INTRODUCTION
Since the advent of the Sahelian drought in early ‘70s, an intense debate over the desertification phenomenon has been raging. The debate has generated some new knowledge, raised interest in, and stimulated commitment to, controlling the phenomenon. But it has also generated some myths, to the extent that some have begun to question the existence of desertification. The issues around which certain myths have been built, and which tend to detract attention from the pressing realities of combatting it and alleviating its effects, include:

- The historical perspective -- Is it a recent or an old and time-tested phenomenon?
- The definition and its extent -- What is desertification, and how common or serious is it?
- The causes and process -- What are the responsible factors and how does it develop?
- The consequences -- What are its visible and not so visible effects? and,
- The remedies and control -- How can we combat it?

This document presents an overview of these issues, with the goal of identifying and
contrasting myths and realities. Some of the former have the potential to confuse issues and negatively impact on policy decisions, actions and approaches required to tackle the problem effectively.

**HISTORICAL PERSPECTIVE**

Desertification is a not a new problem. Archaeological and historical evidence suggest it began several centuries ago (Olson 1981, Grainger 1990), and can be traced back to the mediaeval, and even the neolithic period (Spooner 1989). Recent events following the 1970 African Sahel drought that thrust the issue unto the global agenda, have created the impression, or the myth, that it is a recent and pressing issue.

Inappropriate traditional agricultural methods were apparently responsible for the degradation of the Negev several centuries ago. According to Evanari et al. (1971), soil evidence indicated that a system of narrow-terraced wadis and farm units with small watersheds, which fitted well into natural soils landscapes without damaging the environment, was abandoned for larger catchments systems. These systems eventually led to soil erosion, silting up and destruction because yield demands were greater than the soil and water resources that the landscape could bear. Thomas and Middleton (1994) suggested, however, that climate change might have also contributed a fair bit; they indicated that geological and geographical evidence suggest that the Negev enjoyed a humid climate from about 100 BC to about AD 300. After that it became drier, reaching a critical threshold at about AD 500. Another lesson of land abuse that led to degradation from the distant past comes from the Maya areas of Central America. According to Olsson (1981), soil evidence suggests that the Maya farmed the Valle de Naco in Honduras more than 1,000 years ago. With time, the population expanded into the hills around the valley site, and cleared the upland forests for cultivation. Eventually, the upland was degraded, and its yield declined. The valley flooded because of excessive soil erosion in the upland, the population declined, and the civilization collapsed. More recently, reports of land
degradation leading to desert like conditions were quite frequent in the early part of this century.

Incompatibility between the farming systems, climate and soil status, as well as a premium for political and economic considerations over sustainable land management approaches were responsible for the unprecedented wind erosion in the American Great plains. This resulted in ecological catastrophe and human misery associated with the Dust Bowl of the 1930s 1950s and 1970s. At about the same time the American Great Plains Dust Bowl was raging, Stebbing (1938) called attention to ongoing forest degradation in West African Soudano Sahelian region. A deforestation process, which according to his observations led to erosion, was helped along by sand blown from the Sahara being deposited on denuded land. He referred to this process as the "encroaching Sahara."

In 1927, the term desertification was coined by the French scientist and explorer Louis Lavauden, and popularised by André Aubreville in 1949. In other words, desertification entered into popular language several decades before the Sahelian drought of the ‘70s.

The reality is that desertification is not a new, post-1970 Sahelian drought phenomenon, but an age-old phenomenon dating back several centuries. What is new is its conceptualization and popularization as one of the creeping environmental phenomena of devastating local consequences, but with equally alarming global impact, to which the global community should pay commensurate attention.

DEFINITION

What is desertification? This question has been answered in many different ways by many scientists and institutions who have attempted to define and describe it. In a review of the literature on desertification, Glantz and Orlovsky (1983)
reported encountering more than one hundred definitions of desertification. Since its popularization by Aubreville (1949), the term has apparently presented a conceptual and descriptive dilemma to researchers and institutions; each has emphasized aspects and perspectives related to their disciplines or institutional interests, and has defined desertification differently with respects to a number of important characteristics. The result is a great diversity of definitions, with some contradiction, misunderstanding, confusion, institutional and disciplinary biases and myths about the nature of the phenomenon.

