CHAPTER 3

HUMAN VULNERABILITY TO ENVIRONMENTAL CHANGE

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INTRODUCTION

Three decades ago, in 1972, the international community adopted the Stockholm Declaration, following the Stockholm Conference on the Human Environment. Principle 1 of the Declaration highlighted a healthy environment as a fundamental human right, explicitly stating: 'Man [sic] has the fundamental right to freedom, equality and adequate conditions of life in an environment of a quality that permits a life of dignity and well-being, and he bears a solemn responsibility to protect and improve the environment for present and future generations…' Since then, the Organization of African Unity (OAU) African Charter on Human and People's Rights, and dozens of relatively new African national constitutions, have enshrined a healthy environment as a fundamental human right.

Of particular interest to Africa in the Stockholm Declaration was the condemnation in Principle 1 of apartheid, racial segregation, discrimination, colonial and other forms of oppression, and foreign domination. While these socio-political issues have virtually been eliminated in the region, the environmental objectives have been compromised in many ways.

Over the past 30 years, the environment in Africa has continued to deteriorate, resulting in environmental change which is making more and more people in the region vulnerable due to increased risk and inadequate coping capability. Such deterioration has been acknowledged at various fora, and the World Commission on Environment and Development (WCED) reported in 1987: 'Today, many regions face risks of irreversible damage to the human environment that threaten the basis for human progress' (WCED 1987). The undervaluing of the environment is a major factor in terms of overexploitation of the environment (see Box 3.1).

Human vulnerability to environmental change is complex; it may, in fact, be as complex as ecological processes, where some cause and effect linkages are still not fully understood despite centuries of scientific research. Human vulnerability to environmental change has global, local, social and economic dimensions. It is not synonymous with disasters, even though such and media interest (see Box 3.2).

Box 3.1 Environmental concerns a priority

The advocates of sustainable development have not yet succeeded in raising environmental concerns to a high priority in all countries. The perception remains in some quarters that environmental protection is something that can and should be addressed only when a country is rich enough to do so, and that it is a 'low rate of return' activity. Yet the evidence is mounting that local environmental destruction can accelerate the poverty spiral not only for future generations, but even for today's population. It is obvious that countries which recklessly deplete their natural resources are destroying the basis of prosperity for future generations, but few policy makers have been able to persuade their constituents that, as forests disappear and water is exhausted or polluted, it is the poor of today, especially children and women, who suffer most.

Source: CSD 1997

Box 3.2 Woman gives birth during flood disaster

Sofia Pedro made world headlines in March 2000 when she gave birth to a daughter in a tree as the furious and raging waters of the flooded Limpopo River gushed below, laying to waste surrounding areas and devastating the lives of hundreds of thousands of her Mozambican compatriots. The Mozambican floods killed 700 people and left millions more homeless.

Perhaps the birth of Sofia Pedro's daughter—Rosita Pedro—brought to reality the juxtaposition of the birth of a new human life and the death of others, and the struggle humanity faces today in dealing with the challenges of a merciless, changed environment whose devastation grows in intensity and impact. Often, the impact of episodes such as the Mozambican floods in early 2000 is hidden behind a string of statistics: the number of confirmed deaths, the numbers injured, the livelihoods lost, the infrastructure destroyed, the habitats lost and the damage caused. As the news headlines bombard people with such figures, the human face is lost, reducing people to a footnote of another disaster event.

However, Sofia Pedro refused to be a footnote of that devastating episode of nature in Mozambique, but a living symbol of the human spirit and resilience in the storm of an increasingly unforgiving hostile environment, which has changed dramatically over the past three decades. In those swift-flowing muddy waters below her were many people who were not so lucky. There were also deadly snakes, wild animals, livestock, and tonnes of soil on which millions of people in the Limpopo River basin depended for agriculture and food security. A way of life was swept away to the Indian Ocean to be drowned under masses of water. Left behind was human misery and people whose resilience had been compromised.

Sofia Pedro's story not only exemplifies just how people have become more vulnerable to environmental change, but also that ultimately disasters have the greatest impact on the personal level. Her story has been played out countless times since time immemorial in different regions, countries, communities and homes. Many Sofia Pedros have been rescued in floods, droughts, earthquakes, landslides and avalanches—but even more have perished and continue to do so. The threats to human life today lurk in sudden and intense events such as earthquakes and landslides, and also in more insidious and slow-setting events such as droughts, ozone layer depletion and global warming.

Long after the devastation of the Mozambican floods, Sofia Pedro's story lingers in the mind—a constant reference point not only of the fury of a river in flood, but also of the increased frequency and intensity with which the environment can unleash such terror.

UNDERSTANDING HUMAN VULNERABILITY

The environment is always in a state of flux and has, therefore, always impacted on people and the way they live. The history of humankind abounds with examples of environmental change which have affected civilizations, or which have provided lasting lessons as to how people have been impacted by such change.

In an early example, the pioneering organized food-producing systems in the Nile Valley, under the civilization which ruled ancient Egypt for two and a half millennia from about 5 000 years ago, collapsed after its population peaked. A decline in food production was experienced due to environmental change as a result of massive flooding of the River Nile, which was catastrophic downstream. The river was also transformed over 500 years as heavy rains in the upper catchment area produced more vegetation, reducing erosion and sediment carried downstream. This led to the reduction of the floodplain, and quantities of plant foods declined. 'The levels to which the human population had soared could not be sustained, and the pressure on resources mounted inexorably. Competition for food intensified, doubtless provoking conflict of which the massacre at Jebel Sahaba is probably an extreme example' (Reader 1997, 1998).

A more recent example involves climate variability, an issue highlighted by the WCED, which reported that: 'human overuse of land and prolonged drought threaten to turn the grasslands of Africa's Sahel region into desert. No other region more tragically suffers the vicious cycle of poverty leading to environmental degradation, which leads in turn to even greater poverty' (WCED 1987).

Millions of people in most parts of Africa are directly dependent on natural resources of the physical environment. They are, therefore, more vulnerable to environmental change than people in other regions of the world. It is important to note that people in all regions in the world are vulnerable in one way or another to environmental change, but that their coping capacity is different.

Africa's biophysical and socio-economic characteristics, and the complexity of its cultural diversity, are some of the factors or driving forces which contribute to environmental change which, in turn, impacts on human vulnerability and security. The Africa region is characterized by diverse patterns of elevation, geology, climatic variability and vegetation types. Millions of people in most parts of Africa are directly dependent on natural resources of the physical environment. They are, therefore, more vulnerable to environmental change than people in other regions of the world. It is important to note that people in all regions in the world are vulnerable in one way or another to environmental change, but that their coping capacity is different. For example, in 1999, between two and three times as many disaster events were reported in the United States than in India or Bangladesh. However, there were 14 times more deaths in India and 34 times more deaths in Bangladesh than in the United States in that year. Equally surprising is the fact that lightning causes more deaths in an average year in the United States than do floods, forest fires or tornadoes.

Environmentally unsustainable and inappropriate practices, such as unsuitable agricultural methods, deforestation and water pollution, are the major human-induced causes of vulnerability to environmental change. These are exacerbated by the impacts of climatic variations and interacting with the unique biophysical dynamics, thereby reducing coping capacities for most of the people who are already living in environmentally fragile areas.

For the purpose of this chapter, human vulnerability/security (see Box 3.3) is considered as a continuous variable, whereby vulnerability is the negative part of the continuum and security is the positive part. The two major constituent themes of human vulnerability are exposure to environmental hazards (or contingencies, shocks and stresses) and the coping capability of people which assures them of security.

People who have more capability to cope with extreme events or stresses are at lesser risk and are, therefore, more secure. The stresses to which an individual or household, or a broader social or geographic sub-region or region, are subjected are reflected in the state of helplessness or the lack of means to cope with risks, shocks, stresses or demands (Edralin undated). For example, many African countries in arid and semi-arid areas depend on food aid during some parts of the year. In 2000, for example, 8 million people in Ethiopia faced severe food shortages and had to depend on food aid (ELCA 2000). This was mainly due to adverse weather conditions and the impact upon food production.

Human vulnerability/security is a continuum which is characterized by situations which range from the undesirable state of vulnerability and its characteristics to the desirable state of security and its characteristics, as depicted in the Figure 3.1.

The human vulnerability/security continuum shows how vulnerability and security are defined in terms of coping capacity. Coping capacity increases as you move

Flooded village in the Tana River valley, Kenya, Nairobi

(Glynn Griffiths/Christian Aid/Still Pictures)

Box 3.3 Concept of human security

In 1994, the UN Human Development Report introduced the concept of human security, predicating it on the dual notion of, on the one hand, safety from chronic threats of hunger, disease and repression and, on the other hand, protection from sudden and hurtful disruptions in daily life. Environmental insecurity became shorthand for the dimension of human insecurity induced by the combined effects of natural disasters and mismanaged environmental endowment.

Source: Geisler and de Sousa

from the state of vulnerability towards security and vice versa, along the continuum. People, as individuals or as a community, will be at different stages of the vulnerability/security continuum depending on the socio-economic situation of each individual or group.

Individuals or groups within the vulnerability/security continuum can be classified, in very simple terms, as falling under one of four categories along the gradations of the continuum:

- high risk and low coping capacity;
- high risk and high coping capacity;
- low risk and low coping capacity; or
- low risk and high coping capacity.

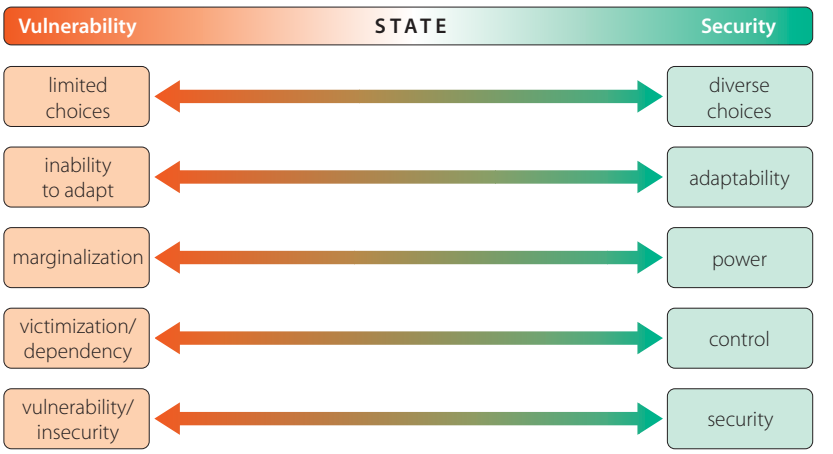
Most African countries fall under the category of high risk and low coping capacity. This is because most countries in Africa over the past 30 years have been at high risk of, for example, floods, earthquakes, lava flows, fires, droughts, civil strife, and armed conflicts and wars, which have increased poverty, exacerbated serious health problems and resulted in hunger. These disasters have displaced populations across national borders and internally, contributing to further environmental degradation, and leading to more vulnerability and insecurity. The impacts have mostly affected the poor, who have low coping capacities.

The high risk and high coping capacity scenario is very rare in Africa. The United States falls under this scenario. Some areas of the United States are at high risk from earthquakes, for example, but impacts, particularly in terms of human casualties, are low. Only pockets of Africa fall under the low risk and low coping capacity. Where natural causes of risks are absent, human-induced changes will be present to make people vulnerable. In any circumstances in Africa for now, the scenario of low coping capacities exists. The low risk and high coping capacity scenario is the ideal.

Vulnerability is also a reflection of human capacity to cope with risks or shocks. Those who are least vulnerable cope the best and enjoy security, while the opposite applies to those households, communities or broader populations who are most vulnerable and who stand to lose the most from the effects of environmental change and other risks, shocks or stresses. Coping strategies have many dimensions, from the traditional to the scientific. Traditional communities in Africa have, for millennia, adapted to environmental change in different ways, including shifts in livelihood activities according to seasons and changes in the environment. They have also managed resources in a sustainable manner, adopting various management regimes to avoid overexploitation and to enhance their own food security (see Box 3.4).

Human vulnerability/security is a complex phenomenon with many interacting dimensions with respect to environmental change, and the resulting human responses and ability to cope with the impacts of such change. For example, desertification and drought are directly linked to poverty, food and water shortages, conflict and mass migration. They increase the risk of fire, decrease the availability of fuel and limit access to

Figure 3.1 Human vulnerability/security continuum



Box 3.4 Cultural value of the environment

The fisherman who throws some of his catch into the sea after a fishing expedition in Ghana is expressing the responsibility which he has, as a member of the community, in ensuring that the fish population in the sea is not depleted. He, therefore, throws some of the live fish back into the sea so that they may continue to breed. And so each time he goes fishing, there will be fish in the sea.

At the same time, the fisherman is expressing gratitude to *Bosompo*, the divinity of the sea, for giving him some of his fish. If the fisherman does not give back some of his catch to *Bosompo*, he will feel that he has been negligent of an important cultural value—gratitude. The fisherman's action is based on the proverb: '*Bosompo ankame wo nam a, wo nso wonkame no abia*'—'If the divinity of the sea does not begrudge you of his fish, you do not begrudge him of your catch.'

And so, while the fisherman is expressing gratitude in conformity with a cultural value dating from antiquity, he is also expressing a concern for the environment by ensuring that there continue to be fish in the ocean and by acknowledging that human beings are responsible for their environment.

