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SOUTHERN AFRICA BEYOND THE MILLENIUM: ENVIRONMENTAL TRENDS AND SCENARIOS TO 2015

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BACKGROUND and ACKNOWLEDGEMENTS

This paper had its origins in a report to the Swedish International Development Agency (Sida) prepared as an input to Sida's 2015 project (Dalal-Clayton, November 1995). The project involved an examination by Sida of the trends and structural factors in various sub-regions of the world and their possible influence on the scope and direction of Swedish aid.

Material for the report was drawn from a wide range of recent publications (listed in the references), but of particular help was the "State of the Environment in Southern Africa" (SARDC 1994) prepared by Southern African Research and Documentation Centre in collaboration with the World Conservation Union (IUCN) and Southern African Development Community (SADC).

In March 1966, the report was presented and discussed along with various other papers on related themes at a seminar in Stockholm organised by Sida's Department for Southern Africa, as part of the 2015 project. Subsequently, it was reviewed in detail at a regional workshop, funding by Sida, co-hosted by IUCN-ROSA and IIED, and held at Xakanaxa Camp in Botswana's Okavango delta in May 1996. The workshop was attended by leading environmentalists from the southern African region (who subsequently provided detailed written comments and suggestions on the text):

Dr Richard Bell	Department of Wildlife and National Parks, Botswana
Munyaradzi Chenje	Southern Africa Research and Documentation Centre, Zimbabwe
Dr Barry Dalal-Clayton	IIED, UK
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Eva Lovgren	Sida
Mikael Segerros	SADC Environment and Land Management Sector, Lesotho
Tami Sokutu	Ministry of Forestry and Water Affairs, South Africa

Several IIED colleagues provided advice, material and commented on particular sections: Christo Fabricius, Ross Hughes, Diana Mitlin (population and urbanization), Jules Pretty (agriculture and pollution), James Mayers (information sources) and Dr Richard Moorehead.

Dr Alan Rodgers (FAO, Tanzania) and Caroline Ashley (Department of Environmental Affairs, Namibia) made many helpful suggestions. Dr Ian Scoones (Institute of Development Studies, University of Sussex) gave advice on the approach to take and reviewed the section dealing with land degradation. Professor Nigel Leader-Williams (Durrell Institute for Conservation and Ecology, University of Kent at Canterbury) provided information on elephant and rhino populations in Southern Africa and valuable comments on the analysis of trends in biodiversity.

Additional information was provided by Munyaradzi Chenje (water issues, pollution and governance), Ruud Jansen (human rights and eco-justice), and Mikael Segerros (SADC-ELMS and land degradation).

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The opinions in the paper are those of the author and do not necessarily represent those of IIED or Sida.

FOCUS AND AIMS OF THE PAPER

The paper is concerned with mainland southern Africa (i.e. not including Madagascar and the Indian Ocean islands) covering the following countries: Angola, Botswana, Lesotho, Mozambique, Namibia, South Africa, Swaziland, Tanzania, Zambia, and Zimbabwe (see Figure 1). The focus is on environmental trends in the region. Critical factors are discussed and scenarios which might determine development during the next 20 years are analysed, and changes that are likely to be needed in development cooperation programs during this period are suggested. The paper looks at the relationship between South Africa and the other countries of the region in relation to environmental trends and future scenarios, and particular attention is given to the problem of environmental degradation.

Developing scenarios for the future is a difficult task, challenged by the key factor of uncertainty. History shows that the unexpected usually dictates the course of events. Inevitably, some people will disagree strongly with the visions, views and interpretations presented in this paper and will argue that quite different scenarios and outcomes are more likely. This is to be expected and all perspectives are valuable in debating the future. Given these difficulties, this paper presents two opposing and deliberately extreme scenarios. They represent the limits of the swing of a hypothetical 'sustainability pendulum' (see Figure 3.1). One scenario is therefore excessively pessimistic and charts a 'doomsday' course to a nightmare future; the other is unrealistically optimistic and envisages a route to an ideal world. As implied above, it is impossible to predict the real future, but it will undoubtedly lie somewhere between these extremes.

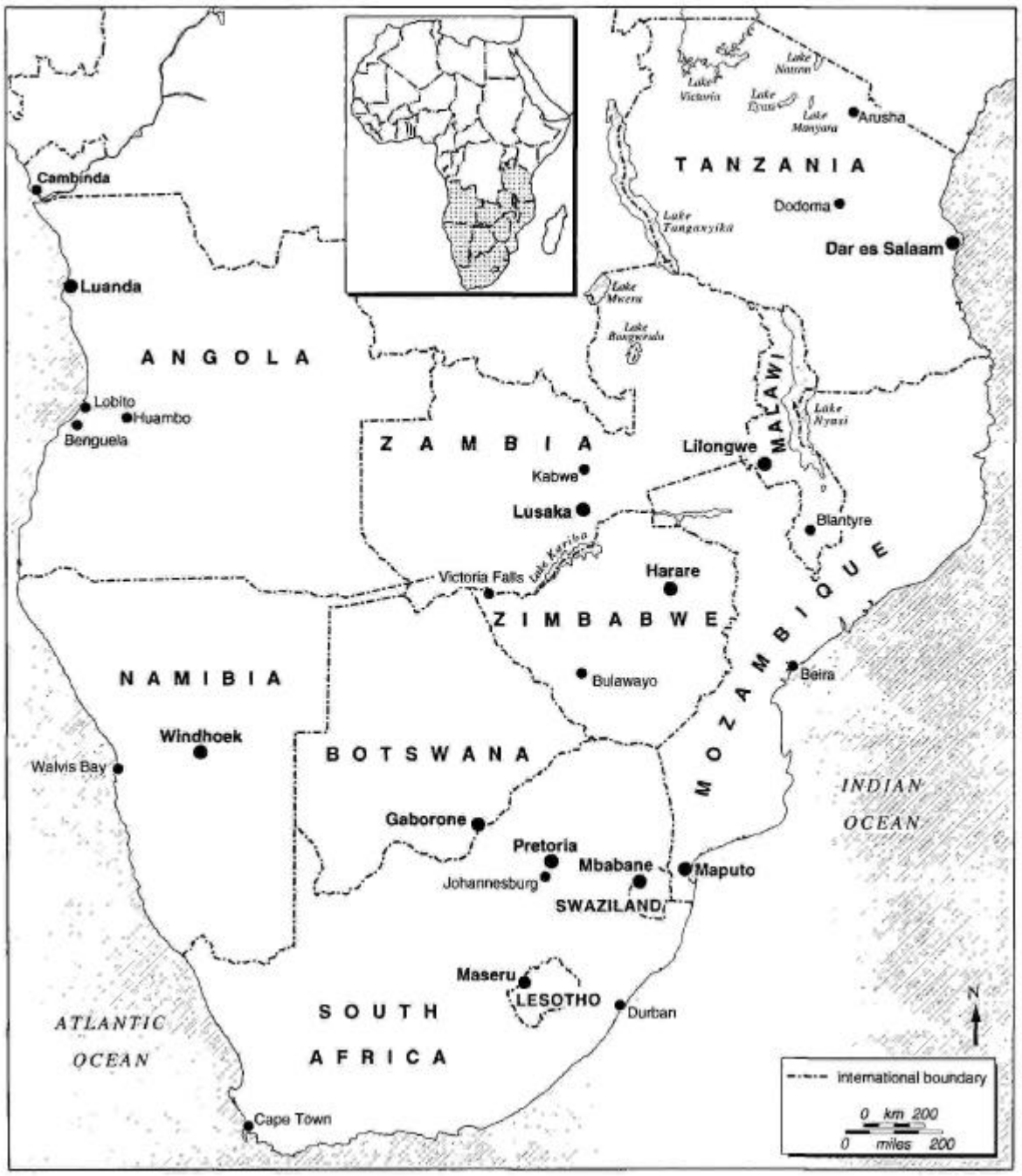
On reading, it may appear that the overall balance of this paper is gloomy or negative as regards both current and potential future environmental trends. The paper does not set out to be deliberately pessimistic. It relies heavily on published literature and other publically available information. However, like the majority of media reports, these tend to focus mainly on environmental problems and threats (the bad news) and positive trends and successes (the good news) are less often written about.

It is important, therefore, to remember that, in many ways, the region is in relatively 'good shape'. Following the end of hostilities in the region and the emergence of democratic governments, there is now a clear political will to 'build for the future' and deal with issues central to sustainable development. There have been positive changes in institutional structures and environmental management systems and a preparedness to experiment with innovative approaches to development (e.g. countries in the region have pioneered participatory initiatives in community based wildlife management which are providing models for many countries elsewhere in the world), and to invest in new technologies (e.g. for renewable energy). Furthermore, there is a strong sense of regional, and bilateral, cooperation (particularly through SADC).

Whilst the paper highlights some serious environmental problems, these need to be seen in an international context. In comparison to most developed countries, southern Africa still has relatively extensive areas of 'untransformed' land (forests, woodlands, wetlands, etc.). The issue is to manage the growing pressures on these resources. Pollution is mainly a localised problem in the region, whilst in the North many countries face widespread and severe problems.

The scenarios discussed in this paper, and the accompanying discussion of environmental trends in the region, are offered with the aim of stimulating debate in southern Africa, amongst governments, academics, NGOs and publics, on some fundamental issues concerning the environment and sustainable development in the region.

Figure 1: Southern Africa



ABBREVIATIONS

AIDS	Acquired Immune Deficiency Syndrome
CWM	Community-based Wildlife Management
DDT	Dichloro-Diphenyl-Trichlor-Ethane (pesticide)
EIA	Environmental Impact Assessment
ETH	Eastern Transvaal Highveld
FAO	UN Food and Agriculture Organisation
GATT	General Agreement on Tariffs and Trade
GNP	Gross National Product
HIV	Human Immuno-Deficiency Virus
IFPRI	International Food Policy Research Institute
IIED	International Institute for Environment and Development
IPM	Integrated Pest Management
IUCN-ROSA	World Conservation Union - Regional Office for Southern Africa
MFA	Swedish Ministry of Foreign Affairs
NSDS	National Sustainable Development Strategy
PTC	Production Through Conservation
PWV	Pretoria-Witwatersrand-Vaal triangle
SADC	Southern African Development Community
SADC-ELMS	SADC Environment and Land Management Sector
SADCC	Southern African Development Coordination Conference (now SADC)
SAPs	Structural Adjustmnent Programs
SARDC	Southern African Research and Documentation Centre
SARDEP	Sustainable Animal amd Rangeland Development Program (Namibia)
Sida	Swedish International Development Agency
UNCED	United Nations Conference on Environment and Development
UNEP	United Nations Environment Programme
WRI	World Resources Institute
ZACPLAN	Zambezi River Action Plan

CONTENTS

Background and Acknowledgements
Focus and Aims of the Paper
Abbreviations and Acronyms

Executive Summary

One: Constraints to Predicting the Future

1.1 Introduction
1.2 Poverty of information
1.3 Disputes and debates
1.4 Livelihood strategies
1.5 Living with uncertainty
1.6 Environmental Rights and Constitutionalism

Two: Some Key Environmental Debates, Trends and Issues

2.1 Land degradation
2.2 Population and urbanization
2.3 The AIDS issues
2.4 Conflict
2.5 Climate change
2.6 Water resources
2.7 Pollution
2.8 Biodiversity and Wildlife
2.9 Energy
2.10 Mineral exploitation
2.11 Threats to marine environments
2.12 Traditional resource management, access to resources, land tenure and rights
2.13 Institutional issues and skills (for environmental management)

Three: Some Scenarios for the Future

3.1 21st century vision in South Africa
3.2 Boundary conditions - the 'rules of the game' and key uncertainties
3.3 Some key environmental trends revisited
3.4 The doomsday scenario - the road to unsustainability
3.5 Building a sustainable future
3.6 The probable future - a world in-between

Four: Recommendations for Governments and Donors

References

Appendices

1. Environmental profiles and strategies for southern Africa

Boxes

1.1 Futurology: experience from India
1.2 Some examples of livelihood strategies
1.3 Environment: what some Constitutions say
2.1 New thinking about range ecology and range management practice
2.2 Production Through Conservation (PTC) in Lesotho
2.3 Climate scenarios and impacts for the SADC region to 2050
2.4 Objectives of the SADC Protocol on Shared Watercourse Systems
2.5 Land Policy Reform in South Africa
2.6 Promoting a Cross-Government Environmental Reflex in Namibia
2.7 SADC Environment and Land Management Sector
3.1 High Road and Low Road Scenarios in South Africa
3.2 Contextual factors for scenario-building
3.3 Drought Nightmare in South East England
3.4 Critical Transitions for Sustainable Development in Southern Africa

Tables

1.1 Means of rural livelihoods other than farming own land. Some examples
2.1 Comparison between the 'old' and 'new' thinking about pastoral development
2.2 Population growth and urban centres in southern Africa

Figures

1 Southern Africa
3.1 The sustainability pendulum
3.2 Resilient and adaptive systems

EXECUTIVE SUMMARY

This paper examines current environmental trends in the southern Africa region and environmental scenarios for the next 20 years to the year 2015, and relates these to socio-economic and geopolitical factors. It is presented in three sections:

Chapter One discusses several key difficulties which inhibit the construction of scenarios of future environmental conditions in the region. Firstly, there is the serious issue of poverty of information in the region - data are lacking for many important variables and much of what are available are unreliable. Secondly, there are on-going, vigorous debates and disputes about a range of environmental trends and issues. For example, there is considerable controversy about land degradation - what is it, how serious is it, and how extensive is the problem ? One of the most important considerations for both current and future environmental trends and environmental management is livelihoods. The vast majority of the people in the region depend directly on the environment for their survival. Yet there is very little knowledge in individual countries about livelihood strategies. These problems conspire to create an atmosphere of uncertainty which makes scenario-building extremely difficult, and casts doubt on its value. The emergence of the issue of environmental rights and their inclusion in national Constitutions is discussed.

In Chapter Two, some of the key issues, debates and important trends are discussed to lay the foundation for subsequent scenarios. In recent years, impressive progress has been made towards regional stabilization and co-operation (through SADC and other agencies) and in reaching regional and bilateral protocols and agreements. With peace and the emergence of democracy in the region, there has been much positive change, e.g. changes in political will, in institutions and environmental management mechanisms, the emergence of new approaches (e.g. farming systems research, community wildlife management), investment in new technologies (e.g. renewable energy) and the beginnings of discussions of land tenure issues. In seeking to make further progress, governments and societies in southern Africa face many challenges in respect of a range of key environmental and related issues. Those discussed in this chapter include:

■ ***Land degradation***

There is no doubt that land degradation is of concern in the region. It has been written about for decades, usually in terms of overcrowding, bad land management, overgrazing and soil erosion. Pastoralists, in particular, have been frequently blamed for overgrazing and causing extensive 'desertification', and small farmers have been blamed for soil erosion. However, recent work suggests that pastoralism probably is not the cause of such extensive or permanent damage to the environment. New thinking about range management has questioned concepts like 'carrying capacity' and 'land degradation' and shown how, in practice, pastoralists adopt well adjusted management approaches in their highly dynamic, resilient, non-equilibrium dryland environments. Considerable doubt has also been cast on the reliability of soil erosion loss figures in the region. Land degradation is often the result of issues such as poverty (poor people often have little choice but to use the land badly in order to survive), unfair land allocation (such as the forcing, in the past, of people into communal areas with poor and fragile soils, where overcrowding is inevitably leading to misuse of the land, erosion and falling soil fertility), and disruption of traditional land management systems. The new thinking presents real challenges to governments (to adapt policies) and to farmers (to change their behaviour to address those very real problems that do exist). Clearly, there is a need for a much more rigorous analysis of the nature and extent of the land degradation 'problem'.

■ ***Population and urbanization***

The population of the region, currently 136 million, is expected to double by 2015. Over 40% are under 14 years of age and this, in the future, will place a severe burden on economies as an expanding and ageing adult population requires jobs and health services. Urbanization is increasing rapidly, much of it due to rural-urban migration fuelled by recent war and conflict as well as by economic factors, landlessness, the effects of drought, etc. But the greatest urban growth will be in small urban centres (< 0.5 million) where people are dependent on agriculture and agriculturally-related industries. Where rural populations are highly concentrated in communal lands, many households are vulnerable to economic and environmental factors. Statistics for urbanization, particularly projections to 2015, contain large margins of error and need to be treated with caution. Nevertheless, rapid urbanization (which is likely to continue) is leading to considerable problems - squatter settlements, unsanitary conditions, inadequate services, urban waste, crime, etc. At the same time, such urbanization may relieve (even if only temporarily) the pressure on land in rural areas. The livelihood strategies associated with urban migration are not fully understood.

■ ***The AIDS issue***

A major problem in assessing the extent of the epidemic is the lack of data and their unreliability - cases are under-reported (maybe as little as 10%) for various reasons (including cover-up). Despite great uncertainties about the course of the epidemic, AIDS will have a significant impact at all levels of society and on all aspects of economies - with enormous pressures on health care systems. Skilled and trained human resources will be severely hit, particularly in major urban centres.

■ ***Conflict***

Past liberation wars, civil conflict, and destabilization (by, for example, South Africa's former apartheid regime) have displaced large numbers of people, creating severe refugee problems in various countries, leading to environmental impacts and fuelling urbanization. But the region is now enjoying stability and increasing democracy with bilateral and regional cooperation (as indicated above) and this represents a major step forward and opportunity to tackle the environmental, economic and social challenges that face the region, and particularly to avert any return to conflict in the future, especially over access to water.

■ ***Climate change***

There is much uncertainty over this issue. Information for the region concerning the potential impact of global warming and how it might be mitigated is uncertain and often not available. Models predict that the region will, in general, become more arid than at present, and that temperatures will rise by between 0.8 and 1.7 ^{o}C by 2030 exacerbating problems in the arid and semi-arid areas, particularly water availability. The impacts are likely to include vegetation changes, increased disease vectors (e.g. ticks), reduced biodiversity (particularly ungulates whose grassland savanna habitats will diminish in extent), accelerated bush encroachment in rangelands leading to smallstock increasingly replacing cattle, and maize is predicted to become an increasingly unsuitable crop.

■ ***Water resources***

Water is arguably the most critical of all resources in the drought-prone region. Studies indicate that southern Africa will experience critical water shortages by 2030 and some countries will be in actual water deficit. Some countries are undertaking or planning massive water supply schemes involving the transport of water between catchments. More dams are being considered. SADC has been coordinating dialogue amongst countries in the region on sound water allocation and water-sharing

agreements (e.g. the SADC Protocol on Shared Watercourse Systems and the Zambezi River Action Plan). A major challenge is to improve catchment management through holistic approaches.

■ ***Pollution***

Monitoring of pollution in the region is weak. In some countries, controls do not exist or are poorly enforced. Population growth, urbanization, industrialization and intensive agriculture are the main contributors to waste generation and pollution. The mining sector is a major polluter (particularly toxic metals and solid waste dumps). In coastal areas, industries discharge untreated waste into the sea and oil spills are a periodic problem. Air pollution is less of a serious problem than in many other parts of the world, though it is a particular problem in South Africa's Eastern Transvaal Highveld where there is a high concentration of coal-burning industries. Pesticide residues have been shown to affect wildlife in lakes and rivers.

There is considerable debate over the need for (polluting) agricultural intensification to feed the growing population on the one hand, and an alternative (non-polluting) approach involving the adoption of resource-conserving technologies and practices and an emphasis on local resources on the other hand. However, the majority of farmers are small-scale and have little choice. They cannot afford expensive chemical inputs (fertilizers, pesticides) and there is little research undertaken on alternatives. As a result, they continue to suffer poor yields and poverty. The poor also suffer the most from pollution - they frequently have no choice but to draw water (for drinking and washing, and for supplying to gardens and livestock) from contaminated sources.

■ ***Biodiversity and Wildlife***

Southern Africa is well known for its protected areas and wildlife, particularly its large mammals - the basis of tourism. But wildlife is under intense pressure: grazing livestock are displacing wild animals; expanding agriculture is converting woodland to farms; dams are altering river characteristics; pollution is increasing; and habitats are being taken for various uses. The open range which large grazing animals require is being severely depleted and interference (e.g. by livestock fences) is inhibiting movement. Poaching has severely reduced elephant populations and black rhinos have been eliminated almost to extinction in some countries. Conservation efforts frequently have been thwarted by ineffective legislation, inadequate penalties and weak law enforcement. At the same time, local people have had few incentives to conserve wildlife in the past. However, innovative wildlife management strategies have been pioneered in the region such as game ranching and community-based wildlife management schemes (e.g. the CBNRM program in Namibia, LIRDP and ADMADE in Zambia, CAMPFIRE in Zimbabwe). Such initiatives are spreading across the region and offer promising and practical alternatives to traditional approaches to wildlife conservation.

■ ***Energy***

Most electrical power in the region is supplied from hydro-power schemes and (polluting) coal-generating stations (particularly in South Africa). Generating further hydro-power is a problem due to strong competition for water on major rivers. The lack of bulk transmission lines limits South Africa from sharing its current spare (but idle) capacity (a southern Africa grid has been suggested). There is debate about the acceptability of building more nuclear power stations in South Africa. A major factor is that most people (particularly in rural areas) rely on wood, charcoal and coal (the latter, again, mainly in South Africa) for cooking and heating. Fuelwood gathering (with water collection) is a major daily activity for many women.

■ ***Mineral exploitation***

Southern Africa is rich in minerals. The richest states are dependent on mineral exploitation (e.g. South Africa on gold and diamonds; and Botswana - which has enjoyed spectacular growth since independence - on diamonds). Others are dependent on mining industries (e.g. Zambia on copper). Mining in the region is large-scale and causes considerable pollution, particularly from solid wastes. Indirect environmental problems are associated with migrant labour which depletes 'home' areas of labour to manage the land properly. In some countries, small-scale mining is increasing (e.g. Tanzania, Zimbabwe) and is often the cause of localised riverbank erosion and chemical pollution (e.g. Mercury).

■ ***Threats to marine environments***

Some marine resources are over-exploited, e.g. prawns and fish stocks. Some habitats are threatened by pollution, mismanagement and misuse, e.g. mangroves and coral reefs. Various species are threatened, e.g. Hawksbill turtles. Coastal erosion is a problem in some areas (e.g. Mozambique, Tanzania), threatening infrastructure.

■ ***Traditional resource management, access to resources, land tenure and rights***

Many traditional customs and practices of land management - which are often locally appropriate and sustainable (and, in many areas, far more suitable than new external solutions) have been, discouraged, eroded and in some cases outlawed (by colonial governments). There has been a steady loss of valuable traditional knowledge, e.g. concerning local medicines. Although severely disrupted, many local resource management institutions could probably be adapted to suit modern political situations and deal with current pressures on resources.

Traditional land tenure arrangements have been dismantled, and inequitable land divisions have been created (e.g. the best land for settlers, poor communal lands for Africans). Independent governments have continued to erode traditional rights (e.g. pastoralists' access to grazing lands).
The expansion of protected area management regimes often denies surrounding communities from entering those areas to garner resources on which they have traditionally depended (e.g. thatching grass, medicinal plants, minor forest products, etc.). The lack of rights and land tenure often prevents poor people accessing loans and credit to invest in land management and to raise living standards. Although these issues are beginning to be addressed, they need urgent attention.

■ ***Institutional issues and skills (for environmental management)***

It is increasingly recognised that broad-based participation of stakeholders is required to define problems, set priorities and goals for environmental management and sustainable development. This is now part of the rhetoric in the countries of the region but, as elsewhere in the world, there is slow progress in giving real effect to these principles. National environment ministries, departments and agencies are generally weak, lacking influence and power, are starved of resources, and lack trained and skilled staff with experience and competence in environmental planning and management. These problems severely limit their ability to monitor and manage the environment. There is a critical need to incorporate environmental and sustainable development planning into national (economic) planning institutions. This needs to be accompanied by environmental education, building environmental awareness and changing attitudes within and across governments and societies.

Regional and international networks and partnerships are becoming increasingly important - particularly SADC (the role of the SADC Environment and Land Management Sector is discussed). Environmental legislation and procedures (e.g. EIA) need to be introduced (where they are absent) or

revised and made effective (i.e. with enforcement and education), and an ethic of sound environmental management promoted.

In Chapter Three, the key debates, trends and issues discussed in Chapter Two provide the basis for examining two scenarios for the future. But first, some pioneering scenario planning work undertaken in South Africa in the period before the end of apartheid is discussed, because it offers a platform for scenario-building for southern Africa as a whole. Whilst many people might disagree with the scenarios developed within South Africa and the assumptions behind them, they represent an important piece of work which had considerable influence within the country. The work also focused on the importance of economic growth and this is a key factor in the scenarios presented for southern Africa in this paper.

The work in South Africa presented options for that country, based on environmental futures, and concluded, amongst other things that South Africa had no option but to become an African 'dragon' - a boom economy to lead the region. This 21st century vision has profound implications for the region: some positive - it could provide the economic lift the region needs; others less positive - it could lead to the region being 'swamped' by South African dominance. But it also true that South Africa has gained much in the post-apartheid era from the experiences of the other countries in the region.

Various boundary conditions, which will govern scenario-building, are outlined. These include those factors which are already set and are likely to remain the same (the "rules of the game"), and others which are largely beyond control (variables or key uncertainties). A number of key environmental trends are briefly revisited to set the scene and bring focus.

Developing scenarios for the future is a difficult task. Uncertainty is a key factor and the unexpected usually dictates the course of events. The two scenarios presented in this paper are offered to stimulate discussion and debate. In this spirit, they deliberately represent two extremes of the swing of a hypothetical 'sustainability pendulum': one is therefore excessively pessimistic and charts a 'doomsday' course to a nightmare future; the other is unrealistically optimistic and envisages a route to an ideal world. The real future will undoubtedly lie somewhere between these extremes.

■ ***The doomsday scenario - the road to unsustainability***

In this scenario, it is assumed that most, if not all, of the current negative trends in the region will not only continue, but will worsen and accelerate. Some trends (e.g. population growth) have in-built momentum. In these circumstances, it is postulated that serious environmental consequences would ensue and lead ultimately to a nightmare scenario with widespread conflict (possibly regional or sub-regional war), extensive environmental degradation and human misery. This 'road to unsustainability' would be driven by a variety of factors:

- economic stagnation and decline;
- consequential worsening poverty;
- rapid population growth;
- the severe loss of skilled and educated people - particularly in urban centres - as a result of AIDS;
- rapid increases in rates of urbanization as a result of refugees from civil unrest (because of disenchantment with governments, and a growing gap between the rich and the poor) and possibly from fighting between countries (due to conflicts over access to water as population growth and rising living standards per capita increases demand, and climate change - with increasing aridity - reduces availability), and also due to land degradation, declining soil fertility, etc;

- increasing loss of habitat and biodiversity as agriculture (both intensive production and subsistence farming) expands to feed the expanding population; and
- the increasing moribundity of government institutions deprived of resources and skills and, subsequently, government collapse.

■ ***Building a sustainable future***

Under this picture, the reverse of the nightmare depicted in the previous scenario is envisaged. Attitudes amongst politicans and civil servants would change as governments increasingly engage in open, participatory processes to develop and implement national and local sustainable development strategies. Lessons from implementation, and feedback though societal dialogue, would facilitate periodic (say every 5 years) review and revision in a cyclical process of 'learning by doing'.

Over time, with increased regional cooperation and collaboration, the economy of the region would improve, living standards would rise, and poverty would decline. Increasingly, the (majority) rural poor would be able to invest in better land management. There would be significant increases in agricultural production - to feed the growing population. These would come (as economic growth took off, enabling increasing investment in education and training) through sustainable farming practices - particularly amongst the majority small-scale farmers - which would recycle nutrients, improve and conserve the land and reduce pollution. Such practices would be enabled by improvements in land rights and access to credit and appropriate technologies. Small urban centres would play a vital role in stimulating and supporting the growing rural economy (particularly appropriate agribusinesses and related enterprises).

