

Desertification in the Drylands: A Review of the African Situation

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Abstract: Desertification is best conceived as land degradation in drylands. It is a process of sustained decline of the biological productivity of drylands; the end result is a desert, or skeletal soil that is irrecoverable. The term has raised considerable debate in the literature, and there is little purpose served in the post-UNCED era in expending further energy debating the definition and concept independently from land degradation in general. Enough is now known to conclude that the desertification problem is not a myth and that it is an extremely complex and intractable problem, affecting 3.6 billion hectares of the world's 5.2 billion hectares of drylands and some 900 million people (about 20% of the world's population). The nature and causes will be particular to any given situation, depending on the natural ecosystem variables and history of land use. Desertification is normally a very slow process and thus can be assessed over decades of observation, not years. In so far as Africa is concerned, although there are clearly areas of land that have become degraded, establishing the extent and trends is not easy. The failure to standardise what is being measured and the lack of widespread unambiguous measures has made monitoring difficult and often unreliable. This paper provides a snapshot of desertification in the drylands of Africa. It is contended that desertification in the drylands of Africa is a complex and multifaceted problem which appears to be caused by climate and human mismanagement of the environment. The principal focus of this paper is therefore a review of the current status of dryland degradation (desertification) and its main causes, i.e. the natural and human disabling factors. The paper also highlights the consequences of desertification and the efforts to combat the problem in Africa.

Key words: Desertification, dryland degradation, drought, desiccation, climate change, disequilibrium theories of range ecology, Boserupian principle, Environmental Kuznets' Curve, globalization and the new economic order, Structural Adjustment Programme, Desertification Convention.

Recent years have witnessed widespread land degradation in Africa's drylands as a result of human action and climatic factors. Symptoms include reduction of biomass produced by rangelands and consequent depletion of feed material available to livestock; reduction of available wood-biomass and consequent extension of the distance to be travelled to obtain firewood; reduction in floristic diversity and complexity; reduction of available water

due to decrease of river flow or groundwater resources; reduction or failure of yield in rainfed or irrigated farmland; encroachment of sand bodies that may overwhelm productive land, settlements or infrastructure and disruption to society due to deterioration of life-support systems and society's consequent need for outside help (relief and aid) or for its people to seek haven elsewhere (environmental refugees). While there is general agreement that such

desertification has been increasingly occurring on the continent, opinions differ as to the precise magnitude of the problem (extent and rate of desertification) and what the main driving forces behind this phenomenon are and their relative importance. This paper provides an overview of desertification. The focus is on the magnitude, spatial dimensions and causes of desertification and the issue of its combat in Africa. The paper also indicates some of the debates and contesting views in the emerging literature on desertification in Africa.

The Magnitude and Spatial Dimensions of Desertification

From the onset, I must underline that the precise extent and magnitude of desertification in Africa at present is not known. This is largely because of the poor database and the practical problems of measurement and monitoring. There have been a number of efforts from individuals and research organizations and institutions to determine the extent and status of desertification, but so far, the most widely known have been three global assessments undertaken by UNEP in 1976-77, 1983-84 and 1991-92. However, the data provided by UNEP in its assessments are not comparable because of the different methodologies employed and there has been considerable controversy over these assessments. Much of this controversy has centred on the definition and characterization of desertification and in particular over the accuracy of the statistical information base used by UNEP. The debates and technical squabbles that have sometimes generated more heat than light (see, e.g., Stiles, 1995) need not concern

us here. What is important to note is that even after UNCED the phenomenon of desertification is still not fully understood. To date, there is no consensus on ways of measuring it. Despite notable efforts (see, e.g., European Commission, 2001), the scientific community has, to date, not been successful in establishing an acceptable basis for determining the extent and rate of desertification. Until this is realized much of the effort to assess desertification will continue to be inevitably subjective. There is a long way to go before accurate statistics are available on the extent and rates of desertification in Africa, but this should not influence an appreciation that the problem is growing (Stiles, 1995). Fig. 1 and Tables 1 and 2 show the areas in Africa at risk from desertification. Tables 1 and 2 are based on UNEP's 1991-92 estimates (UNEP, 1992), considered to be the most accurate of its three global estimates. UNEP obtained these from available soil and climatic data and questionnaire surveys sent to national governments. They were not based on field measurements, but on the informed judgements of scientists and technicians (UNSO, 1992; Mortimore, 1998). Therefore these data should be regarded only as indicative and treated with caution. From Fig. 1, it would appear that there are three major areas susceptible to desertification in Africa. These are the Mediterranean lands of northern Africa, the Sudano-Sahel region, including parts of East Africa and the Horn, and Africa south of Sudano-Sahel, where the main areas are the Kalahari-Namib region of southern Africa and south-western Madagascar. UNEP's (1997a) *World Atlas of Desertification* (Second Edition), lists six territories in northern Africa, including