Source Opoku 1999

Interventions addressing human vulnerability to environmental change must be translated into integrated responses which reflect the inter-sectoral nature and processes of the causes and states of vulnerability.

health care. Health effects can include malnutrition, the failure of babies to develop properly, iron and Vitamin A deficiency, infections, blindness and anaemia (Diallo 2000). Women and children are particularly vulnerable. In Africa, 49 per cent of the deaths among children under 5 years of age are associated with malnutrition. A WHO estimate put the number of such deaths in Africa at 3.8 million in 1999 (WHO 2000a). As water sources dry up, people are forced to use heavily polluted water, leading to severe epidemics. In particular, desertification and droughts can increase water-related diseases such as cholera, typhoid, hepatitis A and diarrhoeal diseases (Menne 2000).

The dimensions of human vulnerability analysed in this chapter also include social and economic aspects, that is, poverty, food security, health, civil strife/conflicts, economic dimensions and governance. These complex, interacting dimensions of vulnerability to environmental change can act either as the constituent elements of vulnerability or, depending on the coping capacities (see Box 3.5) and resilience of an affected population, can result from, or be exacerbated by, environmental change. Interventions addressing human vulnerability to environmental change must be translated into integrated responses which reflect the inter-sectoral nature and processes of the causes and states of vulnerability. Because human security depends on the effectiveness of sustainable environmental management and the reduction of human vulnerability to environmental change and threats, responses aimed to address disasters should be quick, adequate and coordinated (UNDP 1994).

The poor are especially vulnerable to degradation of natural systems. Both the global and the local consequences of environmental damage directly affect poor people. Global concerns, such as changes in the Earth's atmosphere, are critical to the livelihoods of poor people, and their consequences last longer than first assumed. For example, a rate of climate change is likely to cause widespread economic, social and environmental degradation over the next century. Therefore, the poorest people in Africa and other developing regions are certain to suffer the most due to failing harvests, growing water shortages and rising sea levels.

Box 3.5 Coping capacities and sustainability

Coping capacities are critical within the concept of sustainability, which is defined as encompassing:

- the ability to cope with and recover from shocks and stresses;
- economic effectiveness, or the use of minimal inputs to generate a given amount of outputs;
- ecological integrity, ensuring that livelihood activities do not irreversibly degrade natural resources within a given ecosystem; and
- social equity, which suggests that promotion of livelihood opportunities for one group should not foreclose opportunities of other groups, either now or in the future.

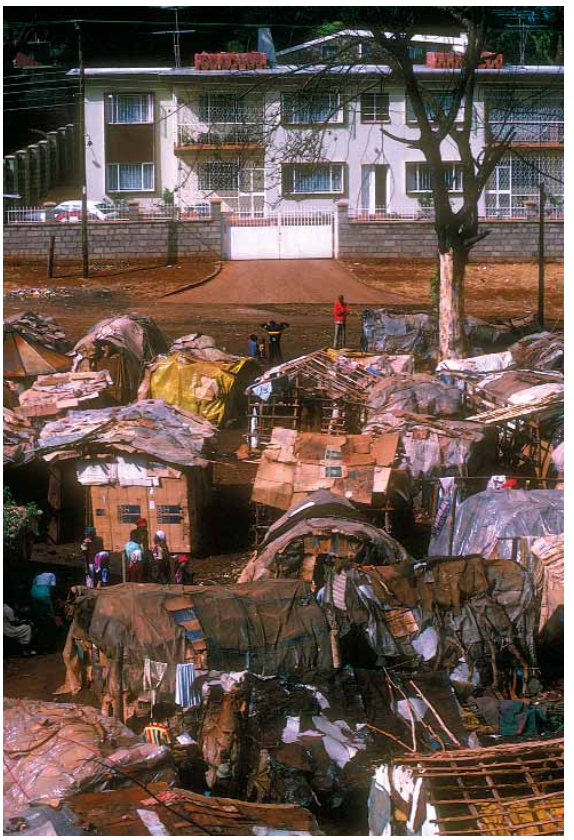
Source: UNDP 1999b

ENVIRONMENTAL CHANGE: IMPACTS ON PEOPLE

The environment is life, supporting people and other living things. Environment is widely recognized as a 'pillar' of sustainable development. It provides essential goods and services which contribute to meeting basic human needs, and is essential to human development and quality of life. It provides services to ecosystems, including water catchments which protect freshwater resources, wetlands, riverbank environments, biodiversity habitats and ecologically functioning landscapes. The environment is also a sink of the wastes generated from different human activities.

In Africa, there is a high dependency on agro-sylvo-ecological systems, which are very sensitive to the impacts of the state of the environment and environmental change. The root causes of environmental change have both natural and human-made factors, and include interactions between them.

The environmental changes which have occurred in Africa since 1972 have been highlighted in Chapter 2, which provides a comprehensive overview of the key issues facing the region today. The changes highlighted in Chapter 2 do not only have regional dimensions, but also have sub-regional and national implications. Global processes also influence environmental change in Africa, for example, greenhouse gas emissions and their impact on climate change. The vulnerability of people in the region to environmental change, therefore,



Refugees from a degraded agricultural land living in a slum in Nairobi, Kenya

Mark Edwards/Still Pictures

manifests itself—to a lesser or greater extent—at these different levels, and is a major factor in terms of sustainable development in Africa.

One of the impacts of human vulnerability to environmental change is the forced movement of people, creating what has come to be known as environmental refugees. The notion of environmental refugees describes a new insight on an old phenomenon—large numbers of the world's least secure people seeking refuge from insecure biophysical environments (Geisler and de Sousa 2000). Although the phrase 'environmental refugee' is controversial among advocates of the classical definition of refugees (political and social), it has gained in popular usage. It has been estimated that, globally, there were 25 million environmental refugees in 1994, more than half of whom were in Africa (Myers 1994).

Impacts of the state of the environment

In sub-Saharan Africa, 61 per cent of the population lives in ecologically vulnerable areas characterized by a high degree of sensitivity and low degree of resilience (IDS 1991). This is not necessarily by choice, but by force of circumstance, because other options are either unavailable or have been exhausted.

Perhaps one of the major threats of the state of the environment is malaria—a major killer in the region. Between 300 million and 500 million cases of malaria—which involve mostly the poor—are recorded in Africa annually. They cause between 1.5 to 2.7 million deaths, of which more than 90 per cent are children under 5 years of age (World Bank 2000, Nchinda 1998). Malaria slows economic growth in Africa by up to 1.3 per cent each year and, according to statistical estimates, the gross domestic product (GDP) of sub-Saharan Africa would be up to 32 per cent greater if malaria had been eliminated 35 years ago (WHO 2000b).

It is estimated that, by 1999, malaria had cost Africa about US$100 000 million in lost economic opportunities—or nearly five times more than all development aid provided to the region in 1999 (IRIN 2001). According to a report by the World Health Organization (WHO), Harvard University, and the London School of Hygiene and Tropical Medicine, malaria slows economic growth in Africa by up to 1.3 per cent each year. This slowdown in economic growth due to malaria is over and above the more readily observed short-term costs of the disease. With a GDP of about US$300 000 million, the short-term benefits of malaria control in sub-Saharan Africa are estimated at between US$3 000 million and US$12 000 million per year (WHO 2000b). According to UNICEF, the average cost for each nation in Africa to implement malaria control programmes is estimated to be at least US$300 000 a year. This amounts to about six US cents (US$0.06) per person for a country of 5 million people.

Some of the causes of malaria are summarized in Box 3.6, which also indicates the areas on which health programmes could focus in order to fight the disease.

The health crisis situation in Africa has been summarized in Table 3.1, which indicates the high percentage of the population of the region who are undernourished, and who have HIV/AIDS, malaria and tuberculosis. During 1992, cholera affected almost every

Box 3.6 Malaria: factors related to human vulnerability

A number of factors, many of them relating to various dimensions of human vulnerability, appear to be contributing to the resurgence of malaria:

- the rapid spread of resistance of malaria parasites to chloroquine and other quinolines;
- frequent armed conflicts and civil unrest in many countries, forcing large populations to settle under difficult conditions, sometimes in areas of high malaria transmission;
- migration of non-immune populations—for reasons of agriculture, commerce and trade—to areas where malaria transmission is high;
- changing climatic conditions, especially rising temperatures and rainfall patterns;
- water development projects, such as dams and irrigation schemes, which create new mosquito breeding sites;
- adverse socio-economic conditions, leading to a much-reduced health budget and gross inadequacy of funds for drugs;
- high birth rates, leading to a rapid increase in the susceptible population of those younger than 5 years of age; and
- changes in the behaviour of the vectors, particularly in biting habits, from indoor to outdoor biters.

(Nchinda 1998)

country in the region of the South African Development Community (SADC), claiming hundreds of lives.

Climate change, and human activities which transform habitats and create conditions suitable for parasites and disease organisms to breed, have a significant impact on the distribution and prevalence of vector-borne diseases (VBDs) in Africa. Climate change affects vector survival primarily through minimum temperatures, impacting the latitude and elevation of distribution, as well as the length of season permissive to transmission of VBDs (IPCC 1998). Meteorological variables, subject to climate variability and global atmospheric change, can therefore create conditions conducive to the spread of disease or, in the case of flooding or drought, clusters of outbreaks.

Impacts of environmental change

Human-induced environmental change, brought about by rapid population growth and overexploitation of natural resources, is considered to be the overriding cause of natural resource degradation, deepening poverty and increasing food insecurity in sub-Saharan Africa (FAO 1998). Such situations have forced farmers and others dependent on natural resources and agro-ecological systems to move into low-potential ecosystems, where the resulting damage can worsen and become irreversible. The degradation of natural resources which are essential for future production extends across the agro-ecological system, from the depletion of soil nutrients to overgrazing, overfishing and deforestation (FAO 1998).

Environmentally unsustainable and inappropriate practices are the major human-induced causes of vulnerability. These are exacerbated by the impacts of climatic variations and by interacting with the unique biophysical dynamics, resulting in reduced coping capacities for most of the people already living in environmentally fragile areas.

Table 3.1 Health crisis and challenges in Africa

Sub-region (countries)	Undernourished people (% of total population) 1996–98	People living with HIV/AIDS *Adult (age 15–49) 1999*	*Women (age 15–49) 1999*	*Children (age 0–14) 1999*	Malaria cases (per 100 000 people) 1997	Tuberculosis cases (per 100 000 people) 1998
Northern Africa (6)	6.8*	0.24*	–	–	1 321*	51.5
Western Africa	22.9	3.5	176 600	15 303	9 275.7	69.4
Central Africa	34.8	5.8	160 937	13 254	3 240	98
Eastern Africa	48	7.59	534 978	48 439	6 759	167
Southern Africa	35.7	19	525 818	34 409.1	16 838	301
IOC	23	0.12	5800 *(Madagascar)*	450 *(Madagascar)*		

Source: IES-Preparation WSSD 2001

*Note: More than 50 per cent of undernourished and more than 95 per cent of all HIV/AIDS and malaria cases for North Africa are from the Sudan.

Some environmental policies also contribute to human vulnerability, for example, the creation of national parks and protected areas without the necessary Environmental Impact Assessment (EIA), which takes into account social, ecological and economic aspects. Such policies, which also include the construction of reservoirs, have been described as 'ecological expropriation'. The growth of protected areas in Africa has been used as an indicator in the generation of 'other environmental refugees'. This category of environmental refugees is different from those impacted by, for example, storms, floods, droughts, fire and El Niño effects. The number of protected areas in Africa grew from 443 (88 662 000 hectares (ha), or 3 per cent of the land area) in 1985 to 746 (154 043 000 ha, or 5.2 per cent) 12 years later. Long-lasting conservation has been devastating for hundreds of thousands of Africans (Geisler and de Sousa 2000). This is mainly as a result of displacement and exclusion. However, there have been positive biodiversity conservation results.

Impacts of land degradation

The conversion of natural habitats, such as forests or wetlands, for agriculture and cultivation of marginal areas has not only contributed to land degradation, but has also impacted on people's livelihood options. Desertification processes reportedly affect 46 per cent of Africa and, of that, 55 per cent is under high or very high risk. A total of about 485 million people are impacted (Reich and others, 2001). The projected effects of climate change in Africa include expanding arid areas and increasing variability in rainfall. This threatens to add to the current rate of desertification, a crop yield decline of 10–20 per cent in parts of the region, and food insecurity.

With wind and water erosion extensive in many parts of Africa (25 per cent of the land is prone to water erosion and about 22 per cent to wind erosion (Reich and others, 2001)), millions of peasant farmers are constantly at risk of food insecurity. Soil erosion not only reduces productivity of the land, but also requires farmers to utilize more and more fertilizers and other chemicals. While comprehensive data for soil loss rates in Africa are unavailable, estimates from the past three decades range between 900 and 57 000 tonnes/km^2/annum (t/km^2/a) (Rattan 1988). For example, more than 800 million ha of soil—representing 60 per cent of the total land areas of the semi-arid Sahel region—are affected or threatened by human-induced degradation. Some 224 million ha in the Sahel, in which the Lake Chad basin is located, are already severely degraded. Major causes of soil degradation include cropping activities such as reduced fallow periods, inadequate replenishment of soil nutrients, poorly managed irrigation and overgrazing. During the 1980s, Ethiopia's highlands were reported to have lost 3 million tonnes of topsoil annually (MacKenzie 1987). The cost of erosion in Zimbabwe was estimated to be US$20–50/ha/a on arable land and US$10–80/ha/a on grazing lands. In South Africa, estimates in 1992–93 reached US$237 million, some 15 per cent of gross national agricultural product (Mackenzie 1994).

