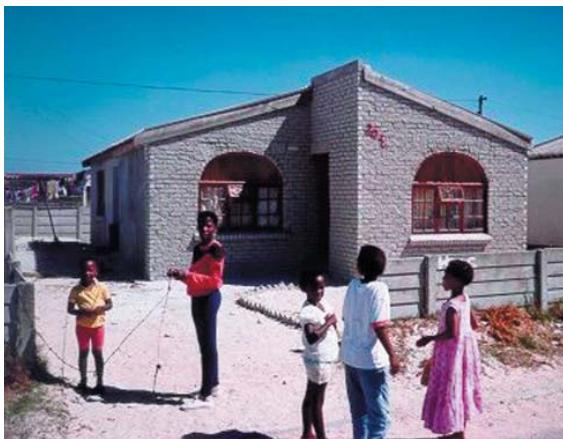
### URBAN AREAS AND THE ENVIRONMENT IN SOUTHERN AFRICA

The rapid growth and expansion of urban areas in Southern Africa are causing an unprecedented level of localized depletion of natural resources, discharge of unprocessed wastes into the environment and massive demands for urban services. Most Southern African municipalities have not been able to keep pace with the demand for basic services such as housing, roads, piped water, sanitation and waste disposal. Provision of health and education services and facilities has also lagged far behind urban population growth. The overall result is that the environment has become hazardous to human health through rapid spread of water-borne and respiratory diseases, and this situation is compounded by a lack of health facilities, low levels of education and employment opportunities and, hence, a reduced ability to afford improvements to living conditions.

#### **Unplanned settlements in Southern Africa**

The gap between urbanization rates and rates of housing and service provision—together with colonial and post-colonial apartheid development policies—has created a wide range of settlement types with stark inequities in terms of tenure, access to land and shelter, and provision of services. Large informal settlements have developed on the periphery of towns and cities, furthest from economic opportunities, transport networks and urban amenities.

In general, these informal settlements are characterized by insecure (or illegal) tenure, unstable structures, inadequate water supply and sanitation, lack of waste disposal facilities, and poor electricity



Housing development project, South Africa

*Mark Napier*

supplies. Meagre and overburdened health, education, and social services compound these problems, creating unhealthy living conditions and social problems such as high crime rates, prostitution and drug abuse (e.g. Napier 2000, GJMC 1999, DEA&T 1999). Gauteng, South Africa's most urbanized province has over 24 per cent of its population living in informal settlements (Statistics SA 1998). In Dar es Salaam, Tanzania, about 70 per cent of the 3 million residents live in unplanned settlements with marginal access to piped water, sanitation, drainage, or basic social services (UNCHS & UNEP 1997).

Environmental impacts of poor and insufficient housing include uncontrolled urban development in fragile areas such as flood zones, on steep slopes, or in wetlands and other unique natural habitats. This in turn poses a threat to the residents, who are at greater risk of flooding, landslides, and outbreaks of diseases such as cholera or vector-borne diseases such as malaria. For example, in Johannesburg's Alexandra township (South Africa) there were some 3 800 households living on an infill site, and 5 500 households living on the banks of the Jukskei River in 1999 (Alexandra Renewal Project 2001). Unusually heavy rains during December 1999 and January 2000 precipitated flooding of the Jukskei River and 120 households were washed away (Disaster Relief 2000). There have also been recent cases of cholera reported in Alexandra, and there is now a plan to move residents to alternative, more sanitary

conditions (Alexandra Renewal Project 2001).

Provision and upgrading of urban infrastructure have thus become priorities for municipalities of the sub-region, and great strides have been made in recent years to improve urban living conditions. These include the award-winning Luanda Sul Self-Financed Urban Infrastructure Program in Angola, which aimed to provide satisfactory shelter for a significant proportion of urban migrants who fled the conflict during the 1980s. Since 1994, 2 210 dwellings have been built by the 16 702 people they now shelter, together with 12 km of power lines, 70 km of clean water pipes, 23 km of drainage, and 290 000 m<sup>2</sup> of paved roads (UNCHS 2000). Lesotho's Urban Upgrading Project—through involvement of local authorities and communities—has housed 267 families, of which 134 were female-headed households (UNCHS 2000). In Namibia, a National Housing Policy was approved in 1991 and, together with a National Shelter Strategy, has facilitated production of over 3 400 housing units, improved women's access to shelter, and is assisting an additional 1 300 families per year (UNCHS 2000). South Africa's efforts have included the production of over a million low cost houses in the last six years (Department of Housing 2000) representing an addition of at least 17 per cent to the national stock of formal housing (based on Statistics SA 1998). However, this is still short of the massive backlog, which stood at 5 million units in 1994 (Everatt 1999). Problems of inadequate housing have been fundamentally complicated by lack of access to land and financing. For instance, the housing demand in Zimbabwe now stands at over one million units, from 670 000 units in 1995, with the greatest shortages being experienced in major cities where the annual population growth rate is between 3–6 per cent. The private and public sectors are currently able to produce approximately 18 000 units per year, which is far below the required levels (SARDC 1999).

Water supply and sanitation rates in Southern Africa have, on average, improved over the last decade (the United Nations International Drinking Water and Sanitation decade), although millions of urban residents still do not have clean water or adequate sanitation (see Box 2g.3). Access to clean water is highest in urban areas in Botswana (100 per cent) and lowest in Angola (34 per cent) (WHO/UNICEF 2000). Access to sanitation is much higher in general, with Malawi, Namibia, South

### Box 2g.3 Improving water supply services in Southern Africa

Municipalities and local authorities have identified access to clean water and sanitation as priorities for development, and several local level projects have been established, with funding from national development budgets as well as with the help of international donors. Many countries in the sub-region have also reformed their legislation to reflect the right of all citizens to adequate sources of clean water. In Zambia a National Water Supply and Sanitation Council has been established to co-ordinate supply by local utilities. Following a recent outbreak of cholera, Mozambique received a US\$36 million credit from the World Bank to upgrade sanitation and to chlorinate drinking water in the cities of Maputo and Beira.

Source: World Bank 1998

- *Privatization of waste collection services has been encouraged by structural adjustment programmes in an attempt to raise additional funds. Unfortunately, this has, to an extent, worsened the problem of improper waste dumping, as companies sometimes avoid using designated dumping sites where they are supposed to pay a fee*
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### Management of pollution and waste in Southern Africa

Per capita solid waste generation averages 0.7 kg/day in Zimbabwe, while in Tanzania it is 1 kg/day (Chenje 2000). More people living in urban areas means greater levels of waste generation. As municipalities cannot cope with this, large quantities of solid wastes are not collected, are not treated, or are not disposed of in designated sanitary landfills. On average, less than two-thirds of urban households in the sub-region have access to garbage collection services. The situation is most extreme in Lesotho, where only 7 per cent of urban households have garbage collection facilities (UNCHS quoted in WRI, UNEP, UNDP & World Bank 1998). As a consequence, large quantities of solid waste are illegally dumped or burned, resulting in increased pollution of both the air and soil. By contrast, Windhoek in Namibia recycles 4.5 per cent of waste, 3 per cent is incinerated, and the rest is disposed of in sanitary landfill (UNCHS 2001c). In Gaborone (Botswana) and Maputo (Mozambique) nearly all solid waste is disposed of in an open dump rather than a sanitary landfill (UNCHS 2001c). This gives rise to unhygienic conditions where the proliferation of disease vectors is facilitated, and risks of surface and groundwater contamination are high. Methane emissions may also be dangerous to nearby residents and contribute to atmospheric pollution and global climate change.

The major constraint on proper management of solid waste in cities of Southern Africa is inadequate finance (UNCHS 1996). Privatization of waste collection services has been encouraged by structural adjustment programmes in an attempt to raise additional funds (see Box 2g.4). Unfortunately, this has, to an extent, worsened the problem of improper waste dumping, as companies sometimes avoid using designated dumping sites where they are supposed to pay a fee.

The slow pace of development of urban infrastructure in Southern Africa has resulted in increasing traffic congestion throughout the sub-region, with central business districts of most major cities having inadequate public transport networks and parking space. However, the sub-region has also witnessed a significant rise in the number of cars, currently translating as 51 persons per car (WRI, UNEP, UNDP & World Bank 1998) compared to 197 persons

Africa, Tanzania, Zambia, and Zimbabwe, having over 95 per cent access in urban areas (WHO/UNICEF 2000). In areas where water supply and sanitation are inadequate (mainly informal settlements), there are higher risks of water-borne diseases such as dysentery, cholera, typhoid, parasitic worms and flukes, as well as skin and eye infections that can be cured by enhanced levels of hygiene. Pools of stagnant water are also ideal breeding habitats for disease vectors such as mosquitoes. Environmental impacts of poor water supply and sanitation include the risk of contamination of groundwater as well as surface water, eutrophication, and changes to biodiversity. For example, the town of Victoria Falls (Zimbabwe), which has a population of more than 3 000, discharges 8 000 m<sup>3</sup> of wastewater into the Zambezi River, including raw sewage, because the town's sewage treatment facilities are overloaded and subject to frequent breakdowns (Chenje 2000). Nitrate and phosphate levels in the effluent exceed Zimbabwean standards and may be a contributing factor to the spread of water hyacinth in Lake Kariba which lies downstream. Total coliform counts in the effluent are also high and this poses a health risk to downstream communities and the town's 32 000 annual visitors (Chenje 2000).