In its original form, as presented by Aubreville (1949) (who is considered the father of the term), desertification was referred to as a human-induced process of degradation that transformed tropical forest into savanna, and savanna into desert-like regions. Since then, others have come up with definitions that consider the phenomenon as a process of change (Rozanov, 1990), as an event or the final phase of the process of change (Mainguet, 1991), or a combination of the two. Still others have included in the definitions, a number of descriptors to indicate the form of change (destruction of the biological potential of land - UN, 1977), the location of the change (usually drylands - UNCED, 1992), the reversibility of the change (Nelson, 1990), and the cause of the change (people related activities - Thomas and Middleton, 1994; climate variability - Tucker et al., 1991; or both climate and people related activities - UNCED 1992).

We reproduce below, some of the more prominent definitions to capture the variability hinted above.

Desertification is the notion that the extent of deserts - dry areas with few plants - is increasing, usually into the semi-arid lands (Warren and Agnew 1988).

Desertification is the impoverishment of terrestrial ecosystems under the impact of people. It is the process of deterioration in these ecosystems that can be
measured by reduced productivity of desirable plants, undesirable alterations in the biomass and the diversity of the micro and macro fauna and flora, accelerated soil deterioration, and increased hazards for human occupancy (Dregne, 1986).

Desertification is the diminution or destruction of the biological potential of the land that can lead ultimately to desert-like conditions. It is an aspect of the widespread deterioration of ecosystems and has diminished or destroyed the biological potential, i.e. the plant and animal production, for multiple use purposes at a time when increased productivity is needed to support growing populations in quest of development (UN, 1977).

Desertification is a process of sustained land (soil and vegetation) degradation in arid, semi-arid and sub-humid areas, caused at least partly by people. It reduces both resilience and productive potential to an extent which can neither be readily reversed by removing the cause, nor easily reclaimed without substantial investment (Nelson, 1990). Desertification is land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors, including climatic variations and human activities (UN, 1992). This working definition was agreed upon recently at the 1992 United Nations Conference on Environment and Development.

This plethora of definitions might give the impression that the phenomenon is well-understood, but that is a myth. In reality, it hides a lack of knowledge of what it is. This apparent uncertainty has led to a misunderstanding as to how to tackle it effectively. This science and/or institutional-based paradigm diversity is unfortunate, because policies are often guided by scientific knowledge and outputs, and probably account for the perceived lack of progress in combatting desertification. As a final reality check on the issue of definitions, we call attention to the fact that current definitions which focus exclusively on drylands, would
exclude Aubreville’s observation as to where it could occur. We believe the process could occur anywhere except perhaps in the desert itself, and make a plea to broaden the contemporary view as to where the process might occur.

**EXTENT AND MAGNITUDE**

The literature on desertification suggests that about 33% of earth’s surface is susceptible to desertification. This proportion represents all of the global dryland (arid, semi-arid and dry sub-humid) totalling about 51,720,000 square kilometres (5.2 billion hectares). Apparently 70% of this land mass is already subjected to varying degrees of degradation. According to Dregne and Chou (1992), the proportion is that high because of the dominance of rangelands which have a high percentage of degraded land. These figures are often quoted, but have also equally been challenged as to their accuracy. Thus, Warren and Agnew (1988) queried the claim of a desertification threat to 33% of Earth’s surface in the following terms. "An example of a misleading statistic is the claim by the UNDCPAC (1987) that 35 per cent of Earth's land surface is threatened with desertification....." On the other hand, Dregne and Chou (1992) admitted that the information base upon which the estimates in their report were made was poor, because anecdotal accounts, travellers description, personal opinions, local experience and some research reports provided most of the data. UNEP has also confirmed the problem of inadequate data bases. Franklin Cardy, the Director of the Desertification Control Programme at UNEP, in a recent article (Drylands, People, and Desertification control -UNEP Looks Ahead), indicated that there is no question that the scientific basis for determining the extent of desertification is too subjective, and that there are clear inadequacies in the type of data base used to construct the Atlas of Desertification published by UNEP in 1992. He concluded that more detailed information of better quality is urgently needed, although the shortcomings of available information do not necessarily negate the increasing scope, severity and worldwide impact of desertification.
The reality is that the extent and magnitude of the phenomenon are not yet accurately known, for two reasons. On the one hand, the poor data base from which the estimates are calculated, and on the other hand, the exclusion from the "affected areas" of areas where the aridity index - the ratio of average annual precipitation to potential evapotranspiration is greater than or equal to 0.05, and less than or equal to 0.65 (see following Table).