The dependence on rain-fed agriculture increases the risk of food and economic insecurity, especially in areas of high climate variability. Restricted access to foreign markets, heavy agricultural subsidies in OECD countries and limited processing before export add to Africa's vulnerability to international price fluctuations and, therefore, to its failure to realize the full potential of its land resources. OECD countries spend more than US$300 000 million annually—roughly equivalent to the entire GDP of sub-Saharan Africa—on agricultural subsidies (Wolfensohn 2001).

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Wind and water erosion is extensive in many parts of Africa, placing millions of peasant farmers at risk of food insecurity.

UNEP

Conflicts over land in Africa have occurred for centuries, but have become more frequent in recent years, most notably since independence from European colonialism. These are complex issues, with conflicts over land resources between races, the state and other stakeholders, and conflicts within and between families and communities. Colonial rule imposed artificial boundaries on African populations, with little or no regard to the community fabric or wildlife habitats, and with damaging effects upon issues such as migration routes of animals. The designation of conservation areas also forced communities off their ancestral land, without compensation. During the past decade, there have been a number of land grabs and retrospective claims against governments, largely due to landlessness and displacement.

Droughts are probably the most serious factor in terms of human vulnerability to environmental change.

UNEP

Impacts of freshwater mismanagement and pollution

In terms of freshwater, at least 13 countries suffered water stress or scarcity (less than 1 700 m^3/capita/a and less than 1 000 m^3/capita/a respectively) in 1990. The number is projected to double by 2025 (PAI 1995). While 62 per cent of people in the region had access to an improved water supply in 2000, rural Africans spend much time searching for water as water sources become more distant and harder to locate. A total of 28 per cent of the global population without access to improved water supplies live in Africa (WHO and UNICEF 2000).

Freshwater and groundwater pollution is a growing concern in many areas, further limiting access to safe water. Poor water quality leads not only to water-related diseases, but also reduces agricultural production, meaning that more foodstuffs and agricultural products must be imported. Poor water quality also limits economic development options, such as water-intensive industries and tourism, a situation that is potentially disastrous to developing countries in Africa.

Droughts are probably the most serious factor in terms of human vulnerability to environmental change. Eastern Africa, for example, has suffered at least one drought per decade for the past 30 years (CRED-OFDA 2000). In the 1970s in Ethiopia, drought killed 400 000 people, and about 1.2 million others were displaced. About a decade later, in 1984–85, a total of 7.8 million Ethiopians were affected, causing 1 million deaths. For a region which is dependent on rain-fed agriculture, drought is an ill omen. In times of drought, for example, a drop in water levels in dams and rivers may affect the concentration of sewage and other effluent in rivers, resulting in outbreaks of diseases such as diarrhoea, dysentry and cholera. Reduced water flows during droughts also decrease the capacity of rivers, streams and swamps to dilute agro-chemicals and fertilizers in fields, adversely affecting soil ecosystems and potential agricultural production. These drought-related problems are likely to increase under projected climate change, although vulnerabilities and control measures will affect the impact (IPCC 1998).

The poor are usually the most affected by flood or drought-induced crop failure. Malnutrition and famine have resulted from both droughts and floods, and food imports and dependency on food aid associated with this have contributed to limiting the economic growth of affected countries. For example, in the Horn of Africa, where 76 per cent of the population is classed as agricultural, there is an important connection between food security and poverty (FAO 2001) because, for the majority of the poor, agriculture is the main source of livelihood. Several processes of environmental vulnerability are at play in the Horn of Africa: drought, which causes widespread periodic famine in the region; localized floods; and the threat of locust swarms (FAO

2001). Power generation, which drives economic activity, is also affected by episodes of drought, leading to load shedding or power outages.

Floods also contribute to the vulnerability of people in Africa. In Southern Africa, for example, the devastating floods of 1999–2000 affected more than 150 000 families (Mpofu 2000). Mozambique alone lost US$273 million in physical damage, US$247 million in lost production, US$48 million in lost exports and US$31 million in increased imports as a result of the flooding (Mozambique National News Agency 2000). Degradation of wetlands, such as the Kafue wetlands in Zambia, damming of rivers, deforestation and overgrazing lowered the environment's ability to absorb excess water, and magnified the impact of the floods (Chenje 2000, UNDHA 1994). Poor water supply and sanitation led to high rates of water-related diseases such as ascaris, cholera, diarrhoea, dracunculosis, dysentery, eye infections, hookworm, scabies, schistosomiasis and trachoma. About 3 million people in Africa die annually as a result of water-related diseases (Lake and Souré 1997). In 1998, 72 per cent of all reported cholera cases in the world were in Africa.

Impacts of habitat and biodiversity loss

As has already been highlighted, loss and degradation of habitats have been widespread in Africa. Some 0.78 per cent of forest area was lost in 1990–2000, representing a total loss of some 5.2 million ha. Increasing demand for fuelwood, which accounted for more than 90 per cent of roundwood produced in 1990, has accelerated the destruction of forests, which now cover about one-third of the African region. Every year, an area of about 4 million ha (roughly the size of Switzerland) is deforested. The situation has been particularly alarming in the Lake Chad basin, as a result of the demand for fuelwood. In addition to losing populations of various species, the cost of deforestation to people in Africa may be massive, particularly considering the fact that many populations depend on wildlife for food and other goods. Deforestation is a threat to people's livelihood options, contributing to habitat loss, soil and wind erosion, and general land degradation. For a region which virtually depends on fuelwood for its energy needs, deforestation also has social and economic costs. In many sub-regions, fuelwood makes up 61–86 per cent of primary energy consumption; some 74–97 per cent of this is for household consumption. Charcoal production, which is widespread in the region and which provides many jobs, is a US$1 000 million activity (Amous undated). Unsustainable forest harvests threaten this industry, exacerbating the problem of unemployment.

Habitat and biodiversity loss can also affect tourism in the region, contributing to poor economic performance. This has serious impacts on revenue and jobs, particularly in countries in Eastern and Southern Africa, which are heavily dependent on wildlife tourism.

Wild food plays an important role in food security for rural people and is also, increasingly, a commercial commodity which is traded nationally and regionally. In many urban areas, meat from wild animals commands a significantly higher price than meat from domestic animals. Very large quantities of meat are involved. It has been estimated that, in the moist forests of Central Africa alone, as much as 1 million tonnes of wildlife (primarily forest antelope, wild pigs and primates) may be killed for food each year.

Rural and urban populations across Africa depend largely on medicinal plants, often collected from the wild, for their health needs, due to preference or a lack of affordable alternatives. Some species, such as the montane tree *Prunus africana* and the southern African devil's claw *Harpagophytum* spp., are also exported in significant quantities. Overharvesting, agricultural encroachment and unregulated burning are believed to be contributing to the decline of many species in the wild. Unsustainable activities may foreclose such livelihood options, making more and more people vulnerable.

Every year, an area of about 4 million ha (roughly the size of Switzerland) is deforested.

Disasters

Human mismanagement of environmental resources and processes significantly exacerbates the impacts resulting from disasters, and their effects on natural resources. Box 3.7 highlights some recent environmental disasters in Africa.

East Africa is exposed to seismic hazards due to the presence of the Rift Valley system. Earthquakes have been identified as a major threat in the area, which covers about 5.5 million km^2 and holds more than 120 million people (Midzi and others, 1999). The vulnerability of East African populations to seismic events has been underscored by a recent study which

It has been estimated that, in the moist forests of Central Africa alone, as much as 1 million tonnes of wildlife (primarily forest antelope, wild pigs and primates) may be killed for food each year.

Box 3.7 Vulnerability to natural disasters

Extreme droughts have resulted in exceptional food emergencies in Burkina Faso, Chad, Ethiopia, Kenya, Niger, Rwanda, Somalia, Sudan, Tanzania and Uganda (FAO 2001).

People in Africa are also vulnerable to floods, such as those which submerged more than 79 000 ha of planted land, severely affecting the livelihoods of nearly 120 000 farm families in central Mozambique in February and March 2001 (FAO/TCOR 2001). Farmers lost their crops, livestock, food and seed reserves, and hand tools. Simultaneously, the cyclone Dera hit the provinces of Nampula and Tete in March 2001, devastating about 2 000 families which depend on fisheries. The floods and cyclone also caused severe damage to infrastructure. As a result of the damage and loss of livelihoods due to these extreme events, the Food and Agriculture Organization (FAO) launched an appeal for US$8.71 million in assistance for Mozambique.

In North Africa (Egypt and Algeria), 22 earthquakes killed 14 405 people, and affected another 106 150 people, between 1980 and 1998 (EM-DAT undated). In mid-January 2002, lava flowing from the erupting Mount Nyiragongo destroyed half of the city of Goma in the eastern Democratic Republic of Congo, together with crops and biodiversity. More than 400 000 people fled to take refuge in neighbouring villages and in Rwanda.

advises that the region's capacity in earthquake preparedness and hazard mitigation needs to be improved 'significantly' (Midzi and others 1999).

In Central Africa, Mount Cameroon has erupted twice in the past 40 years, pouring out tonnes of lava and destroying farms and biodiversity. The last eruption was in the year 2000, and earth tremors occur every three to four years on average. Explosive emissions of toxic gases from Lake Nyos and Lake Mounoun, both crater lakes in the mountainous west of Cameroon, killed thousands of people, livestock and wildlife in 1986. Box 3.8 gives examples of disasters which have struck Nigeria in the recent past.

Although natural disasters cannot be prevented, sustainable utilization and management of the environment can increase coping capacities at

Box 3.8 Disasters in Nigeria

Four main categories of disaster have occurred in Nigeria over the past three years, and they have had significant environmental consequences.

Industrial accidents

- On 10 July 2000, a pipeline in Nigeria exploded, killing about 250 villagers. Fires burned out of control about 20 km from the town of Jesse.
- On 27 January 2002, at least 600 people were drowned and thousands were rendered homeless after multiple bomb explosions at a Nigerian military armoury, triggered by an accidental fire. Mass panic ensued.

Civil strife and conflicts (some related to community land resource ownership)

- On 4 June 1999, ethnic clashes flared up in Nigeria's southern oil industry hub of Warri. Dozens of people were reported dead in six days of fighting.
- On 19 July 1999, at least 60 people died in clashes between Hausa and Yoruba tribes near Lagos.
- On 26 July 1999, troops were sent to Kano after at least 60 people were killed in renewed ethnic clashes in northern Nigeria.

Property rights and unequal sharing of benefits from natural resources

- On 1 January 1999, at least 19 people died in clashes in Nigeria's oil region after an ultimatum to oil firms to leave ethnic Ijaw areas.
- On 3 June 1999, local youths set fires at four separate points on the Warri-Kaduna products pipeline near the village of Adeje, after police arrested suspected product thieves. The number of dead was undetermined.

Rural and urban poverty which lead people to take deadly risks to get money

- On 18 October 1998, fire engulfed more than 2 000 villagers who were scrambling for petrol near a ruptured pipeline in Jesse, outside Warri. Nearly 1 000 people were killed.
- 14 March 1999, at least 50 villagers who were scooping up gasoline from a broken products pipeline at Umuichieichi-Umungbede village in Abia state were burned to death after an explosion.

community level. An effective management regime would include: economic policies which encourage smallholder agricultural production; the enforcement of relevant laws and regulations; incentive measures which encourage agricultural and biodiversity conservation at community level; and integrated and coordinated planning. The integration and implementation of sustainability strategies at community and national levels would enhance coping capacities by reducing dependency on aid. Sustainability strategies would develop and support an enabling environment for households and communities, and would improve forecasting abilities which could forestall the potential of environmental events to translate into environmental disasters.

SOCIAL DIMENSIONS TO HUMAN VULNERABILITY

Changes in the structure and distribution of populations can be both a cause and an effect of vulnerability to environmental change. As land degradation spreads and food insecurity grows, as a result of climatic variability and global warming, more and more people are forced to migrate to urban areas, for example, in search of work and other opportunities. People with the most diversified livelihoods, education, power, adaptability and security, among other factors, are most likely to cope with adverse environmental change, because they are more secure. The reverse is true for those lacking such endowments.

Up to 65 per cent of urban dwellers in some African regions live in poverty, with little or no access to social and urban services which constitute decent living conditions.

UNEP

POVERTY

Environmental changes almost always have a greater impact on those who live in poverty. People in Africa, the majority of whom are poor, depend directly on what they can grow, catch or gather. Poverty can be exacerbated by environmental change in complex ways, particularly in natural resource-based African economies. Land degradation, deforestation, lack of access to safe water and loss of biodiversity, compounded by climatic variability, all contribute to a general reduction in environmental quality and to an increase in vulnerability for populations which are dependent on natural resources (World Bank 1997). Degradation of resources reduces the productivity of the poor, who mostly rely on such resources. It makes poor people even more susceptible to extreme events, such as drought or floods, economic fluctuations and civil strife (World Bank 1997). Poverty severely impedes recovery from these events, and weakens social and ecological resistance, especially as the poor are unable or do not have the opportunity to invest in natural resource management.

Table 3.2 averages the poverty (human development) indicators for the various sub-regions of Africa, using three levels of evaluation: high human development; medium human development; and low human development. The table also indicates: the number of countries in each sub-region at each level of evaluation; the number of people, on average, who live on US$1 a day; and the number of people living below the national poverty line.