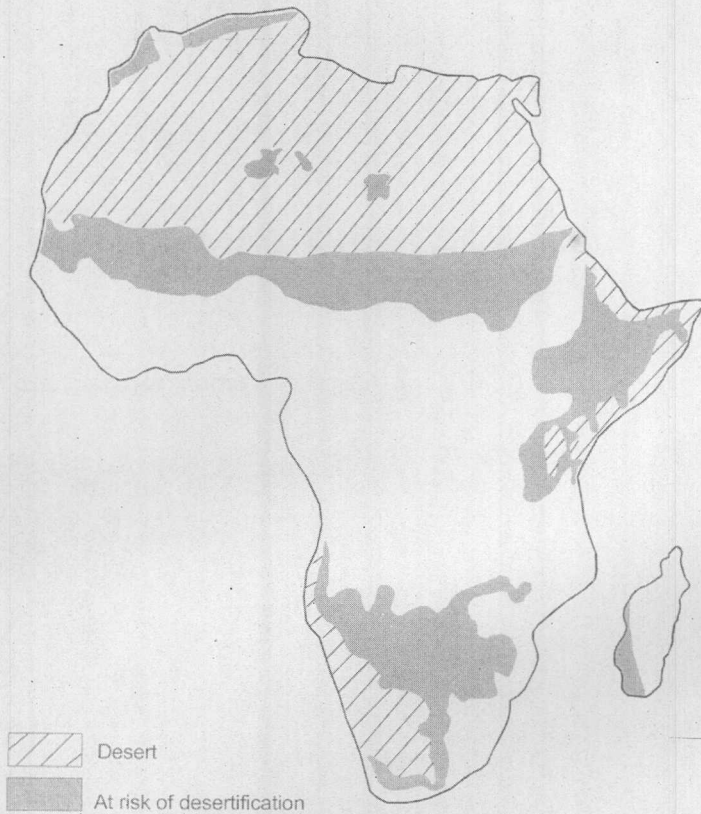


Fig. 1. Africa: Areas at risk of desertification (Source: Darkoh, 1996b).

Cape Verde, 18 in the Sudano-Sahel, including Kenya and Uganda, and 15 in Africa south of the Sudano-Sahel, giving a total of 39 countries as susceptible to desertification in the continent.

Of the 39 countries at risk from desertification, 17 are least developed countries, made up of 13 from the Sudano-Sahel and four from the Kalahari-Namib region (United Nations, 1982). As pointed out by the United Nations (*ibid*), these countries experience extreme economic and social difficulties, such as very low income per head, extremely poor agricultural

productivity and support mechanism, low level of exploitation of natural resources, high illiteracy rate, malnutrition, hunger and disease, in addition to the hazards of drought and desertification.

According to UNEP (1992), drylands that are already desert and those that are arid, semi-arid and dry sub-humid cover 1959 million hectares or 65% of the continent (Table 1). If we exclude the hyper-arid deserts which cover one-third of the drylands, then the remaining two-thirds or 1277 million hectares make up the arid, semi-arid and dry sub-humid areas.

Table 1. Extent of drylands, susceptible areas and population

Aridity Index	Ecosystem	Extent (Mha)	Population (million)	Density (per km ²)	Desertification status
< 0.05	Hyper-arid	672	58 (9%)	8.6	Not affected
0.05-0.20	Arid	504	41 (6%)	8.1	Affected
0.21-0.50	Semi-arid	514	118 (18%)	22.9	Affected
0.51-0.65	Dry Sub-humid	269	109 (16%)	40.6	Affected

% figure represents % of total population of Africa and the population figures are for 1994.
Source: UNEP (1992, 1997a).

These are the areas prone to desertification and, according to UNEP (*ibid*), contain a population of about 400 million (two thirds of all Africans). Subsequent re-evaluation of the population on the basis of the 39 countries identified as susceptible to desertification in the drylands for the second edition of UNEP's World Atlas of Desertification, has put the total population figure at about 298 million (UNEP, 1997a: 105)

UNEP's 1991-92 assessment shows that 998 million hectares of rangelands (or 74% of their total area), 48.7 million hectares of croplands (or 61% of their total area), and 1.9 million hectares of irrigated croplands (or 8% of their total area) are affected by desertification at moderate to

is mostly by degradation of the natural vegetation partly accompanied by serious deterioration of soil. Despite the unreliability of the data these findings definitely indicate a dramatic situation in the land resources of the drylands of Africa.

Most recently, an interesting estimate has been made by Reich *et al.* (2001) that appears to confirm how severe and widespread desertification hazard is in the drylands of Africa. Applying a radically different approach, including the use of GIS, Reich *et al.* assessed what they called 'vulnerability' to desertification, using information on soils, climate and previously evaluated land resources. A global soil and climate GIS database of Africa developed by Eswaran *et al.* (1970) was used to

Table 2. Status of desertification/land degradation in the drylands of Africa

Irrigated land			Rainfed croplands			Rangelands			Total agriculturally used drylands		
Total (M ha)	Degraded (M ha)	%	Total (M ha)	Degraded (M ha)	%	Total (M ha)	Degraded (M ha)	%	Total (M ha)	Degraded (M ha)	%
10.42	1.90	18	79.82	48.86	61	1342.35	995.08	74	1432.59	1045.8	73

Source: UNEP, 1992.

higher levels (Table 2). According to the estimates, 73% of all agriculturally used drylands in Africa is affected to some degree by various forms of land degradation. This

provide the biophysical resource database. According to this study, desertification processes currently affect 46% of Africa and a total population of 485 million. There

