Chapter 1

Drought and climate variability in the Limpopo River Basin

INTRODUCTION

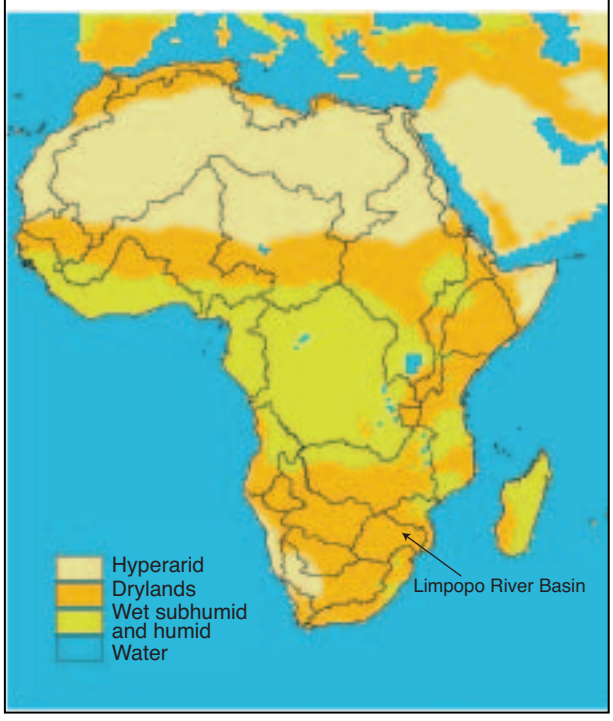
Drought is a normal recurring event that affects the livelihoods of millions of people around the world, and especially the 200 million people living in southern Africa. Climate variability, which includes erratic and unpredictable seasonal rainfall, floods and cyclones, contributes to the risk of farming across most of southern Africa, but especially in marginal rainfed agricultural areas that are characterized by low and erratic precipitation. The latter situation is reflected in relatively low and notably unpredictable levels of crop and livestock production. A serious drought or a series of consecutive droughts can be a disaster-triggering agent that exacerbates social and economic problems, and reduces the overall livelihood security of a society. These problems are most severe where economies are least diversified and virtually everyone depends either directly or indirectly on agriculture. Extended periods of drought or unusually high rainfall or flooding in these areas can have devastating effects on the already marginal levels of production, placing subsistence farming in jeopardy.

People living in areas prone to drought or flooding have developed livelihood and production systems to minimize the risks posed by extreme climatic variations. Although farmers have long maintained a suite of indigenous strategies and options to manage risk and to deal with poor overall productivity in spite of low returns to land, labour and capital, it is generally acknowledged that low-resource agriculture is no longer capable of meeting the livelihood demands of rising populations in these fragile dryland environments (Figure 1 and Box 1).

Owing to increased populations in the last century and the growing pressure on land, land use has become more intensive, and land and people have become more vulnerable to climate events. Within a more complex environment and through sophisticated production systems, people, livestock, crops and wildlife are competing for increasingly scarce resources. Over time, pressures and intensification will lead to greater susceptibility to future droughts and floods, resulting in further degradation of resources and loss of productivity – a downward spiralling effect.

Drought conditions frequently require government intervention in the form of emergency food relief, often supported by large amounts of donated food aid. Drought preparedness by governments has generally taken the form of creating food reserves (mainly maize) at national level to compensate for production shortfalls and provide for possible emergency relief. While these costly relief efforts have been perceived as a necessity, such short-term interventions have generally precluded support for longer-term development processes, particularly in those areas with dry climate conditions. As low and erratic

FIGURE 1
Dryland basins of Africa



BOX 1

Drylands

Drylands is the common name for arid, semi-arid and dry subhumid ecosystems that are characterized by low and irregular rainfall and high evapotranspiration and cyclical droughts.

In areas with summer rainfall, arid zones typically receive less than 400 mm of rainfall annually, while semi-arid and dry subhumid zones receive about 400–600 mm and more than 600 mm respectively.

Drylands as defined by the United Nations Convention to Combat Desertification (UNCCD), encompass the arid, semi-arid and dry subhumid zones where mean annual precipitation (MAP) over annual reference evapotranspiration (ET_o) is between 0.05 and 0.65.