Economic growth would lead to better performance by better-staffed government institutions, with improved and harmonised policies and legislation accompanied by policing and enforcement of environmental regulations as a complement to rising environmental education and awareness. These improvements, helped by regional cooperation would help to guarantee peace and stability within countries and regionally, particularly with the successful implementation of water-sharing agreements. Increasing environmental awareness and understanding of the economic and functional importance of biodiversity will lead to significant investments in habitat and biodiversity conservation. Poaching would be eliminated and species reintroduced into their former range. The region would grow as a tourism mecca, further spurring economic growth and prosperity.

The real future, as suggested above, probably lies somewhere between the 'extremes' of these opposing scenarios. However, it is impossible to predict the exact alignment of the route. The doomsday scenario of following a 'road to unsustainability' is clearly unrealistic, but it does provide a powerful image, suggests some of the dangers to guard against, and highlights the fact that much still needs to be done to deal with existing environmental problems.

The 'sustainable future' scenario relies heavily on the governments developing and implementing cyclical National Sustainable Development Strategies or their practical equivalents and envisages a major role for stakeholder involvement. In practice, the critical issue is getting strategic decisions made. Of course, the countries of the region need more power, more water (from somewhere), more food, etc. Effective decision-making structures and processes are required to ensure that all impacts, including environmental ones, of possible solutions to such problems are considered, and that the most effective or least-cost options are chosen. Hard choices will have to be made and tangible environmental 'losses' (e.g. as a result of new dams) will be inevitable. Intangible benefits will probably arise through the growth and development that occurs.

Both scenarios suggest that much is to be gained from continuing and building on the successes of the current processes of cooperation and innovation within the region.

The best way of dealing with uncertainty and to prepare for the unexpected will be to adopt *resilient and adaptive organisation and management systems* in which there is a balance of responses between maintaining the status quo where this is helpful or necessary, and adaptation where change requires it, with a strong emphasis on anticipating pressures and managing the change process. A practical way to move towards this aim will be seek to balance conventional 'top-down' planning with local inputs into development strategies.

In Chapter Four, a range of preliminary recommendations are made where donors might focus attention.

CHAPTER ONE

CONSTRAINTS TO PREDICTING THE FUTURE

1.1 Introduction

Over the last 30 years, the countries of southern Africa have seen great political changes: the colonial powers have withdrawn, minority governments have been replaced and apartheid ended, and one-party states have given way to democracies. Sometimes these changes have been peaceful, in other cases they have followed protracted struggles and armed conflict.

The political transformations have been accompanied by great social changes. For example, there has been an explosion in the region's population, urban centres have mushroomed and rural populations have migrated to the cities in search of work. The demand for permanent housing, for water, sewage and transport systems, for industrial and consumer products has increased dramatically.

These pressures have had their environmental consequences. For example, there is now significant land degradation in many areas; pollution (particularly in urban areas) is steadily increasing; there has been a significant loss of forests (much converted to agricultural land and/or cut for fuelwood) and biodiversity, with the survival of some species now threatened - some are already extinct throughout much of the region (e.g. the black rhino). The proposed SADC Policy and Strategy for Environment and Sustainable Development notes:

> "After a decade of largely unsustainable development in Africa, the livelihoods and lives of many people and the economic prospects of most countries continue to be threatened by environmental degradation. Most SADC countries now face a formidable series of critical demographic, social, economic, agricultural, energy, technological and institutional transitions in order to move toward development that is economically, socially and environmentally sustainable" (SADC ELMS, 1994).

A great deal has been written in recent years describing existing environmental conditions and present trends in the region and in individual countries. Much of this is contained in environmental profiles, national conservation strategies, national environmental action plans, sustainable development strategies, sector plans, and similar documents (see Appendix 1). But there have been few attempts to examine what the future is likely to hold for southern Africa. What are likely to be the environmental, social and economic trends in the period 2000-2015 and beyond, and the interactions between these trends; and what are their probable consequences for the countries of the region ? What are the possible policy options to respond to these scenarios ? This is the challenge that the next generation of national sustainable development strategies will have to meet, in southern Africa as well as elsewhere. This paper attempts to explore these issues.

This is a difficult task as much can happen over a twenty year period. The unexpected is always likely to happen, as experience from India shows (see Box 1.1). And as Ezekial (1975) has noted:

> "The world of futurology is full of the wreckage of projections that have been completely disproved by actual developments. The main problem arises from the fact that futurology finds it impossible to deal with large and unpredictable shocks to the economy which make nonsense of the assumptions on which all projections have to be made, and, in particular, of the basic assumptions of continuity which underlies the entire process of projection-making"

Box 1.1: Futurology: Experience from India

In 1970, a group of Indian scholars produced an eight volume report (the *Second India Study*, see Ezekial 1975) assessing the implications of the doubling of India's population that demographers in 1970 considered inevitable. The study predicted a range of scenarios, some of which have materialised, and others which have not. A follow-up study compared the predicted scenarios with actual developments (Repetto, 1994), and showed how the authors of the original study failed to foresee oil price changes, the globalisation of the economy, and India's move away from a centrally-planned regime. As a result, the capital and resource requirements, and environmental impacts, of India's growth were substantially less than predicted. Indeed, neither technology nor resources were the main problem - where development has faltered, the stumbling blocks have usually been institutional and policy-related.

Even five years ago, who would have predicted a peaceful end to apartheid ? Whilst this is a political issue, it also has considerable environmental implications related to South Africa's influence and role in the region.

Not only is it difficult to predict changes themselves, but also the rate by which people and governments adapt to changes, and hence their impact. On the other hand, people are always adapting to changing environmental conditions, particularly rural people. It is also clear that governments in southern Africa are also adapting rapidly to current problems and evolving new policies. Whilst prediction is a problem, we can at least try to identify critical factors for environmental planning and management, to provide guidance to environmental managers and to help them set priorities for their work.

The Southern African Research and Documentation Centre (SARDC) notes that "many techniques have been used to predict the future, from casting bones to reading the stars to vast mathematical modelling incorporating large amounts of data" (SARDC, 1994). Most studies of the future have examined past experiences and directions and current trends and projected these into the future. This was the basis of visions presented in the concluding chapter of a recent book prepared by SARDC in collaboration with IUCN and SADC following a three year study (SARDC 1994). It was also the approach taken by UNDP in 1979 in convening the Monrovia Symposium - the first entirely African assessment of the continent's development perspectives from the previous 20 years and for the following 20 years. The symposium explored the question, "What kind of Africa by the year 2000?"[1]. As a follow up to the symposium, UNDP commissioned a manual on future studies for use by African planners (UNDP, 1986).

Apart from the socio-economic paths and environmental management ethics that individual countries have already adopted or might follow in the coming years, a number of key factors will influence any analysis of current environmental trends and any attempt to derive possible scenarios for the period 2000-2015. Amongst these are such issues as the availability and reliability of the necessary environmental data; disputes and debate about particular environmental 'problems'; and the lack of knowledge about livelihood strategies. These issues are discussed in this chapter in sections 1.2 to 1.5.

[1]The conclusions from this event so raised consciousness of the challenges, options and opportunities facing the continent that it led in 1980 to the adoption of the "Lagos Plan of Action" by 50 African Heads of State and Government as a guide for the region's development for the following decades.

The issue of environmental rights and their inclusion in national Constitutions is discussed is section 1.6.

Chapter Two focuses on selected environmental issues which are key to any consideration of the future whilst Chapter Three presents two different scenarios: one visioning a track towards a sustainable future, the other outlining a downward path to an unsustainable southern Africa characterised by environmental catastrophe. These are the polarities between which the future lies.

A list of useful national environmental reference documents is provided in Appendix 1

1.2 Poverty of Information

Whilst there is a wealth of documentation on the environment in the countries of Southern Africa, a major problem is that, all too often, a significant proportion of the data which they report has not been 'ground truthed' by field observations, but is based on or summarises information from other existing sources, much of which is itself repeated from elsewhere. Furthermore, there is often uncertainty about the reliability of data in the original sources. This means that questionable information continues to be given currency without checking, and various 'environmental myths' which they are used to support, such as the extent and seriousness of land degradation in the region, are perpetuated. This particular issue is returned to in section 2.1.

As indicated above, a major question arises over the reliability and comparability of statistics reported for environmental processes in the region (this problem is not restricted to southern Africa). A notable example is the widely varying figures for soil erosion reported in different countries - probably because of the use of different methods of measurement. Conventional wisdoms about soil erosion and the reliability of particular data sets have recently been called into question (Stocking, 1996) (see section 2.1).

In practice, for many environmental factors for which reliable data are required to assess trends meaningfully and to predict future positions, the available data are either questionable or not sufficiently available. Another example is the difficulty of making comparisons between data for rural and urban populations in different countries - a point taken up in section 1.3.

The poverty of information in southern Africa is a serious impediment to predicting future environmental trends. However, whilst there is an undoubted problem with data availability, in some cases the problem is more one of 'invisible information' - i.e. information exists, but it is dispersed, inaccessible (even kept secret) or un-recognised. A key challenge in addressing many sectoral and cross-sectoral information issues is to think creatively about accessing hidden and unconventional information sources as well as making obvious existing information more useful.

Planners and policy-makers have no choice but to make use of such data as are available, but great care is required, given the problems discussed above.

1.3 Disputes and Debates

Serious questions are being asked and a series of debates are taking place over various environmental 'problems' or trends (land degradation, the effect of AIDS, the impacts of climate change, etc.). For some time, a number of trends have been taken as fact and have been the subject of a considerable amount of alarmist writing (e.g. on rates of soil erosion and desertification). For example, during the 1980s, famine and images of starving rural people created a perception in the industrial countries of environmental or ecological catastrophe in Africa. Africa was 'in crisis' (Timberlake 1988) and the

problem was, at least in part, blamed on African farming methods. For example, the World Bank (1989, p95) commented:

> "Pressure on the land is resulting in declines in crop yields and in overgrazing. Vegetative cover is weakening, erosion accelerating".

Whilst this was, and remains, true in some areas, there are many exceptions where traditional systems have coped with such problems. Thus, in contrast, other observers have pointed to the sophisticated and sensitive way in which many African farmers manage their environment, e.g. Richards (1983) noted:

> "Technical characteristics of African land management systems ... are inventions appropriate to changing environmental and economic conditions. There is no intrinsic reason why they should be treated as survivals from an era of traditional subsistence production or as evidence of involution in the face of population increase and capitalist exploitation. Recent ecological research suggests they may be better regarded as advanced rather than backward farmers".

In the last few years, new evidence and new ways of thinking have challenged previously-held 'certainties' (see, for example, Scoones (1994) on pastoral development). Some of the key environmental issues and debates concerning southern Africa are discussed in Chapter Two to illustrate the difficulty. Most are still largely unresolved and are the subject of considerable dispute amongst experts and opinion-formers. This makes it difficult to draw conclusions about trends, both existing and in the future.

1.4 Livelihood Strategies

Perhaps one of the most important implications of resolving these debates and of environmental, social and economic changes in southern Africa over the next 20 years, will be increased understanding of and strengthening of the livelihood strategies of the region's peoples. The latter greatly affect the use and management of natural resources and need to be much better understood and strengthened. Yet whilst a few studies have looked at livelihoods in particular countries (e.g. Scoones 1996, in Zimbabwe) or in particular environments in the region (e.g. IUCN 1992, in Botswana's Okavango delta), in general, little seems to have been published. For example, in South Africa, there is little actually known about livelihhod strategies in many of the overcrowded communal lands (homelands). This makes prediction about the consequences of environmental trends for people very difficult. Whilst there is a large body of knowledge about the former Ciskei and KwaZulu Natal, this is mainly unpublished or available only in poorly-disseminated reports (Christo Fabricius, pers.comm).

Throughout southern Africa, the primary concern of the vast majority of the region's 136 million people is securing a livelihood - gaining a living, including livelihood capabilities, tangible and intangible assets (Chambers & Conway 1992). Employment can provide a livelihood, but most livelihoods of the poor are based on multiple activities and sources of food, income and security, involving complex management and use of natural resources. 57% of the population live in rural areas where they:

> "gain their livelihoods in a variety of ways from different types of farming and a wide range of other activities. They do so with varying degrees of success according to their access to resources and employment and how they deal with pressures arising from social, economic and environmental change. Life for many entails a daily struggle in which much energy and ingenuity is needed to secure livelihoods in the face of various crises" (Bernstein, 1992).

It needs to be noted, however, that there are difficulties in defining 'rural' with any great precision. In population censuses, 'rural' and 'urban' are defined by residence in settlements respectively below or above a particular size. The cut off point for settlement size varies between countries: in one it may be 5000 inhabitants, in another 10,000. This makes precise comparisons impossible. Furthermore, many rural people move between rural areas and towns, and between different rural areas. Such movements occur with varying frequencies, for different lengths of time, in regular or sporadic patterns of migration, and for a variety of reasons. The latter include: to seek work, sell produce, gain education, visit relatives, purchase goods, and for official business (i.e. with government officials, lawyers, etc.). The livelihood strategies of many rural households are dependent on regular or intermittent contacts with the urban economy, to supplement farming incomes and to obtain basic consumption goods (salt, cooking oil, sugar, soap, textiles, medicines). Similarly, some urban residents, when faced with declining real incomes and employment opportunities rely, at least in part, on rural relatives for their supplies of food staples. Furthermore, many urban dwellers have strong links with rural areas in order to maintain their rural assets (e.g. farms, cattle) Such key rural-urban linkages and interactions are important, but often overlooked.

Farming, including crop cultivation and pastoralism, is of key importance to rural economies virtually everywhere. As Bernstein (op.cit.) points out, it is

> "a direct source of employment and income and an indirect source through a range of activities 'upstream' of farming (supply of inputs, like tools, seeds and fertilizers; and of services, like credit, technical assistance and construction and maintenance of infrastructure such as irrigation works and roads) and 'downstream' of farming (processing, transport and marketing of crops and livestock products). In addition, incomes from farming and its linked activities in the countryside generate demand for a range of consumer goods and services".

But many rural people cannot achieve an adequate and secure livelihood from farming: some are landless; others are 'marginal' farmers because their land is of poor quality[2] or is too small (often as a result of increasing land fragmentation), or is located in a difficult and unpredictable environment or is a long way from markets, or because they are under pressures from big farmers and merchants or suffer from adverse market conditions and government policies. For rural people in such circumstances, livelihoods are pursued through a variety of means, as illustrated in Table 1.1, and often requiring mobility over shorter or longer periods.

Chambers (1995) also writes of the usually diverse and often complex livelihood strategies of the poor. He compares them to foxes - after the saying of Archilochus that "the fox has many ideas but the hedgehog has one big idea":

> "Full time employees in the industrial world and industrial sector are hedgehogs with one big idea, a single source of support. Those poor people, often powerless, desperate or exploited, who have or can have but one survival strategy are the same - slaves, bonded labourers, outworkers tied to single supplier-buyers, beggars, some vendors, prostitutes, and some other occupational specialists. But most poor in the South, and more now in the North, are foxes with a portfolio of activities, with different members of the family seeking and finding different sources of food, fuel, animal fodder, cash and support in different ways in different places at different times of the year. Their living is improvised and sustained through their livelihood capabilities, through tangible assets in the form of stores and resources, and through intangible assets in the form of claims and access".

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[2] Under the "social engineering" policies of apartheid South Africa, many people were forcibly relocated to create artificially high population densities in unproductive areas. People have settled in these areas, and are now reluctant to leave. As a result, such areas are suffering from extreme land degradation (Christo Fabricius, pers.comm).

Table 1.1: Means of Rural Livelihoods Other Than Farming Own Land. Some Examples

	Wage Employment by:	*Self-Employment in:*
Agriculture	(Richer) farmers	Share-cropping or other tenant farming
Agriculturally linked	Input suppliers, contractors, crop merchants, transporters	Artisanal production (e.g. tools, equipment), small-scale processing, hawking produce.
Non-agricultural	Industry (including fishing and timber, etc), trade and other services	Artisanl resource use (eg fishing), handicraft production, petty trade and other services

Source: Adapted from Bernstein (1992)

Box 1.2 lists a range of strategies and sources of food, income, support and survival. Pretty (1995a) also takes up these themes in discussing the complex, diverse and risk-prone (CDR) nature of agriculture for many poor farmers in the world, and how such CDR farmers seek to reduce risk and increase food and income by complicating, diversifying and, where labour is available, intensifying their farming systems, adding to their enterprises. They also engage in a wide range of other activities, e.g. small shops, milling, transport, etc.

1.5 Living with Uncertainty

The inadequacy or questionability of available information, ongoing disputes and debates about environmental issues, and general knowledge gap about livelihood strategies all conspire to create a situation of uncertainty in which it is extremely difficult to make predictions about future environmental trends and their consequences. This points to the need for a systematic but adaptive approach to environmental management based on learning through trial and error. Natural resource management policy is not a simple technocratic exercise but has to deal directly with issues of uncertainty - a challenge which is highlighted well by Wynne (1992).

For donors, the main implication is a need to plan within the uncertainties by helping and facilitating processes which allow the relevant issues to emerge and be discussed in an open, participatory way, so that sustainable development strategies can be identified and the right kinds of investment made. Mistakes are likely to be made but these can be used in a constructive way. Donor-funded projects could usefully include a sizeable contingency element to enable flexibility and adaptation as experience is gained and new needs and solutions are identified. The lack of information should not be used as a reason for inaction.

Some of the key debates and important environmental issues and trends are discussed in the next chapter. These provide a background for the scenarios outlined in Chapter Three.

Box 1.2: Some Examples of Livelihood Strategies

■ **Home gardening** - (both rural and urban) and the exploitation of micro-environments.

■ **Common property resources** - fishing, hunting, grazing and gathering in lakes, ponds, rivers, the sea, forests, woodlands, swamps, savannas, hills, wastelands, roadsides ... for any of a vast range of fish, animals, fodders, wild foods, fibres, building materials, fuel, fertiliser, medicines and much else.

■ **Scavenging** (mainly urban) and **gleaning** (mainly rural), including traditional rights and access to private residues (buttermilk, crop residues as fuel, etc.).

■ **Processing, hawking, vending and marketing**, including produce from home gardens and common property resources.

■ **Share-rearing of livestock,** where livestock are lent for herding in exchange for rights to some products and/or offspring.

■ **Transporting** goods (and people) with a horse, donkey, mule, cart, bicycle, or head or backloading.

■ **Mutual help**, including small borrowings from relatives and neighbours.

■ **Contract outwork** - weaving, rolling, cigarettes, making incense sticks, etc.

■ **Casual labour** and piecework especially in agriculture.

■ **Specialised occupations** - barbers, blacksmiths, carpenters, prostitutes, tailors, etc.

■ **Domestic service** - especially by girls and women.

■ **Child labour**, both domestically (collecting fuel-leaves, twigs, branches, dung, collecting fodder, weeding, herding animals, removing stones from fields and ticks from livestock, etc.) and working in factories (making matches, candles, fireworks, etc.), restaurants, people's houses, etc.

■ **Craft work** of many sorts.

■ **Mortgaging and selling assets**, future labour and children.

■ **Family splitting**, including putting out children to others.

■ **Migration** for seasonal work in agriculture, brick-making, urban construction, etc.

■ **Remittances**

■ **Seasonal food-for-work, public works and relief.**

■ **Stinting**, in many ways, with food and other consumption.

■ **Begging.**

■ **Theft**

■ **Farming illegal crops**, e.g. Canabis in KwaZulu Natal

■ **Triage** (i.e. assorting according to quality) especially with girl children and weaklings.

Source: Adapted from Chambers (1995).

1.6 Environmental Rights and Constitutionalism

The peoples of southern Africa have always had close traditional ties to their local environment, utilising natural resources for sustenance and development. But environmental rights were usurped under colonialism when rights to land were removed and also rights of access to some of the resources on which they had depended for generations. However, environmental rights have come to the fore in southern Africa following recent democratisation.

Interpretations of the meaning of 'environmental rights' differ. A useful definition is offered by Chenje (1995):

> "Environmental rights [for both present and future generations] means a healthy environment and the right of access to that environment for sustenance, recreation, aesthetics, survival and livelihood"

This implies the right to be safe from harmful exposure, to prevention, to protection from pollution and environmental damage, to compensation, and to enforcement.

Taking a cue from the traditional human rights approach, a strong effort has been made within the UN (through the UN Sub-Commission on Prevention of Discrimination and Protection of Minorities) to set an official standard of environmental justice, to enshrine in international law every person's equal right to a healthy and healthful environment, and efforts have been made to get the General Assembly to agree an official convention on safeguarding 'environmental human rights' (Sachs 1995).

Already, more than 60 national constitutions in the world recognize at least some responsibility to protect the environment. Within the southern Africa region, the new democracies (e.g. Malawi, Mozambique, Namibia, South Africa and Zambia) have enshrined environmental issues in their constitutions (see Box 1.3). Including such rights in constitutions is one things; guaranteeing them is more difficult. As Chenje (1995) observes:

> "Is it possible to guarantee environmental rights when the majority of our own people live under abject poverty ? .... when less than half of the population in the region has access to clean water, health services and sanitation ? What good is a healthy environment when less than half of the population in southern Africa has no access to health services ?".

Chenje goes on to argue that:

> "Without environmental rights and justice, it is impossible to achieve sustainable development. Without sustainable societies, we cannot have sustainable development. Without equitable access to resources, the under-privileged will continue to exploit resources just to survive..... But those [environmental] rights carry with them obligations - we should ensure that our activities do not have negative environmental impacts on other citizens".

Community involvement has the potential to serve as a direct deterrent to the abuse of environmental and human rights. But communities can only fully participate in development if they have the rights of full access to information. In some countries, increasing institutional transparency is being pursued through pushing for 'rights-to-information legislation (e.g. the 1986 Emergency Planning and Community Right-to-Know Act in the USA, which led to the annually produced Toxics Release Inventory).

Box 1.3: Environment: What Some Constitutions Say

Malawi : Article 13 of Chapter III (Fundamental Rights) commits the State to actively promote the welfare and development of the people of Malawi by progressively adopting and implementing policies and legislation aimed at, *inter alia*, managing the environment responsibly in order to "accord full recognition to the rights of future generations by means of environmental protection and the sustainable development of natural resources".

The State also has an obligation to prevent the degradation of the environment; provide a healthy living and working environment for the people of Malawi, and to conserve and enhance the biological diversity of Malawi.

Whilst the new constitution is not specific about environmental rights *per se*, Article 30 (2) states that the "State shall take all necessary measures for the realisation of the right to development. Such measures shall include, amongst other things, equality of opportunity for all in their access to basic resources, education, health services, food, shelter, employment and infrastructure".

Mozambique: the constitution obliges the state to promote efforts to guarantee the ecological balance, and the conservation and preservation of the environment, seeking to improve the quality of life for citizens. Article 72 (Fundamental Rights, Duties and Freedom) states that Mozambican citizens "shall have the right to live in a balanced natural environment and shall have the duty to defend the same".

Article 80 further provides an opportunity to citizens to compel the state to protect their environmental and other rights. It states that "all citizens shall have the right to present petitions, complaints and claims before the relevant authority to obtain the restoration of rights that have been violated, or in defence of the public interest".

Namibia: Article 95 (Promotion of the Welfare of the People) refers to the maintenance of ecosystems, essential ecological processes and biological diversity of the country, and utilization of living natural resources on a sustainable basis for the benefit of all Namibians, both present and future; in particular, "the Government shall provide measures against the dumping or recycling of foreign nuclear and toxic waste on Namibian territory".

South Africa: Widespread provisions are aimed at ensuring a healthy environment. The constitution stipulates that "every person shall have the right to an environment which is not detrimental to his or her health or well-being". Section 175, Sub-section 3, extends this right to local governments: "A local government shall, to the extent determined in any applicable law, make provision for access by all persons residing within its area of jurisdiction to water, sanitation, transportation facilities, electricity, primary health services, education, housing and security within a safe and healthy environment, provided that such services and amenities can be rendered in a sustainable manner and are financially and physically practicable". The constitution also provides for the restitution of land rights.

Source: Adapted from Chenje (1995).

CHAPTER TWO

SOME KEY ENVIRONMENTAL DEBATES, TRENDS AND ISSUES

This chapter discusses selected aspects of some of the critical and emerging environmental issues which are of key importance in any consideration of future scenarios. Some of these issues are the subject of uncertainty and (sometimes intensive) debate. It is not the intention to present a comprehensive review of all aspects of environmental debates, nor all environmental trends and issues which are important in the southern African region. Rather it is hoped to illustrate, through examples, some of the key issues which will affect the future, even if exactly how cannot be predicted.

2.1 Land Degradation

Definitions

Much has been written about the issue of land degradation in Africa (see, for example, Dahlberg 1994) and there have been many definitions of **land degradation**. Their simultaneous use is the subject of considerable debate and much confusion. There is particular disagreement over the meaning of the term *'desertification'*, including over which physical processes should be included. In general, most definitions refer to man-induced changes which reduce the productivity of soil or rangeland (e.g. soil erosion, nutrient exhaustion, increased salinity, overgrazing, etc.).

Abel and Blakie (1989) offered a useful definition of degradation of rangeland which links resources to production potentials, and this definition has since been adopted by many as a general definition of land degradation:

> "Range degradation is an effective permanent decline in the rate at which land yields livestock products under a given system of management. 'Effective' means that natural processes will not rehabilitate the land within a timescale relevant to humans, and that capital or labour invested in rehabilitation are not justified.... This definition excludes reversible vegetation changes even when these lead to temporary declines in secondary productivity. It includes effectively irreversible changes in both soils and vegetation".

Some observors claim this definition is too restrictive, placing undue emphasis on livestock and ecologically irreversible changes. They advocate alternative defintions which stress the importance of economics (Arntzen 1990; Warren & Agnew 1988, Biot 1991). In a review of definitions, Dahlberg (1994) suggests that the differences between definitions "have less to do with changing environmental conditions, and more with changing perceptions of the relationship between man and the environment".

An old problem

It is argued that land degradation is one of southern Africa's most serious and widespread environmental problems. But such claims are not a new phenomenon. There have been reports of impending disaster for decades. For example, Allan (1949) reported serious degeneration of woodland and soil deterioration in overcrowded 'Reserves' in eastern Northern Rhodesia (now Zambia) after the Second World War. Kay (1965) describes the situation:

> "Large areas were deforested and fallow periods were insufficient to permit regeneration of the woodland. Overgrazing and annual bush fires contributed to the degradation of the vegetation both on the plateau and in the dambos, and 'any prospect of recovery became increasingly remote as the soils deteriorated under the punishing

> treatment' (Trapnell 1943). Soil deterioration - the loss of organic matter and available plant nutrients and of the structure of the soil - is less readily observed than soil erosion but is equally serious and, in fact, it greatly facilitates erosion..... Destruction of the vegetation cover, particularly on steep slopes and dambo margins, and soil deterioration greatly increase run-off and reduce the stability of soils. Excessive sheet and gully erosion follow; valuable top-soil is removed, and deep gullies are cut in dambos and other drainage lines and the local water table is thereby lowered and water supplies are endangered".

Similar problems continue to be identified today in many areas of the region, and assertions are made about their consequences. According to SARDC (1994),

> "A combination of inequitable land allocations [this issue is returned to later] leading to high population densities in specific areas, and poor farming methods, have led to declining productivity of grazing lands, falling crop yields and diminishing water supplies. This has been aggravated by increases in livestock numbers without a commensurate increase in land area for grazing".

Soil erosion

UNEP (1992) reports that over 50% of the soil degradation in southern Africa is due to overgrazing, with cultivation causing most of the rest. The contribution of domestic felling of trees for fuelwood, fencing and other purposes is said to be relatively minor. The view in Namibia is that the problem is not so much there being too many cattle *per se*, but too many grazing in one place for too long - so the issue is one of management (Ashley *et al.* 1995; NAPCOD 1996).