Macro-economic crises affect the poor in several ways, all of which contribute to their vulnerability to environmental change. The situation is such that: living standards are reduced; the ability of the poor to grow out of poverty is constrained; malnutrition rates among children increase, as do school dropout rates; and household effects are sold at depressed prices (World Bank 2000). The situation only helps to perpetuate chronic poverty and to reduce overall economic growth. In the process of livelihood reduction, people become more vulnerable to environmental change because of diminished coping capacity, and the potential to adopt environmentally hazardous coping

Table 3.2 Poverty indicators for African countries

Sub-regions (number of countries in each)	number of countries in each category	% population below income poverty line: *US$1 a day (1993 PPP USD) 1983–99 ave.*	% population below income poverty line: *National poverty line 1984–99 ave.*
A. HIGH HUMAN DEVELOPMENT: No African country in this category!			
B. MEDIUM HUMAN DEVELOPMENT:			
Northern Africa (7)	5	23	19.8
Western Africa (14)	2	39	31
Central Africa (6)	4	xx	40
Eastern Africa (7)	1	27	42
Southern Africa (11)	6	32.2	28.5
IOC (4*—Reunion excl.)	3	–	10.6
C. LOW HUMAN DEVELOPMENT:			
Northern Africa (7)	2	29	75
Western Africa (14)	12	47.1	49
Central Africa (6)	2	67	64
Eastern Africa (7)	8	29	45.5
Southern Africa (11)	4	51	70
IOC (4*—Reunion excl.)	1	63	70

Source: Summarized from JES-Preparation WSSD 2001

strategies—such as settling in floodplains or on unstable slopes—is enhanced.

Much of the rural poverty problem is characterized by the existence of:

- increasing landlessness;
- a large number of farmers with very small holdings;
- a lack of resources to invest in agricultural improvement;
- the 'urban pull' effect;
- low levels of rural education;
- migration to urban areas of those who do achieve an acceptable level of education;
- overvalued exchange rates, which discourage agricultural exports; and
- poverty amongst women.

The rural poor are particularly vulnerable to stresses, such as extremes of temperature and rainfall (climate variation which results in drought and floods), general financial shortage, and persistent illness and bereavement. They are even more vulnerable to shocks, including famine, floods, epidemics and major changes in markets.

About 40 per cent of the region's poor live in urban areas and, depending on the countries and urban settlements, between 15 and 65 per cent of African urban dwellers live in poverty, with little or absolutely no access to social and urban services which constitute decent living conditions (Soumaré and Gérard 2000). Rapid rates of urbanization in Africa can be attributed to the effects of colonialism, rural-to-urban migration, weak rural economies and a poor industrial base which cannot absorb unskilled labour from rural areas. The result of rapid urbanization is the radical transformation of the structure of cities, accompanied by complex social, economic and environmental changes (Rabinovitch 1997). There is strong evidence to suggest

A child carries water across an open drain in a village in Ghana; water pollution and poor levels of sanitation frequently lead to a predominance of water-borne diseases in the African region.

that urban environmental hazards—such as biological pathogens and various pollutants—are a major cause of or contributor to urban poverty and, for much of the urban poor population, environmental hazards are the main causes of ill-health, injury and premature death (Satterthwaite 1999).

Poor people, especially in urban areas, often settle in fragile zones with high population densities. This increases the overall impact of exposure to risk under conditions of heightened vulnerability, as the case study in the Box 3.9 illustrates.

Health

Environmental damage—whether it is water or air pollution, or waste and sanitation—has serious consequences for human health. Generally, most countries in Africa face high environmental threats to health (WRI and others, 1998), a situation which poses a profound challenge to the region.

Pollution of water and air, and their impact on human health, is of immediate concern. Water pollution and contamination impact on people in the region, resulting in the predominance of water-borne diseases. Air pollution—from industrial and car exhaust emissions, and the burning of traditional fuels in homes—kills a large number of people each year. People die from respiratory damage, heart and lung diseases, and cancer. Urban air pollution causes close to 1 million premature deaths worldwide every year, primarily due to respiratory diseases (World Bank 2000) affecting mostly the poor. About 4 million people die annually due to overcrowding, and from indoor pollution caused by burning biomass fuels for cooking and heating (WRI and others, 1998). As many as 25 million poor agricultural workers in the developing world (11 million in Africa alone) are poisoned by pesticides every year, and hundreds of thousands die.

In Africa, human vulnerability is exacerbated by poor health caused by unmitigated or heightened exposure to disease, malnourishment and undernourishment, and weak public health institutions

Box 3.9 Vulnerability in Manchieyt Nasser, Cairo

The Manchieyt Nasser township, located at the heart of Cairo, developed from a long-standing limestone quarry and dump site—activities which moulded the rugged contours of the site to what is it today. The township now represents the biggest informal squatter settlement in Egypt, with between 350 000 and 500 000 people living on a mountainous site of 7.27 km^2.

Most of these people are exposed, on a daily basis, to a plethora of natural and human-made environmental hazards. At the same time, they face the continuous possibility of legal charges for illegal occupation of state-owned land. Most of them lack the choice to reduce their economic and health vulnerability as a result of the environmental hazards. More shanty-town dwellers were moved into the area in 1960 and, in 1972, garbage deposition was relocated to the area.

The infrastructure and social services in the township are scanty and inadequate—and some have become obsolete. The construction of dwellings on environmentally fragile and risky spots has been commonplace. Pollution in the area results from informal manufacturing activities, leaking raw sewage, the open burning of garbage and mounting heaps of solid wastes. The area has also become a refuge for outlaws and illegal practices, due to its virtual inaccessibility to security forces. These changes have only worsened an already bad environmental situation, rendering the inhabitants more and more vulnerable. Thus, the area was the most badly damaged by an earthquake which struck Cairo in October 1992. Today, a considerable number of inhabitants still live in very dangerous spots in the area.

Osama Salem unpublished case study 2001

and interventions. Linked to this is poverty and the coping capacities of the population at risk to effectively reduce their vulnerability to infectious diseases, poor or irregular nutrition, and the myriad of health conditions that are associated with poverty in urban and rural areas. The survival indices which are a reflection of the general health situation in Africa are summarized in Table 3.3.

Poor health, lack of or inadequate access to health services, low or skewed investment in health services (concentration in few urban centres) and dysfunctional health policies all contribute to lower life expectancy and high mortality rates in African countries, as indicated in the table. Health-related interventions may also contribute to vulnerability by, for example, contributing to the evolution of drug-resistant organisms, or by exposing food webs and people, through the process of bioaccumulation, to toxins such as DDT.

The effects of infectious diseases—such as HIV/AIDS, tuberculosis and malaria—are felt throughout society and, if unchecked, they damage the social fabric of the community, diminish agricultural and industrial production, undermine political, social and economic stability, and contribute to regional and global insecurity (WHO 2000a). The linkages between environmental change, poverty, reduced quality of health and vulnerability are complex, and their individual impacts and causal effects are not easy to isolate. However, the lack of scientifically proven evidence of such causal changes in Africa does not mean that these changes do not exist; rather, it may reflect the lack of available epidemiological data as a result of poor or absent surveillance and health information systems (IPCC 1998). There is, consequently, a pressing need for scientific investigation on the assumptions about environmental change and its impacts on human health and vulnerability.

Infectious diseases such as HIV/AIDS, tuberculosis and malaria can thrive in poor communities, and the limited access to health-care services means mortality rates are high in many regions.

UNEP

The HIV/AIDS epidemic has spread with devastating speed. It is among the leading causes of death in sub-Saharan Africa (World Bank 2001), where 2.4 million adults and children are estimated to have died due to HIV/AIDS in 2000 alone (UNAIDS/WHO 2000). The HIV/AIDS epidemic is not only the most significant public health problem affecting large parts of sub-Saharan Africa; it is also an unprecedented threat to the region's development (World Bank 2000). More than 95 per cent of the 36 million people in the world living with

Table 3.3 Health progress and setbacks in African countries

Sub-region	Life expectancy at birth (years)		Infant mortality (per 1 000 live births)		Under-five mortality rate (per 1 000 live births)	
	1970–75	*1995–2000*	*1970*	*1999*	*1970*	*1999*
Northern Africa (6)	52	66.1	123.8	38.7	190.7	51.2
Western Africa (16-1)	42.7	49.7	161.3	106.3	273.3	174.2
Central Africa (8-1)	43.7	49.1	139.6	103.6	233.3	163.2
Eastern Africa (8-1)	44.7	50.1	133.6	94.7	212	147.9
Southern Africa (11)	47.7	46.2	127.6	91.3	205.1	142.2
IOC (4.1)	–	–	–	–	–	–

Source: JES-Preparation WSSD 2001

HIV/AIDS are in developing countries, and 25.3 million of them are in sub-Saharan Africa (UNAIDS 2001, UNAIDS/WHO 2000). In Africa, HIV/AIDS is largely a rural/urban poor issue, where a matrix of socio-economic, cultural and gender-related vulnerabilities indicate that the links between AIDS, food insecurity and poverty are strong and deadly (FAO undated).

HIV/AIDS is a threat to sustainable agriculture and rural development through its systemic impact (FAO/UNAIDS 1999). At the household level, HIV/AIDS can result in labour shortages and declining productivity, reduced income, increased expenditure on medical treatments and an increase in the dependency ratio due to the rise in the number of dependents relying on a smaller number of productive family members. Smallholder agriculture is a vital sector for rural households and national economies in many African countries. HIV/AIDS is affecting agricultural production through the decimation of household labour, the disruption of traditional social mechanisms, and the forced disposal of productive assets to meet the costs of medical care and funerals. The disease also results in the loss of traditional farming methods, inter-generational knowledge, and specialized skills, practices and customs.

Marginalization of traditional systems

One of the most destructively persistent historical legacies of Africa's past has been the subversion and destruction of indigenous coping strategies due to foreign military, political, administrative and economic interference. Colonial dispossession of the richest traditional pastoral and agricultural lands from Africans, and the commodotization of agriculture production for export purposes, marked two of the most far-reaching colonial interventions which have significantly contributed to Africa's current state of vulnerability. The loss of pasturage and farmland to colonial settlement/private ownership, and insecure land tenure for the native population, have further undermined traditional coping strategies. In Eastern and Southern Africa, in particular, indigenous Africans were confined to marginal, and increasingly degraded and unproductive, lands due to the impacts of settler agriculture, colonialism and subsequent changes in traditional land tenure which exacerbated negative environmental change after independence. In Ethiopia, for example, foreign resource conservation measures introduced by the government between 1971 and 1985 not only eroded indigenous processes of resource conservation, but also led to soil erosion and impact on crop production (Singh 2000).

Environmental stress, such as deforestation, can cause community-level conflict.

UNEP

Civil strife and armed conflict

A total of 26 armed conflicts erupted in Africa between 1963 and 1998, affecting 474 million people in Africa, or 61 per cent of the population. Some 79 per cent of people were affected in Eastern Africa; 73 per cent in Central Africa; 64 per cent in Western Africa; 51 per cent in Northern Africa; and 29 per cent in Southern Africa (ECA 2001). Another impact of armed conflict is the creation of refugees. In 2001 in Central Africa and the Horn of Africa, for example, a total of about 9.6 million people were either refugees or internally displaced as a result of armed conflict (US Committee for Refugees 2001). Refugee settlements often result in environmental degradation which, in turn, increase human vulnerability, limiting livelihood options and exposing the refugees to health risks.

Environmental change due to environmental stress has an indirect impact on the outbreak of conflict. Environmental stress—including deforestation, land degradation and scarce supply of freshwater—alone, and in combination with high population density, increases the risk of low-level conflict.

Armed conflict over resources can also spill over national borders. In 1977–78, deforestation and soil

HIV/AIDS leads to labour shortages, decreased productivity, reduced income and an increasing number of dependents. In turn, traditional farming methods are often lost together with, inter-generational knowledge, and specialized skills, practices and customs.

degradation, in conjunction with rapid population growth, forced Somali pastoralists to migrate to Ethiopia, resulting in conflict between the two countries (Molvoer 1991). Overgrazing induced widespread deforestation and desertification in Somalia, prompting the large migrations of Somali pastoralists into Ethiopian territory. The migrations brought the Somali pastoralists face to face with local Ethiopians who were dependent on the same resources. The bitter competition between these groups fuelled cross-border tensions which eventually found an outlet in armed conflict between the two nations.

Conflicts in the region are partly attributed to disputes over environmental resources. For example, Liberia/Sierra Leone/Guinea conflicts are partly attributed to contest over the resources of the Manor River basin. The DRC/Rwanda conflicts, the Sudanese conflict, and tribal conflicts and wars in many African countries are attributed, in part, to contest over natural resources. Environmental problems which are exacerbated by civil strife, armed conflicts and wars are threatening the survival of large numbers of people in the Africa region, and these problems are becoming increasingly serious. The types of environmentally related conflicts include:

- Simple scarcity conflicts which may arise over three major types of resources: river water, fish and agriculturally productive land. These renewable resources are likely to spark conflict because they are rapidly becoming scarce in some regions, they are essential for human survival and they can be physically seized or controlled.
- Group identity conflicts, which are likely to arise from the large-scale movements of populations brought about by environmental change, for instance, the earlier Ethiopia/Somalia example.

The situation described above is vividly illustrated by a case study on natural resources scarcity and conflicts, summarized in the Box 3.10.