<table>
<thead>
<tr>
<th>Ecosystem</th>
<th>Aridity Index</th>
<th>Desertification Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hyper-Arid</td>
<td>&lt; 0.03</td>
<td>Not affected</td>
</tr>
<tr>
<td>Arid</td>
<td>0.03 - 0.2</td>
<td>Affected</td>
</tr>
<tr>
<td>Semi-Arid</td>
<td>0.21-0.50</td>
<td>Affected</td>
</tr>
<tr>
<td>Dry-Sub-Humid</td>
<td>0.51-0.65</td>
<td>Affected</td>
</tr>
<tr>
<td>Sub-Humid and Humid</td>
<td>&gt;0.65</td>
<td>Not affected</td>
</tr>
</tbody>
</table>

**PROCESS AND CAUSES**

Process. The process of desertification is not one of advancing deserts, but usually starts in small areas or pockets of land where, due to a number of factors, the vegetative cover is reduced to the extent of exposing the soil to erosion. If neglected, these small pockets of land will continue to grow, and finally coalesce to form larger, seriously degraded areas. This is the type of observation made by Aubreville and was the message he intended to convey when he used the term desertification to describe "how deserts are being born today under our eyes." The myth of the advancing desert has, however, gained ground and the Sahara is sometimes pictured as a sea of sand dunes invading the Sahel and swallowing large chunks of farm land. Mobile sand dunes are
portrayed as creeping forward onto cultivated land, damaging crops, and burying houses. As indicated by Nelson (1990), the advancing sand dune is a popular myth and/or misconception of desertification, although it could be found in localised cases as in some parts of North Africa, Mauritania and the Sudan.

This myth was popularised by Hugh Lamprey, an ecologist who compared the position of the edge of the desert in Western Sudan at two different times, in 1958 and 1975, and concluded that “it is evident that the desert's southern boundary has shifted south by an average of about 90-100 km in the last 7 years.” The Sudanese Government readily accepted this statement, and added that it is currently advancing at the rate of 5-6 km per year (DECARP, 1976). Others have since disproved Lamprey's findings which were not based on a sound scientific and methodological approach. Dregne and Tucker (1988) noted that a permanent vegetational shift of 5-6 km per annum could only be established with perhaps 30 to 40 years of observation by meteorological satellites and ground studies. This is a far cry from Lamprey's approach of a one-time aerial survey comparison to a vegetation map drawn by others. As others have indicated, the process evidently is not one of advancing deserts emanating from desert margins, but is rather, a complex process of invasive degradation radiating from centres of unsustainable land use. Although sufficient evidence has been provided to dismiss the myth of the spreading desert, the idea, unfortunately, appears firmly implanted in many minds, including decision-makers who make crucial policies for combatting desertification.

**Causes.** There is no shortage of causes, contributory and predisposing factors for land degradation in the drylands. The raging debate in the literature identifies three schools of thoughts; those who identify natural climatic variations as the major cause; those who lay the blame squarely on human activities; and those who attribute equal responsibilities to climatic variations and human activities. Climatic variations and human activities related to land use are so intricately
linked that to try to separate them into primary and secondary causes would be foolhardy, as they often pose the chicken and the egg problem. We group them, therefore, under direct causes, in contrast to socio-economic and political factors, which constitute the indirect causes of desertification (see figure on Causes, Effects and Control of Desertification).

**Direct causes**

*Climate.* The debate on the link between climate change, or climatic variation, and desertification is inconclusive. Nelson (1990) tipped the balance in favour of a direct linkage when he concluded that about 70% of the problem of desertification can be attributed to natural events such as uncontrollable climatic events and population growth, and advocated climate research and population work to tackle the problem. A similar view was held by the Swedish team that worked in the Sudan for over 30 years. They concluded, among other things, that no widespread changes in vegetation cover took place that could not be explained by climatic variations, and that crop yield variations could mainly be explained by climatic variations, rather than a secular trend (Olsson 1983). Others (WMO, 1982; Hellden, 1992), however, have concluded that there are no adequate long-term data sets to support such causal relations between climate change and desertification. Nevertheless, there is some evidence of increasing aridity in the Sahel over the last two to three decades (Hulme et al. 1992), and a two way interaction between drought and desertification is evident. According to Warren and Agnew (1988), drought can precipitate land degradation by reducing water supplies in a system that is already imbalanced through over-exploitation. Land degradation, in turn, may contribute to drought by feedback mechanisms involving surface albedo, soil moisture, and possibly dust.