Whilst the use of improved seed varieties and fertilisers can increase yields for a time, real productivity declines with soil degradation. It is predicted that in 30-50 years, crop yields in the region will be reduced by 50% if the degradation of cultivated lands continues at current rates (Scotney & Dijkhuis, 1990). According to Twyford (1988), after over 20 years of soil erosion, the effectiveness of fertilizers had already been cut by 50% in some intensively farmed areas in Malawi. Stocking (1986) has calculated that soil nutrient loss in Zimbabwe through soil degradation costs as much as US $50 per ha per year on cultivated and US $80 per ha per year on grazing land. The costs for the region are undoubtedly enormous.

Figures for soil erosion are available for most countries. But they vary considerably, probably because of using different methods of measurement. In any case, they give no real indication of productivity changes. SARDC (1994) reports examples of national calculations of annual rates of soil loss through erosion (e.g. 300-400 million tonnes in South Africa[3], 96 m.tonnes for Zimbabwe's Save Catchment, 3 m.tonnes of topsoil in Zambia from cultivated land, and 50,000 tonnes of soil in Swaziland from gully erosion alone). But how reliable are such figures ?

Stocking (1996) has challenged conventional wisdom about soil erosion in Africa, exposing contradictions between the scientific evidence of erosion, the selective use and misuse of results, orthodox 'knee-jerk' responses to visual evidence of erosion, and policy responses:

> "Soil erosion 'facts' may be as hidebound with bias, error and prejudice as the outpourings of social science..... A major pillar of received wisdom in narratives about environmental change and environmental policy-making in Africa may not be as solid as some scientists and policy-makers would wish us to believe".

He points out that there are many false assumptions, particularly about scale effects (notably from data from field erosion/runoff plots), and that great caution is needed about relying on generalizations,

[3] This volume of soil, when loaded into seven tonne lorries parked bumper-to-bumper, would stretch 7.5 times around the equator !

interpolations and extrapolations based on the available data. The potential for experimental errors is raised and doubt is cast on the validity of some of the methods used to determine soil erosion, particularly the use of soil mounds beneath trees, and Stocking even challenges some of his own calculations in Zimbabwe. Biot (1990) has similarly called into question the trustworthiness of this technique.

Decision-makers, planners and donors clearly need to exercise caution over claims for the rates and extent of soil erosion. Yet there is, without doubt, much soil erosion in the region. However, there is surprisingly little information available about its extent, despite its importance.

> "At this stage it must be admitted that the total picture of soil erosion in the region is not clear. We might have quantitative data for small catchments and on individual fields. But on a larger scale, the extent of soil erosion in the region consists of evidence which needs further proof and validation. However, for anybody who has travelled in the region, there is no doubt that the situation has to be taken with serious concern" (Segerros & Maro 1995).

Nor is much known about the processes involved and cost-effective control measures (Chakela *et al.* 1989). The World Atlas of Desertification (UNEP 1992), shows the most extensive serious degradation as occurring in central and western South Africa, with localised pockets of serious degradation in Angola (between Luanda and Huambo), in northeastern Botswana, and in central and northeastern Tanzania. Little or no soil degradation is indicated over half of the region. However, given the challenges raised by Stocking (1996) and others, the reliability of this picture may be questionable, particularly in arid and semi-arid areas. Another initiative is the erosion hazard mapping programme started in 1986 by SADC ELMS in the SADC countries and an equivalent exercise in South Africa. However, this exercise considers only physical parameters and ignores socio-economic aspects and may be of limited use (Mikael Segerros, pers.comm).

For several decades, soil erosion research has been undertaken, soil conservation legislation has been enacted, and there have been repeated warnings of the threat of advancing soil degradation (some genuine and of great concern, others quite overblown with no factual basis). Yet there are still serious information gaps which make it difficult to provide reliable predictions of increases in soil degradation and the severity of the problem in southern Africa. However, SARDC (1994) provides a useful review of the state of soil erosion in the region's ecozones.

Several types of soil erosion are important. Water erosion is greatest on slopes (even as gentle as 3%) and hillsides. Gully erosion can be spectacular and highly visible, carrying a lot of sediment locally, but it contributes only a modest amount of sediment in regional terms. It is usually a symptom of a degraded catchment, not the cause; and is far less significant than sheet erosion as far as soil productivity is concerned. Sheet erosion is much less obvious, but is by far the most important and widespread - probably accounting for about 50% of all soil loss. Wind erosion is significant in some areas, particularly in arid and flat areas with little vegetation to break winds, e.g. in Botswana, Namibia, and parts of South Africa, Tanzania and Zimbabwe. Physical degradation affects soils to a more limited extent. It includes such problems as soil capping and crusting by heavy rain, compaction by livestock and machinery, and waterlogging from over-irrigation. Salinisation, acidification, loss of nutrients and organic matter, and pollution are forms of chemical degradation - mostly the result of human activities, particularly intensive high-input agriculture and irrigation.

Various factors combine to affect soil erosion. Much erosion occurs during heavy storms at the outset of the rainy season when vegetation ground cover is minimal. It is generally agreed that maintaining vegetative cover conserves soil - roots binding and aerating soil, protection from wind and heavy rain, reducing evaporation, etc. However, Stocking (1996) describes some of the ambivalent effects of vegetation on soils - it does not always have a positive and protective influence on sites where it grows - and points to the need to carefully "assess the specific conditions of site, slope, rainfall and

vegetation type before determining whether or not plant cover is likely to conserve soil". However, in most cases, maintaining plant cover provides an effective way to control erosion, particularly for resource-poor farmers. Paradoxically, it has been argued that, in some circumstances, erosion may be useful in removing low nutrient status upper soil layers to expose nutrient-richer subsoil or weathering material (Richard Bell, pers.comm).

Fire is employed to improve soil fertility (through ash), kill insects and poisonous weeds, and to stimulate grass growth for grazing. But it is often used late in dry seasons (sometimes deliberately to 'control' bush encroahment) - but these late "hot" burns tend to bake the soil surface and limit water penetration, leaving the soil bare and vulnerable to rain, wind and sun. Droughts in the region exacerbate these problems with the roots of perennial grasses dying and annuals failing to set seed. As SARDC (1994) note,

> "there is a vicious circle between drought and soil productivity. Drought increases soil degradation problems, while soil degradation magnifies the effects of drought. Because of this, droughts can help to pinpoint areas of poor land management. Prolonged droughts during the 1980s exposed poor cultivation practices in parts of the Kgalagadi, South Africa's Cape and Zimbabwe, for example".

Overgrazing

Another important issue about which there is considerable dispute is 'overgrazing'. A large proportion of the people of the region is dependent on cattle and other livestock, particularly in the dry savannas and semi-arid areas which are not suited to crop production. The distribution of livestock is uneven in different countries and numbers vary significantly between droughts and
periods of good rains. Over the period 1988-90, it is estimated that there were an average 45 million cattle and 71 million sheep and goats in the region (WRI 1992). The blame for soil degradation in the region is frequently placed on subsistence livestock-owners but, in practice, large areas of the degraded land in the region are actually under commercial ranching - notably in Namibia, South Africa and Botswana. In the latter country, a market economy, the production of cattle for sale, together with the sinking of thousands of boreholes, resulted in a rapid increase in livestock numbers between the drought years of the early 1960s and those of the early 1980s. Grazing land policy has been constantly under review and many ranching projects have been attempted but without great success. Many of the largest stock owners are wealthy townspeople, some of whom have little knowledge of rangeland requirements. Furthermore, they often have dual-grazing rights, first grazing their cattle on communal land and then, when the grass is 'finished', moving them to private land (e.g. in Botswana).

Rangeland degradation, due to overstocking and overgrazing, is usually described as including: loss of overall plant cover and, consequently, increased water and wind erosion; decline in palatable grasses; invasion by unpalatable grasses, poisonous plants and thorny shrubs; and physical degradation through trampling. Whilst there is general agreement on these impacts, rangeland degradation has become the subject of considerable debate, with continuing dispute amongst 'experts' over the resilience of rangelands and their capacity to regenerate (Sandford 1982, Campbell *et al*. 1990, Skarpe 1991, Abel 1993). In fact, over the last few years, there has been major rethinking of various assumptions about range ecology and range management practice, focusing on environmental relationships in equilibrium and non-equilibrium ecosystems (see Box 2.1). These issues have been shown recently to be just as important and

Box 2.1: New Thinking About Range Ecology and Range Management Practice

"What were once the hallmarks of the discipline are now questioned. The utility of terms and concepts such as 'vegetation succession', 'carrying capacity' and 'degradation' are being reassessed, particularly for the dry rangelands where system dynamics are dominated by highly variable rainfall and episodic, chance events such as drought.

The 'new' thinking highlights, in particular, differences between so-called equilibrium and non-equilibrium environments. Equilibrium environments are those that show the classic feedback mechanisms normally assumed in mainstream range management, In such settings vegetation change is gradual, following classical successional models. Livestock populations are in turn limited by available forage in a density-dependent manner, so that excessive animal numbers, above a 'carrying capacity' level, result in negative effects on the vegetation. In the longer term this is assumed to cause more or less permanent damage - degradation or desertification. Such environments are typically found in wetter areas with more predictable patterns of rainfall.

By contrast, in non-equilibrium environments, range degradation is not such an issue. Production potentials of both grassland and livestock are so dominated by rainfall (or other external variables) that the livestock populations are kept low through the impact of drought or other episodic events. Livestock, under such conditions, do not have a long-term negative effect on rangeland resources. Such non-equilibrium environments have highly dynamic ecosystems and are typified by the arid or semi-arid zones where rainfall variability is high.

In practice, the distinction between these contrasting environments is often blurred. There is clearly a gradation between these two separate ideal types.

Three propositions summarise the recent thinking of range ecology:

■ Many arid and semi-arid grazing ecosystems are not at equilibrium and external factors (e.g. drought) determine livestock numbers and vegetation status. Grazing therefore has a limited effect on long-term grass productivity. In such situations, opportunistic or tracking strategies [matching of available feed supply with animal numbers at a particular site] are environmentally benign and waste less feed;

■ The productivity of African rangelands is heterogenous in space and variable over time; therefore, flexible movement is critical; and

■ African pastoral production systems are influenced by a range of different livelihood objectives. Therefore, blueprint interventions aimed at boosting single outputs (e.g. meat) using simplistic management tools (e.g. fixed carrying capacity) as part of standardized models (e.g. ranches) are unlikely to work".

In essence, the history of livestock development in Africa has been one of equilibrium solutions being imposed on non-equilibrium environments. For example, the ranch model - aimed at maintaining stability through regulating animal numbers and balancing grass species composition with fenced paddocks, water points and reseeded rangeland - is ill-suited to highly dynamic non-equilibrium ecosystems. But this model continues to be promoted and repeatedly fails in such areas. The development challenge is not the transformation of pastoral systems into ranching systems, but increasing the efficiency of tracking.

Source: Scoones (1994).

relevant in South Africa as elsewhere in the region (Dikeni *et al.* 1995)[4].

[4] There are some contradictions about the biodiversity impacts of rangeland degradation. A recent study in xeric vegetation in South Africa found a loss of plant and insect species in response to prolonged intensive livestock grazing, but an increase in the diversity of terrestrial reptlies (Fabricius & Burger, 1996).

Although the point is debatable, it has been argued that wild animals impact on southern Africa's ecosystems far less than livestock, since they generally consume a much broader range of plants than cattle and eat more shrubs and trees (Taylor & Walker 1978) and most range further from water sources than livestock, and since livestock tend to be "concentrated in relatively small areas year-round and protected from predators and diseases" (SARDC 1994).

Pastoralists (particularly nomads) have often been blamed for adversely affecting the environment - through overgrazing particular areas, but there is plenty of evidence to contradict this idea. For example, the Maasai in Tanzania's Ngorongoro District are said to destroy grass cover and cause soil desiccation, but studies of the area do not substantiate this view (Homewood and Rodgers 1984; Biot *et al.* 1992).

The new thinking in range ecology (see Box 2.1) also highlights the need to revise conventional wisdom about the relationships between pastoralists and their environments (Table 2.1). But land appropriation for other uses is steadily decreasing the areas available to pastoralists, often taking the best grazing lands, and forcing pastoralists to concentrate in smaller areas - with inevitably increased impacts on vegetation - and to use more marginal lands. Land appropriation also disrupts transhumance. In Namibia, the key issue is not just the size of the area available to pastoralists but access to seasonal grazing and opportunities for mobility. Closing off a corridor can be disastrous, even if the extent of lost land is small. In Tanzania, large areas of Barabaig pastoralists were alienated from prime dry season grazing sites when the government established large wheat farms in Babati District (Lane & Scoones, 1991; Lane, 1996), and cultivating peoples

Table 2.1: Comparison Between the 'Old' and 'New' Thinking About Pastoral Development

Area	'Old' Thinking	'New' Thinking
Objectives	Focus on commodity production; livestock development.	Focus on livelihoods: pastoral development.
Range management	Open range improvement (legumes, fodder trees, rotations). Paddocking and restrictive movement: fences	Focus on key resources: improvement, rehabilitation, creation. Mobility and flexibility: no fences.
Planning	Blueprint development planning	Flexible, adaptive planning, with local involvement and a recognition of uncertainty.
Drought	'Normal' year development and drought relief separated. Focus on production issues in 'normal' years	Drought 'proofing' and safety net provision integrated. Focus on tracking: de/restocking, supplementary feeding, etc.
Tenure	Fixed tenure regimes: privatization (or exclusive communal). Conflict issues largely ignored.	Flexible tenure: complex mix of overlapping and integrated regimes. Focus on conflict negotiation, mediation and arbitration.
Institutions and administration	Service delivery package through centralized extension services. Extension workers for technical delivery.	Pastoral organisations for local management issues. Extension workers as institutional organizers.

Source: Scoones (1994)

have settled extensively in similar sites even though the soils are not suited to cultivation - a fact that is likely to lead to land degradation problems in the future. Destocking is sometimes suggested to reduce grazing pressure and counter land degradation. But this is unlikely to work - particularly if on a voluntary basis - since most pastoralist families now have less than the minimum 30-45 cattle needed to survive. However, recent 'state and transition' models for arid shrublands have demonstrated the irreversibility of land degradation beyond critical threshold levels (Milton *et al.* 1994; Fabricius & Burger1994).

The new thinking on rangeland has challenged conventional views about livestock management. Critics argue that it implies that there are no environmental land degradation problems associated with rangelands when, in practice, degradation is clearly occurring and rural people have to struggle harder because of it. They also complain that the new thinking appears to prescribe a single and unrealistic solution based on traditional and strong communities. However, the new thinking has opened debate focusing on how resources are managed and by whom, as opposed to numbers of cattle and carrying capacity issues.

Crop production

A major challenge in southern Africa is to feed the rapidly-growing population. Agricultural production is being increased through opening up forests and grazing lands to cultivation, and by intensification and irrigation. But the extent of suitable arable land is limited. Increasingly fewer farmers now practice shifting agriculture and, without fallow periods, much land is becoming exhausted. There is also increasing pressure to use unsuitable marginal lands, and this is likely to add significantly to the region's genuine land degradation problems. The situation is bad enough in many existing cultivated areas - even under modern farming techniques. Many farmers remove weeds and crop residues without substituting with manure or fertilizer, depleting the soil of organic matter and leaving land bare for long periods. Regular ploughing has been shown to lead to organic matter loss (Elwell 1989) and to plough pans, particularly in soils with duplex profiles in which light sandy topsoils overlie a heavy clay subsoil. Excessive fertilizer applications (particularly nitrogen fertilizer) leads to increased soil acidity and the release of toxic substances which inhibit plant growth. In South Africa, it is estimated that 10% of the cultivated land is affected by acidification (> 5 million ha severely; 10 m.ha moderately) (Farina & Johnston 1988).

Land allocation and land pressure

Another major factor influencing land degradation, alluded to earlier, is the issue of land allocation. SARDC (1994) describe the problem as follows:

> "Before colonisation, there was an abundance of land in southern Africa and population pressure was low[5], so very little damage was done to the soil. The colonial administrations did not recognise that traditional African forms of agriculture, such as pastoralism and shifting cultivation, were appropriate and sustainable use of land over the long-term. They believed that Africans were wasting land, and used this as a justification to designate most of the best land for themselves.
>
> Today's soil-degradation problems are largely a consequence of the inequitable, colonial land-allocations. The problem now is not solely the quality of the land but the high population densities. Historically, lands designated for blacks in some countries were insufficient to allow for population growth, and today are extremely crowded. High population densities drive farmers onto marginal lands which erode more easily, and do not produce much, while the decreasing grazing area has to carry increasing livestock numbers".

[5] This point is misleading as human, livestock and wildlife numbers reached a long-time low in the last quarter of the 19th century. Before that, human populations were much higher.

These problems are particularly acute in the communal areas of Zimbabwe and the 'homelands' of South Africa, and pose a serious socio-political challenge to the governments of those countries.

Elsewhere, current economic and political policies of governments critically affect human pressure on the land. In Malawi, for example, commercial agricultural estates are strongly promoted. This has limited the land available to rural families and, in the southern part of the country, population densities now exceed 300 people/sq km. Many families have less than 1 ha to cultivate and are forced to crop the land continuously. Poverty is widespread and families are barely able to feed themselves There is insufficient land to keep cattle and therefore no organic manures are returned to the soil. It is not surprising that land degradation is increasing.

It will be essential to address poverty issues as part of any programme to reduce land degradation. Otherwise, even though methods of soil erosion prevention and control may be promoted, individuals and families will be unable to respond to them.

The region has seen various erosion-control programmes over the past few decades, most of which have failed due to their experimental nature; or because farmers' needs were not considered or they had no influence, yet they were expected to contribute much labour for few obvious benefits. The focus of agricultural extension is now on appropriate tillage methods and biological control approaches, whilst in Zimbabwe, a promising "no-till tied ridging" technique is being developed with communal farmers, building on local knowledge. Similarly, rehabilitation programmes are more likely to work if they are developed with local people, can adapt to local conditions, can change approach if needed, and are given time to become accepted and for the benefits to be recognised amongst communities. The Production Through Conservation (PTC) approach in Lesotho illustrates the issue (Box 2.2). A similar approach is the catchment approach to soil and water conservation in Kenya where local communities are purposefully involved in the analysis of their own farming and conservation problems, and decisions and recommendations made with their active participation (Pretty *et a*l. 1995). Another more local example is the Soil Conservation and Agroforestry project Arusha (SCAPA) in Arumeru District in northern Tanzania.

The challenge

Clearly, the debate on new thinking in rangeland management has implications for how the region deals with the issue of land degradation. Adapting to this thinking presents a real challenge, partly because the prescriptions are not clear - it is not often practical to revert to traditional ways - and the implications for institution-building and participant-led technology choice are expensive and intensive in terms of time and skills. Nevertheless, the new thinking is helping to highlight new directions, for example:

- it switches the focus from degradation of rangeland - which is probably less degraded than it appears - to degradation of arable land and lost tree productivity, and degradation as a result of irreversible changes in soil conditions and woody plant cover.

  For example, in Namibia, desertifiction is estimated to cost rural households about N$ 1 million per year in lost subsistence or cash production, but the majority of this is from lost access to wood products and reduced arable land fertility, not from lost livestock productivity (Quan *et al.*, 1994).

- it identifies the problems associated with the disruption (often by governments) of traditional sustainable management practices, or the failure of traditional institutions to adapt to new changes, e.g. increased population density, community gragmentation.

For example, again in Namibia, the Sustainable Animal and Rangeland Development Program (SARDEP) is focusing on institution-building to reconcile long-standing principles of common property resource management with current land pressures. Whilst the debate over land tenure in South Africa is very political, it is also trying to address what leads to sustainnable management.

Box 2.2: Production Through Conservation (PTC) in Lesotho

The PTC approach has grown from a pilot project to a national program and now serves as a tool in translating the government policy of democratization and people's participation into action. The approach of PTC is compared below with conventional approaches to soil conservation.

Conventional Approach	**PTC Approach**
■ Facing departments, divisions, donors	■ Facing farmers
■ National/government problems	■ Farmers' goals and visions
■ Blue print planning	■ Process planning
■ Centralized system	■ Decenetralized system
■ Covering whole districts, dispersed	■ Focus on capacity and interest
■ Area-based projects	■ Program support to districts
■ Specialist service through teams	■ Generalist interdisciplinary field staff, backed by specialists
■ Conservation	■ Sustainable production
■ Focus on land and natural resources	■ Focus on people
■ Incentives and grants	■ Interest, self-help, ownership
■ Extension messages supplied	■ Farmers' demand for service
■ Target group: general	■ Target group: specific
■ Strengthen ministry's ability to supply extension messages	■ Strengthen farmers' confidence to demand services
■ Wait for farmers' demands	■ Stimulate farmer demand and facilitate communities' expression of demand

2.2 Population and Urbanisation

The present and future people of southern Africa will determine environmental trends, through their decisions and actions. According to international statistics (Table 2.2), the population of the region in 1995 stood at 136 million, and is expected to roughly double by 2015. For the region, population growth averages 2.9% per year, although rates for individual countries vary between 2.2 and 3.8% (Table 2.2). In most countries, over 40% of the population is under 14 years of age, implying a high dependency rate and an expanding adult population in the future. This expansion is reinforced by declining death rates arising from improvements in health and nutrition. Although quite high, growth rates are stable or decreasing in six of the region's 11 countries. With the exception of Lesotho and Malawi, population densities are relatively low.

Table 2.2: Population Growth and Urban Centres in Southern Africa

Country	Population (millions) 1995 (a)	Average annual growth rate (%) 1990-5 (b)	Population (millions) 2025 (b)	Density per sq km (persons) 1995 (a)	Population in urban areas (%) 1970 (b)	1995 (b)	Projection to 2015[6] (b)	Annual urban growth rate (%) 1990-5 (b)
Angola	11.1	3.7	26.6	9.0	15	32	46.7	6.3
Botswana	1.5	3.1	3.0	2.6	8	28	47.9	7.0
Lesotho	2.1	2.7	4.2	67.5	9	23	39.3	6.2
Malawi	11.1	3.5	22.3	118.3	6	14	24.3	6.2
Mozambique	16.0	2.4	35.1	22.3	6	34	54.2	7.4
Namibia	1.5	2.7	3.0	2.4	19	37	57.0	5.9
South Africa	41.5	2.2	70.9	34.0	48	51	62.7	2.9
Swaziland	0.9	2.8	1.6	53.0	--	31	49.2	6.2
Tanzania	29.7	3.0	62.9	33.6	7	24	40.3	6.1
Zambia	9.5	3.0	19.1	13.0	30	43	52.9	3.5
Zimbabwe	11.3	2.6	19.6	29.1	17	32	47.9	5.0
TOTAL	136.2		268.3					
AVERAGE		2.9		40.0		31.7		5.7

Urban Centre Sizes in Southern Africa (b)

	1 - 5 million			0.5 - 1 million			Under 0.5 million		
	1970	1995	2010 proj.	1970	1995	2010 proj.	1970	1995	2010 proj.
No. centres	2	5	8	3	3	2			
Pop.(million)	2.56	7.96	13.66	2.32	2.46	12.95	6.20	123.85	203.62
% urban pop	23.1	34.9	43.1	20.9	10.8	3.5	56.0	54.3	54.5

Sources: (a) WRI (1996); (b) United Nations (1995).

[6] These estimates for urban population in 2015 contain large margins of error, and the recent round of censuses at the beginning of the 1990s suggests that they are likely to be too high rather than too low.

Three major trends are evident in the population dynamics of southern African countries: first, population will be expanding rapidly during the period to 2015; second, the demographic structure of societies will place a great burden on national economies - initially because of the large youthful population and, subsequently, as a result of an expanding and ageing adult population that will require jobs (livelihoods) and health services (Mhone 1994). Thirdly, by far the greatest urban growth is taking place in small urban centres with population under 0.5 million (see Table 2.2) where people are dependent on agriculture and agriculturally-related industries for their livelihoods.

As Rowley and Holmberg (1992) point out, there are still some people who have "Malthusian fears of humans swamping the Earth and swarming over national borders". However, in terms of environmental impact, population is now seen more clearly as a multiplier of the interaction between consumption per person and the technologies to supply that consumption and dispose of the waste (Erlich and Erlich 1991). The increasing population has been identified as multiplying the effects of the region's environmental problems (SADC ELMS, 1991). Slowing the rate of population growth - conventionally through family planning - is often seen as a key way to ease and tackle the 'pressures' on the environment. But it is now generally accepted that the best approach is to reduce poverty and increase standards of living - and indeed this is now the professed focus of most donor agencies.

With the exception of South Africa, most of the populations of the countries in the region are rural dwellers and are dependent directly on agriculture, or - as already noted - live in agriculturally-dependent small urban centres with populations exceeding 2000. Where the rural population is highly concentrated in communal lands, many households are vulnerable to economic and environmental factors. As Mhone (1994) notes:

- there is an increasing concentration of land in the hands of a few better-off peasants while the majority are left with smaller parcels of land, often in areas that are environmentally poor and removed from the infrastructure and major markets;
- poorer households tend to have inadequate labour resources. This is illustrated by the tendency for household size to correlate directly with farm size among communal farmers, i.e. the larger, well-to-do farming households not only have more land but also larger households;
- extension services are more often targeted at and taken advantage of by the few better-off farmers;
- population pressure increasingly is undermining the capacity of the land held by impoverished households to carry these households;
- vulnerable rural households are under pressure to diversify their income sources and members disperse to take up a wide range of activities. This entails migrating to mines to work, to urban areas for casual wage labour, to squat, to engage in semi-feudal tenancy arrangements on better-off farms, to take on rural non-farm activities that have low productivity and so on. The pressure on households leads to a division of labour by sex and age that disadvantages females and children; and
- communal areas are overburdened by the cheapening of wage labour by subsidies to urban areas and by having to accommodate spent labour from the formal sector.

Despite the preponderance of rural population in the region, urbanization[7] is one of the most pervasive and powerful dynamics affecting southern Africa (Dewar, 1994). In sub-Saharan Africa,

[7] Urbanization is used here to refer to the growth of the number of people living in towns and cities and the commensurate growth of these settlements through rural-urban migration and natural increase.

excluding South Africa, the number of towns with a population of more than one million grew from one in 1960 to 14 in 1980, with 45 predicted by the year 2000 (Fair, 1990) (see Table 2.2 for southern African figures). Generalisations about urbanization are difficult as the experiences of countries in the region are significantly different. Also the statistical data are not reliable and need to be used with caution, but they do indicate a clear pattern of what is happening. Current levels of urbanization vary. The lowest is Malawi (14%), the highest are South Africa (51%) and Zambia (43%) (Table 2.2). But rates of urbanization are generally very high, exceeding rates of natural increase by a significant margin as a result of rural-urban migration (see Table 2.2)[8]. The causes of such migration vary and are complex. They include: economic factors, landlessness, ecological and environmental factors (loss of soil productivity through land degradation, the effects of drought, etc.), social and political factors. Rates of urbanization in Mozambique and Angola have been greatly influenced by war in those countries. In the former, thousands of rural people have moved to the towns for protection. In the latter, the same pattern has been balanced, since the mid-1970s, by a subsequent drift from the towns to the rural areas. Since the mid 1980s, in various areas, government-controlled and guerilla-controlled towns and settlements have been evacuated and repopulated as the war has fluctuated.

A number of population dynamics are evident: rural overcrowding, particularly where there is communal land tenure (discussed above); higher densities around regional transportation routes (e.g. a high proportion of people in Zambia live in towns and settlements along the main railway line); and rural-urban migration - South Africa's Pretoria-Witwatersrand-Vaal triangle is a major target. In 1990, 38% of Lesotho's entire male labour force worked in South Africa, although the figure has declined substantially in recent years (Europa, 1992). Although natural increase is the main cause of urban population growth in the most urbanized countries (particularly South Africa and Zambia), rural-urban migration is the main contributor in the less urbanized countries. The interpretations put on these pressures are the source of some debate. Dewar (1994), for example, argues that the consequence of these forces has been 'hyper-urbanization', which he describes as:

> "a rate of urbanization that is too great for the urban systems to accommodate adequately in terms of formal sector job creation, the provision of social and utility services, housing programs, etc. The manifestations of this are vast, often unserviced, informal or squatter settlements, hawking and other forms of informal economic activity, begging, high incidences of crime and so on ..... South Africa, since the mid-1980s, has moved from a situation of total control to one of almost no control. It is estimated that more than six million people live in informal settlements, many of which have only rudimentary services".