Table 3. Estimates of areas vulnerable to desertification

Vulnerability class	Area subject to desertification		Population affected	
	km ²	%	Million	% of African population
Low	4,225,000	14.2	154.5	19.9
Moderate	4,741,000	15.9	196.1	25.3
High	3,213,000	10.8	134.8	17.4
Very high	1,466,000	4.9	22.4	2.9

Source: Reich *et al.* (2001)

are about 4.2 million km² (14.2%) under low risk, 4.7 million km² (15.9%) under moderate risk, 3.26 million km² (10.8%) under high risk and 1.5 million km² (4.9%) under very high risk (Table 3). The study notes that practically every country in Africa is prone to desertification, but the Sahelian countries at the southern fringe of the Sahara are the most vulnerable.

National surveys of desertification reported by UNEP in its Desertification Control Bulletin (for example, No. 20, 1991) also reveal that desertification is widespread. In Sudan, for example, desertification affects 1.6 million hectares of irrigated farmlands (94% of the total), 8.8 million hectares of rainfed croplands (82% of total), and nearly 97 million hectares of rangeland (Kassas *et al.*, 1991). In the northern and north-eastern regions of Nigeria, 12.5 million hectares are subject to ecological degradation (*ibid.*). A national land degradation assessment and mapping in Kenya in 1997 shows that out of 275,482 km², approximately 91,807 km² (33.3%), 142,729 km² (51.8%), and 33,768 km² (12.3%) of the land area in the country are subject to slight, moderate or severe hazard of land degradation, respectively (UNEP, Government of the Republic of Kenya, and Royal Netherlands Government, 1997).

In South Africa, Hoffman and Ashwell (2001) have determined the status of land degradation by compiling comparative land degradation statistics and presenting three categories of maps that show Soil Degradation Index (SDI), Veld Degradation Index (VDI) and Combined Index of Land Degradation (CDI). Their maps reveal that the problem of desertification appears most severe in communal districts of Limpopo Province (Northern Province), Kwazulu Natal and Eastern Cape. In the absence of adequate statistics about the status of soil and vegetation resources in South Africa, Hoffman and Ashwell used a novel approach in which they drew on census figures and the scientific literature in combination with PRA approaches, involving a series of 34 workshops with agricultural extension officers and resource conservation technicians to arrive at their land degradation indices.

Apart from the figures in Table 2 for land losses for irrigated land, rainfed cropland and rangelands there are no reliable data on the present rate of desertification in Africa. However, according to UNEP (2000), an estimated 5 to 6 million hectares of productive land are affected by land degradation each year in Africa. Certain local studies using different diagnostic indicators also provide more detailed

additional information and a few examples will suffice. In the Baringo study area of 360,000 hectares in Kenya, calculations give the rate of vegetation degradation as 1625 ha per year which gives the annual desertification rate of 0.6% (Kassas *et al.*, 1991). In Marsabit district, also of Kenya, calculations give the rate of vegetation degradation as 17,937 ha per year or an annual desertification rate of 1.3% (*ibid.*). In Tunisia, calculations give the average annual loss of productive land by desertification of around 10,000 hectares within the last century. Thus the average annual desertification rate of 10% is characteristic of the desert fringes of Tunisia.

In summary, while the areas at risk of desertification in Africa are more easily identified, quantifying desertification and determining the exact extent and rate, however have been problematic. A major problem is the lack of reliable data. Much of the data currently available and being used in assessments is suspect. Identification of desertification in Africa is an uphill task over which there is little unanimity on how to approach it.

Currently much debate is raging as to how much of Africa is desertified and at risk from desertification. This is generally because of the different operational definitions being applied, the difficulties of monitoring and the use of different criteria (Thomas and Middleton, 1994). Also, because of the difficulty of precisely defining and measuring desertification, and the widely held paradigm that dryland ecosystems are highly resilient, a second major controversy is presently brewing on whether or not desertification is actually occurring in several of the susceptible

drylands in Africa. The latter dispute has become a classic example of arguments between pessimists and optimists, or neo-Malthusians and Cornucopians

Pessimists believe that despite the measurement and definition problems, desertification is real and poses a threat to land and livelihood. They are concerned about the threat and believe that the sooner we combat desertification the better for a sustainable future for Africa. The optimists on the other hand dispute the evidence for desertification. They argue that if identifying desertification means identifying irreversible damage, then this is actually quite difficult because many ecosystems have considerable capacity to recover from natural cycles of climatic change or human intervention. They believe that dryland ecosystems, especially rangeland ecosystems, are highly resilient and that the state of rangeland ecosystems in arid and semi-arid areas in Africa is determined more by stochastic abiotic factors, notably the highly irregular supply of rainfall than anything else. In view of these convictions, optimists think that pessimists have exaggerated the extent and scale of desertification in drylands. In their view, there is no cause for alarm. Their arguments are a total rebuttal of proposals put forth by those who believe that desertification is a serious issue.