#### **Box 2g.4 Improving waste management in Dar es Salaam**

In Dar es Salaam (Tanzania) less than three per cent of the city's solid waste is collected due to lack of appropriate vehicles and inadequate cost recovery (UNCHS & UNEP 1997). As part of a new Environmental Planning and Management Process, waste management services have been privatised, an emergency clean up operation was launched, and management of disposal sites has improved. New City Council bylaws were introduced to facilitate collection of revenues and innovative fiscal incentives for rehabilitating the fleet of vehicles were also established.

Source: UNCHS & UNEP 1997

per car 20 years ago (WRI, UNEP & UNDP 1992). The advanced age of most of the vehicles, and heavy dependence on leaded fuel and diesel contribute to high levels of smog and particularly lead pollution.

Other urban sources of air pollution include industrial emissions and smoke arising from domestic consumption of coal, wood, and charcoal. Human health impacts include elevated incidence of acute respiratory infections such as asthma and bronchitis. Buildings are corroded and surrounding plant communities are subjected to toxic pollutants.

Most cities in the sub-region have established air quality standards and have monitoring programmes in place. In South Africa, where the problem is greatest because of the highest density of industries and vehicles, an Atmospheric Pollution Prevention Act (1965) stipulates the latest technologies to be used in controlling noxious and offensive emissions. The same act, which is being updated, makes provision for control of smoke from industrial operations by establishing grounds for prosecution of offenders, and empowers the Minister of Transport to make regulations regarding the exhaust emissions from vehicles operating on public roads. However, enforcement of this regulation is weak owing to lack of resources for monitoring and prosecution. Some municipalities (including Cape Town and Durban) also have bylaws preventing the burning of refuse, but again, these are not always adhered to.

#### **Towards sustainable urban development in Southern Africa**

In addition to the specific responses listed above, a number of policies and strategies have been put in place at national level. In Malawi, a national housing policy has been developed, while in South Africa an urban development strategy was recently launched for discussion. In Zimbabwe, a policy of decentralization encourages the development of rural service centres, commonly known as growth points, to relieve the pressures of population and pollution on major urban centres. However, the policy has not met with much success, as the service centres continue to be shunned by many, probably because of the complexity of push and pull factors that contribute to urban growth rates.

Legislation requiring environmental impact assessment prior to development is another recent feature in most Southern African municipalities, and local development plans taking into consideration the priorities for integrated environmentally-sensitive and socially-acceptable development have been widely adopted. Maseru (Lesotho), Lilongwe (Malawi), Maputo (Mozambique), Windhoek (Namibia), East Rand (South Africa), Bulawayo, Chegutu, Gweru, Harare and Mutare (Zimbabwe) have all put in place local environmental plans and implemented them to some extent (UNCHS 2001c). The City of Cape Town approved an Integrated Metropolitan Management Policy in 2001 and implementation of a number of strategies for tackling air pollution, litter and illegal dumping, and for creating open space and managing environmental education has begun (City of Cape Town 2001). Funding is still the major restriction for many municipalities, and alternative strategies are required to boost local authorities' capacities.

#### **CENTRAL AFRICA**

The average level of urbanization in Central Africa in 2000 was 48 per cent, ranging from 81 per cent in Gabon to 24 per cent in Chad (UNCHS 2001a). This represents rapid growth, over the last decade in particular, with urbanization rates of over three per cent for all countries, and reaching five per cent or more in Equatorial Guinea and Gabon. However, urbanization rates were even higher during the previous decade,

when economic growth encouraged employment in urban areas. The largest cities in Central Africa are Kinshasa (5 million) in Democratic Republic of Congo (DRC) and Douala (1.6 million) and Yaoundé (1.4 million) in Cameroon (UNCHS 2001a).

### THE SIGNIFICANCE OF URBAN AREAS IN CENTRAL AFRICA

Central Africa has a long history of urbanization. Cities or urban centres started as commercial, administrative and mining towns and as seaports during the colonial period. As a result many major or capital cities are on the coast (including Libreville and Douala) where access to trade, travel and international communications is enhanced. Libreville is the economic and administrative capital of Gabon, concentrating 50 per cent of the population, 50 per cent of employment, and more than 80 per cent of GDP. Douala is Cameroon's most important city and the main industrial centre. It is a port city with industries such as aluminium smelting, brewing, textiles manufacture, and processing of wood and cocoa. Kinshasa is also a port, on the Congo River estuary, and serves as the political, administrative, and industrial capital of DRC (UNCHS 2001c). Although cities have become the main catalysts of economic growth in Central Africa, urbanization has caused massive problems of poverty and environmental degradation.

### URBAN AREAS AND THE ENVIRONMENT IN CENTRAL AFRICA

Environmental consequences of the rapid urbanization and urban population growth include intensifying pressures on natural habitats and resources to satisfy the growing demand for space, housing, and water for drinking and sanitation. Municipalities and utility companies are unable to provide housing and infrastructure quickly enough to meet this demand and sub-optimal services are therefore provided, with sub-optimal environmental standards and conditions.

Dualism between customary and modern tenure laws is also apparent in the urban centres and, together with high land and property prices, is one of the causes of unplanned or illegal construction. Rapid development of informal settlements or

shantytowns ensues, characterized by overcrowding, unstable or unhealthy housing, inadequate water supply and sanitation, and lack of electricity supply and waste collection.

### Unplanned settlements in Central Africa

In Yaoundé, Cameroon, the majority of urban residents are squatters or tenants. There are conflicting pressures on residents to purchase properties and rents are high. However, property prices have also risen recently, while incomes have declined because of devaluation of the currency (UNCHS 2001c). By contrast, land prices in Douala are lower, and there is a much higher proportion of house owners and no squatter settlements (UNCHS 2001c). In the DRC, security of tenure is also complicated by disparities between modern legislation and traditional laws. For example, the DRC's 1973 Land Act stipulated that 'land is the exclusive inalienable and unprescriptable property of the state', but the acquisition of land remains subject to the consent of the land chief.

The city of Libreville, Gabon, is experiencing uncontrolled urban development resulting from a shortage of serviced plots, an absence of planning tools and instruments, and a lack of urban space control. The demand for housing stands at approximately 6 000 units per year (in a city with a population of 500 000), and available land for development is minimal (there are 14 hectares of 'green spaces' per 10 000 hectares) (UNCHS 2001c). The results are that over half of the population lacks proper housing; there is rapid development of unplanned, inadequately serviced, and often unsafe settlements; and illegal occupation is as high as 85 per cent (UNCHS 2001c).

One of the most important environmental impacts of uncontrolled urbanization in Central Africa is its spread into fragile ecosystems, including delicate or highly erodible slopes, natural drainage waterways or valleys, and areas that are subject to flooding. Due to the intense competition for space in urban areas, green spaces are rapidly disappearing and areas usually deemed unsuitable for housing are the only refuges available for the urban poor, who are then vulnerable to flooding, landslides, and outbreaks of pests and diseases. Although planning regulations are in place, they are poorly monitored and enforced. Development in and modification of green areas results in changes to

biodiversity, risks of pollution of soil and water, changes to soil fertility and stability and, especially in wetland areas or areas where there is standing water due to lack of sanitation, high risk of disease transmission. Dense, unstable, and poorly sited settlements are also vulnerable to the impacts of floods, landslides, and fires.

Water supply and sanitation provision has also fallen behind rates of urban growth in many Central African cities, largely due to lack of municipal funds and capacities. On average, 59 per cent of the urban population has access to clean water (over 80 per cent in Cameroon and DRC), whilst 54 per cent has access to sanitation (but only 14 per cent in Congo and 25 per cent in Gabon) (WHO/UNICEF 2000). Inadequate water supply and sanitation pose a threat to human health via exposure to pathogens such as cholera and intestinal parasites. They also pose a threat to the surrounding environment if sewage and wastewater are discharged untreated. Untreated discharges contaminate soil and water bodies, creating a risk to human health via transmission of disease vectors or toxic elements, and threaten biodiversity through effects on the ecosystem such as eutrophication and contamination with heavy metals and inorganic compounds.

### **Management of pollution and waste in Central Africa**

Solid waste generation in Central Africa was recorded in 1993 as 0.6 kg/person/day in Brazzaville, 0.8 kg/person/day in Yaoundé, and 1.2 kg/person/day in Kinshasa (UNCHS quoted in WRI, UNDP, UNEP & World Bank 1998). Relatively few households had access to solid waste collection, however, (none in Kinshasa, one-quarter in Bangui (Central African Republic), and 44 per cent in Yaoundé). Residents of Douala and Brazzaville fared better, with 60 and 72 per cent respectively (UNCHS quoted in WRI, UNDP, UNEP & World Bank 1998).

The lack of capacity to collect, treat, and dispose of solid waste stems from inadequate municipal budgets and insufficient sites. In many cases, refuse collection is restricted to high-income areas. Where refuse is collected, it is often dumped at the edge of the city in open sites such as wetlands or water courses, rather than in regulated landfill sites. Whereas 62 per cent of Douala's solid waste and 70 per cent of Libreville's waste is disposed of in sanitary landfill, the figure for

Brazzaville is less than one per cent, and 40 per cent goes to open dumps (UNCHS 2001c). Here it poses a health risk to rubbish pickers, and to the water supply system, through leaching of toxic and decomposing material and blocking of drainage channels. Furthermore, 38 per cent of Brazzaville's waste and 32 per cent of Kinshasa's waste are burned in the open, posing a further risk to human and environmental health though the emission of toxic fumes (UNCHS 2001c). Very little is recycled, as infrastructure and services for collection and recycling have not been established and there are few markets for recycled materials.