*People-related activities.* These are a complex mix of causes all linked to land-use systems that can be grouped into four categories; deforestation, cultivation, rangeland grazing and inappropriate use of irrigation technology which could result in salinization - a form of land degradation. There is some consensus that
all of these activities could overcome the resilience of the dryland and cause
degradation. Deforestation for fuel wood, agriculture, pasture land and industrial
uses goes on unabated even in the drylands where vegetation is sparse, 
to meet an increasing demand for land and food. The removal of trees exposes
the soil to the sun, wind and water, and eventually to erosion by these elements.
According to Glantz and Orlovsky (1983), cultivation practices that can lead to
desertification are; land clearing practices such as slash and burn, cultivation of
marginal land, cultivation of poor soils, reduced fallow periods, and the
indiscriminate use of mechanized farming. Uncontrolled use of these practices
may lead to overcultivation, which has been identified as the principal cause of
dryland degradation by a number of people (Warren and Agnew 1988).

Indirect causes
If we accept the suggestion that deforestation, over-cultivation, over-grazing and
poor irrigation management are direct causes of desertification, it is pertinent to
ask why people would knowingly damage their environment. The answer lies in
the explanation given by Warren and Orlovsky (1988); land degradation takes
place in societies under stress. To illustrate this, they pointed to the stress of
drought and the effect of the stock-market crash of 1929 on the price of wheat
that contributed to the Dust Bowl of the 1930s. We identify the following social,
economic and political factors as stress factors, that contribute to, and
exacerbate, the above direct causes.

The population pressure. A number of attempts have been made to suggest that
population increases have no direct bearing on land degradation, and some
studies have found no correlation between population data and land degradation
(Olsson, 1985). It has even been suggested that a selective decrease in
population may be the operative mechanism (Kates et al. 1977): for example, in
West Africa where degradation is occurring in the face of a decrease in active
male population, or in developed drylands, where degradation is occurring as the
human population decreases. Nevertheless, it is clear that population growth
puts pressure on natural resources in drylands in at least two ways. Firstly, increased population means an increased demand for food, which has to be produced by increasing productivity (yield per ha) or production (area under cultivation). In most cases, the additional food comes from the latter, including an expansion into marginal and fragile lands 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 over-cropped, with all of the known consequences.

The stress of poverty. With a shortage of capital resources, poor people exploit their limited resources to meet immediate and pressing needs even if such short term exploitation compromises the long-term stability and viability of such resources. Hence, poverty has an indisputable impact on desertification.

The stress of land ownership. Changes in land tenure systems with the advent of political independence in many of the West African countries, for example, have led to a cohabitation of modern private and traditional communal land tenure systems. However, new political realities have sufficiently weakened the latter, to make the tragedy of the commons a common phenomenon. As indicated by Hardin (1968), it would be in the interest of the pastoralist who owns his livestock individually, but his land communally, to over-graze for a personal short-term gain, and a societal long-term loss.

The stress of the new global economic order. Declining commodity prices and unfavourable trade terms, could, and do, encourage or compel dryland farmers in developing countries to degrade their land resources in the race to produce more to increase dwindling returns from increasingly poorly-priced primary production.

The stress of inequitable distribution of resources. Land resources are usually inequitably distributed between men and women, small-scale producers and
large, commercial concerns, pastoralists and crop farmers. It is the poor, fragile land that pastoralists who need good land for pastoral strategy have access to. Women, who carry a large part of the burden of farming, have no access to and cannot own land in most parts of Africa. Marginalized groups that have no access to, nor control over, land resources cannot be expected to exploit such resources in a sustainable manner, and often do not.

These are some of the social, economic and political factors that enable, encourage, or even compel, people to adopt destructive land-use practices. If the stress from these underlying factors is not removed, efforts directed at the direct causes will only yield short-lived results, and the consequences of desertification will be intensified.

**EFFECTS AND 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, loss of biodiversity including medicinal plants, climate-related disasters, including health hazards from dust particle movements, environmental refugee problems, loss of livelihood systems, disruption and break-up of social structures, etc. (see figure on Causes, Effects and Control of Desertification). What is not well known, and what have generated some debate, controversy and myths are the costs associated with these effects, (it has been suggested that too much money has already been spent on desertification control), and the nature and extent of the off-site effects of desertification (it has been suggested that desertification is exclusively a Southern problem, because it is most severe there, and its effects are most acute).
Several attempts have been made to calculate the economic impact of desertification, made-up income foregone as a result of land degradation and the cost of controlling and repairing damaged land (Aveyard, 1988; Dregne and Chou, 1992). According to Dregne and Chou 1992, not all desertified land can be reclaimed economically, and they estimated that 52% of all desertified land can pay back the cost of rehabilitation. They estimated the income foregone by not rehabilitating this land at $28 billion US annually, while the annual cost of rehabilitation was estimated at $11 billion US; they concluded that the benefits are 2.5 times higher than the costs. Estimates from UNEP are of the same order, with rehabilitative costs of about $10 - $22.4 billion US estimated at
half the cost of income lost ($45 billion US) due to desertification. It should be noted that none of the estimates included the difficult task of assessing the social cost of human misery suffered by the affected people. In other words, the reality belies the myth that too much money has been spent on mitigating the effect of desertification.