The views of the optimists stem mainly from the pioneering work of Behnke and Scoones (1993) on non-equilibrium or so called Disequilibrium Theories of Range Ecology (DTRE) which were formulated to improve dryland management in Africa following the repeated failures of conventional management strategies. DTRE

rejects the old notion that dryland ecosystems follow equilibrium dynamics. Instead such systems are characterized by high levels of temporal and spatial variability. DTRE explicitly recognizes the resilience of the savannas, and, because of this resilience, arid and semi-arid ecosystems are deemed not prone to collapse even under heavy grazing pressure (Brockington and Homewood, 1996). As Lykke (2000), however, has recently pointed out, the ecological aspects of DTRE are to a large extent theoretical or based upon extrapolations from a few case studies, atypical for African rangelands in general. Reviewing a number of relevant field-based studies, Lykke (*ibid*) has reached the conclusion that disequilibrium systems as described in Scoones (1996) are, from an ecological point of view, the exception rather than the rule, since they are primarily based on the scientific work from two projects: one from Turkana district in Kenya and the other from Minindee district, Australia. The ecology of the two reference areas is not typical for arid and semi-arid zones in Africa and "it is not feasible to extend the scope of the 'new ecological thinking' to Sahelian realities by merely extrapolating from these two areas to arid and semi-arid areas in general" (*ibid*).

Causes

That natural and anthropogenic factors are the driving forces of desertification in Africa cannot be disputed. What is disputable is their relative importance. In the current raging debate in the literature, three schools of thought can be identified: those who identify natural factors such as climatic variations as the major cause, those

who lay the blame squarely on such human activities as overgrazing, overcultivation, deforestation and poor irrigation practices, and those who attribute equal responsibilities to natural and human activities (Smith and Koala, 2003). I believe that desertification is a complex multifaceted problem in which natural and human activities are inextricably intertwined and operate in different mixes depending on the local situation. Therefore to try to separate them into primary and secondary causes would be foolhardy as they often pose the chicken and egg problem. I, therefore, group them under direct causes, in contrast to socio-economic and political factors.

Direct Causes

Climate

From all available accounts, drought if not prolonged, does not in itself pose an intractable threat to the long-term viability of rural production systems in the drylands of Africa, but it accelerates negative consequences of resource abuse. Overuse of one renewable resource in turn often reduces viability of others, and this negative dynamic intensifies when drought periodically strikes the area (Gorse and Steeds, 1987). Droughts are short-term (1 to 2 years) deficits in rainfall. Productivity loss during drought can generally be accommodated by existing ecological, technical and social strategies. Long-term (of decadal order) deficits in rainfall (desiccation) seriously disrupt ecological and social patterns and require national and global responses. Generally, however, neither drought nor desiccation *per se* will

give rise or cause desertification in dryland areas. Much depends on the resource management in these areas. When human mismanagement weakens the natural system, drought and desiccation often lead to desertification (WMO, 1983; Darkoh, 1989, 2003).

The definition of desertification provided by UNCED in 1992 cites climate variation as a direct causal factor and implicitly links desertification with climate change. "Climatic variation" or "climate change" refers to short-term climate variability and longer-term climatic trends or shifts caused by natural mechanisms or by human activity (Kelly and Hulme, 1993). Climate change does cause global warming often through greenhouse gas emissions (GHGs). However, it is not known to what extent GHGs released from Africa under dryland systems of land use are enhancing the earth's warming. Research is continuing in this sphere.

That climate change is occurring in Africa is now an established fact. In the Sudano-Sahel, as Nicholson (1978), Kelly and Hulme (1993) and Hulme and Kelly (1993) have amply demonstrated, annual rainfall during the most recent decades (1961-1990) has been between 20 and 40% less than it was from 1931 to 1960. Within contiguous Africa, Kelly and Hulme (*ibid*) have shown that there has been a net-shift toward aridity, especially toward hyper-aridity and a consequent net loss of semi-arid and dry subhumid land. However, determining the precise contribution of climate change to the problem of desertification in Africa is problematic.

Human activities

The human activities that contribute directly to desertification include overgrazing, overcultivation, deforestation without reforestation and inappropriate use of irrigation technology. These lead to an acceleration of processes already common in African drylands, e.g., the physical and biological degradation of soils, wind and water erosion, and soil salinization. For example, on rangelands overgrazing leads to a diminution of the sparse vegetation in addition to soil compaction, which then often leads to soil erosion. Soil erosion is also the greatest threat in areas of rainfed cultivation. In irrigated areas the dominant processes are waterlogging and salinization. These human disabling activities have been discussed extensively in the literature (see, for example, Wellens and Millington, 1992; Darkoh, 1993; 1996a and b, 2003a). The stresses posed by these activities are fuelled by local and external forces such as population pressure, urbanization, poverty, land ownership, inequitable distribution of resources, conflicts, national policies, globalization and the new economic order, which are discussed below.

Indirect Causes

Population pressure

Smith and Koala (2003) explain the impact of population growth on natural resources in two ways. Firstly, increased population means increased demand for food, which has to be produced, by increasing productivity (yield per hectare) or production (area under cultivation). In most cases the additional food comes from the latter, including an expansion into marginal and fragile land that are highly

susceptible to degradation. Secondly, increased family size means a parcelling of land resources with each subsequent beneficiary owning an increasingly smaller plot, which is then overcropped with all the known environmental consequences.