Others point out that such judgements imply that there is some optimum level of urbanization but that history does not really support such an analysis. Whilst increasing rates of urbanization can be problematic, there are many cities in countries such as the affluent USA that have grown very rapidly without any problems. This, it is argued, suggests that the problem is one of finance and development rather than urban growth *pers se* (Diana Mitlin, pers.comm.). In practice, whilst conditions in overcrowded urban centres may be dreadful, people actually move to such areas and stay in them for rational reasons (it can be far easier to survive in an urban area than in a remote rural area - the conditions are not good in the city, only better). There are clearly some benefits from urban migration. For example, in some areas it relieves direct pressure on the land. Of course, elsewhere it might not relieve such pressures, but it does slow the increase. And wage remittances by urban workers are very important in enabling rural families to manage on meagre rural subsistence, and to invest in the land or long-term strategies.

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[8] The rate given in Table 2.2 for South Africa has little meaning. Relative to GDP, the country has a low rate of urbanization because apartheid laws, and not economic and social factors, have determined where people have lived. The country is now undergoing rapid adjustment (Diana Mitlin, pers.comm.).

But urbanization at today's rapid levels can cause considerable problems. SARDC (1994) summarise them as follows:

> "Housing and other services are often unable to keep up with demand, leading to squatter settlements and unsanitary conditions. Infrastructure (such as roads, or water and sanitation services) designed for specific population levels, breaks down under the strain of trying to serve too many. Towns and cities place difficult demands on water and fuel resources. Cities also produce huge amounts of waste in the form of sewage and industrial pollution, rendering water in rivers and lakes dangerous. Urban areas are the largest and most concentrated pollution sources in the region".

At present urbanization rates, over half of southern Africa's population will live in towns and cities by the year 2000 and this means that the pressures described immediately above will increase. While rural population is declining in percentage terms, absolute numbers are increasing. Thus, overall, urbanization does not relieve pressures on rural resources - it merely slows the increase.

No country in the region has adopted a cohesive urban land policy and urban development occurs in fragmented parcels - frequently grafted on to separated townships. As a consequence, whilst some township and squatter settlements have very high densities, other urban settlements are sprawling, fragmented and low-density, making poor use of land, water and other scarce resources. They contribute to environmental deterioration, are expensive and inconvenient for inhabitants, prohibitively expensive to service, almost impossible to provide with efficient public transport and generate few opportunities for small entrepreneurs (Dewar *et al.* 1991).

Whilst the rapid development of squatter settlements is usually seen as a problem (due to under-servicing and under-resourcing), some people view this trend as a benefit since people are building communities, finding jobs and creating local demand, etc. Some even suggest that urbanization, far from being a major dilemma, represents a solution to aspects of population growth by relieving direct pressures on rural environment resources. They also point to the increasing contribution of 'urban agriculture'.

Another factor which has affected urban growth in the region has been structural adjustment programs (SAPs), many promoted by the World Bank, which have influenced national economic growth rates, the size and allocation of government expenditure, and the impacts of government policies on different sectors. The impacts have varied in different countries. In general, the poor in urban areas have borne the burden of increasing prices of essential basic commodities, including food, resulting from SAPs and, in some countries, there has been increased unemployment and income loss following fiscal and monetary contraction. There have also been constraints on access to basic social and public services such as education and health due to reduced public expenditure. SAPs have impacted on public sector employment in some countries, e.g. through falling wages, civil service cuts, etc. Construction in other countries has been cut back. Many SAPs have reduced government subsidies for food, leading to increased prices which particularly affects the urban poor, especially those who rely on bought (as opposed to home-grown) food. The impact of SAPs may often have been to increase poverty, but the extent of the impact depends on who is most affected by cuts in public expenditures and recession. The poorest, who may not have access to services, may not be affected. Higher prices charged for services may also lead to better utilities with better quality of service and coverage. SAPs may also disproportionately affect women, because of their particular roles in households (e.g. child rearing - affected by cuts in child and maternal health services; household management - affected by reduced water quality or reduced garbage collection). The World Bank is increasingly promoting poverty reduction and mitigation measures in SAPs.

Several points are important in considering future policies and actions. Continuing rapid rates of urbanization appear inevitable. Past experiences and failures suggest that policies to counter this are unlikely to work, but efforts can be made to mobilize resources to promote secure livelihoods for people in the rural areas, enabling them to (choose to) stay there. Urbanization is usually seen as a problem issue and most official development actions are responses to 'the problem'. But more imaginative initiatives can be taken which might enable urban people to play a greater role in solving their own problems, e.g. providing urban households with secure tenure and promoting empowerment-based urban development strategies. The importation of inappropriate (usually northern) planning and urban management systems and approaches has not worked in southern Africa. Dewar and Uytenbogaardt (1991) take the view that:

> "It is necessary to move away from the township mentality that focuses almost exclusively on utility services and shelter and to give attention to creating qualities of 'city' - urban places that are vibrant, conducive to efficient public transport and flourishing small businesses, convenient for people on foot and notable for the quality of life. All this would require compaction instead of sprawl, integration instead of fragmentation, and a rich mix or overlap, instead of separation, of activities and uses".

Most research on urban issues in Africa has focused on the large cities. The potential of small towns as potential catalysts for rural development has received little attention, but this is a key issue. Much development aid to rural areas has ignored the urban component. Yet rural and urban economies are interdependent and complementary. As Baker (1995) notes, "much rural income is not derived directly from agriculture but takes the form of off-farm and non-farm income generated by farm households, often in small towns". The whole issue of rural-urban linkages needs much more research attention and policy consideration. Agricultural and land use planners tend to deal with rural issues, whilst town planners focus on urban problems. No-one appears to have responsibility for the linkages between the two and most governments have no strategy covering these issues.

2.3 The AIDS Issue

Population trends are likely to be affected by the AIDS (acquired immune deficiency syndrome) epidemic which began to spread in the region in the late 1970s and early 1980s, and is now reaching massive proportions. The disease is a major challenge facing governments.

A problem in assessing the extent of the epidemic in the region is the lack of data and the unreliability of the data that are available. Cases are greatly under-reported (maybe as little as 10%) for various reasons, e.g. limited medical coverage, civil conflict, bureaucratic inefficiencies, and cover-up and refusal to record or publish statistics (Whiteside 1994). South Africa probably has the best data in the region on HIV incidence.

Most cases are among heterosexual men and women and paediatric AIDS is common (so-called Pattern II Aids) (although, in South Africa, until 1987, Pattern I AIDS was prevalent - with most cases amongst homosexual/bisexual men and intravenous drug users - with paediatric AIDS uncommon).

The region has had a varied experience of AIDS to date. In parts of the region, particularly Malawi and Zambia, levels of HIV infection in the general population are approaching those of Uganda and other Central African countries, and here the epidemic appears to be approaching its peak. Generally, however, in other areas, the epidemic is in its early stages and the incidence is much lower, e.g. Botswana, Lesotho, Namibia, South Africa and Swaziland. A further factor is the rapidly increasing incidence of endemic diseases which have hitherto been under some control: malaria, tuberculosis (TB) and, in paediatric HIV cases, measles. Inoculation campaigns against these diseases are hampered by HIV infection in that the vaccine, instead of conferring immunity, can cause the disease.

The spread of HIV (and TB) in the region is being aided by social and political stresses: internal and cross-border migration (mainly in search of employment, and mainly to South Africa), refugees, conflict and civil war, militarization (now very much reduced), drought (causing movement of people), poverty, high levels of sexually-transmitted diseases, rural-urban linkages, etc. As a result, HIV probably will spread rapidly in southern Africa - perhaps more rapidly than elsewhere in Africa because of the numerous factors that put the population at risk (Whiteside 1994). The spread of the disease cannot be halted - at best it can be slowed.

What are the implications for the region ? This is the subject of considerable debate. Some observers have predicted that it will cause a decline in population growth rates, even reducing the actual population; demographers argue that AIDS will have virtually no effect on total population growth because of high fertility rates; others say that the lack of reliable information on the extent of AIDS makes any prediction questionable. Many commentators believe that economic growth will be affected adversely. There have also been predictions that labour will become scarce and that high levels of mortality will induce political turmoil. Whiteside (1994) concludes that "all of this could happen, but awareness of these dangers may go some way to averting them". Whiteside also reports that there is consensus amongst southern African modellers that the numbers of HIV-positives in the sexually-active population will not exceed 20-40% at the peak of the epidemic and the southern African population will not decline.

Despite the uncertainties, the disease will have a significant impact at all levels of society and on all aspects of economies. There will be enormous pressures on public and private health care systems. A key indirect impact is that skilled and trained human resources - already in short supply - may be the first to be hit by the epidemic, slowing firms, industries and economic growth, and affecting both subsistence and commercial agriculture. A serious issue is that AIDS appears to spread first in urban populations, where a disproportionate proportion of the skilled and educated people will be infected - the very ones that societies can least afford to lose. There are likely to be major implications for government resource allocations due to the costs of testing and HIV-related illnesses clogging up health care systems, particularly hospital beds.

Whiteside (1994) suggests various steps that can be taken:

> "The first is to acknowledge - at all levels - the presence of the disease. All the countries in the region should gather and make available data on HIV incidence and its rate of spread. There should be regional discussions on the epidemic and the role of regional co-operation in slowing it.
>
> The immediate aim should be to slow the spread of HIV and the long-term aim to plan for its impact on the economies, [environment (author's addition)] and societies of Southern Africa. One of the most immediate ways to slow the spread would be to reduce mass movement of people without their families. This would entail looking at the refugee crisis and giving migrants, internal and international, the opportunity to have their families with them.
>
> Research is needed urgently on the sectoral and macro-economic [and environmental (author's addition)] effects of the disease. Knowing what it may do will be a large part of the battle in coping with it. In the long run AIDS will be largely a disease of the poor and disadvantaged and the best response is development and equitable economic growth".

The governments of southern Africa face a critical choice - for which a decision is immediately required. They can either ignore AIDS and hope that it goes away (as some are doing), or they can accept its presence and deal with it seriously, try to halt its spread, and plan for its consequences. Donors can play a major role in persuading governments to make the choice and in helping them to take action.

2.4 Conflict

The region is currently enjoying peace, stability and democracy which has facilitated bilateral and regional cooperation (particularly through SADC) on many environmental and economic issues, as discussed elsewhere in this paper. As a result, we can be optimistic about continued progress in dealing with the many problems facing the region.

This stability follows thirty years of troubles which saw liberation wars (in Angola, Mozambique, Namibia, South Africa and Zimbabwe), civil conflicts (in Angola and Mozambique), and destabilization by South Africa under apartheid (throughout the region). Apart from the civil war in Angola which flared afresh after the elections in 1992, other immediate military threats in the region have largely disappeared. However, instability beyond the region's borders can still affect countries in southern Africa[9].

The impacts of war

Whilst the potential for renewed war in the region now appears remote, it is important to note that past wars have had a range of direct environmental impacts (some of which continue to affect the region). SARDC (1994) lists these as including fires, bombings, pollution from war chemicals, trenches, anti-personnel traps and the felling of trees to remove cover. De-mining in the rural areas of Angola[10] and Mozambique remains a huge and urgent task. Indirect effects include over-exploitation of wildlife for food or cash[11], lack of management and law enforcement in protected and other areas, and refugees and displaced people (may of whom migrate to urban areas) who may cause localised environmental problems.

One of the most important environmental consequences of war in the region has been the displacement of people (in search of 'safe' areas) and ensuing random settlement of refugees, but the environmental impacts have depended on the numbers of people at any site and the duration of their stay. Large numbers concentrated in a small area often cause much more damage than fewer people dispersed over a large area. Malawi has borne the brunt of the Mozambican refugee problem. SARDC (1994) discusses the issue of armed conflict in the region and its environmental consequences in some detail. Paradoxically, the report points to some actual environmental benefits when areas become depopulated during armed conflict such as the revival of previously depleted wildlife populations and the regeneration of natural vegetation, e.g. the *Acacia* and *Faidherbia* forests in Mozambique.

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[9] For example, the recent civil war in Rwanda resulted in an influx of refugees into Tanzania, and fighting in eastern Zaire in late 1996 was a cause of great concern - with the potential of drawing some of the countries in southern Africa into the conflict (either by providing military forces to keep peace or to separate warring factions). South African forces have been engaged in peace keeping duties in Burundi.

[10] Recent press reports put the number of mines laid in Angola between 9 and 11 million (almost one for each of the 11 million population) which continue to kill and maim innocent victims. It is suggested that there is one amputee per 344 inhabitants and that tens of thousands of victims have been fitted with artificial limbs. Land mines cost less than $ 3.5 to buy, but between $ 350 and $ 650 each to clear (London Evening Standard, 14 and 15 January 1997).

[11] For example, there was illegal hunting by the military in Northern Namibia and Angola during the liberation wars. Heavy poaching by UNITA-related troops continues in southern Angola and the Caprivi strip due to their lack of food. War generally makes weapons more widely available, and therefore facilitates illegal hunting.

Similarly, much cultivated land in Mozambique has laid fallow for many years during the war and, in these areas, the government is now promoting its potential for good land husbandry.

More environmental damage has resulted from indirect effects than from direct destruction. The environmental damage resulting from the conflicts in Angola and Mozambique (and in neighbouring states) has not been fully assessed. There is a lack of verified data on war impacts, and baseline environmental data from before the conflicts, needed for comparison, is very limited. However, the people have been left among the poorest in the world.

Potential for domestic conflict

The current domestic and regional transformation processes that have led to much progress in governance, cooperation and institutional change could be affected should domestic conflicts arise. Ohlson and Stedman (1993) listed the following areas of potential conflict within the region's countries:

- conflicts over control of government or territory;
- conflicts associated with war termination and reconciliation;
- conflicts of participation caused by the monopoly of political power by a dominant party or racial group;
- conflicts over inequitable distribution of resources; and
- conflicts over identity, due to ethnicity.

More recently, Odén (1995) suggested a number of possible threats to the democratization process in southern Africa :

- serious conflict between Inkatha and the ANC government in South Africa, and an attempt to secede KwaZulu/Natal from South Africa, increasing the level of violence and creating a more unstable political environment;
- UNITA returns to war in Angola [12];
- a return to one-part rule or military coups in countries where the new multi-party democracies are perceived as 'no-good' systems if their introduction fails to deliver material improvements for the majority of the population

Parts of some countries could conceivably become vulnerable to separatist tendencies, e.g. the Cabinda region of southern Angola.

[12] A peace accord in 1994 ended two decades of civil war in Angola. A Government of National Unity and Reconciliation was due to be inaugurated in January 1997, but was postponed when negotiators for the government and the National Union for the Total Independence of Angola (UNITA) reached a deadlock, following new demands and conditions set by UNITA. A briefing report by SARDC (1997) notes that "suspicion still exists between the Angolan government and UNITA. Reports say more than 15,000 UNITA soldiers have disappeared from the UN assembly points further widening the mistrust gap. UNITA is also allegedly refusing to hand over to the government some areas it controls in the diamond-rich areas of the north".

Potential for intra-country conflicts

The future of southern Africa in terms of further serious conflict is impossible to predict. External factors will undoubtedly influence stability in the region. Odén (1995) highlights the following:

- higher investment of external capital in South Africa than in other countries, increasing regional imbalance;
- increased protectionism in the European Union as a defence against international competitiveness - the Lomé Convention (in its present form) will expire in 2000, and priveleges in the EU market may be eroded or abolished; and
- political stability in the region is being eroded by organised international crime which "is increasingly using southern Africa as both a market and a transit area for trade in drugs, arms and luxury cars".

Two resources that could be the focus of considerable future conflict are fishing and water. Foreign fishing fleets are already plundering marine resources. If the region is ravaged by further and persistent droughts, then competition - even conflict - for access to water has been suggested as a possibility, despite the considerable progress made to date by SADC in establishing a water protocol for the region (see section 2.6). After all, Egypt, Sudan and Ethiopia have already been in conflict over the waters of the Nile. As Ohlsson (1995) observes:

> "Attention on security aspects of water issues so far has been concentrated on the risk of water transfer schemes creating conflicts - political or ultimately violent - between states in the region. The mere perception of such risks is a security threat in its own right, undermining confidence-creating measures between countries. On the merits of available evidence, however, the regional cooperative framework seems strong enough to handle present aspects of this threat, particularly since officials on all levels from the new South Africa seem very concerned about eliminating any ground for suspicion of regional great power ambitions.
>
> Furthermore, concentrating on security in this traditional inter-state sense may obscure the potentially much larger risks in the long run of environmentally-induced scarcities creating misery and conflicts within countries, leading to consequences which are very difficult to foresee. Conflicts between states may turn out to be among these consequences. It is worth underlining, however, that the most likely scenario for such future conflicts to arise will be through a failure to meet the *internal* challenges facing governments and states already today.
>
> . These risks can be mitigated by cooperation, understanding, trust, identifying the expectations and concerns and by determining the potential of the resource base, so that negotiation can be based on facts.
>
> Development cooperation efforts aimed at preparing countries in the region for a strategy of *learning to live with aridity* (i.e. using the available water, where it is available, to its greatest advantage) therefore seems imperative, as part of a larger strategy of preparing for the inevitable long-time and large-scale forces of societal change - with their inherent capacity of creating break-down tendencies for the state - being at work for the duration of the foreseeable future in the SADC countries".

Implications

In recent years, southern Africa has invested greatly - and made much progress - in developing cooperative mechanisms for environmental and natural resource management, notably through the regional institutional framework of SADC. This has been possible because of the peace and stability in the region. Clearly, a major bulwark against any return to conflict will be to continue such regional approaches, rather than permitting competition for access to resources.

2.5 Climate Change

There is much uncertainty about both the issue and the consequences of climate change. Following worldwide concern about greenhouse warming, several general circulation models have been constructed to predict the nature of climatic changes. The implications of these models are the subject of much debate and their forecasts can be used only as a guide. The significance for the region of four of these models, based on a doubling of atmospheric carbon dioxide, have been reviewed by Tyson (1986, 1991). He concluded that there appears to be agreement that, with increasing atmospheric emissions of greenhouse gases, summer rainfall will decrease over subtropical regions of southern Africa and will increase over tropical regions of southern Africa. In addition, lower rainfall over the winter rainfall region of the southern Cape is also probable. Over the long-term, it is predicted that much of southern Africa will become more arid than at present. This will exacerbate the current problems in the arid and semi-arid lands that constitute much of the region.

A subsequent study of climate scenarios for the SADC region (Kelly & Hulme, 1992), undertaken by IIED and the University of East Anglia and sponsored by Sida, highlighted that information for the region concerning both the potential impact of global warming and the means by which that impact might be reduced is often uncertain and, in many cases, simply not available. The report outlines a range of possibilities for the climate future, using estimates for three points (Dar es Salaam (Tanzania), Harare (Zimbabwe) and Gaborone (Botswana)). The scenarios do not take account of local heating effects caused by urban expansion and represent rural areas beyond urban influence They all agree on a rise in temperature in the region by the year 2030, but figures vary between 0.8 and 1.7 ^{o}C, depending on location and scenario. By comparison, there is much disagreement between the climate models for regional precipitation. Some scenarios show annual precipitation falling between 6 and 13 % by 2030; others suggest an increase between 7 and 14 % by the same year.

A more up-to-date study (Hulme 1996) provides climate projections to 2050. The same direction of trends is assumed to 2010, but with changes less developed and probably linear over this period. This report points out that southern Africa has seen temperatures increase by 0.5^{o}C since the 19th Century (a pattern similar to global changes) with the warmest years this century occurring since 1980 and the warmest (and driest) decade being 1985-94. A further warming by 1.7^{o}C is calculated by the 2050s. Associated with this warming, three patterns of climate change are defined (Box 2.3)

If the predicted changes do occur, there will be inevitable changes in ecosystems and species are likely to become extinct, at least locally. It is likely that many of the currently threatened plant species in the fynbos (a biome in South Africa comprising mainly sclerophyllous shrub vegetation with high diversity of endemic plant species) will become extinct. It is also predicted that sea levels will rise and that drier conditions will induce regional shifts in food production (as maize becomes unsuitable) and the availability of water.

While the studies discussed above suggest that climate change will impact adversely on the region, some positive spin-offs from such change have also been suggested:

> "It is assumed that climate change would promote an increase in sardine and anchovy distribution and quantities, particularly along the west coast of Namibia, guaranteeing large stocks of harvest from the sea .... It has also been deduced that ..... under the "wet" scenario [see Box 2.3], the SADC region would become wetter, eliminating the scourge of periodic drought periods. There would also be an increase of grassland and forest biomes" (Chenje & Johnson, 1996, p192).

Box 2.3: Climate Scenarios and Impacts for the SADC Region to 2050

Scenarios: Three patterns of climate change in southern Africa have been suggested by a recent study commissioned by WWF: the 'core' scenario which sees modest drying over large parts of the region and changes in variability; a 'dry' scenario in which the region experiences rainfall decline of up to 20%; and a 'wet' scenario in which most of the region gets wetter. In all cases, temperatures rise and the scenarios also define changes in other important climate variables, such as vapour pressure, cloud cover and potential evapotranspiration.

Vegetation changes: For all three scenarios, the area of Tropical Seasonal Forest in SADC declines, largely at the expense of Tropical Dry Forest which expands. This change is greatest in the 'dry' scenario. Savanna areas also decline in the 'core' and 'dry' scenarios at the expense of Warm Grasses and Shrubs. Desert and Semi-desert areas expand under all three scenarios, these biomes expanding northeastwards into larger areas of Botswana and Zimbabwe. This expansion is not very noticeable under the 'wet' scenario. If improvements in plant water use efficiencies due to elevated CO_2 concentrations are assumed, the predicted vegetation changes are much reduced.

Maize: Under conditions of future climate change, maize suitability decreases throughout southern Africa.

Vectors: For ticks, areas to the west of their present-day distribution will become more suitable, whilst areas to the east will, in general, become less suitable. Tsetse will experience a net decrease in climatic suitability, with the vector concentrated either in the west of their present range ('core' and 'dry' scenarios) or in the central/northern part ('wet' scenario).

Ungulates: The greatest negative impacts of climate change are on ungulate habitats in the grassland savannas of southeastern SADC (South Africa) where ungulate richness is predicted to decline under all three scenarios. All of the individual species in that region also show a consistent decline in their distributions. The important climate characteristics that distinguish this region from others appears to be related to temperature rather than precipitation, hence the consistent response among the three climate change scenarios. Additional possible negative impacts on ungulate diversity are predicted in the arid highlands of northwestern SADC (Botswana, Namibia, Angola).

Rangelands: The impacts of climate change will be mostly incremental, accelerating existing processes of environmental changes with respect to rangelands. Climate change is expected to accelerate bush encroachment (a trend towards thorn bush savannas) and a switch from cattle to smallstock since the latter are better adapted to marginal conditions. These ecological changes may have the following impacts on human activities: i) reduce overall development potential because of reduced useful biomass and loss of biodiversity; ii) changes in sectoral suitability, returns and attractiveness; iii) lower incomes; and iv) reduced livelihood security coupled with increased income inequalities.

Human impacts: The actual human impacts of climate change will depend on the relative resilience and coping abilities of different social groups. In general, the commercial sector and the high-income households in communal areas are best equipped to adjust properly and in a timely fashion.

Source: Extracted from Hulme (1996).

It is suggested by some that global warming has already affected the region - causing recent droughts. But scientific evidence is not yet available to support this contention. In any case, droughts have occurred in southern Africa since pre-historic times, and this makes it difficult to distinguish the

contribution of climate change to such episodic events. Whatever the uncertainties about climate change, it will be prudent to expect (as a norm) and plan for further drought periods in the region.

A major problem when the rains return after a drought is flash floods, especially where soils are bare and baked hard so that water runs off rapidly. Apart from damage to life and property, such floods can cause severe soil erosion. Climate change may, therefore, result in many new areas becoming susceptible to such periodic flooding, particuarly as the extremes (between periods of drought and good rainfall) become exagerated.

Susceptibility to drought can be reduced through improvements in awareness, education and training, and learning to cope with it - accepting that drought is the norm and that, in many areas, average rainfall is a windfall. But such improvements will require research to increase the knowledge base and understanding of the various factors concerned in drought. Improved information and early warning systems have already been established, and these need to be incorporated in drought planning. In addition, it might be better to use median rather than average rainfall in planning and setting long-term stocking rates.

Whatever the uncertainties, serious consideration needs to be given to adaptation to climate change in the region. Countries will need support so that they have the resources necessary to anticipate and plan for the disruptive consequences by adjusting land use and resource management to the demands of the changing environment. Examples of possible responses include tapping local knowledge, increasing the focus on small-scale community-based approaches, and promoting water-harvesting technologies, water conservation and storage. For rangelands, for example, Hulme (1996) suggests several crucial areas for adaptation in the region:

- policy re-assessments in favour of smallstock, wildlife and possibly gathering products. In Namibia and Zimbabwe, land reforms need to be considered;
- more research on these activities and on human activities under marginal conditions;
- economic diversification, creating alternative income opportunities outside agriculture and alleviating poverty; and
- drought-proofing measures such as early-warning systems, improving resource security, etc.

Changes in the region's climate, even if only partially in the direction of the scenarios predicted, are likely to place additional incremental stress on ecosystems which are already under pressure. As Hulme (1996) points out, these pressures include: increasing population (whole region), increasing subsistence needs (whole region), endemic droughts (most of the region), unequal land distribution (e.g. Namibia, South Africa, Zimbabwe), and a very limited coping ability -particularly in crowded communal rangelands (although this issue has been little researched and coping abilities are probably better than Hulme suggests).

A recent study of water resources in Zimbabwe discusses a 'worst case' scenario in which increased competition for water would create social unrest and political disturbance, nationally and regionally. However, the authors also suggest that a more positive scenario with more optimal (than at present) water management can be achieved by:

> "imparting a holistic view of water resources, by improving planning and management institutions and enhancing their capacity, by putting a proper pricing strategy in place, and by combining a careful further development of new resources with a massive effort in conservation and recycling" (Nilsson and Hammar, 1995).

2.6 Water Resources

Water is the lifeblood of southern Africa and a recent review by SADC, IUCN AND SARDC provides a comprehensive overview of water issues in the region (Chenje & Johnson, 1996). It is possibly the most critical of all the region's resources given that much of southern Africa is drought-prone and water-poor. Episodic droughts have a severe environmental impact on the countries in the region (see, for example, Tiffen & Mulele, 1994). It is argued (Coetzee, 1994) that it is most likely that water shortages will limit development in the region and that water management will become an increasingly important part of development strategies. Only a few countries have engaged in developing water conservation and management strategies, e.g. Botswana, Namibia and South Africa. Such strategies need to address several key challenges:

- increasing water scarcity in the region, leading to competition and shortages (and therefore a need to prioritize water use) and increasing economic and environmental costs of supplying water;
- supplying adequate water to individuals and maintaining supplies to support human life - particularly to rapidly urbanizing communities;
- maintaining water quality - increasing urbanization and industrialization will cause increasingly serious pollution threats; and
- maintaining water sources and avoiding permanent environmental damage as a consequence of unsustainable levels of off-take from sources such as rivers and acquifers.

They also need to raise public awareness about the value of water, and its wise use in homes and industries. Climatic changes (see previous section) will only add to and complicate these challenges.