The analysis of the relationship between environmental change (especially that which leads to scarcity), violent conflict and security has highlighted both positive and negative social effects (Matthew 2000). The negative social effects of environmental change include:

- Decreased agricultural production and productivity, which may arise as a result of the effects of deforestation, as well as of the degrading and decreasing of available agricultural land.
- Depressing economic performance as a result of environmental degradation, leading to further impoverishment in the affected countries.
- Population displacement, compelling people to migrate in search of livelihood opportunities.
- Intensifying group identity tensions, forcing people onto marginal lands and promoting resource capture by social subgroups—all of which may generate diffuse and persistent misery, frustration and resentment.
- Rendering individuals and groups increasingly vulnerable to natural and human-made disasters.
- Disruption of legitimized and authoritative institutions and social relations.

Box 3.10 Natural resources scarcity and conflicts

The semi-arid land of northern Uganda is usually referred to as Karamoja. It is home to pastoralists called karimojong, made up of several tribes which depend on livestock for food, payment of bride price and other cash needs.

Karamoja is characterized by low/unreliable rainfall. Scarcity of water for human and animal needs, and inadequate pasture for grazing, results in overstocking of livestock in the area in relation to the carrying capacity of the limited pasture. The groundwater resources on which the population depend has been reducing because the water table in the area has been falling since 1960, as a result of the effects of drought and other aspects of environmental degradation. Also, the rate of livestock loss is high, due to the effects of drought and disease. Furthermore, about 50 per cent of Karamoja is a protected biodiversity conservation area, where the government prohibits any human activities.

The explosive situation described above has led to internal armed conflicts and cattle raiding between the different tribes, and also to external armed conflicts with people from neighbouring countries with the same resource scarcity problems.

Source: Y. Moyini, Natural Resources Scarcity and Conflicts: Case of Northern Uganda *(unpublished 2002)*

Box 3.11 Conflicts and the environment

The civil war in the Democratic Republic of Congo has been devastating to the country's wildlife, killing thousands of elephants, gorillas (which are among the world's most endangered animals, with only a few hundred surviving in the wild today) and other endangered species. After three years of fighting in the Congo, the number of okapis, gorillas and elephants has dwindled to small populations. Participants in the many-sided conflict have plundered resources to fuel the fighting. Soldiers have slaughtered elephants for meat and ivory, and buffalo for meat.

In Garamba Park in northeastern Congo, an area controlled by Ugandan troops and Sudanese rebels, nearly 4 000 out of 12 000 elephants were killed between 1995 and 1999. In other parks and reserves, including Kahuzi-Biega park, the Okapi reserve and Virunga park, the situation is equally grave. In Kahuzi-Biega park, a zone controlled by the Rwandan and Rwandan-backed rebels, just two out of 350 elephant families remained in 2000—the rest must have fled of their own accord or may have been killed, because two tonnes of elephant tusks were traced in the Bukavu area late in 2000. The war has made both humans and wildlife vulnerable.

Park rangers with impounded ivory, Central African Republic

Photo: Mathieu Laboureur / Still Pictures

Source: United Nations 2001

Armed conflicts, in addition to exacerbating environmental degradation and increasing human vulnerability, also cause a lot of damage to invaluable environmental resources, especially wildlife and biodiversity, as illustrated in the Box 3.11. This situation is the same with all the armed conflicts which have taken place or which continue to take place today in Africa.

Armed conflict not only contributes to the degradation of the environment, but also contributes to the breakdown of legal and institutional frameworks which are critical to environmental management. In Mozambique, the war which ended in 1992 resulted in the fragmentation and collapse of the management of protected areas (Chenje and Johnson 1994). It also foreclosed livelihood options for millions of people who were forcibly displaced to relatively safe areas but which, however, had more limited livelihood options (see Box 3.12).

One of the results is that some large communities are forced to survive on food handouts or are forced to overexploit their immediate environment in order to survive. This becomes a vicious circle, where the poor overexploit their resources, limiting the environment's ability to recover. As the state of the environment deteriorates, the people's livelihood options also become limited, worsening their poverty and vulnerability. For example, the 1999 UN secretary-general report on the war in Angola, said that among the immediate consequences of the war were the higher level of malnutrition, especially among young children, and the dismal sanitation and health conditions which seriously increased the risk of epidemics (UN 1999). Box 3.12 also provides additional information on how armed conflicts impact people.

Box 3.12 War causes health problems in the Democratic Republic of Congo

The number of people in critical need of food in the Democratic Republic of Congo remains at an estimated 16 million, or roughly 33 per cent of the country's population. The uprooting of rural populations and isolation from their traditional food sources, together with the declining economic situation, continue to be the underlying causes of this troubling situation, which is aggravated at Kinshasa, where about 70 per cent of the population of 7 million live on less than US$1 per day for food. Some 18 per cent of children in the inner city, and more than 30 per cent in the outskirts, suffer from chronic malnutrition. Less than 47 per cent of the population is estimated to have access to safe drinking water.

Source: UN 2000

ECONOMIC DIMENSIONS TO HUMAN VULNERABILITY

The economy is both a pressure and a victim of environmental change. The overexploitation of resources for economic growth may cause environmental change, and such change may, in turn, negatively impact economic performance. The 1991–92 drought which hit most of Southern Africa forced the Zimbabwe stock market to decline by 62 per cent, causing the International Finance Corporation (IFC) to describe the country as the worst performer out of 54 world stock markets. The country's manufacturing sector declined by 9.3 per cent in 1992. Research shows that drought caused a 25 per cent reduction in the volume of manufacturing output, and a 6 per cent reduction in foreign currency receipts. In South Africa, a model developed by the Reserve Bank of South Africa indicated that the 1991–92 drought had a net negative effect of at least US$112.4 million on the current account of the balance of payments. It is estimated that about 49 000 agricultural and 20 000 jobs in non-agricultural sectors were lost as a result of the 1991–92 drought (Benson and Clay 1994).

There are both direct and indirect economic implications of human vulnerability to environmental change which involve costs. Direct costs are dramatically illustrated when losses resulting from the impacts of floods, earthquakes, wind storms or fires on the infrastructure and property of the affected communities are evaluated and calculated against the expenditure required to rebuild or repair lost capital assets, and to provide aid and basic services to affected people. The economic impacts of overharvesting natural resources, such as fish or timber, can result in vulnerability as these resources, on which people depend for their livelihoods, become scarce. Because the affected population has become vulnerable and has lost coping capacities, such costs are usually taken up by governments, relief agencies, donors and, in many cases, nearby sympathetic communities usually give assistance, especially in kind.

At the micro-economic level, the impacts of adverse environmental change on human vulnerability, as individuals and households become economically insecure, result from the following: reduced productivity and production; reduced income; reduced reserves; reduced purchasing power; increased demand for subsidies, aid and assistance; reduced capability to pay taxes; increased indebtedness; and poverty, food insecurity and health problems.

At the macro-economic level, the impacts of adverse environmental change follow on directly from the micro-economic impacts. They include: reduced taxes to the treasury; increased budget deficits; decreased social spending; increased foreign aid dependency; decreased debt repayment; decreased competitiveness; decreased foreign exchange; and overall poor economic performance.

Sub-Saharan Africa has low overall economic performance, including low industrial performance. The factors which contribute to the poor performance of Africa and which render most of the population vulnerable to environmental change have been summarized as follows:

- low levels of private investment due to macro-economic instability, inadequate legal systems and conflict;
- high tax and import duty rates which discourage foreign investment;
- bad governance and corruption;
- high levels of debt and dependence on foreign assistance;
- low rates of return on capital and labour;
- low overall productivity rates;
- over-valued exchange rates;
- poor infrastructure; and
- insufficient competition and monopolistic structures. (World Bank 2001)

It must be noted that the results of the above are not linear, because they involve complex economic and social processes.

The data in Table 3.4 illustrate the situation with regard to dependence on foreign assistance, foreign investment and debt servicing, which decrease export earnings.

Many African countries have persistently faced social and economic difficulties since independence. Although some countries in the region depend on mineral resources for their foreign exchange earnings, most of the countries rely principally on agriculture which has, and continues to be, the single largest employer of the population. Economic growth for most African countries has been sluggish or negative and, in most instances, has impacted heavily on the welfare of the people.

Table 3.4 Aid, private capital and the debt crisis in Africa

	Official development assistance				Net foreign direct investment as % GDP		Total debt service as % exports	
	Total US$m	*Per capita US$*	*As % GDP*					
Sub-region	***1999***	***1999***	***1990***	***1999***	***1990***	***1999***	***1990***	***1999***
Northern Africa	473.5	14.6	5.3	1.5	0.6	1.4	27.9	18.7
Western Africa	247.5	51.9	17.7	11.5	0.6	1.5	19.3	16.2
Central Africa	154.2	32.1	14.9	6.4	1.2	3.5	15.3	9.9
Eastern Africa	314.5	36.7	20.7	12.4	0.0	1.2	37.3	24.1
Southern Africa	331.5	35.6	15.5	7.3	1.2	7.3	18.6	16.8
IOC	140.4	32.8	11.5	7.2	0.6	1.1	18.7	14.3

Source: JES-Preparation WSSD 2001 and Assessment of Progress on Sustainable Development in Africa Since Rio 1992, UNEP

The international community has a considerable and varied involvement in social and economic development in Africa. Most sub-Saharan African countries have been affected by macro-economic disequilibrium, with inflation and unsustainable current account deficits. In most countries, the balance of investment has shifted to the towns, while the productive sectors of their economies have continued to depend largely on the rural areas, because of their dependency on agriculture.

Oasis in the Sahara Desert, Libya

UNEP/Vesselin Voltchev

While micro-economic and macro-economic problems contribute to environmental change and human vulnerability, the situation is exacerbated by unresponsive governance. Inappropriate domestic spending and bureaucratic inefficiencies have added to the economic burden on people and the environment.

Structural adjustment programmes

Most sub-Saharan African countries have been affected by the International Monetary Fund (IMF) and World Bank (WB) Structural Adjustment Programmes (SAPs) of economic reform, with varying results for their economies and varying effects on the poorest people. Adjustment policies have been characterized by:

- removal by governments of subsidies on essential services, such as education, health and transport;
- reduction of the civil service labour force through retrenchments;
- removal of subsidies on agricultural inputs; and
- liberalization of commodity prices.

Most of the policies introduced as a result of SAPs have tended to impact negatively on the economic situation, human livelihood conditions, human vulnerability and coping capacities in Africa, but at different scales, and with considerable differentiation between countries, affected sectors and populations. The WCED noted in 1987 that: 'most of the world's poorest countries depend for increasing export earnings on tropical agricultural products that are

vulnerable to fluctuating or declining terms of trade. Expansion can often be achieved at the price of ecological stress' (WCED 1987). In Southern Africa, for example, SAPs have resulted in major job losses in Malawi, Mozambique, Tanzania, Zambia and Zimbabwe, increasing poverty levels and pressure on the environment (Chenje 2000). Overall, people in these countries have become more vulnerable, both socially and economically, because degraded environments are producing fewer resources.

SAPs also increase vulnerability to disaster in urban areas which are not necessarily disaster-prone by nature. The SAPs contribute to accelerated urbanization, population movement and population concentration, which make low-income urban dwellers more vulnerable to the impacts of disasters (Hamza and Zetter 1998). Liberalization of pricing systems and intensified exports have translated into forest losses in Côte d'Ivoire, where rising cocoa production has been the primary source of decreased forest cover—which has been reduced from 12 million ha in 1960 to 3.9 million ha at present. Similarly, in Cameroon, the IMF encouraged the government to reduce export taxes on forest products, to devalue the local currency and to cut government jobs. The lack of financial resources and personnel to enforce forest protection, combined with few incentives for appropriate forest management and land use, resulted in a 49.6 per cent increase in lumber exports between 1995 and 1997, and the wholesale destruction of one of Cameroon's most valuable environmental resources (FOE 2000).

Debt burden

The persistent dependence on external financing by African countries has made it difficult for them to remain on the sustainable development track. However, many other factors have also contributed to economic stagnation; these include governance, civil strife and disasters. Regional engagement by multilateral financial institutions such as the WB and the IMF comes at a price for recipient countries. Sub-Saharan Africa's total external debt rose from US$176 874 million in 1990 to US$216 359 million in 1999 (World Bank 2001). Some 48 of the 52 African countries spend about US$135 000 million every year repaying debts to rich foreign creditors. The region's massive foreign debt burden has been described as 'a new form of slavery, as vicious as the slave trade' (Colgan 2001). African countries have been receiving financial assistance from the developed countries in order to balance their development budgets in the midst of growing financial difficulties due to poor commodity prices, globalization and other factors (UNDP and others, 2000). For example, sub-Saharan countries exported goods and services worth about US$96 584 million in 1999, while total external debt amounted to US$216 359 million in the same year (World Bank 2001).

Saddled with heavy debt commitments, many African countries are unable to build and maintain economic reserves. The overall result is: further erosion of regional coping capacities; greater vulnerability to both internal and external stresses and shocks; indebtedness; increasing reliance on foreign aid; and reduced competitiveness in the face of economic globalization. Africa's heavy international debt burden contributes substantially to human vulnerability and

Box 3.13 Africa's indebtedness

Africa's official debt at the end of 1999 stood at approximately US$170 000 million (WB 2000). In sub-Saharan Africa, debt service consumes between one-quarter and one-third of foreign exchange earnings, diverting resources from productive investments. Africa paid back US$1.31 in debt service for every US$1 received in aid grants in 1996 (Jubilee 2000).