The responses adopted by countries in the sub-region to address waste management problems include improved urban planning and management, establishment of programmes for waste disposal, and enforcement of existing regulations, urban environmental education, monitoring, and community participation as well as involvement of the private sector in urban sanitation. Libreville municipality has launched a 'Clean City' campaign, and local environmental plans have been implemented to improve environmental and social conditions. However, lack of legislation empowering local authorities and lack of assistance in transfer of state funds to municipalities remain barriers to their effectiveness (UNCHS 2001c).

Air pollution is an emerging issue in urban centres of Central Africa, although few data are available at present to provide quantitative analysis of the sources or impacts. Sources of pollution include increasing vehicular traffic and advanced age of many vehicles, industrial activity, and household consumption of traditional fuels. Lack of connection to electricity supply forces many households to burn coal, wood or even refuse to provide energy for heating and cooking. These fuels give off toxic fumes and are dangerous to human health, causing respiratory disorders.

### **Towards sustainable urban development in Central Africa**

In Cameroon, the government has embarked on a decentralization process, and there has been increased community participation, especially in implementation of projects aimed at improving living conditions (UNCHS 2001c). At the recent 25th Special Session of the United Nations General Assembly and Istanbul+5 Conference in June 2001, Cameroon also reported that

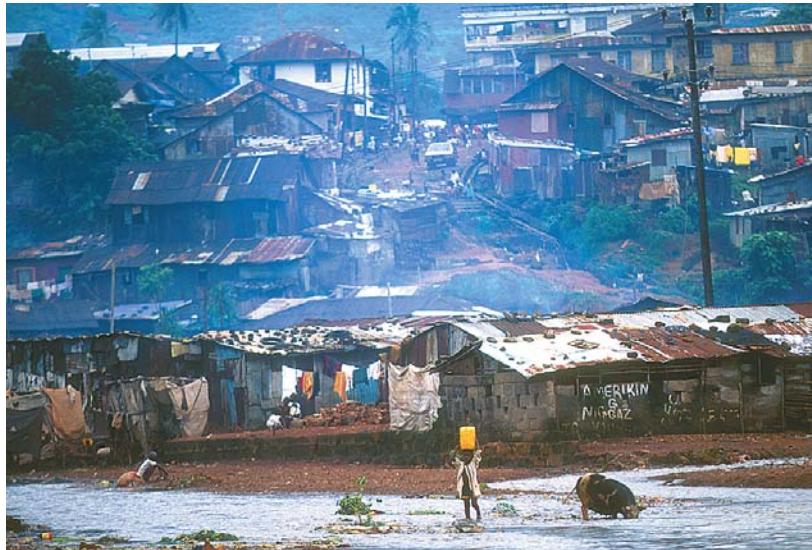
it had put in place an environmental management strategy for urban development. Additional national programmes recently developed include a programme for poverty reduction, environmental protection, governance, and health, fertility and nutrition. However, no assessment of the performance of these actions was available at the time of writing. The Congolese delegation reported that the human settlement development strategy has four major components, namely security of tenure, adequate housing for all, promotion of equality in access to credit, and provision of essential services. However, attention so far has been focussed on reconstruction and post-conflict development, and there is still significant work to do to achieve the goals of this strategy. Gabon noted that a national Habitat committee had been established, partnerships between national and local government and civil society had been forged, and community infrastructure projects had been implemented with financial assistance from the World Bank.

## WESTERN AFRICA

Approximately 38 per cent of the population of Western Africa lives in urban areas—on a par with the average for Africa as a whole (UNCHS 2001a). Cape Verde is the most urbanized country with 62 per cent of the population living in urban areas, and Burkina Faso the least with just 18.5 per cent of its population in urban areas (UNCHS

Freetown slum,  
Sierra Leone

*Edgar Cleijne/Still Pictures*



2001a). The predicted average rate of urbanization for 2000–2015 ranges from over five per cent in Burkina Faso and Niger to three per cent in Cape Verde (UNCHS 2001a). Thirty years ago, only one Western African city (Lagos) had a population of more than a million. By 2000, cities with populations exceeding one million included Ouagadougou (Burkina Faso), Abidjan (Côte d'Ivoire), Accra (Ghana), Conakry (Guinea), Bamako (Mali), Ibadan (Nigeria), Lagos (Nigeria), and Dakar (Senegal). Lagos, the largest city in Africa and the 6th largest in the world, has an estimated current population of 13.4 million people and this is expected to grow to over 23 million by 2015 (UNCHS 2001b).

## THE SIGNIFICANCE OF URBAN AREAS IN WESTERN AFRICA

The growth in urban populations in Western Africa is the result of a combination of high overall population growth, and migration. Migration, in turn, is a composite of rural push factors and urban pull factors. The population pressures, climatic variability, and fragmentation of tenure and traditional systems, contribute to degradation of soil and vegetation, diminishing yields and worsening food insecurity in rural areas. Prevailing educational systems are also more oriented towards training people in urban occupations than to improving agriculture or animal husbandry in rural areas.

The lure of employment and the perception of improved quality of life in urban areas are increasingly attracting rural populations to the cities. The concentration of amenities (such as health care, educational and recreational facilities) in capital cities such as Abidjan, Accra, Dakar, Lagos and Bamako, and minimum wage legislation also makes urban centres more attractive and employment more favourable than the insecure dividends of subsistence farming. Although several countries of the sub-region (including Côte d'Ivoire, Senegal, and Nigeria), experience internal migrations, especially urban-urban migration, a high percentage of migrants from other countries is adding to the growth of towns and urban areas in Western Africa. The percentage of foreign residents in Côte d'Ivoire increased from 23.3 per cent in 1965 to 35.9 per cent in 1990 (Toure & Fadayomi 1992).

## URBAN AREAS AND THE ENVIRONMENT IN WESTERN AFRICA

Urban growth rates in Western Africa exceed the capacities of municipalities to provide adequate housing and services such as water supply, sanitation, waste disposal, communications and transport infrastructure, health services, and education. High unemployment in urban areas also contributes to widespread poverty and poor living conditions.

Several coastal wetlands in Western Africa have come under increasing threat in recent years from industrial pollution, eutrophication due to sewage, and contamination with solid wastes. Wildlife habitats, especially waterfowl habitats, have also been destroyed (IDRC 1996). In response, some sites have been declared Wetlands of International Importance under the 1971 Ramsar Convention, and are now protected (Ramsar 2001).

### Unplanned settlements in Western Africa

Rapid urban growth—complicated by poor urban planning and control of land use, lack of financial resources and inadequate investment in environmental management—has led to the proliferation of urban slums in Western Africa. Although it is difficult to quantify the number of people living in slums, it has been reported that 42 per cent of the population in Liberia's capital, Monrovia, are squatters and, in Nouakchott (Mauritania), approximately 12 per cent of the city's area is taken up with slums (UNCHS 2001c). In Abidjan, Côte d'Ivoire, a number of schemes have been implemented to improve the living conditions of the 20 per cent of the population estimated to be living in slums. These include the Programme for Institutional Support to Settlement Policy, creation of an Agency for Land Management and the creation of a housing bank (UNCHS 2001c). In Ghana and Nigeria, improved security of tenure and enhanced gender-equality in tenure have been reported in recent years, resulting from sound municipal governance and the evolution of democracy. Although there is no legislated right to adequate housing, the governments aim to provide protection from forced eviction by documenting ownership of properties (UNCHS 2001c). Similar efforts are underway in Senegal (see Box 2g.5).

In 2000, an average of around 70 per cent of Western Africa's urban population had access to

### Box 2g.5 Settlement upgrading in Senegal

Unplanned developments accounted for 25 per cent of Senegal's urban areas in 1987 when the Dalifort Settlement Upgrading Pilot Project was launched. The programme aimed to assist squatters in improving their own living conditions, whilst adhering to environmentally sound practices. To date 500 inhabitants of Dalifort have secured land titles, and water supply, electricity, garbage collection and individual sanitation has been provided for the 7000 inhabitants. This success has sparked interest from a further nine informal settlements (with a total of 100 000 inhabitants) and a presidential revolving fund has been established to provide financial sustainability.

Source: UNCHS 2000

improved water supply and sanitation, although there were wide differences across the sub-region (WHO/UNICEF 2000). In Côte d'Ivoire and Senegal, for example, over 90 per cent of urban populations had access to improved water supply, whereas in Guinea-Bissau and Sierra Leone less than 30 per cent of the urban population had access (WHO/UNICEF 2000). Over 90 per cent of the people in urban areas in Cape Verde, Guinea, Mali, and Senegal had access to improved sanitation, whereas in Sierra Leone, just 23 per cent of the urban residents had sanitation (WHO/UNICEF 2000). Data are not available for Liberia.

Water pollution, arising from inadequate water supply and sanitation, is both a public health risk and an environmental problem in many cities. Diarrhoeal diseases are amongst the most prevalent preventable diseases, especially among children, and have been correlated with inadequate sanitation. The World Health Organization reports, for example, that washing hands with soap and water can reduce the incidence of diarrhoea by one-third (WHO/UNICEF 2000). Other water-borne diseases include parasitic worms and flukes, and skin and eye infections. Provision of adequate, clean water supply can reduce the incidence of these diseases by up to 70 per cent (WHO/UNICEF 2000). Furthermore, pollution of surrounding habitats and water sources can render them unsuitable as wildlife habitats or can even cause poisoning of wildlife and loss of biodiversity, as well as

reducing their productivity and posing further health risks to local residents.