The only major natural lakes are in the north of the region (e.g. Lakes Malawi, Tanganyika and Victoria). Elsewhere, with seasonal and unreliable rainfall, storage dams are necessary to ensure supply. But dams, whilst vital, cannot solve the region's water problems. High evaporation causes major losses, silting-up reduces dam capacity, and many rivers have low flow or dry up in the dry seasons. Industry and agriculture make major demands on rivers. Agriculture uses water directly - through irrigation schemes, or indirectly - by lowering groundwater tables (irrigation accounts for almost 75 percent of all water used in the region (UNFPA 1991). Factories and mines also use huge quantities of water. Whilst some is returned (sometimes polluted), much is lost. Increasing industrialization will lead to greater demands on water resources. More efficient water use, and improved controls on water pollution will be needed to reduce and prevent river degradation. Pollution issues are dealt with in section 2.7.

Groundwater is very important throughout southern Africa, particularly during the dry season and year-round in the arid areas. The depth at which water can be found varies greatly, from about 20 m in the east of the region, to almost 200 m in many parts of Botswana and up to 600 m in western Namibia (Fr_ling, 1996). Groundwater taken from hand-dug wells or springs, or pumped from drilled wells and boreholes is the main source of water for many people throughout the region, supplying 80 percent of the human and animal populations in Botswana and at least 40 percent in Namibia. In some areas, high-yielding boreholes are used for irrigation, e.g. in the Pangani basin in Tanzania. If the region becomes more arid, as climate change models predict (see section 2.5), this could lead to excessive abstraction of groundwater resources, severely lowering water tables, causing salt water intrusion in coastal areas and, in extreme cases, destroying aquifers.

Demand for water in the region is increasing rapidly. In water-scarce Namibia, for example, demand for state-supplied water increased from 37 to 95 m cubic metres per year between 1970 and 1993 - an average increase of 4.2 percent per year[13], and regional demand is projected to rise annually by almost 3 percent up to 2020 as the human population grows (Chenje & Johnson, 1996). Various studies point to critical water shortages in the future. SARDC (1994) argues that, at current population growth rates and with existing water pricing and allocation patterns, southern Africa will be experiencing chronic water shortage by 2030. Similarly, based on water scarcity ratings[14] developed by Falkenmark (1991), Coetzee (1994) argues that:

> "By the beginning of the next century, all the countries in the region will be experiencing some scarcity, there will be *water stress* in South Africa and Zimbabwe, and Malawi will face an *absolute water scarcity.* By the year 2025, the situation will be considerably worse, with South Africa, Zimbabwe, Malawi and Lesotho all facing absolute scarcity and Mozambique experiencing water stress".

Recognizing these scenarios, some countries have started to make plans for future water supplies. South Africa's industrial heartland lies in the Pretoria-Witwatersrand-Vaal triangle (PWV) where supplies from the Vaal river are already overstretched. A massive scheme is being undertaken to replenish the Vaal river with supplies from the Senqu river in Lesotho drawing from a network of dams, canals and tunnels, and a hydro-electric power scheme (the controversial Lesotho Highlands Water Project)[15]. Even more ambitious schemes have been suggested to pump water to the PWV from the Zambezi river, between Zambia and Zimbabwe. However, this proposal raises serious water rights issues, particularly with flow in the Zambezi falling to record low levels during the 1991-92 drought.

The Windoek area in Namibia is currently supplied by a network of dams and canals, transporting water from north-central Namibia. With increased demand having depleted this water system, the government of Namibia has suggested extending a pipeline from the Okavango river, on the Angolan border, south to Grootfontein, to boost the central water supply. The impact of such off-take on the Okavango river, and particularly on the Okavango delta, is unknown. However, following pressure from Botswana and environmentalists, this issue is now being studied by an environmental impact assessment.

Such expensive schemes, which are almost always dependent on foreign loans or aid, often provide temporary solutions - effectively buying time, and transfering water stress to the donor basin/country. Furthermore, elsewhere in Africa, large inter-basin schemes and international water supply projects have failed to deliver the expected goods (Adams 1992) and are inherently plagued by security threats. In these circumstances, great care is needed before embarking on new schemes in southern Africa. Clearly there is a growing need for increased water supplies in the region, although the

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[13] As a consequence, Namibia has recognized the need for managing water demand through pricing and water efficiency measures and prioritizing use (putting people and livestock first), whilst increasing supplies to technically and economically feasible limits (NAPCOD, 1996).

[14] To quantify present water demand and to relate this to the pressures from increasing populations, Falkenmark (1991) has rated water scarcity on a scale of 1 to 5, using the number of persons per million cubic metres of water per year. Absolute water scarcity (levels 4 & 5) occurs at figures exceeding 1000 persons/million m^3, whilst water stress (level 3) occurs between 600-1000 persons/million m^3. Below 600 persons/million m^3 (levels 1 & 2), there are water quality and dry season problems.

[15] Project construction commenced before impact assessments were published. Mechanisms to compensate the rural economy in Lesotho for its loss of an important resource (these are controversial and not completely supported by the rural communities) were only implemented well into the project's first phase.

amounts needed could be significantly reduced with investment in proper demand management and improved water use efficiency. It will be equally important to determine the most appropriate sources (e.g. comparing desalinization[16] with tranport via canals for countries like Namibia), and to balance the costs and benefits of increasing water supplies. For example, South Africa has introduced a very innovative program of catchment management which focuses on the removal of invasive alien plant species from catchments in the southern Cape. This has already resulted in a greater increase in water supplies than a new dam would have provided, whilst also providing jobs and environmental benefits.

Dams are also important throughout the region. Those at Kariba and Cahora Bassa have greatly changed local environmental conditions, impacting on biologically important floodplains and affecting livelihoods. They also became covered by aquatic weeds, and became anaerobic as vegetation rotted leading temporarily to fish deaths. There are always plans being made and debated for further dams to both store water and generate hydro-power. Further proposed dams on the Zambezi at Mana Pools and below Victoria Falls at Mpata gorge (on the stretch where the river passes through Zambia/Zimbabwe) have been the subject of great controversy over probable environmental impacts, particularly in the case of the Mana Pools site. A proposed hydro-power dam on the Kunene river (between Namibia and Angola) near Epupa Falls is currently the subject of a feasibility study and much debate. Other ideas have been mooted to dam the Cuito river in Angola. This could lead to catastrophic changes in the dynamics of the inland Okavango delta in Botswana into which the river discharges, with mega impacts on habitat, wildlife and livelihoods for the communities dependent on the floodplains.

There are also a number of internationally known wetlands (swamps, marshes, floodplains, etc.) which are ecologically important. Some are under threat. The Southern Okavango Integrated Water Development Project, proposed by the Botswana government, generated considerable international opposition. The government responded openly by asking IUCN to conduct an independent review of the proposals. The team unanimously took the view that the project was based on a number of deficiencies and would be environmentally destructive for the Okovango delta, and recommended that it be terminated in favour of alternatives (IUCN 1992). But controversy continues in Botswana over the project.

Concern amongst the region's countries about limited water resources has led to much discussion about regional water allocation. SADC has been coordinating an ongoing dialogue, initially amongst the eight riparian nations along the Zambezi river. The Zambezi River Action Plan (ZACPLAN) process aims to "establish equitable and ecologically sound water allocation and sharing agreements along the river basin" (Meintjies, 1995). This had led to discussions involving all SADC member states which have established clearly defined procedures for instituting regional water management schemes. 11 of the 12 SADC member countries have signed (and four have ratified) the "Protocol on Shared Watercourse Systems" (see Box 2.4) which provides ground rules to standardize future regional water agreements (specifics will still require negotiation) and to prevent further exploitation by more powerful states. Some agreements between riparian states on the management of shared watercourse systems have also been developed outside the SADC
framework. The SADC Environment and Land Management Sector (ELMS), coordinated by Lesotho, was responsible for water management issues until August 1996 when heads of state and government created a separate SADC water sector, also coordinated by Lesotho.

[16] More research is need on the future potential of desalinization in the region, particularly whether the energy requirements and technology are affordable and manageable.

Box 2.4: Objectives of the SADC Protocol on Shared Watercourse Systems

In respect of the shared watercourse systems in the region, the objectives are:

- to develop close cooperation for judicious and coordinated utilization of the resources;
- to coordinate environmentally sound development in order to support sustainable socio-economic development;
- to have regional conventions in equitable utilization and management of the resources;
- to consolidate other agreements in the region regarding common utilization of certain watercourses; and
- to promote the SADC integration process in accordance with Article 22 of the Treaty establishing SADC.

Source: SADC (1995).

The recent drought in southern Africa has raised serious questions about the suitability of large areas for growing maize - now the staple crop in much of the region. Sorghum - a more drought-resistant cereal - is being suggested increasingly as a more suitable crop (e.g. Coetzee 1994). Atenyo (1993) has suggested some broad guidelines for future water management which, perhaps not surprisingly, emphasize the need to acknowledge water shortage, promote efficient water use, provide clean drinking water, ensure environmental sanitation, and foster ecosystem preservation. There is also a clear need for sound catchment management. Others point to the wastefulness of irrigation and stress the need for water conservation and priority-setting, e.g. water for domestic use and industry rather than irrigation (NAPCOD 1996; Mikael Segerros, pers.comm). It is suggested that the region has no need for extensive irrigation and that it has more than enough areas to feed the region on rainfed agriculture. However, this situation is unlikely to persist if the region becomes increasingly arid.

In rural areas, more efficient use is more likely to come from small-scale, participatory, community-based initiatives (e.g. water-harvesting and small-scale irrigation) and harnessing indigenous technological knowledge[17], than from aid-driven large projects, many of which have failed in the past (see, for example, Adams 1992).

In future, regional policies and agreements will need to plan development around available water resources. Planning development whilst ignoring the reality of water limitations, and subsequently trying to make environmental adjustments to support unsustainable goals and initiatives, is likely to lead to disaster.

[17] For example, valley-bottom soils in Angola have been exploited in an ecologically sound manner, using ditches and mounds to raise and lower the water table; and the WaChagga people in Tanzania have used sophisticated and complex irrigation and furrowing systems on the slopes of Mt Kilimanjaro for a long time, supporting high population densities (Chenje & Johnson, 1996).

Perhaps one of the most important implications of the water problem, as suggested above, is the need for demand management (some countries such as Namibia and South Africa are already taking up water pricing). Priority-setting will also be important and will mean integrating assessments of water availability and costs with national economic and development planning. Innovative approaches, such as natural resource accounting will help, but institutional changes (integrating different ministries and technical staffs) will also be required.

2.7 Pollution

It is very difficult to assess the overall extent of pollution in the region and its impact on the environment and human health in southern Africa since data are lacking. There has been no long-term regional study of pollutants. Even when known to exist, pollution is not always monitored. Furthermore, pollution controls either do not exist in some countries or, where they do, they are often poorly enforced. Nevertheless, some generalizations can be made.

Population growth, urbanization, industrialization, mining and intensive agriculture are the main contributors to waste generation and pollution. Uncontrolled urbanization - with overcrowding and poor sanitation - invariably leads to the contamination of fresh water sources with bacteria (most commonly faecal coliforms) which then cause diseases such as gastroenteritis, typhoid and cholera. Also, the release of household chemicals (e.g. cleaning products and insecticides) leads to pollution of both rivers and groundwater. Urban sewage in coastal areas tends to be discharged into the sea.

Industries release aerial emissions, liquid effluents and solid wastes (sometimes toxic) into the environment either in an uncontrolled manner (examples of major polluters include textile factories and pulp-and-paper mills)[18] or through waste management systems that use landfills, incinerators and treatment facilities. A major polluter of rivers in southern Africa is the mining sector, causing water acidification and discharging a variety of highly toxic metals (e.g. arsenic, mercury, cadmium and lead). As rainfall is seasonal in the region, the ability of many rivers to dilute pollutants varies during the year. The disposal of solid mine waste also presents serious problems. Durning (1990, p.15) suggests the scale of the problem in South Africa: "the nation's 450 mine dumps cover some 10,000 hectares between them and hold perhaps 20 billion tons of rocky waste". Examples of environmental problems include: coal dumps which, if they ignite, can burn for years; asbestos dumps - exposure to the tiny fibres can cause lung cancer; and leakage/leaching into water courses and seepage into groundwaters of toxic tailings. Even small-scale mining and mineral processing operations can be extremely damaging, depending on the chemicals used. For example, mercury (often used by artisanal gold miners to separate gold and sand, especially in Tanzania and Zimbabwe) washed into water courses, is transformed into bio-available forms and accumulates in living organisms, where it can lead to serious illnesses and deaths.

In coastal areas, most industries dispose untreated wastes directly into streams or rivers which flow directly into the sea. The seas off the major urban centres around the region's coasts are highly polluted. Cook and Koch (1991, p 134) note that coastal cities and towns in southern Africa discharge more than 850 million litres of industrial and human wastes into the sea daily through more than 80 pipelines, largely without any treatment. The seas around these coastal centres are also subject to oil spills and discharges from oceanic tankers. Major oil spills include six off South Africa since 1965,

[18] For example, the 126 factories in and around Maputo do not have waste-treatment systems and release toxic products, poisons, non-biodegradable substances and organic matter into the environment. The main contaminants are: sulphuric and nitric acids, caustic soda, ammonium salts, phosphates and sulphates, organic substances and pathogens (Couto, 1995).

two off Tanzania in 1981 and 1986, and one in the Mozambique channel in 1992. Chronic pollution occurs from frequent minor spills and routine disposals of oil-waste from smaller vessels.

South Africa's Eastern Transvaal Highveld (ETH) produces the worst air pollution (particularly sulphur dioxide) in southern Africa due to the high concentration of coal-burning industries. Elsewhere in the region, such pollution is not a serious problem. The affects of acid rain resulting from emissions in ETH have not been well-studied, although potentially vulnerable ecosystems and areas have been identified (SARDC, 1994).

In many parts of the world, agricultural chemicals are a major problem. Pesticide residues render water unfit for consumption and enter food chains, with harmful consequences for wildlife. A well-known example is the spraying of DDT near streams and rivers in Zimbabwe in the 1970s to control tsetse fly. Residues concentrated in birds of prey at the top of the food chain with disastrous effects - egg shells became so thin that they would break before the chicks hatched. DDT has been substituted with Endosulphan (highly poisonous to aquatic life, though the effects are temporary) and, in areas where there is a serious risk to aquatic systems, systemic pyrethroids. The storage and disposal of obsolete stocks of pesticides presents considerable health risks, e.g. in Tanzania. There is also significant herbicide use, particularly on sugar estates, cotton and forestry plantations which use large quantities.

Fertilizers cause relatively little harm to wildlife, compared to pesticides, but may affect human health. Nitrate in water has been linked with methaemoglobinaemia (blue baby syndrome) in infants, but there is little information for the region, probably because the condition is not recognized. Following an exhaustive search, Conway and Pretty (1991) reported only one account which refered to a high incidence in a rural area of Namibia, but it was not clear whether livestock wastes or some other factor was the cause of the nitrates. In many parts of the world, fertilizer run-off causes eutrophication in rivers and lakes. Eutrophication has become a serious problem in South Africa's Vaal and Orange rivers.

With rapid population growth, increased food production in southern Africa is vital. But the region is characterized by generally poor soils. Increased fertilizer use is expected to be necessary, but there is an intensive debate over the approach to be taken. For example, IFPRI/FAO (1995) hold that "there will have to be a very substantial increase in the use of mineral fertilizers to meet the food needs of human populations by the year 2020". Others argue that it is better to sustainably intensify agricultural production first, with an emphasis on resource-conserving technologies and practices and on local resources (e.g. Pretty 1995a). They claim such an approach can yield substantial environmental and economic benefits for farmers, communities and nations. Depending on the results, further inputs from mineral fertilizers can be applied later. If the solely pro-fertilizer view holds, and massive effort is invested in increasing fertilizer use in southern Africa (particularly on large-scale commercial farms - most small-scale farmers cannot afford the heavy use of fertilizers), then increased pollution problems can be expected.

Household burning of fuelwood, crop residues, manure and coal (20 million people use coal) for heating and cooking also leads to localised health hazards in the region. Additionally, grass and forest fires (at least half of the region's savanna woodlands are burnt each year, mainly to stimulate new grass growth) generate vast quantities of smoke. Some people argue that such pollution influences regional weather patterns and contributes to global climatic change.

It is the poor who usually suffer most from pollution. As SARDC (1994) points out:

> "People who are poor are at higher risk because they are more likely to live and work in polluted environments, and are more likely to suffer from inadequate nutrition, which exacerbates the toxic effects of pollution. Industrial

workers and those in the mining industry are exposed to noxious gases and poisonous chemicals. Workers on commercial farms handle poisonous chemicals [frequently they wear no protection and receive no training in their safe usage]. Low-income housing is typically located near rubbish dumps, electric-power plants, mines and factories spewing smoke".

Many people - again, usually the poor - frequently draw water (for drinking and washing, and for supplying to gardens and livestock) from sources which are contaminated with poisons after passing through industrial areas, mines and agricultural estates.

Education of managers, workers and the public will help to raise awareness of the dangers of pollution and the hazards faced, and also concerning the solutions to these problems. More research is needed to determine groups of people and environments/ecosystems which are likely to be at risk, and to facilitate better pollution management. Integrated pest management approaches will help to reduce pesticide use. Better pollution monitoring and the stricter enforcement of pollution control legislation is clearly needed.

2.8 Wildlife/Biodiversity

Of its abundant natural resources, southern Africa is probably best known in the North for its wildlife, particularly its large mammals. Wildlife forms the basis for economically-important tourism throughout the region. If it is to be conserved successfully, the definition of wildlife should include all living organisms found in wild habitats - both plants and animals. Southern Africa includes both summer and winter rainfall belts and its habitats range from desert to rainforest and grassland to woodland. Its rich variety of ecological zones has endowed the region with a rich diversity of species. Many of its protected areas are of international repute.

Biodiversity in the region is under intense pressure, mainly as a result of landscape transformation through agriculture, industrial development and mining[19], and a great deal has been written about the threats to it (see, for example, Huntley 1989; Simon *et al*. 1990, SARDC 1994). The challenges include (SARDC 1994; Richard Bell, pers.comm):

- conserving the region's biodiversity and dealing with threats to it;
- sustaining the extensive network of protected areas;
- fostering other conservation measures outside protected areas to maintain species diversity and biological community structures;
- ensuring that countries in the region can afford to naturally diverse landscapes through income generated from wildlife resources; and
- reducing conflicts between people and wildlife.

The protected areas network in southern Africa is probably one of the most extensive in the world, accounting for almost 16% of the region's land area. Not all of the region's ecozones are represented in protected areas, which face many threats (SARDC 1994). Rural poverty and demand for land for agriculture throughout the southern Africa is increasing the pressures around protected areas. In some countries, protected areas have been encroached, for example, in Tanzania and Mozambique.

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[19] Alan Rodgers (pers.comm) is of the view that "we cannot have lions in villages or elephants in rice fields. They must go. Agriculture needs to increase [to feed the growing population] and habitat inevitably will need to be converted to crop production. It is the unplanned loss of wildlife that is bad"

Biodiversity is also being seriously affected by habitat changes throughout southern Africa. Some examples include:

- grazing: livestock select the more palatable grasses, leading to changes in plant species composition; and displacement of wildlife;
- agriculture: woodlands and other lands are being converted to farms for crops;
- dams: alter river characteristics and flooding patterns, and modify nutrient regimes;
- pollution: mainly as a result of urbanization, industrialization and mining;
- fragmentation: wildlife habitats increasingly are being taken and divided for various different uses (settlement, farming, mining, industry, etc.), often interfering with migration and breeding; and
- wildlife: in some better protected areas, biodiversity has been reduced by locally-abundant species, e.g. vegetation damaged by elephants.

Loss of habitat is likely to lead to reduced numbers and possibly even extinction of some species, particularly large mammals which need extensive areas to sustain viable populations, and habitat-specific plants and animals. Severe impacts on wildlife have also resulted from preventing free movement through erecting barriers such as fences and canals. A well debated example is the livestock fence erected in Botswana to separate wildlife from cattle as a result of European Union disease-control requirements for importing beef from Africa. This caused the death of thousands of wildebeest which could not reach food and water in the Okavango delta and Boteti river (Williamson & Williamson 1985). The are plans to extend Botswana's northern buffalo fence and build a new fence along the Caprivi border with Namibia. This follows an outbreak of cattle lung disease (a fatal airborne bovine pneumonia) in 1995 in northern Botswana which led to the slaughter of 250,000 cattle in 1996. The aim of the new fence is to separate cattle from buffaloes (a believed vector of the disease).

In South Africa, most parks are very small and fenced[20] and wildlife populations, unable to disperse, may have become inbred. To prevent a similar problem occurring on private land, intensive genetic management may be required. One approach has been to take down internal fences to establish nature conservancies in Namibia, South Africa and Zimbabwe, allowing wild animals from adjacent farms to increase the size of the gene pool.

One of the most prominent and emotive issues affecting large herbivors is illegal hunting[21]. This has caused severe reductions in the populations of some species (notably black rhinos and elephants) in some parts of the region. Demand for ivory in Asia has led to a decline in overall elephant numbers in the region from an estimated 600,000 in 1979 to only 264,000 in 1989, with the population in Zambia being reduced from 150,000 to 41,000 over the same period (Nigel Leader-Williams, pers.comm.). Dublin *et al.* (1995) estimate the Zambian population to have declined even further to about 23,000 by 1994[22]. This picture is complicated by the fact that elephant populations have been controlled by

[20] often insularized in areas of high human population density or in areas of intensive agriculture.

[21] Richard Bell (pers.comm.) considers the main cause of illegal hunting of elephants and rhinos to have been the weakness of some economies and collapse of the earning power of wages since 1970. This is taken to explain the difference between countries to the north of the Zambezi and those to the South (e.g. Botswana, Namibia, South Africa and Zimbabwe) which have relatively few illegal hunting problems.

[22] Whilst elephant numbers in Zambia have undoubtedly fallen dramatically in recent years, these figures have been questioned since elephants have never been counted outside the Luangwa Valley (Richard Bell, pers.comm.)

culling in some countries (e.g. South Africa and Zimbabwe). It is claimed that the ban in 1989 on ivory sales (under the Convention on Trade in Endangered Species - CITES) has led to a significant reduction in losses to poaching in the northern countries of the region. However, the available data are not adequate to assess current trends (Dublin *et al.* 1995).

More serious has been the effect on black rhinos which have been killed at alarming rates for their horn (mainly for use in oriental medicines in the Far East, and ornamental dagger handles in the Middle East). Between 1970 and 1980, numbers in the region fell from 28,000 to about 9,500, and to only just over 2000 by 1993 (Leader-Williams 1992). However, numbers in Namibia, South Africa and Zimbabwe (where strong protection was provided) actually increased between 1970 and 1990, although there has been a severe decline in Zimbabwe since then as poachers from Zambia, having severely depleted the population there, have operated increasingly south of the Zambezi. By comparison, numbers of white rhinos have increased substantially, from 2600 in 1970 to over 6600 in 1993, although the vast majority are under heavy protection in South Africa (Nigel Leader-Williams, pers.comm.).

Pangolin, giant sable and marine turtles (particularly the Hawksbill turtle) have also been overexploited, and the illegal bird trade (smuggling of eggs and live birds) has severely depleted populations of some species.

Damage to crops, property and human life are major reasons for many people having a negative attitude towards wildlife. The costs they suffer often exceed any benefits gained from wildlife. Wildlife conservation has often been ineffective because of extremely low budget allocations[23] - it is estimated that wildlife agencies require of the order of US $200 per sq km to manage the wildlife estate, but many receive less than US $10 (Richard Bell, pers.comm.). Conservation efforts have frequently been thwarted by ineffective legislation, inadequate penalties, and weak law enforcement (Leader-Williams & Milner-Gulland, 1993). Even Zimbabwe's 'shoot-to-kill' policy (regarded by some as counter-productive) has not completely deterred rhino poachers from Zambia (Milliken *et al.* 1993). Wars (e.g. in Angola and Mozambique) have interrupted wildlife management and conservation activities, and soldiers themselves have resorted to killing wildlife for food and to fund war activities. One of the legacies of armed conflict in the region has been the proliferation of guns, many now in the hands of poachers. But most automatic weapons used by illegal hunters are bought or rented from security forces - a product of low wages which leads to corruption.

Periodic outbreaks of disease (e.g. anthrax, foot-and-mouth, and rinderpest) can temporarily deplete wildlife stocks. Episodic droughts also take their toll, killing high numbers of animals. But their effects are aggravated by some fences and similar obstructions, e.g. cordon fences in Botswana prevent wildlife reaching water during droughts and magnify deaths.

The traditional approach to wildlife management has been top-down, with the state owning wildlife in protected areas and often outside on private or communal land, and enforcing wildlife legislation. Where well supported with funds, this approach has ensured the survival of populations of certain species and contributed to the generation of foreign exchange earnings. However, elsewhere it has proved ineffective in controlling illegal hunting and reducing other threats. It has failed to integrate local people into activities[24], particularly in marginal areas near protected areas, and has often had a critical impact on their food security and livelihoods. Faced with a diminishing resource base,

[23] But many developing countries spend a larger proportion of their national budget on conservation than developed countries.

[24] It never really set out to do so.

conflicts between local people and conservation authorities have escalated, and law enforcement has become less practical and more costly.

By comparison, there have been some innovative approaches to wildlife management on private land in southern Africa. For example, game ranching is practised as a legitimate form of land use, sometimes with similar government incentives and subsidies as domestic livestock. There are now some 10,000 ranches covering 160,000 sq km (SARDC 1994). Ranchers effectively own game on their land in both South Africa and in Namibia (where the majority of wildlife is located on private land). In Zimbabwe, about 10% of commercial farmers have wildlife on their land as proprietors, and many have turned to game ranching. Similar ventures are being established in Swaziland and, in Botswana, 8% of land is privately owned and large areas are used for hunting and tourism (most hunting and tourism outside protected areas in Botswana is on leased concessions on tribal or State land). Game from private land is often used to restock depleted wildlife populations elsewhere. The economic benefits from game ranching, relative to livestock, can be high through sales of trophies and meat, and through tourist and hunting revenues (Cumming 1991).

Over the last decade, new approaches have been initiated in the region through a range of community-based wildlife management (CWM) schemes, mainly outside protected areas[25]. The more innovative ones are typified by the more active participation of local communities. They have sought to devolve power and responsibility for resource management to communities, and local people have become involved more actively in the generation and distribution of benefits for community projects. A recent report by IIED has reviewed a wide range of CWM approaches in Africa and concluded that:

> "community wildlife management is likely to be sustainable ecologically, economically and socially only if wildlife management can be made sufficiently attractive to local people for them to adopt the practice as a long-term livelihood strategy. This does not suggest that local communities respond only to economic determinants, but that these are one amongst a complex set of factors that determine behaviour.
>
> Three broad principles are proposed to guide action towards achieving community-led initiatives: recognition of community rights to ownership of wildlife resources; building on formal and informal structures that facilitate community participation in wildlife management; and operation of effective mechanisms for the sharing of benefits of wildlife resource management with communities" (IIED, 1994a).

It should be noted, however, that concerns have been expressed about the limitations of wildlife use. Some conservationists fear that game ranching restricts population movements and breeding (although the formation of nature conservancies reduces this problem) or leads to over-stocking with key species. The view has also been expressed that community action to reduce poaching and conserve flagship wildlife species for consumptive and non-consumptive use should not be seen as the same as investing in the conservation of habitats and biodiversity. They argue that if wildlife becomes a major land use in which local residents/farmers choose to invest, then maintenance of wildlife habitat is likely. But even so, an area set aside for wildlife use will not necessarily result in greater biodiversity.

The elephant is currently listed in Appendix 1 of the Convention on Trade in Endangered Species (CITES) which is a serious constraint to CWM in the region since this is potentially, by far, the most

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[25] Examples include: the Communal Areas Management Programme for Indigenous Resources (CAMPFIRE) in Zimbabwe; Luangwa Integrated Resource Development Programme (LIRDP) and Administrative Management Design for Game Management Areas (ADMADE) - both in Zambia; Selous Conservation Programme in Tanzania; Chobe Enclave Conservation Trust in Botswana; Namibia's Community Based Natural Resource Management program; and various lesser-known but innovative collaborative wildlife management initiatives in the former "homelands" of Bophutatswana and Kangwane in South Africa

valuable species. Neverthelesss, many people in the region argue that trade agreements such as CITES should not deter governments from developing and implementing programs that respond to national priorities and needs.