Drylands have a "length of growing period" (LGP) of less than 180 days and mostly less than 120 days, where the LGP is defined as the period (in days) during a year when precipitation exceeds half the reference evapotranspiration (rainfall > 0.5 ET_o). Within this range, arid zones have a growing period of less than 60 days, semi-arid zones a growing period of 60–120 days and dry subhumid zones a growing period of more than 120 days.

Chapter 2 provides further information on climate.

precipitation is a key characteristic of these dryland areas, this fact of life must be reflected not only in the preparedness plans drawn up by governments, but also in the longer-term development strategies designed to prevent serious impact of future droughts on the environment and people's livelihoods.

CALLS FOR ACTION

Global

The 1986 FAO study titled *African agriculture: the next 25 years* stressed that Africa has considerable agricultural potential but that several constraints are preventing its realization. This study led to the approval of the International Scheme for the Conservation and Rehabilitation of African Lands (ISCRAL) at the 16th FAO Regional Conference for Africa in June 1990. In essence, the ISCRAL was designed to assist African countries to prevent and combat land degradation. At the Conference, several FAO member countries of the southern and east Africa region highlighted the seriousness and extent of the various kinds of resource degradation in their countries, and requested assistance from FAO in taking appropriate action.

Later, the 1992 United Nations Conference on Environment and Development (UNCED) defined desertification as "land degradation in arid, semi-arid and dry subhumid areas resulting from various factors, including climatic variations and human activities". The UNCED identified areas covering about 65 percent of the total land area of Africa under this definition. The UNCED called for the adoption of an "international convention to combat desertification in those countries experiencing serious drought and/or desertification, particularly in Africa … through effective action at all levels, supported by international cooperation and partnership arrangements, in the framework of an integrated approach which is consistent with Agenda 21" (Article 2, Part 1).

All four Limpopo River Basin countries (Botswana, Mozambique, South Africa and Zimbabwe) have signed the United Nations Convention to Combat Desertification (UNCCD). All parties to the UNCCD have an obligation to "adopt an integrated approach addressing the physical, biological, and socio-economic aspects of the process of desertification and drought" (UNCCD, 2003).

In addition, FAO activities in the follow-up to the World Food Summit (1996), whose plan of action includes multiple references to common objectives with the UNCED, are in direct support of the objectives of that initiative under Commitments 3 and 5.

Africa

In the context of the International Decade for Natural Disaster Reduction (IDNDR, 1990–2000), a Regional Meeting for Africa was held in May 1999 at the headquarters of the United Nations Environment Programme (UNEP) in Nairobi under the theme "Towards disaster reduction in the twenty-first century". Delegates at this meeting recognized in the Nairobi Declaration that the African continent is subject to a wide range of natural hazards and suffers from natural and other disasters that have serious adverse effects on societies and national economies, as well as on critical human and material resources. In this context, communities at risk across Africa find themselves even more vulnerable because of

several aggravating factors, including: poverty, environmental degradation, inadequate exchange of data and information among African countries, and inadequate coordination at the continental level.

The Nairobi meeting recommended *inter alia* that cooperation among African countries in the domain of disaster prevention and risk reduction should be strengthened by adopting national and regional mechanisms to improve the exchange of information, sharing of experiences and knowledge, and technology transfer, and that African countries engaged in sound disaster prevention policies should receive due recognition and enabling support from the international community in order to achieve their set goals. Furthermore, local communities should be considered as primary actors in the design, adoption and implementation of disaster reduction policies and measures.

In 1997, the Food Security Technical and Administrative Unit (FSTAU) of the Southern African Development Community (SADC) organized a high-level drought policy seminar in Botswana in response to the threat of a serious regional drought following a strong El Niño phenomenon. The report of this seminar recognized that drought in southern Africa is a normal and recurring event, and called for long-term action in:

- investment in soil and water management, such as the improved development and management of fragile catchment areas and river basins, including small-scale irrigation;
- reviewing the appropriateness of current crop production patterns and possibilities in support of more intensified crop diversification policies;
- redirecting research towards more appropriate farming systems;
- improved rangeland and livestock management;
- reviewing institutional arrangements and physical infrastructure.

The role of FAO in drought and desertification control

For several decades, FAO has spearheaded agricultural improvement and rural development in arid, semi-arid and dry subhumid zones ravaged by drought and desertification. These activities have involved emergency and rehabilitation actions in the event of drought or other agricultural disasters, such as locust invasions. In addition, they have provided support in the formulation of policies and plans for development in the food, agriculture, forestry and fishery sectors; development of human resources – particularly for rural women – and of national institutions and legislation; and the promotion of research and dissemination of appropriate technologies in the various sectors.