Large debt service payments mean that vital social services must be sacrificed to meet debt payments, which makes the poor in HIPCs even worse off and, by implication, more vulnerable. For example, the United Nations Children's Fund (UNICEF)—which supports calls for the cancellation of debt owed by African countries—says that forest loss in HIPCs was 50 per cent greater than in non-HIPC countries between 1990 and 1995. Sub-Saharan Africa is forced to spend more on servicing its external debts than on the health and education of the region's 306 million children—while child mortality averages one-third more than other regions of the world (IPS 1999). In addition, heavy debt burdens result in increased pressure on the environment because of the growing need by HIPCs to generate foreign exchange to meet debt obligations.

Table 3.5 Africa—total external debt

	Annual average (US$ millions—current prices)		
Sub-region	***1975–84***	***1985–89***	***1999–MR***
Northern Africa	48 632	102 600	109 804
Western Africa	22 766	58 308	76 661
Central Africa	9 254	19 745	31 854
Eastern Africa	6 042	16 636	25 046
Southern Africa	11 084	26 133	63 237
IOC	1 721	4 350	6 074
Total Africa	97 717	228 409	302 655
SSA	54 892	136 754	209 816
SSA Excl. S.A.	54 892	136 751	195 025
SSA Excl. S.A. & Nigeria	46 377	110 830	163 455

Source Compiled from WB 2001

security in the region. The servicing of debt consumes resources which could be spent on development, poverty alleviation and increasing coping capacities. Allied with the question of debt is that of SAPs, which often include obligations to reduce state spending, especially on social development and environmental management—a situation which tends to exacerbate the vulnerability of the poor and other marginal groups to environmental, economic and social stresses. Heavily Indebted Poor Countries (HIPCs) in Africa are also increasingly resorting to unsustainable exploitation of the region's natural resource base in order to boost foreign exchange earnings to service debt.

Table 3.5 gives summary data on the situation described in the Box 3.13.

Sub-Saharan African economic and financial problems were made much worse in the 1970s and the 1980s by a combination of:

- an investment in growth and development which failed to earn the expected rewards;
- the international debt crisis, increases in oil prices and rising interest rates, plus the inadequacy of aid programmes which were meant to provide relief;
- repeated drought, crop failure and widespread famine;
- the failure of agricultural production to contribute significantly to growth, and the increased dependence on imported food;
- widespread warfare and civil unrest;
- the fact that SAPs have so far only been partially successful, and the success recorded has been mainly in terms of systems rather than people, who would have hoped to have their livelihood problems solved through the SAPs;
- reduced competitive ability;
- loss of intellectual property rights; and
- economic policy failures.

Food security

Hunger is the most extreme manifestation of the multi-dimensional phenomenon of poverty, and the eradication of hunger is instrumental to the eradication of other dimensions of poverty. Persistent widespread hunger impedes progress in other aspects of poverty reduction, and weakens the foundation for broad-based economic growth. Hunger also represents an extreme instance of market failure, because the people who are most in need of food are the least able to express this need in terms of effective demand (FAO 2001).

The FAO defines 'food security' as a state of affairs where all people at all times have access to safe and

nutritious food which enables them to maintain a healthy and active life. Food security, therefore, implies the provision of safe, nutritious, and quantitatively and qualitatively adequate food, as well as access to it by all people (NFSD 1996). Food security has three dimensions:

- availability of sufficient quantities of food of appropriate quality, supplied through domestic production or imports;
- access by households and individuals to appropriate foods for a nutritious diet; and
- optimal uptake of nourishment, thanks to a sustaining diet, clean water and adequate sanitation, together with health care.

Households seeking to preserve food security levels may resort to a number of coping strategies to gain access to food. These include: maintaining normal income-generating patterns; adaptation by means of innovative use of available resources or some divestment of liquid assets; divestment of productive assets, such as stock or land; and out-migration and destitution (USAID 1999).

Agriculture, of which 85–90 per cent is rain-fed in sub-Saharan Africa, accounts for 35 per cent of the region's gross national product (GNP), 40 per cent of exports and 70 per cent of employment (World Bank 2000). Year-to-year swings in GDP can be as high as 15–20 per cent, largely as a result of the effects of fluctuations in rainfall on agricultural production (World Bank undated). With the greatest part of African agriculture being rain-fed crop farming, food insecurity is largely caused by variability of rainfall (Khroda 1996). Moreover, about one-third of the region has a mean annual rainfall of less than 700 mm, which is too little to sustainably support rain-fed crop production.

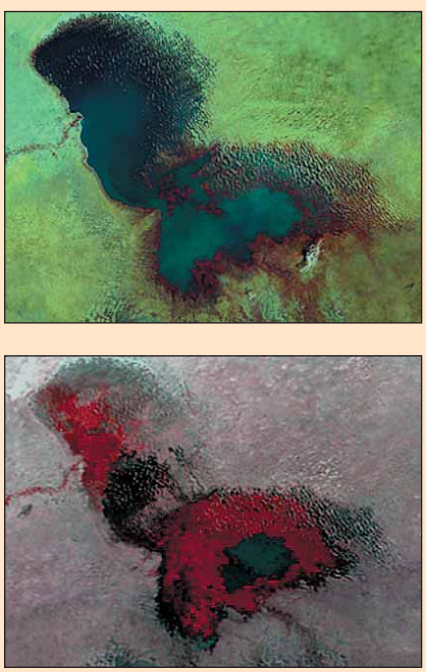
Agricultural production varies from one sub-region to the other and is projected, due to the impact of climate change, to significantly reduce production in the tropics and sub-tropics, areas where food insecurity and

Box 3.14 Consequences of environmental degradation of the Lake Chad basin

Over the years, the effects of drought and unsustainable human activities have continued to degrade the Lake Chad basin in general and the lake itself in particular, in terms of water availability and biodiversity. Water in the lake and its surrounding water systems is decreasing at an alarming rate. This persisting degradation of the entire ecosystem is compromising the performance of agriculture, fishery and livestock, which totally depend on the water and biological resources. The net effect has been the vulnerability of the population in the zone which is occupied mainly by nationals of Cameroon, Chad, Niger and Nigeria. The problem is expected to worsen in the coming years as population and irrigation demands continue to increase.

In 1960–63, the lake's surface area was 25 000 km^2; today, it is only 1.350 km^2. It has been calculated that 25 per cent of the decrease in surface area took place between 1966 and 1975, as a result of drought and excessive evaporation. The persisting low rainfall in the Lake Chad basin has affected its water systems regime. This persisting/chronic degradation of the run-off of the lake's river systems has been compared to 'disease of water' or 'hyper-draining' by some experts. The increase in agricultural water use and the loss of water due to drier climate are exacerbating the massive decrease of water in the lake. Groundwater is abundant, but is difficult to exploit.

The prolonged rainfall deficits and the generalized low levels of the river systems will gradually affect the stocks of groundwater in the region. A total of 11 million people live in the Lake Chad basin. The population is projected to reach 23–30 million in 2020, increasing informal settlements and causing acute water shortage. Demographic pressure, drought, bush fires, unsustainable farming activities and deforestation are exerting pressure on water and soil. The lake is shrinking, and fisheries are decreasing. The consequences of this situation have been drastic reductions in food production in the basin and increased vulnerability as a result of food insecurity.



Satellite photographs showing the disappearing Lake Chad in Central Africa

Goddard Space Flight Centre, 2001

Source: Summarized from Nami, B. (2002). Impacts of Environmental Change on Food Production in the Lake Chad Basin (unpublished)

hunger are already a problem (IPCC 1998). Box 3.14 describes the situation in the Lake Chad basin, where the adverse climatic factor of drought, coupled with unsustainable human activities, have contributed to a reduction in the volume of water in the lake and its biodiversity.

Table 3.6 indicates that, taking the period of 1989–91 as base year = 100, the index of food production per capita in Africa was declining during the years indicated for all sub-regions except for North Africa and, to a small extent, West Africa. The same situation holds for the negative average annual percentage growth in food production for all sub-regions except for the same two sub-regions. This explains why most African countries have depended on food aid, and confirms their state of vulnerability in terms of food security.

Food insecurity results in: malnutrition and increased infant mortality rates; a heightened risk of contracting infectious diseases; ecologically and environmentally destructive coping strategies; migration; heightened dependency on aid; and stunted economic growth (IPCC 1998, USDA/ERS 2000). Estimates of undernourishment indicated that, in 1996–98, 792 million people in the developing world and 34 million in the developed world were undernourished. The data in Table 3.7 indicate the level of undernourishment in Africa.

In sub-Saharan Africa in 1996–98, more than 34 per cent of the region's population was undernourished; some 185.9 million people experienced an average food deficit of 291 kcal/day. In this region, GNP/capita was US$297 against US$1 205 in the developed world. Sub-Saharan Africa has been identified as the region which is most vulnerable to food security, and the only region which shows increases in all indicators of food insecurity. Furthermore, the high incidence of HIV/AIDS in sub-Saharan Africa is expected to reduce agricultural production and productivity, and constraints in financial resources will limit commercial imports, leading to declining per capita consumption and, ultimately, to further undernourishment and the risk of famine (USDA/ERS 2000).

In sub-Saharan Africa, domestic food production accounts for about 80 per cent of consumption (USDA/ERS 2000), in a region where 4 out of every 10 Africans live in conditions of increasing poverty (ECA 1999). Farmers and pastoralists are vulnerable to food insecurity because they produce too little, and do not have enough food reserves. They usually have meagre

Table 3.6 Food production per capita in Africa

	Index (average 1989–91 = 100)					Average annual % growth		
Sub-region	***1980***	***1990***	***1993***	***1996***	***1999***	***75–84***	***85–89***	***90–MR***
Northern Africa	93.3	96	101.2	122	115.3	–1.15	0.82	1.8
Western Africa	96.3	97	100.5	102.1	104.3	–0.8	2.5	0.32
Central Africa	116.4	98.5	98.1	99	99.3	–1.6	–0.1	–0.4
Eastern Africa	98.2	101.2	89	87.9	86.3	–0.7	–0.1	–1.2
Southern Africa	114.2	100.2	94.2	95.9	92.2	–2.6	–0.2	–1.2
IOC	114.5	99.3	96.8	104	93.8	–1.9	–1.7	0.1
Total Africa	101	100	96	99	97	–1.4	0.6	–0.3
SSA	105	100	96	98	94	–1.5	0.5	–0.5
SSA Excl. South Africa	105	100	96	98	94	–1.5	0.5	–0.4
SSA Excl. S.A. & Nigeria	105	100	96	98	94	–0.6	0.4	–0.6

Source: JES-Preparation WSSD 2001 and Assessment of Progress on Sustainable Development in Africa Since Rio 1992, UNEP

Table 3.7 Food and nourishment in Africa (1996–98)

Sub-region (countries)	Food availability	Prevalence of undernourishment		Depth of undernourishment
	Ave. per capita dietary energy supply (kcal/day)	*Proportion population undernourished (%)*	*Number of undernourished (millions)*	Average food deficiency (kcal/person)
Northern Africa (6)	3 055	8*	10.7*	183
Central Africa (6)	1 898	50	38.5	344
Eastern Africa (7)	1 833	42	52.2	359
Southern Africa (9)	1 736	45	28.6	302
Western Africa (14)	2 570	16	33.0	238
IOC (2)*	2 475	23*	3*	245

**Note: Data for the undernourished people in Northern Africa have doubled because of the poor situation in Sudan, and the same is applicable in the IOC with respect to Madagascar.*
Source: Extracted from Report of FAO Committee on World Food Security—Assessment of the World Food Security Situation, 2000

savings and few other possible sources of income. They are more vulnerable to environmental change.

Macro-economic stresses, such as the transition to cash economies, and the penetration by global markets into local economies and the attendant structural changes, further serve to weaken the efficacy of traditional coping mechanisms, and exacerbate vulnerability to food insecurity. Natural hazards and armed conflict present two of the greatest obstacles to achieving necessary coping objectives; that is, increasing agricultural output while seeking additional security through alternative forms of income and stability (FAO 2000).

ADDRESSING HUMAN VULNERABILITY TO ENVIRONMENTAL CHANGE

Increasing human vulnerability due to environmental change is a threat to sustainable social, economic and environmental development. Governments and institutions in Africa have adopted various measures in the past 30 years to deal with issues which contribute to environmental change. These have ranged from political and social measures to economic and environmental measures. At the political level, the Organization of African Unity (OAU) spearheaded the decolonization of the region, facilitating independence to many countries and, in so doing, making natural resources more accessible to millions of people. For example, the elimination of apartheid in South Africa in 1994 helped to reduce the marginalization of most of the people to the abundant resources in their own country. As a result of apartheid, the white farmers, who make up only 5 per cent of the population, own 87 per cent of the land (Moyo 2000). The mean amount of land held per person in South Africa is slightly more than 1 ha for blacks and 1 570 ha for whites (SADC/UNDP/SAPES 2000). This situation has to change if sustainability is to be achieved. The South African government is committed to buying land and resettling the landless.

Other measures have been adopted to enhance sustainable development and to help to reduce the vulnerability of the population, including: investment in human resources; trade liberalization; review of outdated laws; and strengthening institutions at different levels. Such measures have been supported at national, sub-regional, regional and global levels. In terms of environmental management, together with other regions, African countries have adopted *Agenda 21*—the blueprint for sustainable development—and various multilateral environmental agreements (MEAs). Box 3.15 outlines some *Agenda 21* principles which are

Box 3.15 *Agenda 21* principles which are relevant to human vulnerability

A number of the principles of Agenda 21 relate to the issue of human vulnerability:

- Principle 6: The special situation and needs of developing countries, particularly the least developed and those most environmentally vulnerable, shall be given special priority. International actions in the field of environment and development should also address the interests and needs of all countries.
- Principle 8: To achieve sustainable development and a higher quality of life for all people, states should reduce and eliminate unsustainable patterns of production and consumption and promote appropriate demographic policies.
- Principle 15: In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.
- Principle 18: States shall immediately notify other States of any natural disasters or other emergencies that are likely to produce sudden harmful effects on the environment of those States. Every effort shall be made by the international community to help States so afflicted.

relevant to human vulnerability.