Both game ranching and community-based schemes offer promising and practical alternatives to traditional approaches to wildlife conservation. Recent evidence suggests that community-based wildlife management programs are beginning to show results with potentially far reaching policy implications for national development policies (Rihoy, 1995). With increasing aridity (see section 2.5), such programs might offer an economically and environmentally sustainable land use option in many areas.

2.9 Energy

The availability and reliability of electrical power varies considerably amongst the countries of southern Africa. Most is supplied from hydro-electric schemes and coal-powered generating stations (particularly in South Africa). Some countries have a shortage of generating plant and experience periodic power cuts (e.g. Zimbabwe, Tanzania).

However, for cooking and heating purposes, most people (in both rural and urban areas) continue to rely on wood, charcoal and coal (mainly in South Africa). For the majority of rural people in the region, fuelwood is the only source of energy. Fuelwood gathering occupies a high proportion of the day for many women. The loss of forest has been so great in some areas that cow manure is now used for cooking, denying the soil of nutrients. Per capita fuelwood consumption in the region is amongst the highest in the world (SARDC, 1994) and demand is rising with population growth, placing increasing pressure on forests and woodlands which are already under pressure as agriculture expands. Rural electrification is frequently suggested to alleviate this problem. However, it is unlikely to be accessible to most rural people. In any case, unless the widespread poverty in the region is overcome, few people will be able to purchase and use electrical appliances, particularly for cooking (i.e. they may have light but would still cook on fuelwood).

To date, outside South Africa, only about one percent of the region's hydro-electric power potential has been developed (USAID, 1995) - and due to the recent war, the greatest untapped potential is in Angola. But generating further hydro-electric power is a problem. There is already strong competition for water on the major rivers and tensions have arisen, notably along the shared Zambezi river (see section 2.6). As water demand rises, such stresses are likely to increase. Cahora Bassa dam in Mozambique has not produced electricity during the armed conflict in that country, but is likely to come back 'on stream' in the near future, easing regional generating capacity.

South Africa produces and uses 80% of the region's electricity, mainly in its mining and industrial sector. It has a surplus of coal-fired power stations in mothballs and sufficient idle plant to meet the entire needs of the rest of the region (Dingley, 1994). The main limitation currently is the absence of bulk transmission lines to supply other countries. Over the next 20 years, most power stations in the region - particularly those in South Africa - will be at or near the end of their operational lives. Consequently, the need for new power station plant as replacement and to meet growing future needs can be foreseen. A mix of plant is likely including coal-fired stations using the large coal deposits in the southern part of the region (within international limits set for greenhouse gas emissions) - although this will have serious environmental consequences from mining and pollution (see section 2.7); hydro-power stations on the rivers in the northern part of the region (including the Congo river) and possibly nuclear plant in South Africa.

There is considerable debate about the role of nuclear power. Proponents argue that it is a clean alternative to coal, producing less pollution and less risk to the environment and human health. Opponents argue that each of the stages of nuclear power production - including mining, enriching uranium, manufacturing nuclear fuel, reprocessing spent fuel and disposing of nuclear waste - present serious risks. At present there is only one nuclear site in the region, in South Africa.

A 'southern African grid' has been suggested to attain the best economies of scale and mix, to link and share these various types of plant in a regional network. Whether or not this is achieved, the provision of energy to the countries of the region without causing unacceptable environmental degradation is a major challenge. More work is needed on investigating renewable sources such as solar power, wind and biogas. In Namibia, for example, windpower is considered to have potential on the coast, and solar power for rural households - the potentials are being explored, and will be developed, by the Ministry of Energy's new renewable energy program (Ashley *et al.* 1995).

2.10 Mineral Exploitation

Southern Africa is rich in mineral wealth, particularly gold, diamonds, cobalt, platinum, chrome and copper. The richest states in the region (in terms of GNP per capita) - South Africa and Botswana - are dependent for their prosperity on mineral exploitation. South African gold comes from an arc of reefs in the southern Transvaal and the Orange Free State, and the country is a major source of diamonds. At independence in 1966, Botswana was one of the poorest African countries. Since the discovery and subsequent mining of diamonds from 1971, and copper and nickel from 1974, the country has become the fifth most prosperous country in Africa. The Zambian economy is dependent on copper. Chromium is mined in Zimbabwe, uranium and diamonds in Namibia, and petroleum is produced in Angola. Mining in the region is conducted on a large scale. The most direct environmental and health impacts are from various forms of pollution, particularly solid wastes (see discussion in section 2.7). Indirect environmental impacts are associated with migrant labour, both within countries and from other countries, leaving 'home' areas depleted of labour and often unable to manage the land properly.

Small-scale mining and mineral-processing operations can also be damaging to the environment, especially where dangerous chemicals are used - as discussed in section 2.7. Hand-dug mines and gold-panning can be very disruptive. In Angola, small-scale mining of diamonds has stripped vegetation up to one kilometre from river banks, resulting in soil erosion and river siltation which has destroyed fishing. Similarly, gold-panning in Zimbabwe has resulted in river siltation problems. Such small-scale mining can be particularly problematic when it occurs in protected areas, and where more than one sector (e.g. mining and wildlife) has responsibilities and (potentially conflicting) interests. Such challenges in Tanzania are described in Leader-Williams *et al.* (1996). Whilst there can be problems with small-scale mining, the more important issue is the existence of inappropriate policies and the inability to match technology trends to local capacity through, for example, training for small-scale miners.

2.11 Threats to Marine Environments

Some resources are overexploited. Prawns stocks off Mozambique are under heavy pressure, and to a lesser extent off Angola, both from local fishermen and foreign poachers. War in these countries severely inhibited fishing control. Coral reefs (an essential habitat for marine animals) have been seriously damaged by dynamite fishing off Tanzania. The Agulhas bank - 200 km off the southern tip of the continent - is an important fish-breeding area, particularly for the Benguela system along the region's west coast, and is seriously over-fished. Mining of diamonds in the Benguela system off

Namibia is threatening seabed plants and animals. These cold, nutrient-rich waters support rich fish stocks which have been overfished in the past by foreign trawlers (until the area was declared an exclusive economic zone). But local overfishing still persists with significant drops in sardine catches, and reduced fish stocks has led to reductions in a variety of seabirds which breed in the area. There has also been over-fishing in open sea habitats. In response, Namibia introduced (and strictly enforces) an effective annual quota system which has curtailed illegal fishing by foreign vessels. It saw sardine stocks double between 1990 and 1992, although they subsequently declined - possibly due to environmental factors (Crawford 1993).

Soil erosion, mainly due to poor land husbandry in the catchments, is causing excessive silting up in many estuaries, and coastal erosion is serious in some areas, e.g. in Tanzania and Mozambique where it is threatening infrastructure such as roads, buildings and harbours. Threats from pollution have been discussed in section 2.7. Mangroves (vital breeding grounds for prawns) are being over-exploited in Mozambique and Tanzania for timber and fuelwood. A UNEP estimate in 1990 suggested that these countries had lost 60% of their mangroves. More recent estimates put the loss even higher. Major oil spills have also killed mangroves. Another problem is salt water intrusion due to lowered groundwater tables in coastal areas as a consequence of excessive abstraction.

Various animal species are threatened, notably several species of turtle which have been over-harvested for their shells and meat. Increasingly, there is over-collecting of shells for the tourist trade. Efforts are being taken in most coastal countries to establish coastal protected areas and marine parks to conserve habitats and resources. There is a clear need in all countries for effective coastal zone management policies and strategies.

2.12 Traditional Resource Management, Access to Resources, Land Tenure and Rights

Governments and donors alike tend to forget that traditional customs and practices of land management can often be locally appropriate and sustainable, and may be far more suitable than new (and often big) ideas or 'solutions' from 'outside'. Whilst such traditional practices have been discouraged and eroded over many years, in the past they were the norm. Some examples include:

- local approaches to dealing with environmental limitations such as unreliable rainfall, e..g. transhumance (seasonal migration);

- the system of customary land-holding vested in respected Chiefs as custodians (cultivation and other use-rights were granted by the Chief who had power over all resources, including wildlife, and could therefore regulate and limit access to natural resources within sustainable levels). SARDC (1994) comment that:

> "equity in land distribution was common and built on kinship, except that most systems did not give equal rights to men and women. Equity was built on the understanding that when a male was allowed residence in an area, he was entitled to a set of rights, such as those of land for cultivation and grazing. With those rights to use land came rights of access to waterholes, wells and trees - which carried a duty to protect them".

- the *chitemene* system[26] of shifting agriculture in Zambia;

- the cultivation of *dambo*[27] margins, particularly for vegetables;.

[26] Chitmene is a system of shifting agriculture practised in parts of Zambia, characterised by the burning of branches cut from the surrounding woodland on a circular cleared garden site.

- terracing steep lands, cultivating mounds, and the use of fire to burn the 'bush'.

- the use of micro-environments, agroforestry and mixed cropping.

Colonial governments incorrectly viewed many traditional practices (including pastoral production systems) as destructive of the environment. They disrupted and even outlawed many of them. The authority of Chiefs was diluted and traditional systems of land-tenure were dismantled. In other instances, Chiefs became government puppets. Inequitable land divisions were created which appropriated the best land for settlers and marginalised Africans to often infertile communal lands or reserves, leading to overcrowding (see section 2.10). Policies were introduced to impose permanent cultivation within cash economies. This led, in some areas, to serious soil erosion, and strict controls were introduced in some countries to impose soil conservation. These measures often failed (or were abandoned at independence), not because they were technically unsuitable, but because of resistance due to their imposition. In most cases, they did not fit the socio-economic conditions and aspirations of local farmers.

Successor independent governments often perpetuated (or at least did not substantially change) many of these colonial systems and regulations. They have also continued to erode traditional rights, In Tanzania, for example, Barabaig pastoralists were alienated - without recompense - from traditional prime dry season grazing areas when the government developed extensive commercial wheat farms on rangeland in Babati District during the 1980s (Lane & Scoones, 1991). Indigenous techniques of environmental and land management have been further disrupted and eroded by war and conflict (e.g. in Angola and Mozambique) and by rural-urban migration which has depleted rural communities of people available to maintain traditional methods.

Many people, particularly those living in communal lands, now lack any rights to the land they occupy or use, or any formal tenure or title. As a consequence, they cannot effectively own and control the resources on which they depend and frequently are subject to the negative impacts of resource management and use decisions taken by others (often governments). Such people, particularly pastoralists, live in great uncertainty and their livelihoods are insecure. They cannot use land as collateral to secure credit and loans. There is little real incentive to invest in the land and its sound management.

Communities living in areas surrounding protected areas are often prohibited from entering those areas to access resources on which they traditionally have been dependent, e.g. thatching grass, medicinal plants, minor forest products, etc. This has been the cause of considerable conflict and tension. Fortunately, in some areas, the issue is now recognised. Recent attempts to establish community wildlife management schemes (see section 2.8) have gone some way to addressing the problem.

There is an urgent need to address such access issues and institute processes of land reform in the region. Problems are particularly acute for pastoral communities. As Lane and Moorehead (1994) point out, the orthodox view portrays pastoralists as

> "economically irrational and operating with inherently destructive communal land tenure systems, [but this] has been challenged and is now recognized as a flawed basis on which to design future rangeland development strategies. However, these mainstream views, and the policies they spawn, continue to encourage the withdrawal

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[27] Dambo: a term used by local people in Zambia and the surrounding countries to indicate a variety of seasonally wet grass-covered and treeless areas such as floodplains or valley floors. Also known as vleis.

> of pasture land from pastoral production, for the benefit of encroaching farmers and commercial production and for acquisition by individuals and the state. ..... The viability of opportunistic grazing systems within dynamic environments, together with the need for mobility as an essential component of African rangeland management, has now been demonstrated [see also section 2.1]".

Providing appropriate tenure rights to herders is a difficult challenge. Frequently, this issue faces socio-economic and political obstacles because access to land often means access to power. Ideas will need to be tested on the ground. New approaches will need to be firmly based on sound empirical research and will need the clear support of government and technical agencies, and herding groups will need legal recourse when their tenure rules are broken by outsiders. Lane & Moorehead (1994) conclude that:

> "Responsibility for which type of tenure system should be used in a given area should be left to local user groups. There can be no prescribed, rigid model of land tenure. In different areas, different tenure arrangements will be developed by local users, who will learn at their own pace what is most suitable. The role of outside investors and development agencies should be facilitatory, and should adopt an incremental approach to project planning which allows adaptive management to changes in tenure systems. An appropriate role for government and other actors in the pastoral sector is to strengthen institutions for conflict management and the provision of information and legal support to weaker groups".

As noted in section 1.5, some of the democracies in southern Africa have enshrined environmental rights in their new constitutions. This offers hope to address the issues discussed above, but time will judge whether these commitments can overcome the technical and socio-political obstacles. On the positive side, South Africa has made much progress in reforming its Land Affairs Policy since 1994 (Box 2.5) and, in January 1997, the government announced its intention to publish a draft Extension of Security of Tenure Bill which will aim to "create alternatives which provide security of tenure and permanent land rights for the people who now live under vulnerable and subservient conditions".

2.13 Institutional Issues and Skills (for environmental management)

In southern Africa, the links between environmental issues and poverty are as clear as elsewhere in the world. For most people, life is still a daily struggle for food, water, shelter and warmth, and "values of the poor are tied to immediate use of the land and its resources to meet pressing needs" (SARDC, 1994). There is still much mistrust by people of governments at all levels. One of the key requirements for sustainable development is to 'build bridges' and generate trust and cooperation between communities and governments. Just as top-down blueprint strategies and plans have failed in the past, they will not work tomorrow. Broad-based participation of all interest groups is required to define problems, and to set priorities and goals for environmental management and sustainable development. This needs to be matched with the empowering and enabling of groups so they can assume responsibility for, and can undertake, environmental

Box 2.5: Land Policy Reform in South Africa

In February 1996, as part of the process of giving effect to land rights-related provisions in South Africa's new constitution, and also as part of its contribution to South Africa's Reconstruction and Development Programme (RDP), the Department of Land Affairs published a Green Paper on Land Affairs Policy, setting out proposals for a comprehensive and far-reaching land reform program. Its goal is to address the legacy of apartheid in relation to land distribution and to create security of tenure and certainty in relation to rights in land for all South Africans. The Green Paper was the outcome of an extensive process of public consultation around land policy issues. This began with the publication of a Framework Document on Land Policy, distributed in May 1995 for public comment. Over 50 organisations, including farmers associations, NGOs, Government Departments and concerned individuals, responded to the Framework Document. Their comments were then incorporated into a Draft Statement of Land Policy and Principle that was the object of discussion at the National Land Policy Conference held on 31 August and 1st September 1995, and attended by over 1000 South Africans. Proposals range from the nature of state financial assistance in land acquisition to questions of future reforms of the cadastral systems. A central concern in making these proposals has been to translate a broad commitment to social justice and alleviation of poverty, into a set of concrete programmes, legislation and procedures. The Executive Summary of the Green Paper notes that:

"Current land ownership and land development patterns strongly reflect the political and economic conditions of the apartheid era. Racially-based land policies were a cause of insecurity, landlessness and poverty amongst black people, and a cause of inefficient land administration and land use.

For reconstruction and development to proceed, it is argued that land policy needs to deal effectively with the following factors in both urban and rural environments:

- the injustices of racially-based land dispossession;
- the inequitable distribution of land ownership;
- the need for security of tenure for all;
- the need for sustainable use of land;
- the need for rapid release of land for development;
- the need to record and register all rights in property; and
- the need to administer public land in an effective manner.

The case for the government's land reform policy is thus four-fold:

- to redress the injustices of apartheid;
- to foster national reconciliation and stability;
- to underpin economic growth; and
- to improve household welfare and alleviate poverty.

By helping to create conditions of stability and certainty - both nationally and at household level - land reform is described as a necessary factor for sustainable growth and development in South Africa. It is presented as an essential pre-condition for the Reconstruction and Development Programme to succeed.

The government's land reform programme is made up of the following principal components: land restitution, land redistribution, and land tenure reform. In the last year, the Department of Land Affairs has made substantial progress in laying the foundation for a flexible, needs-based approach to these programs and for ensuring that it facilitates delivery throughout the country. Success will depend on a wide range of services in support of land reform, requiring complementary working arrangements between national departments, various levels of government, and partnerships with the private and non-government sectors. Emphasis is also placed on the importance of local participation in decision-making, gender equity, economic viability, and environmental sustainability in the implementation of the land reform programmes".

Box 2.5 continued:

Comments were invited on the Green Paper and were fed into the preparation of a White Paper on Land Policy which was presented to Cabinet in February 1997. The White Paper (yet to be published) carries forward the basic policies and principles contained in the Green Paper, with some improvements based on inputs from interested parties as well as lessons from recent experience.

Source: DLA (1995).

conservation and management, particularly at local levels. Many of the green plans, conservation strategies and sustainable development strategies prepared in the region over the last decade have made important progress in meeting such objectives. But policies and plans can only be implemented if effective institutional mechanisms exist.

All countries in the region have established national environment ministries and departments, and most have created central environment agencies. But, in general, these are weak and lack the influence and political power of other line ministries. Environment is low in the pecking order. In addition, such ministries are mainly starved of budgetary resources to fund operations, severely restricting their ability to monitor and manage the environment. In the region as a whole, there is a severe shortage of trained and skilled people with experience and competence in environmental planning and management (and there has been a steady 'skills drain' from the civil service[28]). Nevertheless, there are individuals and 'staff cells' with the key knowledge and experience within particular government departments in individual countries and in universities, NGOs, industry and elsewhere. This provides a basis on which to build. The scale of the problems facing the region, both now and in the future (see preceding sections), requires that much more investment is made in training.

Donors can help by using their contacts and dealings with governments in southern Africa to focus attention on the urgent environmental issues and scenarios to help raise the influence of environmental departments and agencies, and also to promote the development of environmental awareness and responsibility and an environmental reflex throughout governments - i.e. within all line ministries. The latter will imply that ministries, and particularly those responsible for development planning, adapt their procedures and take into account the availability of natural resources and the impact of their activities on natural resources and other sectors. Namibia, for example, has adopted several mechanisms to promote this approach (see Box 2.6).It will be vital to continue raising environmental awareness within and across government at all levels, as well as in all sectors and across society as a whole. NGOs can play a pivotal role, especially in working with the poor and local communities. Regional and international networks and partnerships will also be important. The African Development Bank has noted that "regional cooperation is not an optional extra; it is a matter of survival (ADB, 1993).

[28] Wohlgemuth (1996) observes that, throughout the region, "lack of funding in the poorest countries means that institutions are disintegrating....Salaries are no longer sufficient to cover the costs of living even for the high level civil servant. This has meant that a large number of civil servants, often the most competent, leave the civil service, in the best case for the private sector or a similar job in a neighbouring country, in the worst case for Europe or the USA. The accepted number (UNDP) is that at present around 100,000 well educated Africans from Sub-Saharan Africa are working outside Africa, while as many 'experts' from Europe and USA are working in Africa".

Box 2.6: Promoting a Cross-Government Environmental Reflex in Namibia

In Namibia, the Cabinet established a Directorate of Environmental Affairs (DEA) within the Ministry of Environment and Tourism with a specific mandate to promote environmental sustainability (through environmental policies, planning and protection) and not only to focus on national parks and wildlife. Three useful approaches are being used to ensure that all arms of government are involved in environmental management:

- the DEA works with other ministries in inter-ministerial fora and programs;
- procedures, passed by Cabinet, require other ministries and sectors to undertake EIAs for proposed developments; and
- natural resource accounting is being used to provide data so that, in future national planning, resource data (stocks and flows) can be integrated with macro-economic data.

Source: Caroline Ashley (pers.comm.).

The SADC Environment and Land Management Sector (ELMS) program was established to define and coordinate priority areas of concern for the region (see Box 2.7). It has made significant progress but much is still to be done. The role of environmental impact assessment increasingly is being understood although only a few countries in the region have yet established EIA procedures (Roe *et al.*, 1995). Environmental policies, laws and practice are also deficient in most countries in southern Africa. Even where elaborate legislation exists, it is often poorly enforced. Countries in the region will need to subscribe genuinely to the ethic of sound environmental management if serious attempts are to be made to tackle the many environmental challenges that already exist and which are likely to become worse over the next 20 years. A sign of commitment will be enacting and then enforcing good environmental legislation.

Improvements in research and training are also vitally needed and a regional environmental training strategy is an urgent priority. In South Africa, the government has cut back on research funding which is of a capacity-building nature and, as a consequence, many top researchers have either left or are planning to leave the country (Christo Fabricius, pers.comm.). This trend is likely to have long term negative environmental implications. The private sector has yet to make a substantial contribution to the funding of environmental research. But some notable achievements have been made in the region in recent years such as the establishment of regional research and training institutions and networks on sustainable land use and agricultural production:

> "The Southern African Centre for Cooperation in Agricultural Research and Training (SACCAR) links and supports over 20 specialized national and regional research institutes on key crops (e.g. sorghum, millet, groundnuts), agroforestry and plant genetic institutues generally. The Southern African Regional Commission for the Conservation and Utilization of the Soil (SARCCUS) has facilitated the regional exchange of agriculture-related technical and scientific information, expertise and know-how for over 20 years" (SADC ELMS, 1994).

Box 2.7: SADC Environment and Land Management Sector

The Southern African Development Community (SADC) was established in 1992 and replaced the Southern African Development Coordination Conference, SADCC (created in 1980). This change also marked a shift in emphasis from coordination to integration and cooperation. The 1992 SADC Treaty includes such prerequisites for sustainable development as "solidarity, peace and security; human rights; democracy and the rule of law; equity, balance and mutual benefit; and the peaceful settlement of disputes". SADC is an inter-governmental institution now involving 12 member states, and each member hosts one or more regional units, usually for key policy areas where they have special concern and competence. The Coordinating Unit of the SADC Environment and Land Management Sector (ELMS) (formerly the SADCC Soil and Water Conservation and Land Utilisation Sector) was established in 1985 within the Ministry of Agriculture in Lesotho. Its mandate has been widened gradually and its current programme aims to help member countries to:

- improve their performance in relation to the sustainable management of natural resources;
- identify actual or potential conflicts of interest that may arise out of environmental degradation and to reconcile such conflicts;
- develop policies and promote practices for the sustainably productive management of natural resources, based upon partnership between government and communities of farmers and other land users; and
- support in stitutions in member countries in their efforts to increase their competence in relation to sustainable resource management and to integrate the various disciplines and contributions of such institutions.

ELMS has a practical focus on improved (rural) resource management for sustainable production, i.e.

- soil erosion, conservation and management;
- land (including range) management;
- catchment and river basic management, including lakes and wetlands;
- rural water resources management for production;
- pollution of urban or industrial origin which affects rural populations;
- pollution arising from agro-chemicals.
- rural community resource management; and
- policy issues regarding the above, including legal rights and obligations and economic issues.

The ELMS Coordinating Unit has undertaken its mandate through training (mostly in collaboration with national institutions) to build institutional capacity, information exchange and awareness creation (often through workshops and seminars), and continuous programme/project development to address issues of priority to member States. In 1994, following intense consultations with member States, SADC ELMS developed the "*SADC Policy and Strategy [P & S] for Environment and Sustainable Development, Toward Equity-Led Growth and Sustainable Development in Southern Africa*". This P & S focuses on the poor majority (people rather than projects) and is an integral part of the larger SADC agenda for equity-led growth and sustainable development in and among SADC countries. The main components of the P & S cover the main environmental policy goals and areas of concern, and a strategic program on priority issues, objectives and proposals for action. The overal P & S program will be coordinated by ELMS. 20 of the key program areas are to be coordinated by ELMS directly as the lead agency, whilst more than 20 others will be the responsibility of other SADC sectors.

Much of the pre-UNCED SADC agenda of priority actions is still valid and in force. Whilst there have been significant achievements since UNCED, particularly in strengthening policy and legal frameworks for change towards sustainable development, expert opinion in many SADC countries is that implementation of Agenda 21 has been inadequate (although, in fairness, Agenda 21 contains a very wide range of recommendations which few - if any - countries have yet to satisfy well).

Source: Segerros (1996).

CHAPTER THREE

SOME SCENARIOS FOR THE FUTURE

Predicting the future is extremely difficult, given the many possibilities and uncertainties, and must be undertaken in the context of adaptive management, i.e. with the capability of responding to new information and adapting. In Chapter One, a number of key factors are discussed which limit our ability to derive scenarios for the environment in Southern Africa over the next 20 years:

- the lack and unreliability of existing environmental data;
- disputes and on-going debates concerning particular environmental 'problems' - some, whilst still seen by the mainstream as facts, have now been shown to be myths; and
- a general lack of knowledge in the region about livelihood strategies, how the main environmental trends and issues are likely to affect livelihoods, and how livelihood strategies will adapt.

In Chapter Two, some key and important debates, trends and issues have been discussed. Despite the great uncertainties, past history of environmental change and current trends allow us to examine certain scenarios. The latter are taken to mean depicting the future through a broad range of possibilities, not pinpointing sharply defined forecasts.

3.1 21st Century Vision in South Africa

In the years preceding the end of apartheid, various studies looked at the environmental consequences of that policy (e.g. Bromley 1995) and considered the future. Some pioneering scenario planning has been undertaken that offers a platform for scenario-building for southern Africa as a whole. A group of people (supported by the Anglo American Corporation) examined South Africa's choices for the future, embracing political, social, economic and environmental issues. Their analysis (Huntley *et al.* 1989) provided a powerful argument to end apartheid and join with the rest of southern Africa to face the environmental challenges of the 21st century. How much influence this work had on political events is not clear[29].

The work considered "both global and regional trends in environmental health, from the potential holocaust of a 'nuclear winter' to the insidious invisible threat of the 'greenhouse effect' and the ozone hole". Against this background of possible global issues, the boundary 'rules of the game' for South Africa were analyzed. These included:

- its basic geography;
- the immense natural diversity and richness of landscapes, habitats, fauna and flora;
- the climate and weather cycles;
- population dynamics and settlement patterns (mass urbanization);
- distribution of key natural resources - minerals, water and arable land;
- agricultural and forestry resources;
- homeland (communal land) poverty;
- marine resources; and

[29] But a subsequent book by one of the authors (Sunter, 1992) had a real impact on political change in South Africa - this is discussed later.

- economic growth and consumption patterns.

Two key uncertainties - the different socio-economic paths and environmental management ethics that the country might adopt - were used to derive four possible environmental scenarios in the early 21st century. They ranged: from (a) the '*Paradise Lost*' of a regional wasteland and (b) the '*Separate Impoverishment*' of continuing down the '*Low Road* (stagnation of the political reform process, big government, more centralized economy and siege mentality); to (c) the '*High Road*' (negotiated political settlement, multiparty political system, decentralized power, free enterprise, mass education, etc.) options of '*Boom and Bust*' where the nation's natural resources were plundered to achieve maximum short-term economic gains and (d) '*Rich Heritage*' where sustained development was pursued.

Taking this process further, Sunter (1992) looked at the future South Africa in relation to Southern Africa and the greater world. Here, he saw the 'High Road' as closing the gap between the rich and the poor nations, and the 'Low Road' as allowing that gap to increase with "dire consequences for the stability of the world" (see Box 3.1).

Whilst many people might disagree with the scenarios put forward by Sunter, and the assumptions behind them, they represent an important piece of work which had considerable influence within South Africa. The work is discussed in some detail because, it focused on the importance of economic growth and this is a key factor in the scenarios presented for southern Africa in sections 3.4 and 3.5. Furthermore, Sunter's scenario development work also depended on establishing clearly those factors which were set and known, and those which were uncertain - an approach also followed in this paper.