### Management of pollution and waste in Western Africa

Waste disposal is one of the most pressing and most visible environmental issues in cities in Western Africa, as elsewhere. Lack of investment in waste collection and disposal facilities, lack of sufficient suitable landfill sites, and growing volumes of waste resulting from increasing consumption, changes in packaging and increasing urban populations have all contributed to a breakdown in solid waste management. For example, in Accra it has been reported that, in 1992, just 11 per cent of the 1.4 million inhabitants had waste collection facilities, and the remainder of residents were dumping their refuse informally (Songsore 1992). In 1989, Abidjan, Côte d'Ivoire, reported that none of its solid waste went to sanitary landfill, 72 per cent was disposed of in open dumps, 15 per cent was burned, and 3 per cent was recycled (UNCHS 2001c). During the same year, the city of Dakar, Senegal, reported that all of its solid waste was disposed of in open dumps (UNCHS 2001c). In Nouakchott, Mauritania's capital, an estimated 600–800 tonnes of household refuse are generated every day, of which 500 tonnes are collected (UNCHS 2001c). This results in large amounts of waste being blown onto streets and into drainage channels (where it causes blockages and creates a risk of flooding), or being burned, giving off toxic fumes and thus threatening human health.

Leachates from solid wastes can contaminate surface and groundwater sources, adding to the problem of inadequate access to safe water and sanitation, and increasing the risk of disease transmission. Responses have included privatization of waste collection, sorting, and disposal, in an attempt to improve coverage and treatment. In Nouakchott, for example, private operators have been collecting and transporting garbage since 1997. However, they are linked to the municipality by contract, and thus still receive inadequate funding.

Reuse of organic waste in urban agriculture is an activity that is rapidly gaining popularity as a means of waste management, and one that is changing the perception of organic material—no longer seen as merely waste but as a useful input to another process.

A sizeable proportion of solid waste is organic (85 per cent in Accra, Ghana), consisting of food leftovers, vegetable matter, leaves, fruit, and bones (Asomani-Boateng & Haight 1999), and urban agriculture is widely practised as a means of supplementing incomes and food supply. The organic compost or fertilizer from organic waste is a valuable addition. Despite this seemingly win-win opportunity, municipal authorities appear reluctant to encourage and commercialize this activity, as it would require changes to urban planning and changes in attitudes towards urban agriculture (Asomani-Boateng & Haight 1999).

Air pollution is another issue of concern in urban areas of Western Africa, arising mainly from vehicle and industrial emissions, and domestic use of coal, oil, wood, or other 'dirty' fuels. Many vehicles in the cities of Western Africa, as elsewhere in Africa, are old and still run on leaded fuel or diesel, and have inefficient combustion. Compounding this is the rapid growth in urban populations, which is now over-burdening the transport infrastructure and road networks, and the high tariffs placed on importing new (and therefore more efficient) vehicles. Congestion and air pollution are thus common in urban areas, and concerns are being raised over the impacts on human health, in particular the incidence of respiratory diseases. Dakar (Senegal) and Ouagadougou (Burkina Faso) are among the many Western African cities experiencing increased motorization rates. Currently there are no air quality standards, and little has been done so far to monitor pollution levels or their impacts on the environment or the health of residents (World Bank 2001b). However, a World Bank approximation of air pollution costs in Dakar and in Ouagadougou amounted to 2.7 per cent and 1.6 per cent of GDP respectively (World Bank 2001b). Policies in place to tackle this problem include promotion of newer, less polluting vehicles and cleaner fuels, reorganization of mass transit, traffic regulation and land use planning in urban centres (World Bank 2001b). The World Bank also launched the Clean Air Initiative in sub-Saharan African Cities, in 1998, to raise awareness of the impacts of air pollution and to identify and implement strategies for improving air quality. A conference held in November 2001, in Abuja, Nigeria, identified options for phase out of leaded gasoline, and provided a framework for development of action plans.

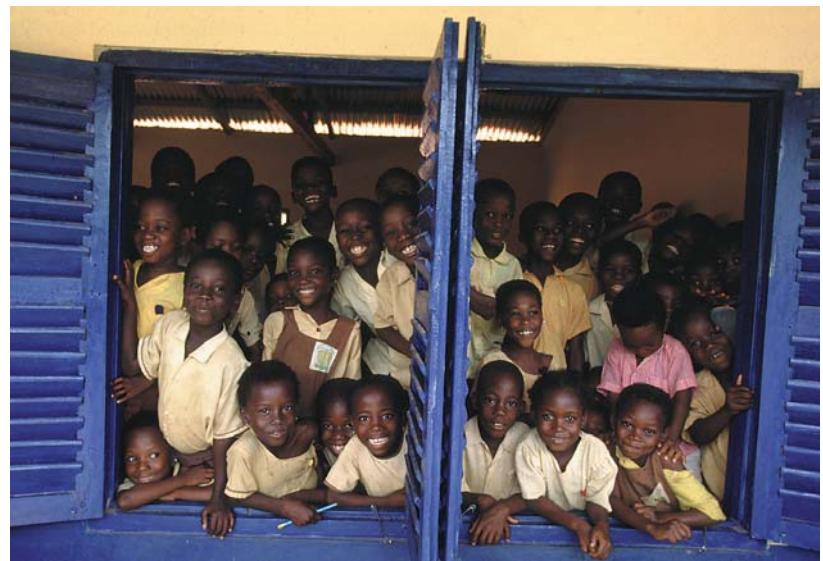
## Towards sustainable urban development in Western Africa

In addition to programmes by local authorities to improve water supply, sanitation, and waste management, many municipalities in Western Africa have enacted legislation to assist with improving urban planning and environmental management. The cities of Cotonou, Parakou, Porto-Novo (Benin) Ouagadougou (Burkina Faso), Abidjan, Yamoussoukro (Côte d'Ivoire), Banjul (Gambia), Accra, Kumasi (Ghana), Conakry (Guinea), Monrovia (Liberia), Bamako (Mali), Nouakchott (Mauritania), Ibadan, Lagos (Nigeria), Bignona, Thies (Senegal), Lomé and Sokode (Togo) have all developed, institutionalized, and implemented local environmental plans (UNCHS 2001c). Many of these and other West African countries also have national legislation or National Environmental Action Plans. Sustained investment in urban upgrading and development of infrastructure is a priority for Western African countries, as for all African countries, in order to keep pace with the rates of urban growth and to improve the living conditions of millions of urban residents.

## CONCLUSION

Throughout history, urbanization has been associated with economic and social progress, the promotion of literacy and education, the improvement of the general state of health, greater access to social services, and cultural, political and religious participation. When properly planned and managed, urban areas are capable of promoting human development, whilst effectively managing the extent of their impact on the natural environment.

However, population growth and rural-to-urban migrations have increased steadily, particularly in developing countries, placing enormous pressures on urban infrastructure and services, both in terms of provision and maintenance. The most serious problems confronting cities and towns and their inhabitants include inadequate financial resources, and planning skills and capacities. Coupled with the rapid growth in demand for shelter and services, as well as rising consumption, this has culminated in many social and environmental problems. These factors strain governments and local authorities' budgets, and their



Primary school children, Ghana

Ron Gillings / Still Pictures

capacities to achieve the goals of sustainable development. Responses urgently required include the eradication of rural poverty and improvement of the quality of living conditions, as well as creation of employment and educational opportunities in rural settlements, regional centres and secondary cities (United Nations Conference on Human Settlements 1996). Additional resources need to be committed to environmental protection and management at the national and international levels, to ensure a sustained supply of fertile and stable soils, good quality water, healthy fresh air, medicinal and nutritional products, and space for recreation.

Improved planning and design of settlements is required to make use of existing sites, thereby containing urban sprawl and limiting the extent of encroachment on natural habitat or agricultural land. Efforts should also be made to encourage the use of recycled or sustainably produced building materials, and innovations are required in building design to reduce environmental impact (e.g. through improved energy-efficiency). Environmental Impact Assessments need to be better integrated with urban planning and management, so that environmental impacts are monitored and managed continuously and within a context of holistic development.

In addition to this, improvements to infrastructure provision and maintenance are a priority for most African countries, although this is not exclusively an urban issue.

A significant proportion of the burden of disease in Africa could be alleviated through improvements in water supply and sanitation, waste disposal, education, and community-based, preventive healthcare. Reducing air pollution in urban centres by regulating the industrial and transport sectors, as well as reducing domestic air pollution through improved access to electricity and ventilation would also make significant inroads in reducing the disease burden in Africa.

'Recognizing the global nature of these issues, the international community, in convening Habitat II, has decided that a concerted global approach could greatly enhance progress towards achieving these goals. Unsustainable patterns of production and consumption, particularly in industrialized countries, environmental degradation, demographic changes, widespread and persistent poverty, and social and economic inequality can have local, cross-national and global impacts. The sooner communities, local governments and partnerships among the public, private and community sectors join efforts to create comprehensive, bold and innovative strategies for shelter and human settlements, the better the prospects will be for the safety, health and well-being of people and the brighter the outlook for solutions to global environment and social problems.' (United Nations Conference on Human Settlements, 1996).