These efforts have mostly taken the form of technical assistance projects in answer to specific requests by member nations. They have also sometimes been undertaken within programmes that group together projects with common priorities and themes, such as the programme to re-launch African agriculture (involving 200 projects in 30 countries); the fertilizer, seed, prevention of post harvest losses and food security programmes; the action plan of the World Conference on Agrarian Reform and Rural Development (WCARRD); and the Tropical Forestry Action Plan. Numerous desertification control and drought control activities have been implemented under these plans and projects, especially for soil conservation, pasture improvement, livestock improvement, small-scale irrigation, cereal storage, agroforestry, development of fuelwood resources, and also for nutrition improvement.

FAO also serves as one of the main partner organizations for the UNCCD. Because most of the technical objectives of the UNCCD relate directly to FAO objectives for the conservation and development of dryland resources, a number of activities implemented by FAO relate to desertification control and contribute to the implementation of the UNCCD. In 1998, more than 100 FAO field projects were directly related to the assessment and control of desertification, covering a wide range of activities, such as erosion control, improvement of water supply, forest and pasture management, local rural development through extension and participatory approach programmes, assistance in the implementation of national information systems and statistics, and formulation of investment projects. FAO support to the UNCCD is coordinated technically by an ad hoc interdepartmental working group (IDWG) established in order to deal with this matter, and composed of representatives from several FAO technical divisions. A memorandum of cooperation was signed in December 1998 between FAO and the Permanent Secretariat of the UNCCD, aimed at achieving the objectives of the UNCCD. This memorandum comprises an extensive programme, covering: (i) support to national and regional

action plans and networks; (ii) compilation and dissemination of best practices; (iii) preparation and dissemination of awareness documents; (iv) establishment and implementation of information systems and databases that cover technical variables related to desertification; and (v) technical support to the UNCCD bodies and international events. The Special Programme for Food Security (SPFS), approved by the FAO Council at its 106th Session, is also playing a key role in the FAO response to the UNCED, the World Food Summit and the implementation of the Resolution on Urgent Action for Africa.

MANAGING THE IMPACTS OF DROUGHT

Definitions of drought

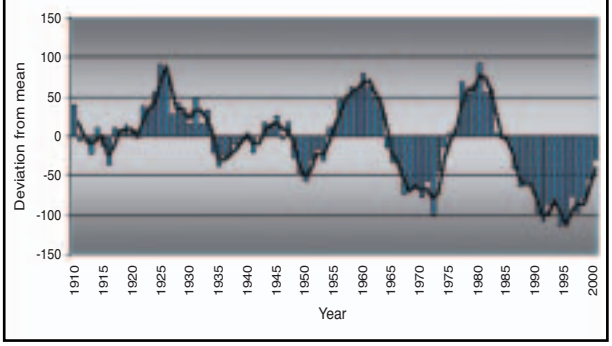
While lack of water is the underlying cause of drought, a large number of other socio-economic factors compound and intensify its effects. Wilhite (1999) states that the absence of a precise and universally accepted definition of drought adds to the confusion about occurrence and severity of drought. The various definitions of drought differ in their interpretation relative to their impacts and must be region and impact specific. Both the natural and social components of drought need to be better understood and addressed in national, regional and international policy planning (Abrams, 1997). Wilhite and Glantz (1985) describe four basic categories or types of drought:

- Meteorological drought: A reduction in rainfall supply compared with a specified average condition over some specified period; defined as a period during which less than a certain amount (e.g. 70 percent) of the normal precipitation is received over any large area for an extended period.
- Agricultural drought: A reduction in water availability below the optimal level required by a crop during each different growth stage, resulting in impaired growth and reduced yields. Agricultural drought relates to an imbalance in the water content of the soil during the growing season, which although influenced by other variables such as the crop water requirement, the water-holding capacity and degree of evaporation, is also largely dependent upon rainfall amount and distribution.
- Hydrological drought: The impact of a reduction in precipitation on natural and artificial surface and subsurface water resources. It occurs when there is substantial deficit in surface runoff below normal conditions or when there is a depletion of groundwater supplies. Hydrological drought reduces the supply of water for irrigation, hydroelectrical power generation, and other household and industrial uses.
- Socio-economic drought: The impact of drought on human activities, including both indirect and direct impacts. This relates to a meteorological anomaly or extreme event of intensity and/or duration outside the normal range of events taken into account by enterprises and public regulatory bodies in economic decision-making, thereby affecting production and the wider economy.