However, others (e.g., Lockwood, 2000) have pointed out that there are two opposing views on population and local environmental change in Africa, closely related to the pessimist and optimists views I have described already. One approach which is Malthusian, sees population growth leading to increased demand and increased use of land with dire environmental consequences as indicated above. The opposing idea, that population growth might have a positive influence on the productivity of environments, is associated with Boserup (1965). According to Boserup, as populations on land grow, the demand for food and marketable crops does indeed increase, and fallow periods shorten. But, rather than this leading to declining productivity and land degradation, it spurs the application of more labor, complementary inputs and new technologies which enhance yields and improve the quality of the land. Tiffen *et al.* (1994) have found collaborating evidence for this Boserupian principle in the Machakos district of Kenya. Thus, it can be concluded that population pressure in Africa can lead either to degradation or to conservation pathways.

Urbanization

Urbanization has a multi-faceted impact on the surrounding countryside, concentrating demand at specific points within marginal environments (Gorse and Steeds, 1987). Rural areas close to urban centres rapidly lose vegetative cover to

meet the demand of the adjacent urban area. Even at the lowest end of the settlement hierarchy, Mainguet (1994:54) notes that around the villages of the Sahel and the north Sudanian zone, the duration of the fallow is not sufficient to restore the fertility of the soil, and rings of deteriorated soil surround the villages. Also notable about urbanization is that growing urban populations exert political pressure on regimes to maintain cheap urban food and fuel wood pricing policies. These reduce farmers' incentives to use inputs to produce foodstuffs more intensively, to plant trees and, in short, to invest in land and in the renewable resource maintenance necessary to sustain the rural base of production.

Poverty

Poverty in Africa has close links with population, urbanization and several other socio-economic factors. Poverty affects practically everyone in the drylands of Africa – from the rural farmer who, since she/he cannot purchase the inputs that would allow more intensive agricultural production, must permanently clear new lands every few years – to the national governments who must use their foreign exchange earnings to service external debts, crippling their ability to invest adequately in land conservation measures. Poverty means people and nations have no surplus resources and this implies that any shock may result in the mining of the environment. Impoverished people would exploit their limited resources to meet immediate and pressing needs even if such short-term exploitation would compromise the long-term stability of such resources.

While these views are true, there has emerged in recent years, a new school of thought that downplays the role and impact of poverty and population pressure on land degradation and emphasises the importance of economic growth if the land degradation problem is to be solved in the developing world. This view, that for convenience, I have designated elsewhere as post-Bruntland view (Darkoh, 2003b), is held mostly among economists. It states that environmental degradation, as economic growth accelerates, is underpinned by a theoretical principle known as Environmental Kuznets' Curve (EKC). This principle, which is similar to the demographic transition theory, states that in the initial phase of economic development a country experiences poverty and increasing environmental degradation but after attaining a certain income threshold, this degradation subsides as further development continues (Kuznets, 1955; Panayotou, 1995; Perrings, 2000; Opschoor, 2003). Thus EKC postulates that environmental degradation follows a quadratic path with respect to income and economic growth. According EKC, while there may be negative environmental effects during the early stages of growth, these are counteracted by later environmental quality improvements as incomes and living standards improve. Nevertheless, there is little guarantee that without appropriate interventions (e.g., soil conservation measures, education, family planning) environmental quality will improve as per capita income rises. Studies are on going at present to test this principle in southern and eastern Africa (Opschoor, personal communication).

Land tenure and lack of property rights

With the advent of political independence, there has been a juxtaposition of modern private and traditional land tenure systems. New political realities have, however, sufficiently weakened the latter, to make the tragedy of commons a common phenomenon in the drylands of Africa. Where property is communally or governmentally owned and treated as a free resource, resources will inevitably be overused with little regard to future consequences. Because of the absence of property rights, individual benefits are more likely to be maximized at the expense of the communal resource as in several instances there are virtually no incentives to use resources sustainably. In addition, customary land tenure practices and indigenous knowledge and practices that conserve biodiversity that were more appropriate to local conditions have often been ignored by the State or have been replaced by laws and policies that contribute to land degradation (see below, under National Policies).

Inequitable distribution of resources

There is a gender-bias in land resource distribution. Not only are women marginalized, but also small-scale producers, pastoralists, ethnic minorities, and indigenous communities. In most rural communities in the drylands, women are at least as important, if not more so, than men in contributing labor, products and income to the family; yet they have little formal say in making decisions about management questions. Existing traditional systems of inheritance discriminate against women as do also the privatization and

individualization of land where traditional usufruct rights have been replaced by legal formalization of group or individual systems of land ownership. Gender discriminatory land tenure laws have increased the intra-household struggle between men and women over access to land resources. Patriarchal practices are still prevalent in many countries in Africa, leading to higher levels of landlessness and poverty among women in both rural and urban areas (Kalabamu, 1998). In some countries, governments have appropriated and nationalized resource systems such as forests and wildlife, curbing access to them by small-scale farmers, pastoralists and indigenous communities. Such marginalized groups that have little or no access or control over land cannot be expected to exploit natural resources sustainably, and they often do not (Smith and Koala, 2003).