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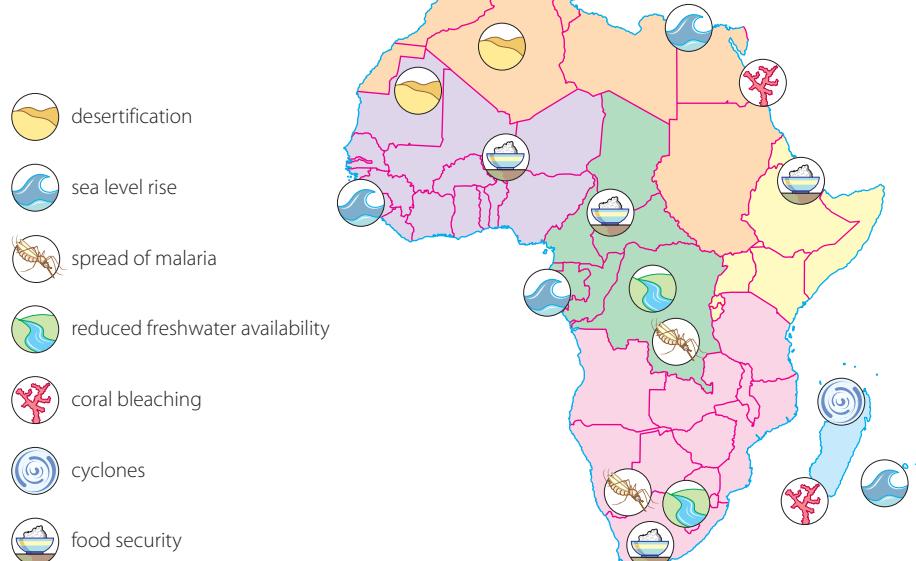
## THE STATE OF AFRICA'S ENVIRONMENT AND POLICY ANALYSIS

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# CONCLUDING SUMMARY

### ATMOSPHERE

**Figure 2s.1 Atmosphere issues for Africa**



Africa is extremely vulnerable to climate variability and climate change. Climate variability means the seasonal and annual variations in temperature and rainfall and their distribution within and between countries. Climate change refers to long-term changes in global weather patterns resulting from changes in the composition of the atmosphere brought about by emissions of greenhouse gases (GHG).

Africa's climate is characterized by considerable variability and by extreme climatic events such as droughts, floods, and cyclones. These have particularly serious consequences for Africa because of the difficulties experienced in the region in predicting their occurrence and in mitigating their effects, and also because many African countries lack the financial resources to make adequate and timely recovery before

the next climatic event. The countries of the Horn of Africa and the Sahel are most prone to drought; those of Western and Central Africa experience flooding periodically. Cyclones occur regularly in the islands of the Western Indian Ocean.

Climate change is likely to bring increased frequency and severity of flooding and drought to those areas already experiencing variability in rainfall. Additional concerns are increased risk of desertification in Northern Africa and on the southern border of the Sahel, and reduced availability of freshwater in Southern Africa, resulting in lowered food security and the spread of infectious diseases (notably malaria) to new areas. The islands and low-lying coastal areas of Central and Western Africa are most vulnerable to the sea level rise resulting from climate change. Coral

bleaching due to sea temperature rise is the biggest threat to the Western Indian Ocean Islands and to the coasts of the countries of Eastern Africa.

Africa's contribution to global GHG emissions is negligible, with the exception of emissions from South Africa and the countries of Northern Africa, which together account for the majority of the Africa region's GHG emissions. However, activities such as deforestation, inappropriate coastal development, and poor land management throughout Africa contribute to worsening of possible impacts of climate change such as drought, desertification, flooding, and sea level rise.

Low air quality is also emerging as an issue in many African countries, particularly the more urbanized and

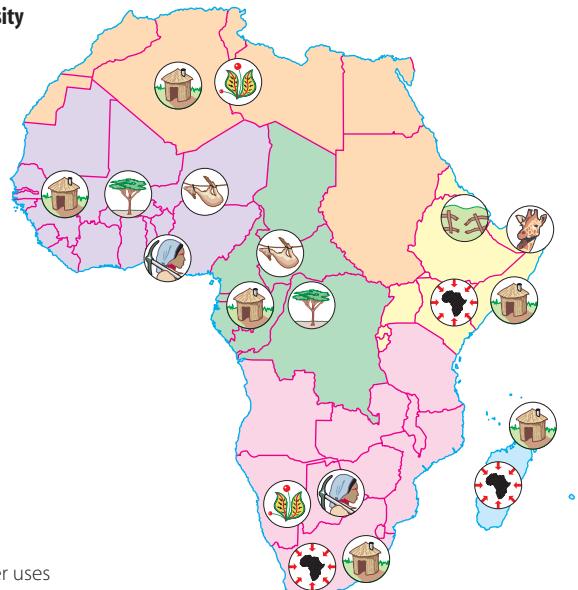
industrialized. In large cities, populations are at risk from respiratory infections caused by emissions from industry and vehicles and—in both urban and rural areas—from the use of wood, coal, oil, paraffin and other such fuels used for domestic consumption, and creating unhealthy indoor conditions.

Urgent action is required to develop alternative, clean, and renewable sources of energy for Africa to avoid increasing GHG emissions and to stem widespread deforestation. The Kyoto Protocol makes provision for funding streams to facilitate such development. Figure 2s.1 shows the major issues relating to atmosphere for Africa.

## BIODIVERSITY

**Figure 2s.2 Threats to Africa's biodiversity**

- (1) bushmeat trade
- (2) forest loss
- (3) encroachment of protected areas
- (4) conflicts between wildlife and pastoralist
- (5) loss of indigenous knowledge
- (6) overharvesting of rare and endangered species
- (7) alien invasive organisms
- (8) habitat loss/conversion to other uses



Africa is endowed with rich and diverse biological resources. These have enormous value for indigenous populations, commercial enterprises, and for development of tourism. These resources are, however, declining rapidly under the pressures of habitat loss, overharvesting of selected species, the spread of alien species, and illegal activities. In Western and Central Africa the main issues are loss

and fragmentation of forest habitat and poaching of endangered species to meet the growing demand for bushmeat. In Eastern Africa, encroachment of human settlements into protected areas and pastoral areas outside of reserves and their cultivation are priority concerns. In Southern Africa, loss of indigenous knowledge and inadequate protection of intellectual property rights are hampering conservation measures,

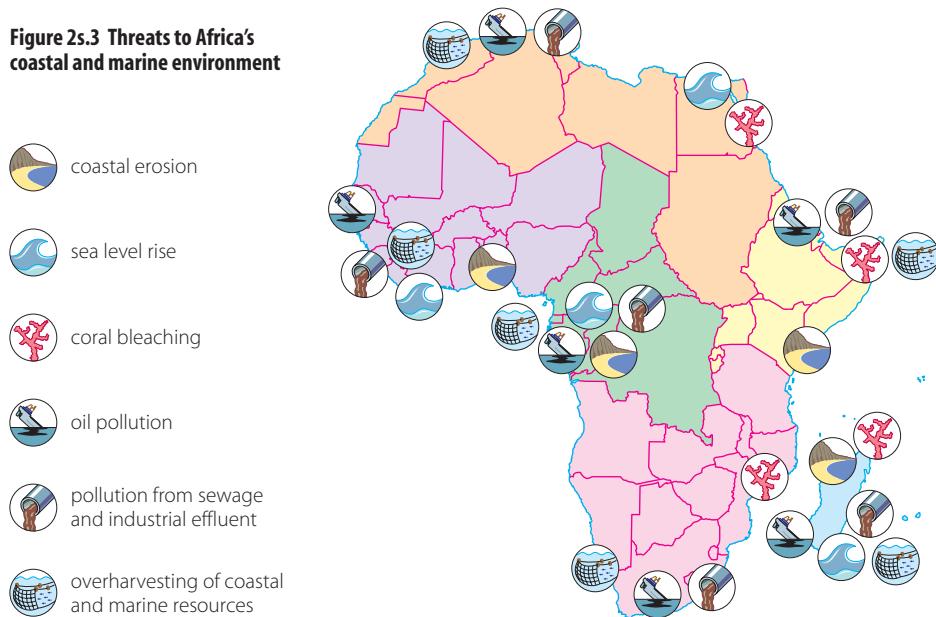
as are overharvesting (legal and illegal) of medicinal plant species, rare and endangered plants, and "trophy" animals and exotic pets. Overharvesting of certain species, particularly medicinal plants is also the primary cause of biodiversity loss in Northern Africa. Alien invasive organisms are a widespread problem throughout the region, particularly in closed ecosystems including Lake Victoria and the Western Indian Ocean Islands.

Formal protection of Africa's biodiversity at both national and international levels has been strengthened over the past 30 years, but the paradigm of conservation is now shifting away from protection and preservation and

focussing more on sustainable use and sharing of benefits. If this is to be achieved in Africa, wider involvement of stakeholders is required, together with additional research and documentation. Biological resources can and should be used to enhance economic growth opportunities, but consumptive and non-consumptive uses need to be managed with a long-term rather than a short-term view, and a fair and protective framework needs to be established to ensure that the benefits of resource use accrue to African communities and nations, rather than to international companies. Figure 2s.2 summarizes the main threats to Africa's biodiversity.

## COASTAL AND MARINE ENVIRONMENTS

**Figure 2s.3 Threats to Africa's coastal and marine environment**



Africa has a long and varied coastline supporting a diversity of habitats, resources, and economic activities. There has been rapid urban and industrial development and growth in tourism in many coastal zones without adequate planning, protection, or provision of infrastructure. As a result of this—and of phenomena in the hinterland such as deforestation and soil erosion—coastal erosion is a growing concern, particularly in Western Africa, Eastern Africa, and the Western Indian

Ocean Islands. Sea level rise due to climate change is a real and serious threat to the Western Indian Ocean Islands and to low-lying coastal settlements, particularly in Northern, Western and Central Africa. Sea temperature rise has the potential to cause coral bleaching which would have damaging impacts on the economies of the countries bordering the Red Sea and Western Indian Ocean.