Occurrence of drought

According to the International Fund for Agricultural Development (IFAD), as cited by Benson, Thomson and Clay (1997), at least 60 percent of sub-Saharan Africa (SSA) is vulnerable to drought and probably 30 percent is highly vulnerable. Extreme drought in the Limpopo River Basin is a regular phenomenon and has been recorded for more than a century at intervals of 10–20 years. An example for Zimbabwe is given in Figure 2. In the period 1980–2000, the SADC region was struck by four major droughts, notably in the seasons 1982/83, 1987/88, 1991/92 and 1994/95. This corresponds to an average frequency of once every four or five years, although the periodicity of droughts is not necessarily so predictable. FAO (1994) identified three drought cycles during the years 1960 to 1993 with lengths of 3.4, 7.1 and 5.8 years, respectively. Amplitudes were 0.38, 0.35 and 0.28 standard deviations, respectively.

FIGURE 2
Zimbabwe national rainfall deviation from mean 10-year running mean (period 1900 to 2000)



Source: GOZ–ZMD (2001).

TABLE 1
Impacts of drought on different economic structures

Various aspects of the economy	Economic structure			
	Simple	**Intermediate**	**Complex**	**Dual/extractive**
Per capita income	Low	Low / low-middle	High-middle/high	Low/middle/high
Main sector	Agriculture	Agriculture, manufacturing	Manufacturing, service	Manufacturing, service, agriculture
Importance and nature of agriculture sector	Mainly rainfed, accounting for > 20 percent of GDP and > 70 percent of employment	Rainfed/irrigated, accounting for > 20 percent of GDP and 50 percent of employment	Mainly irrigated, accounting for < 10 percent of GDP and < 20 percent of employment	Rainfed/irrigated, accounting for 10–20 percent of GDP and 20–50 percent of employment
Intersectoral linkages	Weak	Intensive	Diffused	Weak
Engine of growth	Agriculture	Agriculture/non-agriculture	Non-agriculture	Extractive sector
Infrastructure	Limited	Extensive	Extensive	Limited/extensive
Spatial impact of drought	Largely rural, area directly affected	National, rural and urban population	Largely rural, area directly affected	Rural
Economic recovery following drought	Relatively fast	Agriculture – relatively fast	Agriculture – relatively fast	Agriculture
		Manufacturing – more slowly	Manufacturing – no real impact	Limited knock-on affects

Source: Benson and Clay (1998).

Drought conditions can be expected somewhere in the region in the majority of years, but it is rare for all countries to be drought-stricken at the same time (Bepura, 1999).

IMPACTS OF DROUGHT IN SOUTHERN AFRICA

Macroeconomic impacts

Drought is the most important natural disaster in southern Africa in economic, social and environmental terms (Buckland, Eele and Mugwara, 2000). A report by the United Nations Development Programme (UNDP) states that drought is considered by many to be the most complex and least understood of all natural hazards, affecting more people than any other hazard (UNSO, 1999).

Benson and Clay (1998) reported that little research has been done on the macroeconomic impact of drought in SSA. The main reason is that drought is typically perceived as an agricultural or food supply problem. However, for most SADC countries drought represents the most important type of economic shock they are likely to experience. It is important for governments to understand the macroeconomic impacts of drought when developing drought management policies and programmes.

Drought has primary and secondary (ripple) effects on a household or national economy. Primary or physical impacts include reduction in agricultural production, hydroelectric power generation, water intensive non-agricultural production (processing), and domestic availability of water, which has health implications. Secondary impacts are those that affect gross domestic product (GDP), e.g. reduction in industrial output may lead to inflation and lay-off of labour, which increases unemployment. These factors reduce demand, expenditure, savings and GDP.

The typology presented in Table 1 is useful in distinguishing four country economy scenarios in terms of the impact of drought. Under this approach, South Africa is classified as a dual/extractive economy that consists of a rural economy with a high level of subsistence production as well as a developed urban manufacturing and service sector. Mozambique would be classified as a country with a relatively simple economy, based primarily on agriculture. Botswana and Zimbabwe are classified as countries with an intermediate economic structure based on a combination of agriculture and manufacturing (Chapter 3 discusses the socio-economic characteristics of the four basin countries).