Conflict

Disputes, tensions and armed conflicts have adversely affected and continue to affect several countries in the drylands, particularly in eastern Africa. Civil wars between the north and south in the Sudan and between factions in Somalia have yet to end. The massive conflict in Ethiopia and Angola has ended with a legacy of destruction. In the dry pastoral zones, armed conflicts have resulted from disputes over access to resources. Conflicts in various instances have (a) diverted resources, money and manpower that might otherwise have been used for environmental and developmental purposes; (b) prevented villagers and pastoralists from carrying out their normal way of life, forcing them to use untried methods and new areas; (c) led to actual destruction of the environment

in places and (d) displaced people and created refugees who have then concentrated in camps and towns where they exert intense pressure on the local environment (UNSO, 1992).

The Office of the UN High Commission for Refugees (UNHCR) found that based on 1989 estimates, roughly 11 million trees were cut for shelter needs during the initial period of refugee influxes in Africa (Cardy, 1994). This represents the deforestation of over 12,000 hectares. In addition, about 4 million tons of woodfuel were consumed by refugees in Africa.

National policies

Rural development and agricultural policies since independence have often contributed to land degradation. These include the policies related to the excessive development of cash crop for export, policies for sedentarization of nomads, villagization, low prices for agricultural products (which favour basically the urban population rather than the farmers), and nationalization of land by the State, which weakens the traditional system of range management (ibid).

Globalization and the new economic order

Economic factors and mechanisms at international, national and sub-national levels have contributed to land resource degradation in Africa (Krugmann, 1995). Foreign debt obligations, international trade patterns, economic policies in Western industrialized countries and structural adjustment programs being implemented in African countries, taken together, appear to have compounded the desertification problem (ibid).

African countries are suffering from massive international indebtedness and at the same time, declining terms of trade, have forced the countries to expand exports based on agricultural commodities in order to generate the necessary foreign exchange. The coincidence between indebtedness and export dependence is now quite striking in Africa. Locked into the role of natural resource exporter, most African countries have not been able to diversify their economic base (ibid).

As per capita income growth has stagnated or declined and foreign investment aid had lagged far behind debt payments, Structural Adjustment Programmes (SAPs) have been imposed on many of the countries as a precondition for further aid and a palliative for addressing the internal and external macro-economic imbalances in the national economies. SAPs advocate market mechanisms to achieve efficiency improvements on the supply side of the economy. SAPs do not integrate considerations of environment or social equity. To date, environmental effects of SAPs have not received much attention. Limited assessment and experience suggest that such effects can be positive or negative, depending on particular socio-economic and ecological conditions (ibid). However, in the case of the drylands of Africa, there are indications that point to a range of net negative environmental impacts (ibid). Trade liberalization is an important component of SAPs. That too does not directly address the negative environmental impacts (in the drylands). However, it does affect production patterns and incomes and therefore has an indirect effect on environment.

Massive agricultural and livestock subsidies in Europe and North America are distorting world food markets. Exports by subsidised Northern agribusiness are undercutting price incentives for agricultural and livestock producers in Africa. At the same time, continued protectionism on the part of industrial countries, by way of non-tariff barriers to imports as well as subsidies to domestic producers, have constrained Africa's access to Northern markets.

Land and natural resources in local African economies are fast becoming market commodities as the national and global cash economy penetrate into previously traditional areas. Throughout the drylands of Africa, the process of globalization and commercialization of local marketing, trade and natural resource based livelihood systems and their increasing dependence on distant economic forces are destabilizing traditional social support and risk sharing mechanisms and bringing about strong social stratification and rapid cultural change.

The foregoing are some of the social, economic and political disabling factors, which foster land degradation in the drylands of Africa. If stresses from these underlying factors are not contained, the efforts directed at the direct causes can only be cosmetic and desertification will unabatedly continue in the drylands of Africa. Also, at present little detailed empirical information exists on the impact of socio-economic factors and policy on desertification in Africa. To date, for example, there are no significant studies that have assessed and monitored human reactions to desertification (Darkoh, 1996). More research is urgently needed.

Consequences

The effects and consequences of desertification are well known, and include loss of vegetation, wind and water erosion, loss and/or impoverishment of land resources, reduced food production and productivity, food insecurity, hunger and malnutrition, loss of biodiversity including medicinal plants, climate-related problems, including health hazards from dust particle movements, environmental refugee problems, loss of livelihood systems, disruption and break up of social structures, social unrest and political and armed conflict (Darkoh, 1996a, b, 2003a; Smith and Koala, 2003). Also, serious off-site impacts of land degradation include siltation and pollution of reservoirs, lakes and coral reefs with consequent impacts on aquatic biodiversity (UNEP, 2000). The prospect of climate change represents another potential threat to the productivity of African drylands. One study has concluded that atmospheric warming could lead to a significant decline in crop yields in tropical areas, hitting Africa particularly hard (Monastersky, 1992).