Coastal and marine environments are also under pressure from pollution from land-based and sea-based

sources. Oil pollution is a major threat, with high levels of oil transportation threatening the eastern and southern African coast and islands, and oil drilling and processing activities causing problems along the northern, western and central African coast.

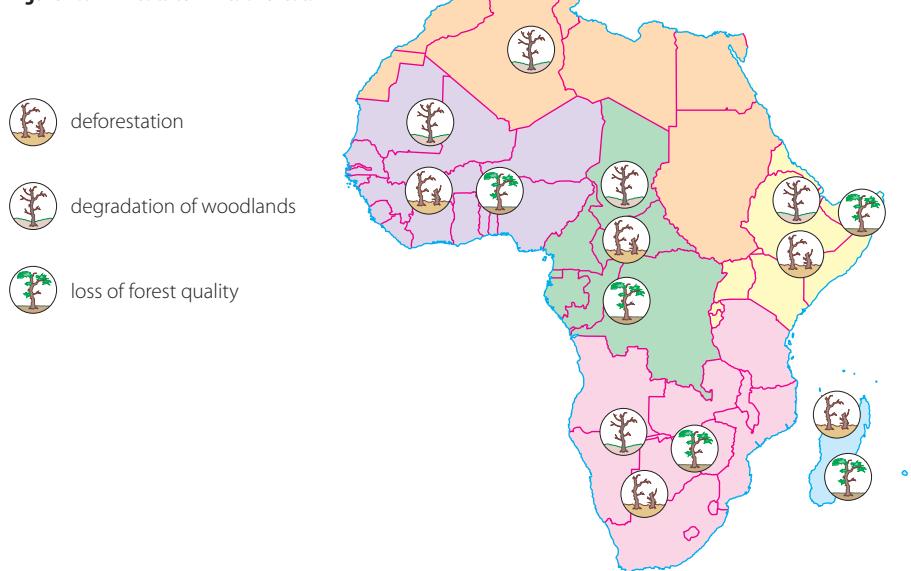
Domestic, industrial and agricultural effluents are problems in most sub-regions, especially around large urban or industrial coastal centres, and in Western and Central Africa where commercial plantations are common in the coastal zone. Overharvesting of coastal and marine resources is a priority concern for countries of Southern and Western Africa and for the island states, because of their relatively large area of Exclusive Economic Zone (EEZ).

Most coastal African countries are party to relevant international conventions and have national policies and

regulations for sustainable coastal development and use of marine resources. In particular, Integrated Coastal Zone Management (ICZM) plans have been developed by many countries, showing commitment to conservative use of the coastal zone and marine resources. These plans are, however, wide-ranging in nature and require considerable resources such as trained personnel, equipment, financial resources, and more effective policing, monitoring, administration and enforcement. Lack of coordination between government departments and between countries is an additional constraint on their effectiveness. Coordination should be strengthened. Figure 2s.3 shows the threats to Africa's coastal and marine environment.

## FORESTS

**Figure 2s.4 Threats to Africa's forests**



Only Western and Central Africa have abundant resources of closed canopy forests, although Madagascar and the wetter parts of Southern and Eastern Africa have equally important but smaller areas of forest. Savanna and woodlands are predominant in Africa's more arid countries. These ecosystems are very different from closed canopy forests but are also rich in diverse natural

resources. Both forests and woodlands play vital roles in supporting national economies and local communities through harvesting of resources, provision of habitats and services derived from the ecosystem. Since the majority of these resources and services have not been quantified in monetary terms, they are often undervalued and threatened by overexploitation.

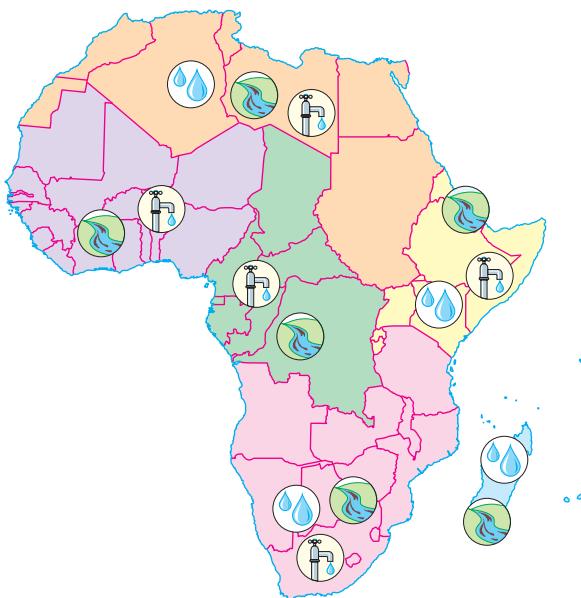
Africa has the fastest rate of deforestation in the world. Competing land uses (agriculture and human settlements mainly) are contributing to the decline of forest and woodland areas and the rising demand for fuelwood and charcoal is also a major cause of deforestation. In addition to ecological impacts, local communities are suffering from loss of livelihood and from loss of vital energy sources. Although policies and mechanisms for enhancing sustainable use of forests are in place in many countries and regional cooperative

arrangements are well under way, implementation and enforcement of regulations are weak because economic forces are pressurizing governments and communities into unsustainable practices for short-term profits. Political commitment to protection of indigenous forests, sustainable harvesting practices and community ownership needs to be strengthened and development of alternative energy sources is a priority. Figure 2s.4 shows the major threats to Africa's forests.

## FRESHWATER

**Figure 2s.5 Freshwater issues in Africa**

- rainfall variability
- freshwater pollution
- access to water and freshwater availability



Lack of availability and inadequate quality of freshwater are the two most limiting factors for development in Africa, constraining food production and industrial activities and contributing significantly to the burden of disease.

Western and Central African countries have relatively abundant freshwater resources and fairly predictable rainfall. However, the distribution of human populations in these countries is such that the various user groups nevertheless experience difficulties and disparities in access to water resources. For example, the rural poor have to walk long distances to collect water

for domestic consumption whereas agricultural and industrial users have access to subsidized resources.

Most other countries, particularly those in Northern Africa, the Horn of Africa, and in the Sahel, experience extreme variability and unpredictability in rainfall as well as frequent drought. User groups experience disparities in access to water resources, with Southern African countries showing the widest disparity in terms of both access and consumption.

Almost all African countries experience problems of water quality and are struggling to upgrade water

treatment and wastewater processing plants. At present, large quantities of industrial and domestic wastewater are discharged untreated into watercourses and coastal waters and the resulting pollution poses a risk to human and aquatic life. Pollution of freshwater also compounds the existing problems of water availability by raising the costs of treatment and supply.

Integrated Water Resources Management (IWRM) is a new, multi-stakeholder approach to meeting the challenges of water supply by curbing demand from certain user groups and encouraging re-use and recycling, as well as

management of aquatic ecosystems and making provision for environmental water requirements. Although there is increasing recognition of the need for, and benefits of, adopting such an approach in African countries, implementation will only be effective if it is supported by adequate finances, and by trained personnel with adequate facilities. Coordination between government departments responsible for water supply and use must be brought in line with the common goal of sustainable use of resources. Figure 2s.5 shows the main freshwater issues for Africa.

## LAND

**Figure 2s.6 Land issues in Africa**

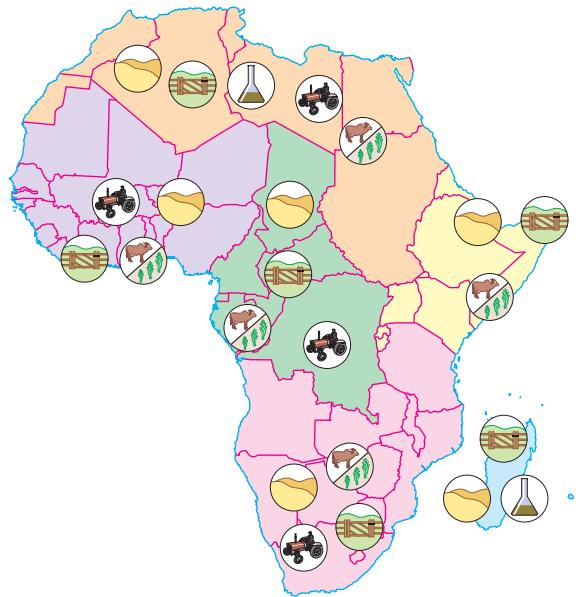
 degradation due to commercial agriculture

 desertification

 competition between land uses

 salinization and chemical pollution

 land tenure



The land and its resources are the cornerstones of Africa's culture and development. Pastoralism and subsistence agriculture are the traditional practices but commercial plantation agriculture has been promoted over the past 30 years, particularly in Western and Central Africa, as the foundation of economic growth. However, Africa's soils are not generally suited to cultivation, rainfall is variable in much of Africa and irrigation has been developed in only a few countries. Dependence on agriculture (in particular a narrow range of crops) has therefore had economic and environmental drawbacks.

National development policies and international trade agreements and/or restrictions have also affected agricultural development and natural resource quality. Soils and vegetation are being degraded largely as a result of increasing use of inorganic chemicals, reduction of fallow systems, increased monoculture, and cultivation of marginal areas. In Eastern and Southern Africa conflict between user groups over land and resources is the priority issue, resulting from competition between agriculture, pastoralists, and conservation areas, and from complex and inappropriate land tenure policies.

Desertification is another serious concern in Africa, particularly in the more arid zones where climate variability and poor land management practices combine to threaten the sustained productivity of soil and vegetation.