A number of studies are now being undertaken of the future of the southern Africa region following the dismantling of apartheid. A recent report of the Scandinavian Institute of African Studies (Odén, 1993) examined some of the issues related to alternative modes of regional integration and cooperation and the role of external resources, especially development aid. Southern Africa has always been and still is an important outlet for South African goods and services. The need to retain and develop these markets is reinforced by the fact that large sectors of the South African economy are not competitive on the world market (Tostensen, 1993). The emphasis has changed from destabilization of the region (under apartheid) to restabilization and reconstruction under the new regime.

3.2 Boundary Conditions - the 'Rules of the Game' and Key Uncertainties

The development of any scenarios needs to take into account two sets of factors: firstly, the boundary conditions - those factors which are already set for the region and are likely to stay the same (called the 'rules of the game' by Huntley *et al.* 1989, and Sunter 1992), and secondly, those factors which are largely beyond control and are likely to change (the variables or key uncertainties).

Those 'rules of the game' listed above in section 3.1 for South Africa apply equally to Southern Africa as a region. In its recent review of the environment of southern Africa, which also included some brief future scenarios, SARDC (1994) examined the context (boundary conditions and uncertainties) in which trends and scenarios were depicted (Box 3.2).

The two main components of global change - human population and climate change - are unlikely to affect the region significantly during the remaining few years of this century, nor is their effect

Box 3.1: High Road and Low Road Scenarios in South Africa

In a study of different future scenarios for South Africa, Clem Sunter (1992) discussed four '*rules for the game*' covering issues related to population, technology, social values and 'winning nations' (with mass education, a work ethic, high savings rate, a "dual-logic" economy - big business and thriving small businesses, social harmony, and acting as a global player). He also pointed to *key variables (uncertainties)* in respect of geopolitics (international order versus disorder), the world economy (particularly relationships - and possible economic conflict - between the USA, Japan and the EU - the 'Triad game') and societal uncertainties (particularly how the three Triad societies will react internationally to the global challenges facing them) which could drive the world down different paths over the next 20 years.

One 'key variable' was seen as fundamental to achieving the 'High Road', i.e. "will the Triad foster a sufficiently viable relationship with the developing world so that the 'Poor Young Billions' uplift themselves or not". For South Africa to take the 'High Road' and become a 'winning nation', Sunter argued that the country "must take the path of the African Dragon" and become the 'engine' economy of southern Africa, just as Singapore, South Korea, Hong Kong and Taiwan are Asia's dragons. He suggested that the country could build on four great strengths: it has the best infrastructure in the region, and abundant untapped mineral resources; it is a "world in one country" which could make it a tourist Mecca; and it is a "nation of entrepreneurs waiting to be released".

This vision, if it materialised, could have profound implications for the other countries of the region. Some people have argued that they will all benefit from the 'lift' to the region provided by a strong South African economy and by improved cooperation. It has also been suggested that they could become 'swamped' by South African dominance (elements of such a trend can already be seen). Following the end of apartheid in South Africa, observors and commentators questioned the extent to which South African industrial power might disrupt the small and fragile industrial base in the other countries of the region and increase their dependence on South Africa ? They pointed to the fact that there are already some indications of South Africa extending its influence in the region: for example, South African goods are now exported to all countries in southern Africa, South African farmers have moved into Zambia and are beginning to acquire land in Mozambique, South African experts and advisers are promoting and 'selling' their skills throughout region (including environmental management skills). Would the latter trend help to build or hinder the development of domestic capacities and competencies ?

The new regional balance following the end of apartheid in South Africa is contining to evolve. Whilst there have been undoubted benefits to the other countries in the region, it is true to say that South Africa has benefitted enormously from the collective experiences of the rest of the region - particularly new thinking and experimentation with models for: community-based natural resource management; extension methods for forestry, agriculture, etc; small scale credit schemes and providing access to finance (eg through group lending); and training at this level.

over the next 20 years sufficiently understood or clear to build scenarios specifically around them. However, they will undoubtedly have profound affects in the long term. Obviously the countries of the region will need to cooperate with international efforts to counter the worst outcomes of the 'greenhouse effect'. And any efforts to deal with population growth will contribute to addressing the global problem.

Some issues can be viewed as surprise 'wild cards' which could have dramatic effects. The regional impact of AIDS is a key uncertainty in this regard (see section 2.3). If global warming occurs, the incidence of a range of tropical diseases could increase dramatically in some areas,

Box 3.2: Contextual Factors for Scenario-Building

Regional resources: Southern Africa's geographical and geological conditions set certain boundaries on what can or cannot be changed. Written records dating back over a century show droughts have regularly afflicted the region in that period, while geological evidence shows recurring droughts going back many hundreds of years. The natural resource base is largely fixed. Geology determines the location of minerals and, in part, soil types. Soil fertility is rarely high, and typically heavy rains deplete nutrients in the soil. Forests and other vegetation grow where the weather, soil and other natural conditions permit. Water is scarce in many parts of the region, especially in the south and west, and natural sources of supply in those areas are few.

Most energy resources are also limited. The majority of people depend on fuelwood, charcoal or, in some cases, coal for domestic heating and cooking. Access to electricity is largely restricted to major cities, and many people cannot afford to pay for electricity or electrical appliances. Little oil or gas has been found or commercially exploited in the region, except in northern Angola, although several countries are still exploring. Renewable energy sources such as wind and sun are abundant but not widely used, and access to technology to harness them has been limited by cost.

International factors: A number of political and economic interactions in the international arena have an impact on the region. In particular, development loans and trade barriers remove a great deal of control over local economies from national governments. The unmanageable debt burden in most countries has severely limited the availability of government funds to monitor and manage the environment. Many countries in the region have to pay huge sums in interest each year without reducing their debt. Low global commodity prices have reduced export earnings, requiring much higher levels of production to earn sufficient foreign exchange to maintain payments. The recently completed Uruguay Round of the Global institutions such as the General Agreement on Tariffs and Trade (GATT) is likely to affect the region, although it is not yet clear how. Other factors include commitments under international agreements and conventions (e.g. on Biodiversity, Climate Change, Desertification, Trade in Endangered Species, etc.).

Global environmental changes: Several global processes will affect the region's environment. Ozone depletion is expected to increase over the next 20-30 years. The likely impact(s) are not clear, but might include decreasing agricultural productivity and increasing incidence of skin cancers and eye diseases. Animal and plant health might also be affected. The effects of global warming (see section 2.5) could easily dwarf those of ozone depletion and could include a rise in sea level, increased diseases and pests, more extreme weather conditions - particularly drought. Changes in weather patterns could disrupt ecosystems, such as the highly productive Benguela marine system on the southwestern coast of Africa.

Adapted from SARDC (1994, p291-292).

e.g. malaria, hepatitis-B, cholera, bilharzia, foot-and-mouth diseases and rinderpest, although probably not in those areas affected by increasing aridity. The region is currently moving towards political stability following the end of wars in Angola and Mozambique, and the end of apartheid and free elections in South Africa. Whether this position will continue, and whether the region's countries can avoid turmoil from internal conflict, is also seen by some as a major uncertainty.

3.3 Some Key Environmental Trends Revisited

A range of environmental trends have been discussed in Chapter Two. Two important positive trends are likely to have beneficial effects on the environment in southern Africa. First, notwithstanding the uncertainties highlighted in section 3.2, the current trend towards greater democracy is laying the

foundation for greater public participation in decision-making. It is enabling the involvement of more people from a wider cross-section of societies in the process of policy development (including in national and local environmental action plans and sustainable development strategies to which increasing attention is now being given in the region), more commitment to policies once agreed, and increased accountability and responsibility - of both governments and publics. Participatory policy-making and environmental management is being encouraged by international accords (e.g. Agenda 21 and the Conventions on Biodiversity, Climate Change and Desertification) to which the countries of the region mostly are committed.

Secondly, scientific advances are being applied in several areas. For example, infrastructural development is increasingly using improved technologies (for dams, industrial processes, solar energy, water and sanitation services and roads, etc.) and there is increasing use of more efficient and non-polluting technology.

There are, however, various trends which are having, and are likely to generate increasing negative impacts on the environment. The problems of pollution from industry, agriculture and urban areas have been discussed in section 2.7. Soil erosion and other forms of land degradation have been considered in section 2.1. These problems are likely to get worse as patterns of increasing urbanization continue and as pressures to increase industrial and agricultural production grow in response to population growth. The latter trend will probably be accompanied by increasing poverty which limits people's options to use environmental resources in a sustainable way. Similarly, continuing debt and limited financial resources available to government departments will also restrict their ability to discharge their responsibilities and manage the environment.

SARDC (1994) contends that much formal education and training in the region is usually based on foreign biases and is "out of touch with local environments, processes and traditions" and, as a consequence, has "overshadowed and disrupted the role of traditional education and culture". Many traditional, religious and cultural practices worked to protect the environment, but have been displaced (and even outlawed) by new 'western' values and by the growth in systems geared to satisfying increasing consumption patterns (see section 2.12). But, equally, the introduction of new ideas needs to be sensitive to traditional values. Finally, episodic natural events such as droughts and floods lead to severe environmental impacts and all countries in the region will need to improve their preparedness strategies.

In the next two sections, two main scenarios are presented to provoke reaction and encourage debate. They paint two extremes and future reality will lie somewhere between. This is a common approach in strategic planning. For example, in a recent exercise aimed at land use planning and resources protection in Gaza, three different socio-economic development scenarios were formulated. Each of them was based on a set of quite extreme assumptions. "This was done to ensure that real development in the future will be at least somewhere in between the extreme conditions considered" (EPD, 1996).

Similarly, extreme scenarios are increasingly being considered as a consequence of debate on the effects of climate change. But it is not only southern Africa that faces challenges from climate change. In the UK, for example, doomsday scenarios have also been predicted - a recent UK press article painted a picture of a major crises in the south east of England early in the next century (see Box 3.3). The key question is whether each country has capacity to respond to change in appropriate ways.

Box 3.3: "Drought Nightmare in South East England"

UK water companies are predicting that acute problems will face the heavily populated south east of England early in the 21st century as a consequence of climate change: Based on these predictions and views expressed by a range of environmental groups, the London Evening Standard recently carried a major article which presented a 'worst' scenario for the summer of 2020. Elements of this scenario included:

- Temperatures are climbing well above 30°C as global warming continues .... and tension is growing in both town and country throughout the region.
- Householders are angry because they are paying more money for poorer water supplies. Many are refusing to pay their water bills and there have been violent demonstrations outside water authority offices.
- Public health is deteriorating. The region is swept by epidemics of diarrhoea and vomiting. Waste water is being recycled on a massive scale and the quality of drinking water is affected. People are bathing less, and eating unwashed chemically-treated fruit and vegetables. It is difficult for the old and sick to get clean drinking water.
- Low river flows have led to a dangerously high concentration of pollutant chemicals in the soil.
- Electricity cuts have been introduced because power stations are running short of the water they need for their cooling towers.
- Environmental damage is widepsread. Dozens of forests and wildlife sites all over southern England have been destroyed by over-abstraction of water.
- Farmers are going bankrupt because they have been stopped from irrigating their fields.
- The soil has cracked in the intense heat, allowing fertilizers and pesticides to seep into rivers, lakes [and groundwaters], further worsening pollution.
- Flash floods occur more frequently because the ground is so dry that it can no longer absorb water.
- Unemployemnt is rising relentlessly.
- The water companies are pinning their hopes on a new generation of reservoirs but their introduction has been delayed by mammoth planning inquiries and opposition from environmental campaigners.
- Older residents of the region are recalling those early signs that appeared during the 1990s and wondering why nothing was done earlier to avert the crisis.

Source: London Evening Standard, 4 March 1997.

The first scenario presented below assumes that current environmental trends continue and get worse, with negative impacts gradually increasing. The second assumes that governments and peoples take effective steps to counter these trends and manage their environments and economies sustainably. The main thrust of the 'High Road' and 'Low Road' scenarios depicted for South Africa (see section 3.1) can be equated to the choice between following these alternative unsustainable and sustainable development paths.

3.4 The Doomsday Scenario - The Road to Unsustainability

It is not unreasonable to assume that most, if not all, of the current environmental trends in the region will continue, at least for the foreseeable future. In any case, some trends (e.g. population growth) have an in-built momentum. Changing course is difficult in the best of circumstances (i.e. where government and societal will exists, where the financial resources to support the changes are available, and where the changes are achievable). Whilst as already noted, great progress has been made in recent years in the region in terms of innovation, institutional changes and regional cooperation, etc., most of the necessary further changes, if instituted, will take years to have a marked effect.

The region is likely, therefore, to suffer considerable environmental consequences as a result of existing trends. But these will be much more severe if the trends worsen and accelerate. In these circumstances - the 'road to unsustainability', as postulated in the following nightmare or doomsday scenario, there would be increased conflict, extensive environmental degradation and human misery. Some of the key variables of such a scenario are considered below.

(i) Poverty and population

Two major factors are likely to have a dominant influence on the environment in southern Africa over the next 20 years - persistent poverty and rapid population growth. Poverty (inadequate financial and other resources) often means that, in order to survive, people have little alternative but to use land and resources unsustainably to satisfy their basic needs. They do not have the luxury to consider the consequences or environmental impacts - even though they may be aware of them, e.g. soil nutrient depletion, soil erosion, excessive tree felling for fuelwood. They are unlikely to be able to afford the costs or the 'surrender' of cultivable land to conservation works. Even animal manure and crop residues, which might be returned to the soil to provide nutrients, are likely to be burned for cooking and heating. Many poor people, particularly in urban areas, have little alternative than to live in squalor in overcrowded and unhealthy slums or shanties in insanitary conditions and without basic services such as clean water and sewage systems.

The region's population is growing rapidly. It is expected to double to at least 270 million by 2015, unless growth rates are changed - either by war, by intervention (e.g. family planning), or by natural events such as the AIDS epidemic (but this is far from certain, see section 2.3) or increased incidences of other diseases as a result of global warming (see section 2.5). There is a built in accelerator to population growth in that a large percentage of the region's population is currently young (over 40% are under 14 in most countries) and will be capable of producing children throughout the next 20 years. As SARDC (1994) comments, "the population is not likely to stabilize for several decades".

In the doomsday scenario, the increasing population will place more stress on the environment, as rural communities are forced to 'mine' resources and as people increasingly migrate to urban areas in search of work, food and shelter, with serious consequences, i.e. increased overcrowding and pressure on already inadequate urban services (see section 2.2.). The population increase will also generate ever increasing pressures to produce more food. The burgeoning urban population will have to be fed by production increases in commercial farming. This most likely will be achieved as a result of an expansion of intensive production, through:

- further increases in irrigation - to the extent that available water resources allow (there are already competing claims for limited water resources from electicity-production and irrigation needs, e.g. on the Ruaha river in Tanzania) - but at the possible cost of localized waterlogging and salinization;

- massive increases in the use of fertilizers and pesticides (particularly on large commercial farms) which, inevitably, will lead to increased pollution of rivers and lakes and other waters with consequential effects on human health and the environment (see section 2.7); and

- probably an expansion of ranching, particularly in the region's extensive grazing lands where more efficient traditional pastoralists (see section 2.1) will be displaced and, in a worst case scenario, their way of life may be completely eliminated.

This picture assumes, of course, that chemical inputs continue to be available and affordable by the commercial farming sector. If economic growth becomes negative, this cannot be guaranteed (see section (iii)) and, in any case, people may not be able to afford to buy food. The worst case scenario here might be widespread starvation. The masses of the rural poor will be unable to afford to use such agrochemicals. Their only recourse will be to cut down more forests and woodlands to expand the land under cultivation and, as suitable land becomes limited, to move into marginal areas such as steeplands and grazing lands. This is likely to lead to massive increases in land degradation (particularly soil erosion, and reductions in soil fertility), leading to consistently declining productivity. Increasing poverty is likely to fuel bad land husbandry and prevent nutrient recycling and investments in soil conservation. There will also be great pressure to bring protected areas and environmentally sensitive areas (e.g. wetlands) under cultivation with loss of habitat, biodiversity and extinctions of many animal and plant species. Furthermore, the insatiable demand for food will mean that people will have little choice but to turn even more to wildlife as a source of protein - placing severe stress on wildlife resources (wildlife per capita has been declining steadily in recent years in any case).

A more optimistic view is that further increases in agricultural productivity are possible. In practice, southern Africa has produced a net food surplus for several decades (although there have been severe food shortages and famine in some areas). However, overall productivity has not kept pace with the growing population. SARDC (1994) concludes that falling per capita production in the region "will lead to a net deficit well before the year 2020. Since other areas of the world are also experiencing these declines, they will eventually export less to southern Africa because they will need more to feed their own people". Of course, the greatest uncertainty in the food production 'stakes' is the uncertain effects of climate change on the food production capacity of the region. As noted in section 2.5, predictions suggest that the region will become increasingly more arid.

These are but some elements of the complex web of consequences that rapidly increasing population and surging poverty might lead to. These key factors will undoubtedly affect all aspects of the environment, economies and societies.

(ii) Economic stagnation and decline

In general, the economy of the region has seen slow growth in recent years. This has restricted the ability of some governments to maintain services such as health and education (which have positive spin-offs for the environment) and to fund agencies responsible for managing the environment. Many industrial plants have not been able to invest in efficient or clean technology. The farming sector, particularly poor subsistence farmers, has been unable to afford inputs or to maintain or install soil conservation works. Predictions of the future economic fortunes of the region are extremely difficult to make, particularly given the uncertainty in the relations between the Triad countries (see section 3.1) which effectively control international trade and commodity prices. However, if the current state of economic stagnation persists or if economic growth continues to decline, then average real incomes will decrease considerably for the majority of people, leading to greatly increased poverty (and its consequential negative environmental impacts - see (i) above), large-scale unemployment, severely

reduced quality of life, increased corruption and crime, and imprisonment in the debt trap for some countries. The World Bank has promoted Structural Adjustment Programs in some of the region's countries, but it is not yet possible to judge what affect these have had on improving economic growth or reducing the extent of poverty.

Another problem is that the economies of some countries in southern Africa have become heavily dependent on aid (e.g. Tanzania, Zambia and Mozambique). Yet, overseas aid flows are beginning to shrink because of budget cuts, particularly those to African nations. Donors are having to rethink the distribution of their aid - some focusing on fewer priority countries, many redirecting aid away from Africa to underpin the new democracies in eastern Europe. What happens if the aid starts to 'dry up' ? Some predict complete economic collapse in aid-dependent countries. Others argue that aid reduction or withdrawal will provide a much needed stimulus as countries are 'forced' to "manage their economies better".

It is suggested, with increasing frequency, that South Africa will provide an economic 'engine' to support the economies of the other countries of the region. But some people are seriously questioning whether South Africa will be able to fulfil this role.

(iii) Water - the key resource

Consumption (for domestic and industrial use, livestock, irrigation, mining and power generation) is expected to double over the next 25 years. Chronic water shortages will emerge over this period and will limit development in the region (it is projected that Botswana, Namibia and South Africa will experience actual water deficits by 2020, with Zimbabwe, Swaziland and Malawi facing severe problems). Assuming that conflict between nations does not occur and that water-sharing is successful (discussions on cooperative water-sharing arrangements between the water-rich and water-poor nations have been taking place under the sponsorship of SADC and UNEP - see section 2.6), this will require more dams which could interfere seriously with the natural conditions of the major rivers and eliminate many important habitats[30]. As SARDC (1994) notes, "both river and lake levels will drop, floodplains will be damaged by loss of annual flooding, and estuaries will be disrupted when the mix of fresh to salt water changes". Disruption to freshwater ecosystems will inevitably affect other ecozones.

In many parts of the world, dam siltation is a serious problem. There is no accurate information on the current trends in siltation in the region's dams. However, if population growth and increasing poverty leads to a massive increase in soil erosion, particularly in marginal areas - as postulated in section (i) above, then it can be assumed that many dams will silt up rapidly and their useful life for power generation and for water storage will be increasingly limited.

Growing urbanization and industrialization (unless curbed by economic stagnation or decline) will lead to increased water pollution levels. These trends are already apparent. As previously pointed out, regulations, monitoring and enforcement are inadequate in most countries in the region. If rates of urbanization escalate (various possible reasons for this have already been mooted), pollution levels could reach critical levels in some areas, and the poor, who often have no choice but to draw water directly from polluted water sources, will be at serious risk. If economies deteriorate, governments are unlikely to have the resources to police and control pollution levels or to undertake the expensive treatment of growing amounts of waste waters and sewage; and if conflicts and domestic unrest become a feature in the region, control will be almost impossible.

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[30] But some development and habitat loss is inevitable - the amount is likely to depend on how sensitively it is done and on strategic planning.

(iii) Conflict and confrontation

The last decade has seen the end of most armed conflicts in the region and a trend towards democracy. However, a surplus of guns from these conflicts is increasingly being used for armed crime, mainly in the richer urban areas. If weak national economies become weaker, and currently healthy ones weaken, with various consequences (e.g. increasing poverty and unemployment - see (ii) above), there will be much wider disparities between the rich elites and the impoverished majority and discontent with governments will probably increase. Such conditions are likely to be a breeding ground for escalating crime and domestic unrest.

The potential for domestic conflict is illustrated by the recent threats in South Africa by the Inkatha Freedom Party (IFP) to destabilize the province of Gauteng following township clashes between IFP members and the police over evictions of "residents staying illegally in houses" (Weekly Mail & Guardian, 13 Dec, 1996); and by increasingly violent strikes in a struggle for democracy in Swaziland (the only "absolute" monarchy left in sub-Saharan Africa) where the King is refusing to allow the formation of political parties.

As already noted, rapid population growth will place heavy pressure on natural resources. This pressure is probably most critical in respect of water - the lifeblood of drought-prone southern Africa. Also, as suggested in the last section, chronic water shortage will become a problem during the next quarter century. This will bring with it the likelihood of competition for water and possibly disputes over allocation, not only within countries, but between countries. Even the prospect of war between countries over access to water cannot be discounted. The Gulf War was arguably as much over access to water as other issues. Such conflicts could well lead to mass displacements of people (domestically and across borders) and large numbers of refugees which will result in a range of direct and indirect environmental impacts (see section 2.4). They are also likely to lead to further increases in urbanization.

(v) Biodiversity

Biodiversity will be under increasing threat over the next 20 years. As pointed out in sub-section (i) above, the need to feed the region's expanding population is likely to lead to the conversion of large areas of existing woodlands and rangelands lying outside protected areas into cultivated land (unless other sources of increased food supply are developed), dramatically reducing the extent of available habitat for wildlife (both plants and animals). But governments are likely to come under increasing pressure to degazette parts of some of the region's protected areas to allow cultivation. Once this process starts and the precedent is set, it may be difficult to limit - especially if the choice is between people and wildlife. In a worst case scenario, one can envisage that, by the middle of the next century, all but a few of the region's parks and protected areas will be under the plough or grazed by cattle (after the elimination, or at least great reduction, of tsetse flies by chemical screens or by massive spraying of pesticides - with its consequent environmental affects).

Natural habitats are also likely to be affected as increasing quantities of fuelwood and charcoal are used for heating and cooking by an expanding poor population. A statistic quoted by SARDC (1994) suggests that, with current population growth rates, annual habitat loss in the region will rise to 8000 sq.km by the year 2020 (it is not clear how this figure is derived, or what kinds of habitat are being referred to). As habitats shrink, the most affected will be the large mammals which require extensive areas in which to feed, breed and migrate. Some species (notably elephants and black rhinos) are already under serious threat from illegal hunting. Over much of the region, rhinos are likely to become extinct over the next 20 years, except in a few highly protected small reserves and game ranches.

It can be assumed that the loss of southern Africa's famous wildlife would severely reduce its attraction as a tourism destination, with potentially serious economic consequences. Lucrative game hunting may be less affected, provided private game ranching is unaffected; but even here, as poverty and hunger begin to bite, people may have little choice but to 'take' such private game as well as animals in communal lands and protected areas to satisfy their protein needs.

Increasingly, areas of species-rich vegetation may be lost forever. Pressures to continually intensify agricultural production (particularly through the use of agro-chemicals) may kill soil organisms and poison habitats (the affects of pesticides has been discussed in section 2.7). And increasing pollution from urban areas and industrial discharges will affect and kill many species.

A range of plant and animal species is already being exploited through lucrative illegal trading, e.g.various birds, reptiles and rare plants. It will be difficult to prevent such trade escalating if poverty continues to grow, and if economies weaken and other forms of income or employment disappear. In addition, as traditional rules are increasingly being eroded and forgotten, the collection of plant and animal species for traditional medicines is growing unchecked.

Both freshwater and marine fish stocks are likely to be severely reduced as the demand for food increases, and in the absence of stronger resource management. Some lakes and rivers are already over-fished (e.g. lake Malawi, lake Malombe, lake Victoria, parts of the Shire river in Malawi) with most of the larger fish already taken. This is leading to the use of smaller and smaller net sizes (mosquito nets are increasingly been used). As noted in section 2.11, marine fisheries are also already being over-exploited. Just as pollution is unlikely to be controllable if the doomsday scenario unfolds, so too will overfishing escalate until stocks are depleted to extremely low levels, and some species may become extinct. Measures to stock lakes with species from elsewhere have already led to the displacement, out-competition and extinction of indigenous species. As demand for food increases, this pattern may be repeated.

(vi) A diminishing institutional response

Countries in the region are already hard pressed - in terms of financial resources as well as trained and skilled staff - to deal with current environmental, economic and social problems. Morale is low. It is already a problem to monitor, regulate and police existing environment regulations. Under the doomsday scenario, the scale of these problems will grow quickly as population and poverty rapidly increase, whilst the ability of government agencies and staff to respond, and their morale, will decrease. They will, in effect, be fighting a losing battle.

At the same time, the collection and analysis of information - vital for environmental management - will become even more ad hoc than it is at present, and greatly reduced; and collaboration both within and between countries to ensure consistent approaches to data collection (for comparisons) will become minimal. As a result, the voice and influence of 'the environment' in policy-making and decision-making will become even weaker than it already is.

3.5 Building a Sustainable Future

The discussion in section 2 has shown that the environment of southern Africa is shaped and affected by a complex set of factors. Some of these are extremely uncertain, e.g. the consequences of global warming or AIDS. Trends in several factors over the next 20 years are already largely set, particularly for population growth. Trends in other factors, to a large extent, will be determined by regional, national and local policies and actions. To work towards sustainable development and a more secure

future, the countries of southern Africa will need to take account of all of these environmental variables, as well as social, economic and political considerations, at national, regional and wider levels. However, practicality suggests that countries will focus on those variables over which they can exert some influence, either because they can promote positive changes or can effectively mitigate negative environmental impacts. Some of the benefits and consequences of following a sustainability route - the 'sustainable future' scenario - are discussed below.

(i) Building the future through sustainable development strategies

Over the last decade, the countries of the region have gained considerable experience in developing and implementing national conservation strategies, environmental action plans, sector strategies and plans. Some have been more effective than others. Nevertheless, all have provided valuable lessons for developing National Sustainable Development Strategies (NSDSs) as called for in Agenda 21 (Carew-Reid *et al.* 1994; Dalal-Clayton *et al.* 1994; Bass *et al.* 1995).

In response to commitments entered into at UNCED and in Agenda 21, the countries of southern Africa are now building on their past experience. They are all developing and beginning to implement 'first round' NSDSs of one sort or another. The evidence to date suggests that few of these are having or have had much real influence on overall development policy - they are not connected with the real centres of decision-making and are too remote from the central planning and budget processes. In other words, currently they are not part of the 'real world' of policy-making. However, they do have real potential if governments can be persuaded to draw these processes into the 'centre of affairs' and if they build on those elements of past strategy processes which have already been seen to work. For example, if monitoring and evaluation mechanisms are put in place, countries will be able to garner experience of what is working well, and what less well.