Unfortunately, despite growing concern, no exact or reliable figures are available to quantify the economic costs of desertification either for individual farmers or society in the drylands as a whole. However, some rough estimates have been made. Income losses from desertification have been estimated at US\$ 42.3 billion annually worldwide and US\$ 9.3 billion for Africa at 1990 prices (Dregne *et al.*, 1991). For rangelands, rainfed and irrigated croplands in Africa, annual losses have been calculated at US\$ 6.9, US\$ 1.9 and US\$ 0.5 billion, respectively (ibid). One

unpublished World Bank study estimates that the equivalent of 20% of the annual GDP of one Sahelian country could be lost through capital depletion of natural resources (Cardy, 1993). In Namibia, the monetized cost of land degradation at household level aggregated over a standard period for a communal area (Ukwalundi) has been estimated at US\$ 2,065 to 2,565 (Quan *et al.*, 1994). And, on the impact of climate change, in one simulation, Monastersky (ibid) found that some African countries could see agricultural output decline by 30 to 50% by the year 2060, even if modest technological and management adaptations to try to cope with climate change were introduced. While such studies admittedly represent very preliminary efforts at quantifying the effects of desertification and understanding the complex environmental trends, they indicate that Africa is becoming increasingly vulnerable to changes both within and beyond its control.

Desertification Combat in the Drylands

Over the past three decades there have been major efforts to combat desertification in the drylands of Africa. Projects related to desertification that have been promoted include, sand dune fixation, reforestation and community woodlot projects, provision of substitutes for fuelwood, range management and water provision, monitoring, training, planning and more general resource management assessment. Other projects address the establishment of new livelihood systems that relieve pressure on dryland ecosystems.

In the last few decades some advances have also been made in the strengthening of existing institutions and the creation of new ones to help combat desertification. For example, in the Sahel, institutional development have included the establishment and strengthening of international institutions (the expanded role of UNSO, the Desertification Branch of UNEP and the *Institute du Sahel*), and new emphasis in the activities of national institutions such as the United States Academy of Sciences (Academy Committee on Sahel) and the bilateral assistance programs of Canada, Denmark, Finland, Italy, the Netherlands, Norway Sweden and the United States of America. Within the affected countries helpful institutional adjustments have also taken place at national and regional levels.

National environmental institutions (ministries, departments, commissions, and so on), non-governmental organizations (NGOs), advocacy groups, and private sector institutions have been strengthened or established to take responsibility for the environment and to promote sustainable development policies and programs. In many countries, however, institutions are still weak and not adequately equipped to implement their functions (UNEP, 1997b). These shortcomings stem from many factors, including a serious shortage of skilled staff, the absence of adequate training facilities, lack of integration and cooperation among major institutions, and counterproductive government policies and legislation (*ibid*).

Regional actions on land degradation in the drylands of Africa have also been strengthened directly and indirectly through

sub-regional institutions such as the Arab Maghreb Union (AMU); the Permanent Inter-State Committee for Drought Control (CILSS), which has instated two specialised agencies – AGRHYMET in Niamey and INSAH in Bamako; the Economic Community of West African States (ECOWAS); the Inter-governmental Authority on Development (IGAD), formerly known as the Inter-governmental Authority on Drought and Development IGADD); and the Southern African Development Community (SADC). For example, under SADC, the Environment and Land Management Sector (ELMS) has developed an environmental and sustainable development policy and strategy that deals with land degradation issues, and the Southern African Centre for Co-operation in Agricultural and Natural Resources Research (SACCAR), established in 1984, coordinates and promotes co-operation in agricultural research and natural resources and training activities. High regional forums have also been established to formulate regional policies and programmes dealing with environment and sustainable development issues. An example is the African Ministerial Conference on the Environment (AMCEN) established under the auspices of UNEP in 1985. This forum has recently been charged with the special role in the implementation of the Convention to Combat Desertification, through its Committee on Desert and Arid Lands (ADALCO). Other examples of regional activities include the Desert Margins Programme, a project coordinated by the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) which addresses problems of food security, poverty and sustainable management of natural

resources and promotes innovative and action-oriented dryland management research to arrest desertification in sub-Saharan Africa. This project is currently being implemented in the affected areas of Botswana, Burkina Faso, Kenya, Mali, Namibia, Niger and South Africa (*ibid*).

Since the 1970s, nearly all countries in the drylands of Africa have been engaged in strategic planning processes, either along with macro-economic reform policies or to implement international conventions and programs (UNEP, 1997b). National Environmental Action Plans (NEAPS), National Conservation Strategies (NCSs), National Plans of Action to Combat Desertification (NPACD) are playing significant roles in integrating environment and development in the countries. At present about 80% of the countries in Sub-Saharan Africa are involved in the NEAP process and other countries are preparing or implementing similar kinds of environmental strategies (World Bank, 1995). The adoption of Agenda 21 by UNCED in 1992 provided the road map to implement sustainable development in which environmental, social and economic considerations blend in mutual support. United Nations agencies, especially UNEP, UNDP, FAO and UNESCO have independently and jointly played catalytic roles in developing and fostering national, sub-regional and regional action programs in combating desertification in Africa, that proactively address the integration of environmental considerations in development planning in African countries.