The claim that desertification is a Southern problem with only on-site and no significant off-site impact needs to be reexamined in the light of recent evidence of transcontinental dust travel. Desertification is not considered a global environmental problem, because, apparently, it does not pass the "transboundary test," i.e. no cause-effect relationship has been established where its action in one territory causes environmental damage in another territory or to the global commons. Environmental events that currently enjoy this status are: Ozone depletion, biodiversity (loss to humanity), Amazonian deforestation (reduced carbon sink). Recent evidence, however, suggests that remote, off-site effects of desertification due to transcontinental dust travel, qualify desertification as a global environmental concern.

In April 1998, American scientist and climatologists tracked a dust storm from Spokane across the country to Washington. The dust was determined to have come from China. On the day it reached Washington, the temperature was apparently 10 degrees F higher than normal and the air was stagnant. According to McNew (1998) meteorologists confirmed that such dust particles, aside from lowering visibility, could cause adverse health effects, block sunlight and affect climatological patterns. For these reasons, they said it was important to understand how and where dust storms form, how long they last, and what can be done to prevent them, or hinder their travel.
This was not the first documentation of transcontinental dust travel. Apparently, more than 100 million tons of dust per annum is blown westward over the Atlantic from Africa (Middleton et al. 1986). This dust comes primarily from desertified land. More recently, Macleod (1998) indicated that evidence exists for a strong correlation between the summer climate of the Sahel and the frequency and intensity of hurricanes formed in the eastern Atlantic Ocean. They argued on the basis of a model being tested that dusty Sahelian airs are a large source of energy used for hurricane formation and maintenance as it blows across the Atlantic. They concluded that if this model is proven, then the dust in the Sahelian air is a factor in causing billions of dollars of material and economic damage to the United States and the Caribbean region, in addition to the social and human costs of livelihoods and lives. These is strong evidence of the transboundary nature of desertification, and this belies the myth that it is a purely Southern problem.

SOLUTIONS AND REMEDIES

There can be no single set of solutions for such a complex problem. An integrated approach that considers as many of the causative factors as possible has to be adopted. We believe that the Convention to Combat Desertification provides such a framework, and has all of the required elements. Some of these elements are:

- Develop a knowledge base through appropriate research to unravel some of the obscure issues surrounding the phenomenon;

- Transfer, share, and disseminate such knowledge and required technology from North to South and vice versa;

- Establish partnerships at the local level where the problem is most acutely felt. The battle will be won at the local level, so establish partnerships and cooperation among all stakeholders - government, NGOs, communities, etc;
• Adopt a bottom-up approach, to ensure that decisions on the design and implementation of programmes are taken with the participation of populations and local communities who best understand their environment;

• Approach this complex problem with an integrated approach that addresses the physical, biological and socio-economic aspects of the processes of desertification within a National Action Program;

• Pay special attention to the economic environment, both internationally and within nations. Poverty, population growth, land ownership, local and political organizational controls, trade, and marketing arrangements - the underlying driving forces or indirect causes - must be tackled to relieve the stress they impose in order to have long-term and permanent solutions.

CONCLUDING REMARKS

As indicated earlier, the objective of this document is to draw attention to some of the myths surrounding the desertification debate, and to confront them with the realities so that the former do not distract attention from the pressing task at hand - that of controlling and combatting desertification. Unfortunately, such myths tend to attract attention, and even when sufficient evidence is provided to dismiss them, they tend to linger in many minds, including those of decision makers who make formulate and implement crucial policies. For example, although there is general consensus that the desertification process is not about advancing deserts, the concept is still to be put to rest, perhaps because it catches and attracts attention. The other side of the coin, however, is that it may lead to the utilization of inappropriate control techniques, and a wastage of resources. Efforts must, therefore, continue to separate myths from realities, and all concerned must devote their resources, energy and time to finding long-lasting solutions that will benefit not only drylands populations, but also the global community at large.
REFERENCES