The latest initiative adopted by African leaders in 2001 is the New Partnership for African Development (NEPAD), whose long-term objective is to 'eradicate poverty ... and to place African countries, both individually and collectively, on a path of sustainable growth and development and thus halt the marginalization of Africa in the globalization process.' Under NEPAD, African political leaders have pledged to work both individually and collectively for peace, security, democracy, good governance, human rights and sound economic management, all of which are the conditions for sustainable development.

The African leaders also recognize that the range of issues necessary to nurture the region's environmental base is vast and complex. They emphasized the need for 'a systematic combination of initiatives to develop a coherent environmental programme ... It is also recognized that a core objective of the (NEPAD) environment initiative must be to help in combating poverty and contributing to socio-economic development in Africa. It has been demonstrated in other parts of the world that measures taken to achieve a healthy environmental base can contribute greatly to employment, social and economic empowerment, and reduction of poverty' (NEPAD 2001).

NEPAD targets a number of areas for action. These include: combating desertification; wetland conservation; global warming; environmental governance; and financing.

Combating desertification

The region has been in the forefront in terms of pushing for an international response to drought and desertification. The result was the adoption and ratification of the Convention to Combat Desertification (CCD). Since the CCD came into effect in 1996, countries (see Box 3.16 on the example of Mauritania) and sub-regions have adopted action programmes to combat desertification. In Southern Africa, for example, where general overdependence on natural resources

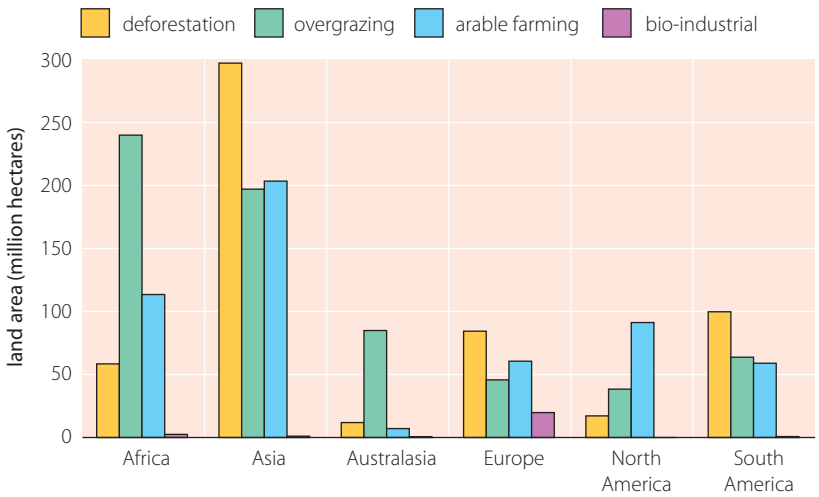
Box 3.16 Fighting sand dunes in Mauritania

In parts of Mauritania, villagers face two major environmental hazards: encroaching sand dunes which take over and destroy vegetation, causing desertification; and lack of water for household consumption and irrigation for agricultural production. Both situations render populations vulnerable by increasing poverty, and leading to food security and health problems, and they can cause civil unrest and strife.

The government has adopted policy measures to address the situation through the Mauritania-Agricultural Rehabilitation Programme, supported by external funding from the International Fund for Agricultural Development (IFAD), and these are yielding good results. Sand dunes, which are engulfing planted areas and which are threatening to engulf villages, are being brought under control in order to reduce environmental impacts and to make the population more secure.

The acute problem of water availability for household needs and agricultural irrigation is also being solved within the same project. Wells are being sunk where water is available in order to satisfy household and irrigation needs, and water is also being pumped from the Senegal River for irrigation. The implementation of the policy is helping to alleviate poverty, and to improve the food security problem and health of the population, thus increasing their coping capacities.

Figure 3.2 Main causes of desertification by region



has been identified as the root cause of desertification, the action programme involves strengthening environmental capacities, enhancing public awareness and mobilizing their active participation in combating desertification, land degradation and the effects of drought (SADC-ELMS 1997). Figure 3.2 illustrates the main causes of desertification.

Desertification does not refer to the moving forward of existing deserts, but to the formation, expansion or intensification of degraded patches of soil and vegetation cover.

Poverty alleviation programmes

Countries throughout the region have adopted various initiatives and programmes to alleviate poverty. As already highlighted, poverty is a major factor in increased human vulnerability to a stressed environment. Many national, regional and international organizations are involved in poverty alleviation programmes in Africa. For example, the African Development Bank (ADB) has developed a five-year programme which makes poverty alleviation and lasting development in Africa priority issues. The ADB's objective is to reduce poverty by half by 2015. According to ADB statistics, 40–45 per cent of the region's population live in absolute poverty, and 30 per cent are classified as extremely poor, including 70 per cent of women. The ADB will focus action on several major areas:

- agricultural and rural development, since the majority of the people in Africa live in rural areas;
- human capital development, through addressing health and education problems;
- 'transversal sectors', which include the environment, gender equality and governance;
- regional integration, which the bank emphasizes as the only means to secure African integration in the world economy and among other groupings; and
- the promotion of the private sector as an engine of growth, job creation and exports. (Kabbaj 2000).

Recently, African environment ministers issued a statement, following an October 2001 African Preparatory Conference for the World Summit on Sustainable Development. In the statement, poverty eradication was identified as a priority area for action (see Box 3.17).

Box 3.17 Eradication of poverty

Although Africa is an indispensable resource base which has been serving humanity for many centuries, poverty in Africa stands in stark contrast to the prosperity of the developed world. The process of globalization has further marginalized Africa, and this has contributed to the increasing incidence of poverty in the region. It is in this regard that the New African Initiative calls for the reversal of this abnormal situation by changing the relationship which underpins it. Achieving the poverty reduction goals of the Millennium Declaration is a joint responsibility of the North and South. It requires the adoption of a comprehensive approach which addresses the key priority areas, including:

- the removal of obstacles which prevent access to exports from developing countries to the markets of developed countries;
- debt reduction/cancellation;
- a review of the conditionalities of the IMF and the WB;
- promoting industrial growth, especially through small- and medium-sized enterprises;
- ensuring access to sources of energy at affordable prices, particularly in rural areas;
- promoting micro-finance;
- enhancing access to basic health services;
- sustainable rural development;
- agricultural development and food security;
- greater access to safe water and sanitation;
- reducing the vulnerability of our people to natural disasters and environmental risks; and
- access to and improved standards of education at all levels. (AMCEN 2001)

Early warning systems

One of the key responses to reduce the vulnerability of people is early warning. Various early warning initiatives have been implemented in the region. The Famine Early Warning System (FEWS) is perhaps one of the more widely known initiatives in Africa. The 1985 famine in Ethiopia galvanized African countries to establish FEWS, with funding support from the United States Agency for International Development (USAID). The main objective of FEWS is to lower the incidence of drought-induced famine by providing timely and accurate information to decision makers regarding potential famine conditions. The monitoring and response to famine has different phases, as shown in Figure 3.3.

Satellite data collected and processed by the US National Aeronautics and Space Administration, (NASA) and the National Oceanic and Atmospheric Administration (NOAA) are used to monitor vegetation conditions and rainfall across Africa. USAID has established a FEWS Network (FEWS NET), which is an information system designed to identify problems in the food supply system which can potentially lead to famine, flood or other food-insecure conditions in sub-Saharan Africa. FEWS NET is a multi-disciplinary project which collects, analyses and distributes regional, national and sub-national information to decision-makers about potential or current famine or flood situations, allowing them to authorize timely measures to prevent food-insecure conditions in these nations. Countries with FEWS NET representatives are: Burkina Faso, Chad, Eritrea, Ethiopia, Kenya, Malawi, Mali, Mauritania, Mozambique, Niger, Rwanda, Somalia, (southern) Sudan, Tanzania, Uganda, Zambia and Zimbabwe (USGS undated).

At a sub-regional level, in 1996–98, countries in Southern Africa established, with the support of FAO technical assistance: the Regional Early Warning System (REWS); the Regional Early Warning Unit (REWU); the Regional Remote Sensing Unit (RRSU); and the National Early Warning System (NEWS) (Chopak 2000).

Vulnerability assessment in Africa

One practical example of vulnerability assessment is the in-depth vulnerability analysis mapping in Mozambique which has been used to classify the country into different food production systems. The project has entailed a

Figure 3.3 Monitoring and response sequence

During normal times: presence of risk of food insecurity

Prevention of food insecurity
- Increase food production and supplies
- Diversify income sources
- Improve management of natural resources
- Strengthen food markets
- Identify vulnerable groups: baseline (FSVP) *

Preparedness
- Routine monitoring of selected indicators for early warning.
- Identify vulnerable groups: current year (CVA) *
- Develop capacity and strengthen partner institutions *
- Develop contingency planning institutions and procedures **

When famine threatens: high probability of specific famine occurring

Early warning
- Monitor and analyse indicators of food insecurity based on:
  - immediate needs and capacities of food insecure *
  - context and environment *
  - source of risk *
- Report results; issue alerts *
- Activate contingency planning groups **

When famine sets in: occurrence of famine

Impact and needs assessment
- Assess impact *
- Conduct emergency relief needs assessments (ENAs) *
- Determine objective(s) of response(s) **
- Determine capacities of households, communities and governments to respond
- Determine information need(s) of response(s) **

As the famine continues: mitigate impact

Provide relief
- Select and plan emergency responses (to rescue and provide relief to vulnerable groups) **
- Provide food relief
- Provide non-food relief (goods, inputs, services, technical assistance)
- Provide information to support response(s) **
- Monitor impact of relief operations on vulnerable groups **

As the famine wanes: initiate recovery

Facilitate development to avert recurrence
- Select and plan rehabilitation activities (restore livelihoods, foster sustainable recovery) **
- Implement longer-term response(s) and programme(s)
- Evaluate response(s) and lessons learned **

* Activities undertaken at present by FEWS FFRs in many instances
** Expanded activities for FEWS FFRs

Source: Hutchinson 1992

Box 3.18 Vulnerability assessments in Africa

The International Geosphere-Biosphere Programme's core project on Biospheric Aspects of the Hydrological Cycle (IGBP-BAHC) adopted a vulnerability assessment approach to develop strategies for sustainable management of groundwater resources. This approach included:

- regional integrated assessments of groundwater abstraction and recharge;
- integration of human vulnerability dimensions (particularly relating to the limited adaptive capacities of poor communities to groundwater scarcity in arid and semi-arid environments);
- stakeholder participation to identify social and environmental stresses;
- strategies for integrated water resource management which lessened pressure on the resource, promoted welfare, enhanced adaptive capacity and reduced vulnerability; and
- development of consolidated databases and continuous monitoring.

Source: Hoff 2001

multidisciplinary group, involving, among others: the Ministry of Health (Department of Nutrition); the Ministry of Planning and Finance (Department of Social Development, Poverty Alleviation Unit); and the National Early Warning Unit within the Department of Agriculture. Some of the preliminary mapping products include: flood risk maps; Normalized Differential Vegetation Index (NDVI) identification of drought risk areas; food systems maps; land use maps; market access maps; and health and nutritional profiles. Collection, analysis and presentation of food security and nutrition has been institutionalized within government, becoming a tool for local development, service delivery and monitoring, as well as scientific inquiry.

One of the major challenges for the region will be to design interventions which identify and target the various interacting dimensions which characterize vulnerability. In broad terms, this implies developing vulnerability assessment methodologies based on multi-disciplinary, integrated and coordinated strategies.

Human vulnerability and security assessment is a valuable tool for integrating environmental concerns into evaluations of livelihood security and sustainable development in the region. In Africa, with major populations exposed to adverse environmental change in both rural and urban areas, vulnerability assessment, IEM and disaster early warning systems can be integrated into a powerful tool for planning towards sustainable policies, plans and development. There are already examples of vulnerability assessments taking place in Africa (see Box 3.18).

Community-based natural resource management programmes

Wildlife management in the region has undergone many changes over the past 30 years, from the colonial policies of protectionism of wildlife at the expense of communities, to sustainable utilization, which supports community involvement. Countries in different sub-regions have implemented or are implementing community-based natural resource management (CBNRM) programmes not only to address the issue of biodiversity conservation, but also to generate income for communities and to help to reduce rural poverty. One of the CBNRM programmes which has been introduced is the *Tchuma Tchato* ('Our Wealth') initiative in Mozambique's northern Tete province (see Box 3.19).

Poaching is one issue being addressed in an increasing number of community-based natural resource management programmes in some regions; such programmes aim to conserve biodiversity whilst at the same time generating income for communities to help reduce rural poverty.

Gilles Nicolet/Still Pictures

Box 3.19 Community takes pride in its wealth

Tchuma Tchato ('Our Wealth'), a CBNRM project, has helped to restore the people's control over wildlife and natural resources in northwestern Mozambique. Traditional hunting, on which the community depended for both food and income, was declared 'poaching' in 1989 by a private landowner to whom the central government had leased hunting rights. Now, with restoration of both control of and the right to derive benefits from the area's natural resources, the community is more inclined to protect those resources, resulting in better conservation of wildlife and habitats.