Primary and secondary impacts

Vogel, Laing and Monnik (1999) list the impacts associated with drought in South Africa, although these could readily be applied to other drought-prone areas in southern Africa as well (Table 2). Table 2 shows that drought impacts are much more than simply a food supply problem, depending on the duration and severity of the drought.

TABLE 2
Impact of drought in southern Africa

Primary impacts	Secondary impacts
SOCIAL	
Disrupted distribution of water resources	Migration, resettlement, conflicts between water users
Increased quest for water	Increased conflicts between water users
Marginal lands become unsustainable	Poverty, unemployment
Reduced grazing quality and crop yields	Overstocking; reduced quality of living
Employment lay-offs	Reduced or no income
Increased food insecurity	Malnutrition and famine; civil strife and conflict
Increased pollutant concentrations	Public health risks
Inequitable drought relief	Social unrest, distrust
Increased forest and range fires	Increased threat to human and animal life
Increased urbanization	Social pressure, reduced safety
ENVIRONMENTAL	
Increased damage to natural habitats	Loss of biodiversity
Reduced forest, crop, and range land productivity	Reduced income and food shortages
Reduced water levels	Lower accessibility to water
Reduced cloud cover	Plant scorching
Increased daytime temperature	Increased fire hazard
Increased evapotranspiration	Crop withering and dying
More dust and sandstorms	Increased soil erosion; increased air pollution
Decreased soil productivity	Desertification and soil degradation (topsoil erosion)
Decreased water resources	Lack of water for feeding and drinking
Reduced water quality	More waterborne diseases
ECONOMIC	
Reduced business with retailers	Increased prices for farming commodities
Food and energy shortages	Drastic price increases; expensive imports/substitutes
Loss of crops for food and income	Increased expense of buying food, loss of income
Reduction of livestock quality	Sale of livestock at reduced market price
Water scarcity	Increased transport costs
Loss of jobs, income and property	Deepening poverty; increased unemployment
Less income from tourism and recreation	Increased capital shortfall
Forced financial loans	Increased debt; increased credit risk for financial institutions

Source: Adapted from Vogel, Laing and Monnik (1999).

Not all of the impacts listed in Table 2 occur with every drought, nor do droughts typically affect the entire region or country. However, almost every year there is some subnational area affected by drought somewhere in the southern Africa region, and usually somewhere within the Limpopo River Basin (SADC, 1999). Drought is a chronic problem in southern Africa and has a major impact on rural livelihoods with the effects lingering long after the actual event. For example, Buckland, Eele and Mugwara (2000) wrote: "…the economies of the [SADC] region are particularly susceptible because of their geographical position, the high proportion of people dependent on rainfed agriculture for their livelihoods, and the strong links between agriculture and the rest of the economy … In the case of the 1991/92 drought [in southern Africa], estimates put the total number of people affected at 86 million, 20 million of whom were considered to be at serious risk of starvation. Cereal output in SADC (excluding South Africa, not then part of the community) fell from an average of 11.3 million tonnes to 6.2 million tonnes. Import needs rose to 7 million tonnes, with a further 5.5 million tonnes for South Africa. In total, 11.4 million tonnes of cereal were imported…".

Botswana experienced several periods of prolonged drought affecting the entire country from 1981 to 1986 that were caused by a succession of below average rainfall years. The cumulative effect was devastating in terms of food and water availability and caused large-scale mortality in livestock and wildlife (Bhalotra, 1987a). This drought is widely regarded as the worst to affect Botswana in living memory. A second period of drought in 1991/92 also affected the entire country and caused widespread crop failure and livestock mortalities.

In the 1991/92 agricultural season, Zimbabwe experienced the worst drought in living memory,

with complete failure of crops and devastation of the livestock sector that rendered most areas semi-deserts. The economic effects were also felt outside the agriculture sector. Largely as a result of the drought, through water and electricity shortages, manufacturing output in Zimbabwe declined by 9.3 percent, with a 25-percent reduction in volume of manufacturing output and 6-percent decline in foreign currency receipts (Benson and Clay, cited in SADC–IUCN–ZRA–SARDC, 2000). In the period 1991–97, the country experienced three major droughts requiring the importation of food to alleviate the associated food shortages. Serious reductions in agricultural output resulted in reduced economic growth and loss of the much-needed foreign exchange normally derived from agricultural exports.