Land tenure reform, international cooperation, and integration of land resource management with

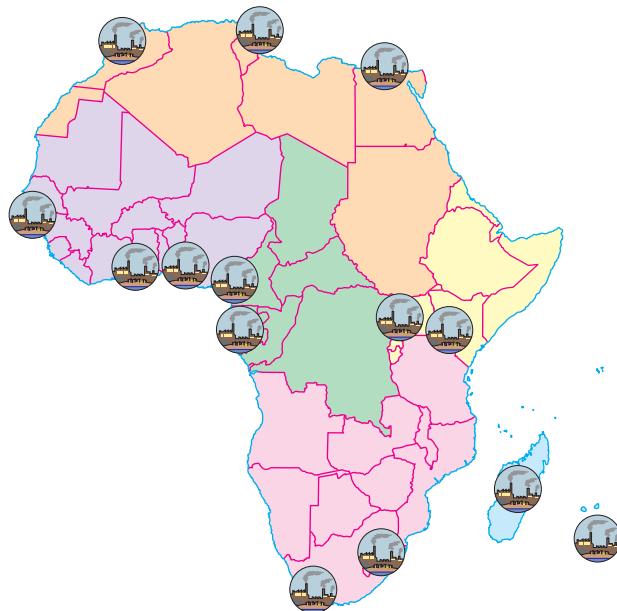
development goals are required. Monitoring of climatic patterns and strategies to alleviate the pressures that economic growth places on terrestrial resources are additional priorities if Africa is to achieve sustainable development and protect its resource base. Figure 2s.6 illustrates the land issues facing Africa.

## URBAN AREAS

**Figure 2s.7 Impacts of urban development in Africa**



- urban issues, including:
- proliferation of slums
  - inadequate waste management
  - poor water supply and sanitation coverage
  - urban air pollution



Although most Africans currently live in rural areas, rates of urbanization in the region are among the highest in the world. While urban areas offer considerable opportunities for employment, education and social services, and contribute substantially to national GDPs, they also have their own environmental problems. In Africa, poor economic growth and low investment in infrastructure have left provision of housing and basic services in urban areas lagging far behind the rate of population growth, resulting in a proliferation of urban slums. Slums often lack access to many essential services such as water, sanitation, and waste disposal, concentrate the pressures of pollution on the environment and are detrimental or even hazardous to human health. Emissions from industry

and vehicles are additional threats to human health in the larger urban areas.

Investment in urban infrastructure is essential to mitigate existing problems and to prevent exacerbation of the pressures exerted on urban areas by rapid population growth and migration. However, sustained economic growth and strategies aimed at job creation and alleviation of poverty are of pivotal importance if such investments are to be made.

Many African countries have implemented air quality standards and pollution abatement regulations, but integrated planning and investment in infrastructure development remain priorities for urban areas. Figure 2s.7 illustrates the impacts of urban development in Africa.

## THE COMPLEX RELATIONSHIPS BETWEEN ENVIRONMENTAL ISSUES

Although environmental issues have been presented here by theme, it is important to recognize they are inter-linked and that they therefore need to be addressed with an integrated environmental management approach. Figure 2s.8 illustrates links between stresses on land and water resources, others are highlighted below.

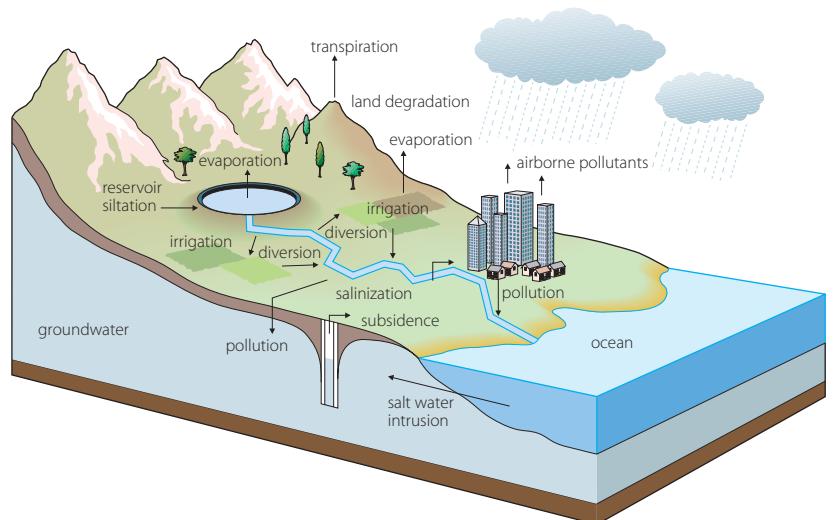
Deforestation and loss of vegetation cover increase the risk of soil erosion, which in turn impacts on aquatic and coastal ecosystems through sedimentation and smothering of habitats. This reduces water availability and quality and contributes to coastal erosion, exacerbating the impacts of climate change on freshwater resources and of sea level rise. Deforestation also affects climatic conditions reducing rainfall and run-off at the micro level (thereby also impacting on freshwater availability and aquatic ecosystems) and contributes to global warming and its impacts at the macro level.

Reductions in rainfall (natural or induced through changes such as deforestation) also impact on infrastructure and urban development, particularly on electricity generation in many parts of Africa where hydro-electric power is well developed. Power shortages and poorly developed central power supplies contribute to deforestation by increasing the population's dependence on wood and charcoal for fuel.

Loss of natural habitat because of urban and agricultural sprawl contributes to declines in biodiversity, loss of economic development potential, and support for livelihoods. Endangerment and extinction of certain species (terrestrial, aquatic, and marine) put pressure on other resources as substitutes are sought to meet people's requirements. Changing patterns of resource distribution also affect life cycles of pests and diseases, and may in turn impact on human health, and crop and livestock yields.

Alien invasive plants cause changes to freshwater availability and alter the diversity and abundance of species within ecosystems. Aquatic weeds also change water quality by adding or removing nutrients and thus affect drinking water quality and human health.

**Figure 2s.8 Interlinked stresses on land and water resources**



### WHAT IS CAUSING ENVIRONMENTAL CHANGE IN AFRICA?

The causes of environmental change in Africa are both natural and man-made, resulting from events and activities both within the region and external to it. For example, climate variability is a natural phenomenon that has impacts such as flooding and drought, but human activities such as deforestation and cultivation of marginal areas contribute to its impacts on human lives, livelihoods, economic growth and on the environment. Climate change is a result of anthropogenic GHG emissions largely from countries outside of Africa, but the impacts of climate change on Africa need to be mitigated to conserve African resources (human, economic and environmental).

In many cases it is not just one force that causes a single environmental change but a complex interaction of forces often seemingly unconnected in time and/or space. It is also clear that some forces have impacts that are particularly relevant to the themes discussed in this chapter, and as such should be addressed as priorities. The most important of are listed here and are discussed more fully below:

- Population growth, urbanization and increasing consumption

- Economic pressures
- Food production systems
- Energy needs and transport systems
- Loss of indigenous knowledge and practices.

**Population growth**, urbanization and increasing consumption are putting pressure on the environment through growing demand for resources such as freshwater the produce of agriculture, forestry and fisheries energy and space for housing and recreational facilities. These forces also exert pressure on the environment in terms of the large and growing volumes of waste and pollution they give rise to. In urban areas, environmental impacts are concentrated in small areas, making the surrounding ecosystems, resources and vast numbers of people highly vulnerable. Development and implementation of population policies is therefore a priority to ensure that population growth and urbanization patterns are in line with economic growth, resource constraints, employment opportunities, and infrastructure development.

**Economic pressures** include government policies to bring more land under cultivation, to grant more logging concessions and fishing agreements, and to promote industrial development, thereby encouraging economic growth and earnings of foreign exchange. These practices are driving environmental change because they encourage unsustainable rates of resource use or extraction. For example, Africa's forests are being felled and timber exported at a rate that exceeds the forest's natural rate of regeneration. Forest areas are declining rapidly as a result. Similarly, fishing rights have been granted to foreign fishing companies that are harvesting resources faster than the natural population-replacement rate and fish stocks are declining as a result. These activities need to be managed in a more sustainable manner so that benefits can continue to accrue to African countries in the long term. To achieve this, the economic base needs to be broadened to lessen the pressure on natural resources.

**Food production systems** are driving environmental change as an indirect result of population and economic pressures. Because there are more people to feed, and because there are pressures for economic growth through export of agricultural produce, commercial food production systems are being transformed to low input, monospecific cultivation with one or two harvests per year. This rapidly exhausts the

soil of nutrients and lowers productivity in the long term. At the subsistence level, farmers are forced to cultivate or graze more and more marginal land as there is greater competition for land from different users. This causes yields to decline and makes resources more vulnerable to the impacts of climate variability and change, environmental degradation, and desertification. The development of population policies, broadening of the economic base, and promotion of soil and vegetation conservation measures would alleviate the pressure from food production systems on the environment and increase food security.

**The energy and transport sectors** in Africa are also significant drivers of environmental change in a number of areas. For example, the transport sector is a major contributor of emissions that are harmful to human health as well as to the atmosphere and to terrestrial ecosystems. Centralized power generation using fossil fuels is a problem in South Africa and Northern African countries, contributing to atmospheric pollution and climate change. In Eastern and Western Africa, hydropower is one of the main sources of electricity. This has a different set of environmental problems associated with it, including inundation of land and displacement of people, disruption of ecosystems, and exacerbation of flooding. A much more widespread problem associated with energy sources in Africa is the use of wood, charcoal and other traditional fuels at the household level. This not only results in high rates of deforestation but also raises the risk of acute respiratory diseases from inhalation of sulphur oxides, nitrogen oxides, carbon monoxide and soot particles. Alternative energy sources need to be developed in the near future to reduce dependence on traditional fuels and keep emissions and other environmental impacts to a minimum.