The *Tchuma Tchato* project region is in the biodiversity-rich 'Tri-Nations Corner', where the borders of Mozambique, Zambia and Zimbabwe meet. The project encompasses six villages in the northwestern part of Tete province, in the mopane woodland, part of a vast, savannah-covered plateau encompassing more than 30 per cent of Mozambique's 799 380 km^2. Tete is one of the least populated of Mozambique's 10 provinces. The project area, which is spread over 2 500 km^2 adjacent to the Zambezi river, has a population density of fewer than 5 people per 1 km^2, compared to about 2 590 people per 1 km^2 in Maputo, Mozambique's capital.

Initiated in 1994, *Tchuma Tchato* was started, in large part, to undo problems created by the two-phase (1964–75 and 1976–92) Mozambican civil war. The conflict destroyed social structures, displaced millions of people, and devastated wildlife management structures and institutions. The Tete region, as well as other parts of the country, became a large, uncontrolled hunting area. Elephant populations were decimated as combatants on both sides hunted the animals for meat and ivory.

Tchuma Tchato's purpose is to make communities aware of the link between their economic welfare and the region's wild animals and biodiversity. The project stresses the advantages of the community acting as caretakers of the animals and the region, which means stopping poaching and overexploitation of resources. Since the project began, the elephant population has increased and is flourishing. The region's biodiversity provides a solid basis for ecotourism. For this reason, a seven-chalet campsite, controlled by the Provincial Directorate of Agriculture and Fisheries through the *Tchuma Tchato* project manager, has been built on the bank of the Zambezi river.

Before the project started, the community derived its income primarily from hunting, subsistence agriculture and fishing. The project created new sources of income by employing some villagers to work as staff at the chalet complex and as game scouts. Revenue from both game hunting and the chalet operation is split three ways: 35 per cent to central government, 32.5 per cent to regional government and 32.5 per cent to the *Tchuma Tchato* project. The six villages involved in the project have established natural resource management councils to help manage the project on their behalf and to decide how revenues are used.

Debt-for-nature swaps

Pioneered by Kenya in 1988, debt-for-nature swaps (DNS) were aimed at curbing the runaway debt burden of the region. DNS, which involves the cancellation of external debt in exchange for the debtor government's commitment to mobilize domestic resources to fund conservation programmes, were meant to achieve two outcomes at once: to reduce external debt and to enhance environmental management. Between 1987 and 1998, more than 30 developing countries, including some in Africa, had benefited from DNS, which generated US$100 million in funding for the environment (UNSO 1998). According to the United Nations Sudano-Sahelian Office (UNSO), for African countries affected by deforestation, bilateral debt is the most promising source of DNS. This is because, in 1998, commercial debt represented 2 per cent of external debt for these countries and, also, multilateral debt had not been the subject of debt swap transactions. The hope is that since multilateral creditors have accepted the principle that multilateral debt can be written off via the HIPC Initiative, DNS involving multilateral debt could take place. Of the 41 countries which may be eligible for the HIPC Initiative, 15 HIPC-eligible countries in Africa are severely affected by desertification (UNSO 1998).

A recent analysis of DNS concluded: 'The debt-for-nature swaps mechanism has been very modestly used until now partly because of the threat it poses on macroeconomic stability of the indebted country, partly because of the complicated dealings involved and finally because of free-riding of northern countries in environmental terms.

'Nevertheless, in its latest version, DNS have become simpler and more significant both in terms of the amount of debt involved and the financial support it provides for environmental projects without inducing macroeconomic instability in the countries involved.

The elephant is a 'main attraction' in the growing market for ecotourism—just one of many reasons why communities need to be aware of the link between their own economic welfare and their region's wild animals and biodiversity.

UNEP

Still, DNS has a more important role to play in the environment rather than the debt arena.' (ECLAC 2001)

DNS is only one way of tackling Africa's debt burden, and this has been recognized by African leaders, who want to see the region achieve and sustain an average GDP growth rate of more than 7 per cent a year for the next 15 years (NEPAD 2001). One of the goals is to implement national strategies for sustainable development by 2005, in order to reverse the loss of environmental resources by 2015.

Indigenous knowledge systems

Indigenous knowledge systems (IKS), which were discouraged during colonialism, are being revived throughout the region in order to promote human-nature linkages and to help communities to adapt to their changing environment. The Hausa of northern Nigeria, for example, developed a wealth of indigenous knowledge to cope with vulnerability to drought and famine in the sub-humid to arid regions of the Sahel (Milich 1997). These included: inter-cropping with nitrogen-fixing legumes; intensive manure application; soil conservation works; poly-cultural production of different cereals to cope with variable soil-moisture regimes; and exploiting different ecological niches to support wet and dry season production respectively. Other household and communal coping strategies included: wild food substitutes; increasing petty trading by women; selling livestock; craft production; out-migration to find work; and a strong communal ethic of sharing food with the hungry.

Pastoralists, such as East Africa's Maasai, exploit the opportunities of the natural system by migrating with their flocks to areas where pasturage has grown following rain. Other coping tactics include splitting herds to minimize risk and setting aside areas as grazing reserves. One important coping strategy throughout Africa is 'communal action based on social capital'. In this strategy, traditional societies in rural Africa draw on the collective strength of the weak to cope with stress in order to decrease vulnerability and insecurity, for example, through informal communal institutional processes, such as barter and trade.

In Southern Africa, for example, various activities have been undertaken to raise awareness among the people. There is a growing realization by governments and civil society that IKS has a lot to offer in natural resource management (Matowanyika 1999). The role of indigenous communities is recognized in Agenda 21, which acknowledges their role in developing 'a holistic traditional scientific knowledge of their lands, natural resources and environment' (UN 1992). Advocates of IKS say that the future of the region depends on people acknowledging the important role of their culture in development (see Box 3.20).

Box 3.20 IKS foundation of Africa's future

'If we want a strong Africa in the future we must lay its foundations on our indigenous knowledge in all areas of our lives. We will borrow ideas and skills from others since we live in an interdependent world, but if we are in possession of our minds, what we borrow will come to enrich and embellish what we already have and not supplant it.'

Source: Opoku 1999

Intellectual property rights

Related to the issue of IKS is intellectual property rights (IPR), which has assumed increasing importance in terms of conservation, management, sustainable utilization and benefit sharing of genetic resources. The plunder of African intellectual property rights contributes to human vulnerability, because the region will be unable to derive benefit from its resources, particularly after patenting.

African countries which are particularly rich in genetic resources, traditional knowledge and folklore

have an interest in the role of IPR, in the sharing of benefits arising from the patenting and use of biological resources and associated traditional knowledge (WIPO 2001). For example, currently, at least 97 per cent of all patents are held by nationals of countries belonging to the Organization for Economic Cooperation and Development (OECD), and at least 90 per cent of all technology and product patents are held by Northern-based global corporations (UNDP 2000, Singh 2001). Similarly, at least 70 per cent of all patent royalty payments are made between the subsidiaries of parent enterprises, and three-quarters of the 76 000-odd patent applications filed to WIPO in 1999 came from just five OECD countries (RAFI 2000, Singh 2001).

Box 3.21 IPR statistics

- Some 86 per cent of known higher plants, 99 per cent of the world's indigenous people and 96 per cent of the world's farmers live in the South (Africa, Asia and Latin America).
- Some 83 per cent of known diversity and *in-situ* knowledge is held in the South.
- The South's share of species diversity ranges from a low of 52 per cent of known fish species to a high of 91 per cent of reptile species. The South has 87 per cent of the global diversity of higher-order plant species and at least 83 per cent of all forests (tropical and temperate) (RAFI 1996).
- Some 75 per cent of *ex-situ* resources and technology are in the North (most of which originated in the South), and it is currently beyond the reach of the Convention on Biological Diversity (CBD) (RAFI 1996).
- Only 22 per cent of all crop gene banks are in the North, but 55 per cent of all seed accessions and 62 per cent of all crop species are in the North's collection. The large gene banks of the Consultative Groups on International Agricultural Research (CGIAR), which are located in the South, are controlled by Northern boards and funding agencies. If the CGIAR collections are deducted from the South's *ex-situ* holdings, its share of banked crop seed will plummet to about one-third of the global total (RAFI 1996).
- Some 83 per cent of recent bio-prospecting projects focus on the South's terrestrial biodiversity, 11 per cent on international waters and only 6 per cent exclusively on the North (RAFI 1996).

Source: Singh 2001

Box 3.22 African model law on intellectual property rights

The African model law on intellectual property rights urges OAU member states to:

- examine ways and means of raising awareness about the protection of genetic resources, indigenous knowledge and folklore, taking into account the need to protect the rights of local communities;
- identify, catalogue, record and document the genetic and biological resources and traditional knowledge, including expressing of folklore held by their communities, within the framework of national laws.
- exchange information and experiences, and continue, within the framework of the OAU, with the search for joint solutions to problems of common concern, and with the efforts aimed at developing common positions, policies and strategies in relation to these issues.

Source: WIPO 2001

Between 1980 and 1994, the share of global trade involving high-tech, patented production rose from 12 per cent to 24 per cent, and now accounts for more than half of the GDP of OECD countries if intellectual property rights on plants and livestock are included (UNDP 1999, Singh 2001). The total revenue from all patents grew from US$15 000 million in 1990 to US$100 000 million in 1998, and is expected to increase to US$500 000 million dollars by 2005 (RAFI 2000). The number of cases of intellectual appropriation of the South is growing steadily. Box 3.21 gives some statistics on IPR.

The OAU has produced model legislation to regulate traditional medicine in African countries, and member states have already adopted it. Box 3.22 highlights some of the provisions of the model law, which will be used as a basis for finalizing uniform national laws aimed at integrating African economies.

CHALLENGES OF REDUCING HUMAN VULNERABILITY

In order to effectively reduce human vulnerability and increase security in anticipation of, during or after adverse environmental change, policies need to be adopted which adequately address environmental issues at national, sub-regional, regional and global levels, as well as enhance their implementation. These policies will:

- raise incomes and standards of living to alleviate/eradicate poverty and to improve on livelihoods;

- improve economic performance by restructuring SAPs to focus also on people, not only on institutions, and effecting better debt management;
- assure food security by technologically transforming rain-fed agriculture to more reliable irrigation systems;
- drastically reform land ownership laws to assure security of land tenure;
- take measures to improve health;
- reduce, if not eliminate, civil strife, armed conflicts and warfare;
- develop and rationalize human resources utilization, bring demographic pressures under control and ensure the participatory approach in environmental management;
- rationalize the exploitation of natural resources at sustainable levels;
- integrate environmental concerns into general development planning;
- establish vulnerability assessments and strengthen early warning systems; and
- institute and enforce governance, and ensure a general enabling environment for sustainable development.

African countries are party to various policy instruments at global, regional, sub-regional and national levels. However, compliance and implementation with these instruments of environmental management and policy are, in many instances, ineffective (see Chapter 5). This is an indication of policy failures which have to be addressed if Africa is to move towards sustainable development. Policy failures can contribute to increased human vulnerability to environmental change. This can be due to inaction on the part of authorities, unsustainable policies, poor implementation of existing policies or insufficient human and financial resources to give effect to policies. Lack of expertise, an absence of political will, other state spending priorities and the so-called 'brain drain' can all contribute to non-effectiveness of policy.

Consequently, there is absolute need to strengthen policy implementation measures at community, national, sub-regional and regional levels. This certainly calls for support at global level, but the responsibility is that of governments, through the necessary political will and commitment, and in cooperation with their sub-regional and regional organizations.

African governments should assume their responsibilities to reduce human vulnerability and increase security by lowering risk and enhancing coping capacities. This will require:

- capacity building at community and national levels;
- the development of information and communication technology;
- the development and promotion of science and technology;
- the integration of environmental management in development planning; and
- the enhancing of governance and accountability, in order to create an enabling environment for sustainable development.

CONCLUSIONS

Environmental change is making people in Africa more vulnerable, with the increase in exposure to risk and inadequate coping capabilities. Many factors impact exposure to risk and coping capabilities, and they have social, economic and environmental dimensions. Poor economic performance, and weak institutional and legal frameworks, as well as overexploitation and other processes, contribute to increased human vulnerability. With models suggesting that human vulnerability is set to get worse in the future (see Box 3.23), the region has to adopt strategic measures to mitigate such vulnerability and to improve human security.

The likely impacts of increasing human vulnerability in the region over the coming decades include:

Box 3.23 Impacts of climate change

Climate change-induced famine may result in more than 50 million environmental refugees in Africa alone by 2060. Globally, sea level rise and agricultural disruption will not be the only causes of human migration. Severe water problems may affect three billion people globally by 2015, and this would encourage mass migrations. Deforestation, soil erosion and desertification may also lead to large movements of people.

Source: Myers 1993

- Increasing poverty, and the targets set under NEPAD to reduce poverty by 2015 will remain just that—a target.
- Governments in Africa are likely to pay less attention to the environment as they try to address the basic needs of their people. Environmental policies and institutions are likely, therefore, to remain weak.
- Women and children will continue to bear the brunt of environmental change, particularly in the region.
- Migration—illegal or otherwise—will continue to be a major factor, with millions of people risking their lives to migrate to urban areas and developed regions.
- Overexploitation of the environment will continue (and even increase), making it difficult to break the poverty circle and vulnerability to environmental change.

Policy makers cannot afford to ignore the need to improve environmental management if the human vulnerability/environmental change circle is to be broken. Sustainable development means taking into account social, economic and environmental issues at the same time, not one at a time.

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