Mozambique regularly experiences both extremes of rainfall variability – periods of insufficient rainfall as well as severe flooding caused by excessive rainfall and cyclones (Box 2). The drought in southern Africa in 1991/92 also had enduring effects and affected more than 1.3 million people, especially the rural poor of the southern and central zones. The impacts were exacerbated by the civil war and caused widespread loss of food supplies and livestock, and environmental degradation (Manjate, 1997). The World Food Programme (WFP) alone spent nearly US$200 million in providing food aid relief. The southern province of Gaza is one of the most drought-prone as well as flood-prone provinces in the country because of its proximity to the Limpopo River and low-lying coastal areas.

In the 1992 drought in South Africa, it was estimated that 50 000 jobs were lost in the agriculture sector, with a further 20 000 in related sectors, affecting about 250 000 people (AFRA, 1993). Although the direct contribution of the agriculture sector to GDP is relatively small (about 5 percent), it still plays an important role in the economy through backward and forward linkages to other sectors (e.g. the purchase of goods such as fertilizers, chemicals and implements as well as the supply of raw materials to industry). The Reserve Bank (Pretorius and Smal, 1992) calculated the agricultural multiplier to be 1.6, and using simulation modelling calculated the loss to GDP during the 1992 drought at about 1.8 percent, representing US$500 million. This is a substantial impact from a sector playing a relatively small role in the economy.

BOX 2

Recent floods in Southern Africa

1984:

Torrential rains from the tropical cyclone Demoina (600 mm in 24 hours at St Lucia) caused extreme flood events in northeastern South Africa and adjacent Mozambique and Swaziland. Hundreds of hectares of fertile alluvial soil under sugar cane were reduced to bare rock beds. Vast areas of KwaZulu-Natal Province were isolated, rivers flooded, bridges and roads washed away. Houses collapsed under the weight of the water and many people were left stranded. Damage to roads and bridges was estimated at US$2.7 million, and the death toll rose to 60.

2000:

The tropical depression and cyclone (Eline) ravaged large parts of Mozambique, South Africa, Botswana and Zimbabwe in February. High winds, torrential rains, and severe flooding left a trail of destruction and heavy loss of life. Large areas of agricultural land were submerged, together with livestock and farming implements. Mozambique was worst affected, with up to 400 people reported dead and about a million displaced.

In April, after devastating northern Madagascar, where it left 13 people dead and 100 000 homeless, the tropical storm Hudah threatened the coast of flood-ravaged southern Mozambique before turning away to be dissipated over northern Mozambique, where 171 mm rain fell.

Drought management in the programming cycle

For many of the already impoverished, food insecure or vulnerable population groups in the Limpopo River Basin, one severe drought, or series of consecutive droughts, may result in the loss of their traditional livelihood system, and thus result in further deprivation. Moreover, consecutive droughts combined with poor natural resource management practices and inappropriate policies will result in environmental degradation and thus a serious reduction in the productive capacity of the land.

BOX 3

Combating land degradation and desertification

Recent studies have challenged the scenario of dramatically increasing land degradation. The conclusion drawn is not that irreversible changes cannot occur, but that drastic changes are inherent in the semi-arid ecosystem, and that these changes are often more dependent on rainfall than on human actions (Behnke and Scoones, 1993).

However, there are sufficient indications that degradation of soil and land resources is expanding rapidly through increasing pressure from human and livestock populations, leading to reduced productivity and diminished biodiversity. Degradation is mainly a reflection of socio-economic conditions and structures, e.g. land tenure arrangements, and lack of conservation of the land. Unsustainable use of the land is the single most important factor contributing to erosion and degradation, which is apparent through practices of overgrazing, road construction, mining, fuelwood collection, and urbanization.

Increasing pressure on the limited land resources caused by a growing population and increasing poverty calls for a new balance between ecosystems, human settlement and production systems. For planning purposes and decision-making it is essential to analyse the relationship between actual erosion and land policy, land use, land tenure, climate, population density and other relevant factors in order to restrict further damage to the land resource base.

Available overviews on erosion and land degradation in the Limpopo River Basin are ad hoc exercises and not based on systematically collected reliable field data. No sound analysis of causes has been attempted, and underlying causes such as overgrazing, intensive cropping and deforestation are only mentioned randomly. There is an insufficient database of land degradation and desertification, in particular lacking data on spatial distribution.