**Loss of indigenous knowledge and practices** is causing environmental change because it results in changes in patterns of land and resource use, obscuring of conservation measures, and foreclosing of opportunities for commercial development of resources. For example, knowledge of the medicinal properties of Africa's plant species could be used in commercial pharmaceutical production, but lack of recognition or documentation of this knowledge is impeding this. Likewise, indigenous plant species that are drought tolerant could be bred and used in commercial agriculture

and traditional practices of agro-forestry and intercropping could be adopted to promote soil conservation. Further resources need to be channeled into research and documentation of indigenous knowledge in order to realize its potential in Africa's development.

### WHAT ARE THE CONSEQUENCES OF ENVIRONMENTAL CHANGE IN AFRICA?

An issue that emerges from this analysis of the environment in Africa over the past 30 years is that of human vulnerability. The pressures described above contribute to climate change, declining yields, the spread of diseases and pests and reduced economic potential, among other impacts. These in turn threaten food production and security, human health, economic growth, lives, livelihoods, and infrastructure. Human vulnerability is a highly complex issue involving many and varied social and economic factors, and further research is required to fully understand the links between it and environmental change. These are explored further in chapter 3 of this report, but the following conditions and trends are apparent from the foregoing analysis:

- Africa is highly dependent on rain-fed agriculture (both crop production and livestock rearing) for national economic growth, and for subsistence of large sectors of the population. Many countries, especially those in the Horn of Africa and the Sahel, are likely to experience increasing variability in rainfall and increasing frequency and intensity of drought over the next few decades. Food production systems in these areas are already under stress from degradation of soil and vegetation and spreading desert margins and countries are already experiencing difficulties in accumulating food reserves. There is therefore a danger that millions of people's livelihoods may be affected and national economic growth will stagnate as a result of repeated crop and livestock losses. Early warning and response systems need to be strengthened urgently, together with long-term means of alleviating economic dependence on cultivation and livestock rearing. The subject of early warning and response is discussed in full in the 'Atmosphere' and 'Land' sections of this chapter.
- Environmental change can be conducive to outbreaks of pests and disease that impact on

human health and economic development. For example, monospecific crop cultivation is more vulnerable to destruction by pests such as locusts; rising average temperatures may encourage the spread of malarial mosquitoes to previously unaffected areas; and reduced freshwater availability and quality increase the risk of infection by gastro-intestinal parasites and bacteria and of skin and eye infections. Issues of human health require a two-pronged approach involving both preventive and curative measures. Preventive measures include maintaining a healthy environment and applying public hygiene standards. Curative measures include investment in health care services. (See 'Atmosphere', 'Freshwater' and 'Urban Areas' sections for fuller discussion).

- Public and private infrastructure is threatened by sea level rise and increasing frequency of floods and cyclones. These will affect communications and transport networks, administrative and commercial activities, and families and communities. Although loss of infrastructure will result in enormous economic losses for all concerned, it is the poorer communities and the poorer nations that will suffer the most, as they do not have the financial reserves to relocate and rebuild. The sooner action is taken to mitigate these impacts—through construction of physical defences, relocation of populations, and innovative design and construction measures—the more effective such actions will be. (See 'Atmosphere' and 'Coastal Areas' sections for full discussion).
- The rising costs of water treatment, food imports, medical treatment and soil conservation measures are not only increasing the vulnerability of food and health, they are also draining African countries of their economic resources in the long term and reducing the effective growth of GNP. Preventive measures need to be implemented fully and immediately in order to reverse this trend and improve security in the long term.
- Loss of biological resources translates into loss of economic potential and options for commercial development in the future. For example, deforestation and biodiversity loss, together with inadequate protection of intellectual property rights, are contributing to the loss of resources as

well as to a loss of understanding of their applications and hence of commercial potential, thus diverting possibilities for economic growth away from African nations. Loss of these resources is also compromising the health of African populations and rural livelihoods. Conservation practices need to be strengthened and strategies for sustainable use of resources need to be developed urgently to preserve and capitalize on this potential. (See 'Forest' and 'Biodiversity' sections for fuller discussion).

### **RESPONSES TO ENVIRONMENTAL CHANGE IN AFRICA**

African countries have responded to the challenges of environmental change by ratifying international agreements, participating in regional and sub-regional initiatives and programmes, and by developing National Environmental Action Plans (NEAPs), Integrated Resource Management Plans (IRMP), Environmental Impact Assessment (EIA) regulations, and other relevant legislation. Such responses are important as they set the framework at the highest level for integration of environmental issues into national governance and establish the boundaries of and administrative capacity for action at national and sub-national levels. African countries have some of the most advanced and coherent policies for environmental management in the world and some exemplary models of public participation in policy formation and decision making. However, Africa's nations must not be allowed to rest on their laurels. They should be encouraged by the international community to put such policies and models into practice, to monitor their effectiveness, and to enforce their objectives. This will require the allocation of financial resources, equipment, trained personnel, monitoring systems, administrative frameworks and institutions, and the enforcement of regulations through economic incentives and disincentives.

Regional responses include development and signature of the Lagos Plan of Action, the Lusaka Agreement, the Abidjan and Nairobi Conventions, and the Accra Declaration. Although some of these have experienced initial difficulties in implementation, they nonetheless testify to the political recognition of the need to improve environmental conditions, and to commitment to such improvement. Initiatives aimed at

sustainable development of shared resources—such as the Nile Basin Initiative, the Lake Chad Basin Commission and the Lake Victoria Environmental Management Plan—are evidence of the foresight of governments and of their commitment to equitable access and use of resources and to sound environmental management. Furthermore, these actions set precedents for additional cooperative arrangements in the areas of research, management, and mitigation of adverse impacts.

In addition, environmental education and awareness-raising campaigns have been successfully implemented in many African countries, as evidenced by the growing prominence given to environmental issues in decision making at national and community level. These are positive steps, in that greater awareness in all sectors of the population facilitates mainstreaming of environmental issues into all activities and decisions. Creation of incentives, such as markets for recycled materials and subsidizing of unleaded fuel, are urgently required to sustain this momentum and turn awareness into action.

### **PRIORITIES FOR FUTURE ACTION**

Priorities for action include strengthening of existing mechanisms by investment in equipment and personnel, as well as enhancement of coordination between government departments and other related organizations, so that environmental and development issues are integrated into all decision making at the national and sub-regional level. Chapter 5 offers a more comprehensive and integrated analysis of policy options and makes specific recommendations. However, some broad outlines for progress can be extracted from the analysis presented in this chapter, these include:

- Using climate change fora to exert pressure on the international community to implement the proposed mechanisms for emissions trading, reforestation schemes, and cleaner development, measures from which everyone stands to gain economically and environmentally.
- Implementation of national and sub-regional action plans developed under the United Nations Convention to Combat Desertification in those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa (UNCCD).
- Strengthening of hazard monitoring programmes and early warning and response systems to

- effectively mitigate and cope with the impacts of extreme events, increase food security, and maintain healthy ecosystems.
- Diversification of economies to alleviate dependence on agricultural production, forestry, fisheries, and other natural resources. In particular, new economic activities should focus on value-addition to the natural resources that are exported, to ensure that maximum benefit accrues to Africa (in terms of employment, skills development, income, and foreign exchange).
  - Advancing trade negotiations to create a more equitable and operational international market for African products.
  - Radical reforms to the energy and transport sectors, including: development and adoption of appropriate clean technologies (to alleviate dependence on wood and fossil fuels without increasing emissions of GHGs, removal of subsidies, promotion of unleaded fuels and conversion to cleaner fuels, and upgrading of public transport systems).
  - Integration of natural resources management programmes, such as ICZM and IWRM programmes. In particular, development of administrative frameworks is required to improve coordination between departments responsible for coastal planning, development, and use of resources. Measures to manage demand also need to be established and implemented so that rates of consumption of resources are brought down to sustainable levels. This can be done through financial incentives such as true-cost pricing. In addition, an effective system for enforcing regulations is required.
  - EIAs should be conducted as part of proactive and holistic development planning. These should be integrated into an overall development plan for a region or area, so that cumulative impacts of all developments are considered and habitat loss and fragmentation are minimized. Highest priority should be given to improved urban planning, provision and maintenance of basic infrastructure and services, and to innovations in design to meet the demand for housing sustainably.
  - Valuation of biodiversity and ecosystem services, particularly in forests and woodlands, and economic reforms to the forestry sector, so that the true value of forests and woodlands is reflected in the prices, and so that harvesting rates are adjusted accordingly.
  - Sustained participation by all stakeholders in management of natural resources, through open and transparent governance systems, involvement in community-level projects, and representation in regional resource management programmes such as river basin management or management of protected areas.
  - Strengthening of national efforts to meet the objectives of the United Nations Convention on Biological Diversity, including establishment of strategies for sustainable resource use, from within and outside of protected areas. In addition, indigenous knowledge and intellectual property rights need to be protected so that the development potential of African resources can be realized with benefits accruing to African countries and communities. Tighter trade restrictions need to be enforced to sustain the progress made in reducing poaching and illegal trade.
  - Reform of tenure and access policies is a priority for nearly all African countries. Improving security of tenure encourages sound environmental management practices and sustainable production levels. Tenure reform will also raise the status of women and other disadvantaged groups, giving them equal opportunities and raising social development standards.
  - Above all, these activities must be integrated into development and poverty-alleviation strategies, so that economic, social and environmental development priorities do not compete with one another, but are rather considered simultaneously and are addressed through mutually beneficial means.