Environmental education, training and information have also been emphasized in

several countries and research, especially on dryland degradation and sustainable development, has been strengthened with support from bilateral and multilateral organizations and institutions. Widespread increases in the awareness of the problem of desertification have led to increases in donor assistance to several countries in the drylands. For example, before 1975, assistance to the Sudano-Sahel countries was about US\$1,700 million annually, 28% of total African assistance. In 1980 assistance to these countries totalled over US\$4,700 million, over 34% of total African assistance (UNEP, 1984). The dearth of finance for anti-desertification activities, however, is still a major constraint. Within this major donor effort, there has been some focus on issues related to desertification and drought. For example, out of the US\$ 4,700 million received in development assistance annually by the countries of the Sudano-Sahel region, an estimated US\$150 million, or about 3.5%, has been allocated directly to desertification control (*ibid*). The success rate of the projects has been difficult to determine for the following reasons: many have not been properly evaluated and monitored, and desertification control projects generally have long gestation periods.

One might ask whether overall, the dryland countries in Africa are winning the fight against desertification after more than two decades since the United Nations first mobilized international support through UNEP to help these countries combat desertification and cope with the threats of drought. Based on achievements in the field, the answer to this question is that there is little indication that the fight against

desertification is being won and UNEP itself admits this. A few battles have been won, for example, against sand dune encroachment, deforestation and soil erosion in a few countries, but in several of them the problem has been judged to be significantly worse in the last three decades. The limited success has been attributed to several factors: lack of political will, lack of funds, lack of people's participation, lack of coordination, destructive land tenure policies, war, misdirected research priorities, and failure of national governments to make desertification a priority (Darkoh, 1989, 1993). An estimated 90% of the activities related to desertification control are not directed to field projects but to planning and co-ordination, infrastructure, and public awareness (Stiles and Brennan, 1986). In a Conference of Parties (COP) of the Convention to Combat Desertification (CCD) meeting in Bonn in March to April 2001 and also at the Johannesburg Summit, African delegates made a strong plea for combating land degradation and emphasized that mobilization of resources still remains a core challenge in the battle against desertification. Likewise concerns were raised for the lack of transfer of technology. In addition, they stressed their disappointment with the response from developed country Parties, particularly the absence of concrete partnership arrangements. African countries also called for strengthening of sub-regional and regional bodies engaged in the implementation of the Convention as well as further empowerment of civil society and capacity building in the training and educational area. If the actions proposed at the Earth Summits in Rio and

Johannesburg are not backed by adequate resources and field projects at local and national levels, Agenda 21 the blue print for action into the 21st century and the Desertification Convention, as well as the Johannesburg Protocol on Land Degradation, would fail just as their predecessor, the United Nations Plan to Combat Desertification, has failed.

Conclusion

Most nations in the drylands of Africa are aware of the desertification phenomenon and are disregarding the optimists' view that there is no desertification. The causes of desertification are both natural and anthropogenic. The natural causes, though predictable at times, are inevitable and very difficult to prevent. On the other hand, land degradation that comes as a result of human activity on the environment, can be prevented. However due to socio-economic and political problems, it has proved very difficult to combat desertification.

I believe that there can be no single set of solutions for such a complex problem as desertification. A multifaceted approach is required if the drylands in Africa are to be managed in a sustainable manner. I also believe that the Convention to Combat Desertification provides such a framework. The Convention has pointed out the need to develop a knowledge base through appropriate research, the need for transferring and sharing technology, the establishment of partnerships at the local level, the adoption of a bottom-up and integrated approach and the need to pay special attention to the economic environment.

What I want to stress, however is that, given the increasing globalization of economic systems and environmental impacts, it is now imperative that the world's nations collaborate to find the means to adapt the evolving needs of humans to the finite resources of the natural environment. In the drylands of Africa, the solution to this challenge will require combining the strengths of both African and non-African knowledge systems. Centuries of experience in managing difficult and risky environments have enabled African dryland producers to identify their production constraints and both select from and experiment with new options as they become available to them (Mortimore 1998: 194). Africans can no longer rely solely on the traditions that once clearly defined their role and position in the natural world (WFF, The Nature Conservancy and USAID 1993). To overcome the obstacles they face, Africans will need many of the technologies that Western science has developed. Yet Africans must use their intimate knowledge of the environment, adaptive capabilities and the role of people within to select, modify and adapt these outside technologies if they are to work effectively within an African social and ecological context. Equally or even more important is an enabling environment that ensures increased social democratization and alleviates the oppressive poverty and other underlying driving forces continuing to suffocate African productivity and sustainability of natural resources.

Finally, the creation of mechanisms to facilitate the active involvement and participation of communities and people

at local level cannot be overstressed. People, information and policies need to be linked to achieve integrated development. Institutional arrangements for involving all stakeholders in the management of natural resources need to be created. While many governments are increasingly recognising the importance of community empowerment in resource management, it is clear that nothing will change until the government institutional frameworks expand and evolve to include the community voice. At the same time it is impossible to empower the community with any approach, no matter how well intended, if it is top-down. Herein lies the conundrum. A new way for government and people to work together must be fostered which embraces this 'community voice' at planning and policy-setting stages; which guarantees delivery of appropriate decision-support information; which provides incentives for cooperation at the grassroots and which commits public resources to institutional tools that strengthen the process and removes those that limit it (UNEP and FAO, 1997).

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