However, a general observation is that the most serious land degradation in the Limpopo River Basin occurs on the rangelands, in particular the communal grazing areas. Severe degradation may also be found associated with other less frequent land uses.

Climate variability and changes also have a profound effect on accelerating erosion and land degradation. Extreme rainfall aggravates the condition of already degraded land through increased runoff and flooding. Lack of rainfall and resultant drought exacerbate desertification processes. Drought acts as a strong catalyst in the initial and progressive degradation of land.

The following general rehabilitation strategies have been recommended in recent decades.

- Rehabilitation of degraded cropland; includes introduction of agroforestry and mixed cropping systems to improve the nutrient status, zero or minimum tillage systems to minimize soil erosion, and physical soil conservation measures.
- Rehabilitation of degraded rangeland; includes introduction of sustainable livestock management, group and individual title to land, zero grazing, and physical soil conservation measures.
- Rehabilitation of degraded forests and woodlands; includes improvement of sustainable communal forest management, development of communal woodlots, alternative sources of energy and agroforestry.
- Improving water management through integrated catchment management, focusing on holistic water use, with a balance between all land uses, including plantation forests, efficient irrigation systems, safe drinking-water, water for cattle, and water harvesting.
- Combating desertification by addressing the socio-economic causes as well as the physical ones. Measures include: introduction of sustainable production methods; integration of trees in crop production systems; and physical methods of wind and water erosion control. People's participation in the development of soil and water conservation strategies is essential. Programmes need to be supported by research into the causes and the most efficient methods to combat desertification.

Whereas all four countries of the Limpopo River Basin have national action programmes (NAPs) in place to implement the UNCCD, there is little to conclude yet on its impact on land degradation. NAPs are designed to make use of existing programmes and projects, and promote additional activities.

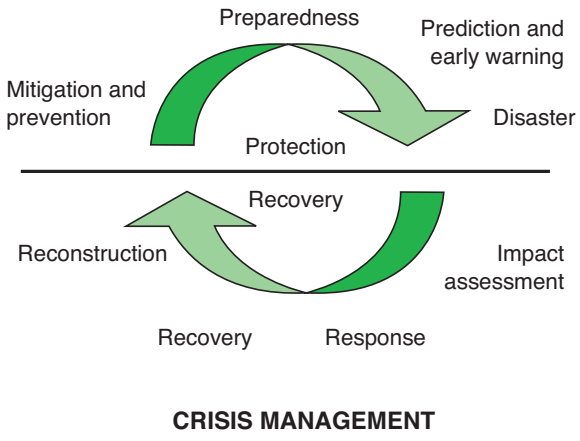
One of the major conclusions from the evaluation of past and present land rehabilitation programmes is that failures have stemmed from not involving the local communities fully in management and decision-making (Sola, 1993).

Various development partners have undertaken substantial work on drought management (preparedness, mitigation, response, rehabilitation and prevention) to help cope with these variations in climate and potentially devastating impacts (Wilhite, 1999; Vogel, Laing and Monnik, 1999; GOZ–NEPC, 1999; Knutson, Hayes and Phillips, 1998). However, more comprehensive and practical field-level interventions adopting self-reliant approaches in managing for climate variability are needed to support longer-term drought and disaster mitigation and prevention at a larger scale (Box 3).

Wilhite (1999) describes a comprehensive cycle of disaster management that can be adapted readily to a drought management scheme (Figure 3). This diagram is useful for visualizing the cyclical nature of activities associated with drought management and the need to include prediction and early warning, preparedness, and mitigation in the planning cycle. Past emphasis on crisis management has meant that society has moved from one disaster to the next without reducing the risks or the impacts. With an improvement in operational capabilities (climate and water monitoring, institutional capacity, information flow, and coordination within response structures) and mitigation and risk management, the impacts of drought could be reduced.

Vogel, Laing and Monnik (1999) also proposed a disaster management planning approach for South Africa where role-players, such as relevant government departments and non-governmental organizations (NGOs), implement and manage their specific disaster policies during periods of "non-disaster". These actions would represent risk management. When a disaster occurs (e.g. drought), each role-player would increase its capacity to respond to the event (referred to as crisis management). Once the disaster has been managed and the situation has normalized, each role-player will continue with risk management. The process of risk management is continuous in the sense that policies and programmes do not come to an end after a particular disaster.

FIGURE 3
Disaster, risk and crisis management cycle



Source: Adapted from Wilhite (1999).