If governments remain committed to the NSDS process, they will be able to feed this experience back through periodic (possibly every five years) strategy reviews and revisions and facilitate the evolution of a cyclical process of learning by doing. With each round, governments will gain increasing confidence and experience in the strategy process. At first, they are likely to draw primarily on the civil service and probably academic skills and knowledge. Increasingly, however, if participatory approaches are encouraged and accepted, they will work with other key players and interest groups. These are likely to include not only government at all levels (from national to local) but non-governmental interests (notably: industry and business, religious groups, community groups, trade unions, social interest groups, environmental organizations, resource users such as farmers and fisherfolk, professional associations, schools and teachers, banking and financial organizations, the media, the judiciary, individual members of the public and international organizations).

Each turn of the strategy cycle (each round) should see an increase in the participatory nature and extent of the process. This will help to build and secure a sense of common purpose and common ownership of the strategy process. Policies and actions will be decided by an increasingly wider array of participants. The process will lead to greater dialogue at all levels and between all actors and interests. It will enable the integration of environmental, economic and social objectives; and where such integration is not possible, it will foster the process of making difficult trade-offs between objectives (a key to sustainable development).

The participatory process and the learning from doing, through successive cycles of strategy revision, is likely to foster spin-off effects. For example, there should be increasing trust and cooperation between government and communities. Stakeholders will increasingly be able to talk to each other and negotiate their differences to build a 'common future'. This should lead to reduced disputes and conflicts over resources and in other areas. Strategy processes will need to be accompanied by mass environmental awareness campaigns, involving the media and schools. They will foster environmental

monitoring to generate information for policy formulation, priority setting and strategy revision, and lead - out of necessity - to institutional development and capacity-building in all sectors. Legal reforms will also be fostered (e.g. the introduction of EIA legislation, changes in land tenure and resource access regimes). National processes will need to complement and link with local strategy development, and feed into regional strategy development which will serve to increase regional cooperation (e.g. through regional bodies such as SADC).

Donors will have a role in assisting the first few strategy rounds (financially and technically) but, increasingly, with success, the processes should become increasingly internalised and become fully integrated with national planning and budgetary processes.

Effective participatory strategy processes will help to develop human resources and improve living standards in the region, off-setting the poverty which currently exists. They will enable traditional knowledge and culture to play a role in influencing the direction of development, and the adoption of a more holistic approach to environmental management. Furthermore, they have great potential to facilitate discussion on ways in which technology can be used, and agricultural and industrial production can be improved, in an ecologically sound way to feed the growing population and support economic growth. It should be possible to stabilize population growth rates in the region by the second quarter of the 21st century if effective NSDS processes are initiated (and seriously maintained in the way suggested above). Their success is probably the only route to securing sustainable economic growth and raised standards of living - the key means to reducing population growth.

Strategic approaches will help to reduce and eliminate current negative environmental trends and build on and sustain positive ones. Some of these trends are easier to address than others. However, many fundamental problems are the consequence of several factors at play together. It will, therefore, be necessary to work on linkages between trends. Strategy processes offer one of the best vehicles for such an approach.

(ii) Reducing poverty and improving living standards

Earlier sections of this paper have highlighted the links between poverty, poor societal conditions and environmental degradation. Alleviating such conditions and improving living standards requires sustained economic growth to enable the creation of wealth. But that wealth needs also to be distributed equitably and used to increase access to essential services. As SARDC (1994) points out, "investment policies should recognize that it is important to provide an enabling environment for people to participate in the benefits of economic development".

The issue of economic development is a complex subject in its own right and cannot be discussed in detail here. Under the 'sustainable future' scenario, it is assumed that the countries of the region will increasingly improve their integration and cooperation (out of mutual need) and find ways to use South Africa's current industrial and production base and comparative economic advantage to boost and drive economic growth throughout the region, with increased trade both within the region and internationally. In practice, South Africa needs the rest of the region as much as other countries need South Africa. Care will be required to ensure that South Africa does not become a 'dragon' at the expense of its neighbours in the region.

It is argued that particular emphasis is needed to promote increased wealth production and equitable distribution in the rural areas where the majority of southern Africans still live. As data in Table 2.2 indicate, even though urbanization is increasing rapidly, by 2010, 55 % of the urban population will be living in centres with a population less than 500,000 and will be dependent on agriculture or agriculture-associated industries. At present, many subsistence farmers (and particularly women who do most of the farming) and those in communal areas (where they do not own the land to use as

collateral) have difficulty in accessing loans and credit in order to improve their production and standards of living, and to invest in sound land management. The Vice President of Uganda, Speciosa Wandira-Kazibwe, recently commented:

> "Unless you invest in women farmers, you are wasting your time. .... Women are going to be the engines of change. ... Women must be helped to own land. Until they do, we cannot expect them to improve productivity. They need credit, and they will repay it".
>
> Address to Conference of International Food Policy Research Institute
> Washington D.C., June 1995

If NSDSs are effective and successful, particularly with participatory processes enabling increasing negotiation of difficult issues and trade-offs on such issues as rights, land tenure and access to resources, then the problem of accessing credit should diminish as innovative ways are found for more and more people to secure tenure to land. Innovative mechanisms for credit provision are likely to emerge, based on successful models elsewhere such as the Grameen Bank in Bangladesh which is helping to raise standards of living in villages by lending to the landless, mostly to women.

Individual countries and the region (through increasing cooperation) will develop and improve preparedness for periodic disasters (e.g. episodic droughts). Disaster planning, monitoring and early warning will combine to facilitate the mitigation (often through regional cooperation) of the worst negative effects of disasters. As economic growth takes off, governments will increasingly have available the resources (which currently are often lacking) to implement environmental protection and management. It can also be envisaged that great improvements will be achieved in approaches, technologies and techniques to mitigate the effects of drought, e.g. improvements in grain storage, extensive adoption of water-harvesting, better land use, the use of appropriate crops, etc.

(iii) Expanding education and environmental awareness

Significant progress in solving the region's environmental problems will come as a result of increasing investment over the next 20 years (as economic growth takes off) in education and training, at all levels, and in harnessing both conventional and traditional knowledge as well as building on cultural and religious experiences and values. Minimum levels of education will be set and provided for all citizens, including girls and women. Education curricula will be developed as a cooperative venture between governments, educational institutions, employers and communities, and these will be practical, holistic and development-oriented. They will utilise indigenous knowledge, language and materials, foster gender equality, and encourage smaller families. Sustainable farming practices will be taught in the curricula of schools and colleges and promoted through agricultural extension services. Using environmental information will become part of the routine portfolios of teachers and the media, and such information will be disseminated through all possible channels including through local languages and traditional mechanisms. The output of research facilities and institutions will increasingly be targeted towards information users and communicators. Apart from government, the media and schools, many other organisations will have access to and a role in information networking, including NGOs, religious groups, resource user groups, etc.

The investment in general education, at all levels, will significantly improve the skills available to government and non-government institutions. Their capacities and performance will improve immeasurably and, with more resources available to agencies following economic growth, there will be much better environmental management in the region.

(iv) Transforming agriculture and managing key resources on a sustainable basis

There is great potential for the basis of agricultural production in southern Africa to be transformed over the next 20 years. Under the 'sustainable future' scenario, economic growth will gradually improve, peace and security will prevail, regional cooperation will be enhanced, and NSDSs will play an increasingly influential and key role in charting a sustainable future. These conditions and developments will foster production systems which, increasingly, will be based on sustainable farming practices which will recycle nutrients, improve and conserve (not degrade) the land and reduce pollution. Although still widely contested, there is plenty of evidence to suggest that low-input agriculture can be highly productive (Pretty 1995a). Such an approach is critical in areas such as southern Africa with extensive areas of fragile soils, limited rainfall and widespread poverty.

Economic improvement will lead to regional investment in agricultural research. Extensive monocropping in large fields - which can damage the soil - will gradually be eliminated and be replaced by practices such as intercropping. But the vast majority of farmers are subsistence producers. The energies of these small-scale farmers will be released as they acquire land rights and gain access to the credit (particularly women who grow most of the food) and technology which they need to invest and raise living standards. Methodologies such as permaculture (permanent agriculture)[31] are likely to take hold. Permaculture is a people-driven farming method which is suitable for both rural and urban areas. For the projected vast increase of people over the next 20 years who will live in agriculturally-dependent small urban centres (see previous sub-section), this approach will provide a vital way of producing food intensively in small plots. As NSDSs lead to policies which help to lower fertility rates, women will be able to increase their food output. Changes in land tenure will also play a major role in encouraging higher and more sustainable food outputs. Affordable and environmentally-sound low-cost agricultural technologies increasingly will be used, e.g. integrated pest management (IPM) through which pests are controlled more cheaply without chemicals. A vision of sustainable agriculture is given by Pretty (1995a; summarised in Pretty 1995b):

> "A more sustainable agriculture tries to do things differently. It pursues an incorporation of natural processes such as nutrient cycling, nitrogen fixation and pest-predator relationships; a reduction in the use of external and non-renewable inputs that damage the environment or harm the health of farmers and consumers; a more equitable access to productive resources and opportunities; a greater productive use of local knowledge and practices; and an increase in self-reliance amongst farmers and rural people.
>
> What has happened recently is that empirical evidence from the field is suddenly beginning to show that sustainable intensification works. Food output from the same land can be increased two to three fold, and sometimes more, with technologies and practices that do not damage the environment and that are accessible to all types of farming families.
>
> [The way forward is] to put farmers at the centre of agricultural and natural resource improvement, work with them and build on their knowledge, develop new partnerships between different agencies, and food production will improve immeasurably".

Pretty points out that successes with this sustainable approach are still only islands of success. This is partly because many scientists, and some international agencies, still argue that the only way to feed the world is through using modern 'improved' crop varieties and breeds of livestock, and high inputs

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31 Permaculture (permanent agriculture) - an idea developed in Australia in the late 1970s by Bill Mollison - is a system under which farmers use no chemicals or other inputs from outside the area where they farm. They grow a mixture of food and tree crops and usually keep small livestock, with each part of the system benefitting the other parts. Trees tap soil moisture, for example, leaf-fall from trees enriches the soil and helps crop growth.

of pesticides and fertilizers. Another reason is that national and international policy environments currently encourage farming that is dependent on expensive external inputs and inappropriate technologies. However, over the next 20 years, this picture will steadily change and, as NSDSs run through increasingly successful cycles, so too will integrated national policies for sustainable agriculture emerge and food production will increase. When Per Pinstrup-Andersen, Director General of the International Food Policy Research Institute, presented IFPRI's 2020 Vision for Food, Agriculture and the Environment in 1994, he stated:

> "The question is not whether we can feed the world, rather it is whether civil society and governments have the political will... to take the actions that are needed".

Under the 'sustainable future' scenario, the governments of southern Africa will find that will, and will be supported by changing international thinking and policies. The transition to sustainable resource management will also include other approaches to counter the effects of poverty including social forestry as well as using appropriate, alternative energy to reduce use of dung and crop residues as fuel. Extension and research networks will be improved and extension officers trained in sustainable approaches to resource use and land management

(v) Curbing pollution

Governments will develop policies, legislation and regulations, and review and revise existing ones, to control pollution. Monitoring regimes will be put in place, strengthened and expanded, and regulations strictly enforced through fines and other measures, discouraging pollution. In addition, incentives increasingly will be provided to enable industries to adopt low - and even zero - emission technologies, and to adopt environmentally-friendly production methods and waste disposal systems, including recycling. The trend will be towards less dependence on high-input agriculture and this will reduce pollution levels.

(vi) Planning for the uncertainty of climate change

Research undertaken by IIED and the University of East Anglia under a pilot project, "Climate Change and the South", shows how future adaptation and current development requirements may be achieved simultaneously in living natural resource sectors. This strategic approach is termed "**sustainable adaptation**". It recognises that, given the present-day priorities of the nations of the South to meet the needs of their citizens, the most effective manner by which they can begin to adapt to future, and as yet unpredictable, climate change impacts on living natural resource systems is to explicitly couple adaptive planning and management responses with sustainable solutions to resource-degrading development pressures. In this way, climate change responses can be based on actions that bring both immediate and long-term environmental, economic and social benefits. The research has demonstrated, firstly, that implementing adaptation policies and practices to minimise future climate change impact disturbances meets directly the current objectives for sustainable land use and forest management; and, secondly, that implementing sustainable land use and forest management practices meets directly the objectives for adaptation. In this way, the needs of both present day and future generations are most likely to be realised. In other words, what is good for sustainable development is also good for off-setting the effects of climate change. The best way for the nations of southern Africa to plan for the future, given the uncertainties of climate change, is to adopt and persevere with sustainable development strategies.

(vii) Regional cooperation and the peace dividend

The current peace and stability will continue and give rise to increasing regional cooperation covering economic development, environmental management and many other fields. This will eliminate the problems and threats from refugees, reduce some of the pressures causing urbanization, and lead to more agreements and action on resource use and sharing (particularly water). Similarly, a regional approach will be adopted to coordinate responses to disasters such as droughts.

(viii) Biodiversity - the mainstay of a tourism mecca

National and regional strategies developed under the emerging sustainability agenda in the region, and improving economic conditions and resources available for conservation, will provide for a mix of well managed and controlled protected areas, buffer zones and other areas managed under community-based wildlife management schemes and approaches, and privately-owned game ranches. Illegal hunting will quickly be eliminated through better controls (including improved policing involving the authorities and communities working together) and as a consequence of raised living standards reducing the incentives for people to engage in such activities. Certain species (particularly elephants and black rhinos) will be reintroduced into areas where they have traditionally roamed. The parties to the Convention on Trade in Endangered Species (CITES) will agree to these species (at least in the southern African region) being transferred to Appendix II of the Treaty, so allowing the major economic potential (through legal hunting) to be realised. The region's physical and biological riches (including its big game) will make the region a major international tourism destination and contribute to employment and economic growth. As agricultural production increases, the pressure on over-exploited fish resources (both freshwater and marine) will be reduced and stocks will regenerate.

Christo Fabricius (pers.comm.) suggests that the keys to the maintenance of biodiversity in southern African savannas are the:

- linking of protected areas (through corridors) to ameliorate the effect of insularization;
- promotion of a variety of land uses (including conservation) at the regional and sub-regional level;
- development of bioregional management plans which incorporate unprotected land into the conservation paradigm;
- identification of keystone species and processes, and focusing conservation efforts on those.
- preservation and re-introduction of megaherbivors in protected areas; and
- recognition of the role of disturbance in enhancing biodiversity.

3.6 The Probable Future - A World In-Between

Sections 3.4 and 3.5 have set out two scenarios which represent opposing 'extremes'. In reality, we might expect developments in the region over the next 20 years to follow a route somewhere between the two extremes.

The 'sustainable future' scenario relies heavily on the governments developing and implementing cyclical National Sustainable Development Strategies and envisages a major role for stakeholder involvement. In practice, the critical issue is getting strategic decisions made. Of course, the countries of the region need more power, more water (from somewhere), more food, etc. Effective decision-making structures and processes are required to ensure that all impacts, including environmental ones, of possible solutions to such problems are considered, and that the most effective or least-cost options

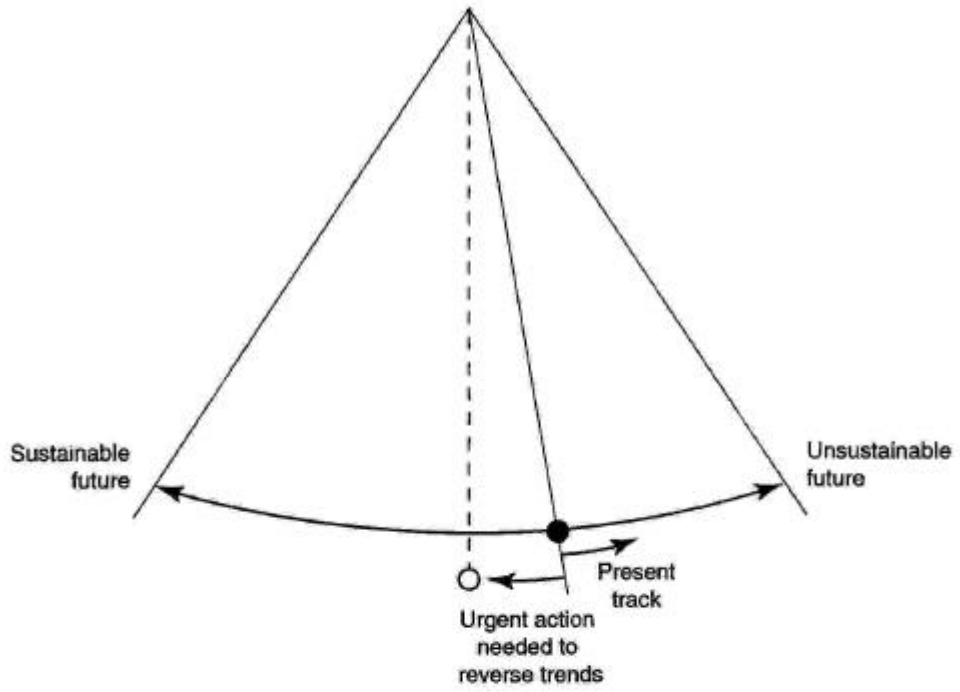
are chosen. Hard choices will have to be made and tangible environmental 'losses' (e.g. as a result of new dams) will be inevitable. Intangible benefits will probably arise through the growth and development that occurs.

Figure 3.1 illustrates this (albeit simplistically) in the form of a pendulum swinging between two poles: a sustainable future, and an unsustainable one. It is impossible to predict the exact alignment or direction of the route. At present, for the southern Africa region as a whole, as elsewhere in the world, the pendulum is clearly tracking in an unsustainable direction for many environmental factors. But it is also true that impressive progress has been made towards regional stabilization and in agreeing regional co-operation (through SADC and other agencies) and in reaching regional and bilateral protocols and agreements. A minimum objective should be that the
net result of development should be neutral (i.e. with the pendulum vertical). But societies have a right to expect governments to take steps to move the pendulum to the left of vertical. Whatever steps are taken, much effort is urgently needed to halt the present 'net' track (for the region) of the pendulum to the right and to begin to reverse the current swing. It is also possible to consider a gradient between these poles, and different countries or sectors may be at different points along the continuum. Equally it is possibly to conceive that different countries and sectors may be at different points on the pendulum's swing and possibly even tracking in different directions. It is argued that for Namibia and possibly other countries, whilst the pendulum is still in the unsustainable sector, it is currently tracking towards sustainability as a result of progress and changes in recent years, e.g. changes in political will, in institutions and environmental management mechanisms, the emergence of new approaches (e.g. farming systems research, community wildlife management), investment in new technologies (e.g. renewable energy) and the beginnings of discussions of land tenure issues (Caroline Ashley, pers.comm.).

But it will be the aggregate of all activities acting together that will determine the overall future. The simplistic nature of Figure 3.1 suggests that the route towards sustainable development is likely to be smooth path. This is unlikely to be the case and the path is more likely to take the form of a tacking track as different policies and actions take countries in the general direction of sustainability but not necessarily along a straight trajectory.

Some developments could bring a mixture of benefits and disbenefits. For example, if there is a move towards rapid modernization through technology 'leap-frogging', this could bring material benefits for some, but problems for others. Currently the bulk of the region's people are engaged in primary production - for this is where the skills lie, but developments which lead to a much higher dependency on technology that could only employ a fraction of the region's population would exacerbate current high levels of unemployment.

Figure 3.1: The Sustainability Pendulum



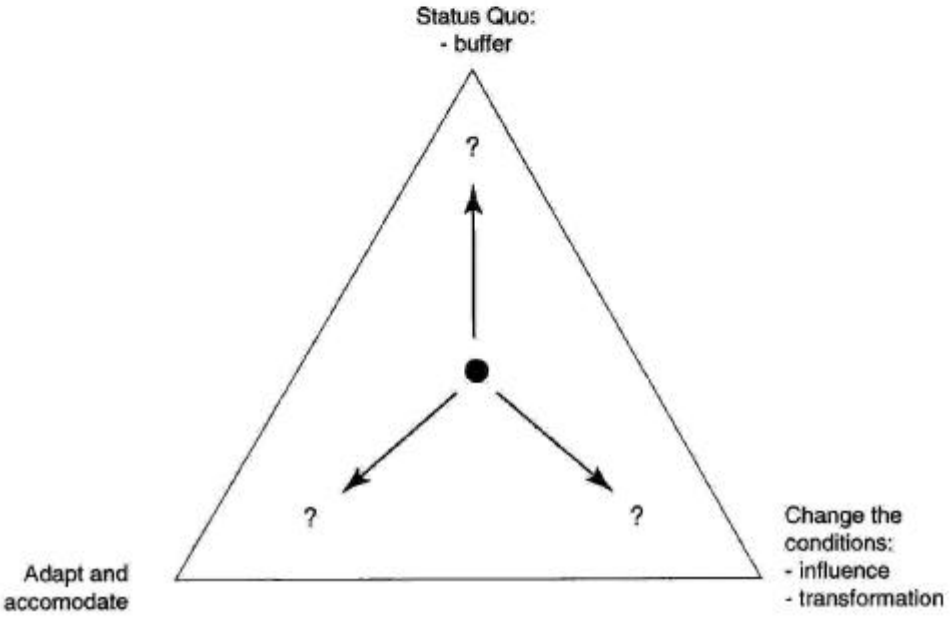


Figure 3.2: Resilient and Adaptive Systems

Note: The management system itself determines the response to pressure and change

In general, many people expect most trends to continue as they are - some perhaps improving, others gettting worse. We cannot discount the unexpected to happen which might lead to major changes. It is clear that governments have little alternative but to plan within a climate of uncertainty and, as in planning for the uncertain effects of climate change, choosing a development route based on principles of sustainable development is likely to be the best strategy. The same conclusion was reached in a case study of Zambia for a Swedish government review of Swedish Aid after UNCED (IIED, 1994b).

Experience to date from many parts of the world suggests that the best approach to dealing with uncertainty will be to adopt *resilient and adaptive organisation and management systems* in which there is a balance of responses between maintaining the status quo where this is helpful or necessary, and adaptation where change requires it. Figure 3.2 illustrates the challenge. Such systems would place strong emphasis on anticipating pressures and managing the change process.

This would require, *inter alia*:

- the open and timely availability of information on trends and changes;
- networking to build links, alliances and partnerships, and to foster participation in decision/rule-making, cost-benefit sharing, monitoring and reviewing the results of development activities, and in innovation and technology development; and
- experimentation, with continuous learning, building capacity, developing multiple skills, using flexible teams, etc.

The control of such systems will need to be dispersed and participative rather than held tightly within governments and top-down in nature. They will also need to be open, not closed-off, so as to be forward-looking and able to influence - and even transform - their external environment, rather than being passive or reactive in nature. Equally, they will need to be able to evolve as events move on.

Whilst unexpected events and unpredictable changes will undoubtedly occur in the region, some essential transformations can already be identified for a transition towards sustainable development. In its Policy and Strategy for Environment and Sustainable Development, SADC ELMS (1994) observes that:

> "After several decades of often marginal economic growth, increasing poverty and escalating environmental degradation, SADC countries face a formidable series of critical transitions in order to move from largely unsustainable development toward development that is economically, socially and environmentally sustainable".

Box 3.4 lists the transitions suggested by SADC ELMS.

Whatever the uncertainties, an article in a special issue of the "New Scientist" magazine suggests that there is hope for the future:

> "It seems to us that [hope for the future] lies where people are getting their hands on technologies for their own use, instead of being told what to do with them by outside experts, This is not large-scale aid, but the woman who can enrol on a literacy class because she heard about it on an independent rural radio station, the teacher who can demonstrate how to use e-mail on a school computer with the help of batteries and a radio link. Increasingly, governments and some donors, including the World Bank, are beginning to accept this view. They are introducing special programmes designed to help small businesses.

We are not deluding ourselves that technology will change Africa overnight - or provide a magic "fix". Most people don't have a phone, let alone a modem. Nevertheless, change is coming. In Tanzania, for example, it costs a quarter of a professor's monthly income to send a one-page fax abroad, but e-mail is twenty times cheaper [if you have a computer !].

What directions the changes ahead will take, no-one knows. What is certain is that each country's future will be different" (New Scientist, p35, 7 October 1995).

Box 3.4: Critical Transitions for Sustainable Development in Southern Africa

Demographic	towards an optimal size and distribution of population and economic activities in relation to the environment and natural resource base;
Social	toward a more equitable sharing of development opportunities and benefits with priority to the poor majority;
Gender	toward expanded rights and participation of women in the development process;
Economic	toward equity-led growth with priority to the poor and to protecting the environment and natural resources needed for future development;
Agricultural	toward better and sustainable use of land for greater food production and productivity with priority to household and regional food security;
Energy	toward more efficient use and less polluting sources of energy with priority to the accelerated development of renewable resources and affordable alternatives to fuelwood for the poor majority;
Technology	toward accelerated industrial development with priority to technologies that produce less waste and are more energy and resource efficient;
Institutional	toward new national and regional institutional arrangements with priority to integrating economic, equity and environmental imperatives in planning and decision-making within and among different ministries and countries;
Governance	toward greater public accountability and participation with priority to new sustainable development partnerships among governments, industry and NGOs;
Capacity-building	toward national and regional relf-reliance with priority to accelerated development and use of local knowhow, technology and expertise;
Development budget	from aid dependence to self-reliance; and
Peace and security	after decades of conflict toward a new era of regional cooperation and integration with priority to the peaceful settlement of disputes and equity-led growth for sustainable development.

Source: SADC ELMS (1994)

CHAPTER FOUR

RECOMMENDATIONS FOR GOVERNMENTS AND DONORS

The range of environmental (and related) issues which governments and donors could address and the actions they could take is very broad. Some suggestions are made below. Some of these are clearly political in scope or related to areas where donor agencies might exert influence or provide leadership; others are of a technical nature.

- **Plan for uncertainty**: Governments in the region, as well as donors, will need to adopt an adaptive planning approach, allow for uncertainty and be prepared for the unexpected to happen - it almost certainly will (not least drought and disasters). In this regard, donors should place a major emphasis on facilitating national, regional and international debates on those environmental issues and trends about which there is controversy (some of these are considered in Chapter Two); and help processes which allow the relevant issues to emerge and be discussed in an open and participatory way. Only in this way will it be possible to identify options for a sustainable future and the right kinds of investments. The conventional donor approach characterised by the (usually) three-year project cycle needs to be replaced by far more flexible and open-ended projects.

- **Encourage and support sustainable development strategies:** Planning for uncertainty accords with the philosophy of national and local sustainable development strategies. Donors should encourage and support governments to increase the commitment to participatory and cyclical National Sustainable Development Strategy (NSDS) processes, enable 'learning through doing', and to bring environmental and sustainable development planning into the mainstream of political decision-making and economic development planning.

- **Continue to support democratization**: It will be vital to continue to promote, encourage and support a continuing process of democratization within the region. In particular a careful package of support will be required in recently war-torn Angola and Mozambique to prevent them slipping back into conflict which will serve to destabilize the region and push it towards environmental degradation. Equally, investment and assistance to South Africa is vital if its newly won freedom is to be safeguarded and its potential to play a leading role in the economic revival of the region (upon which poverty alleviation and environmental stability depends) is to be nurtured.

- **Adopt and promote participatory approaches:** These are recognised as a vital element in moving towards sustainable development, in order to facilitate dialogue and 'ownership' - in both identifying problems and agreeing solutions. Such approaches need to be promoted within and across government, academia, industry and communities, etc. (i.e. horizontal participation) and within and between all levels - national, provincial, district, community, household and individual, and not forgetting groups who are frequently marginalised (e.g. pastoralists, women) (i.e. vertical participation). A strong emphasis is required to put the rhetoric of participation into action. Furthermore, 'bottom-up' needs to meet 'top-down'. Research is needed on the **links and relationships** within and between 'levels', opportunities for 'vertical integration', and the role of meso-level institutions (those operating between governments and communities).

- **Focus on institutional development and building capacity for environmental management**: There is already much emphasis in this area. This is particularly critical for supporting the new democratic processes in the region, and needs to be sustained and increased.

- **Plug the information gap and seek hidden information**: Efforts in this area need to be put in hand. The generation of relevant and reliable environmental data needs to be promoted and supported, with an emphasis on ensuring that comparable methods are used in different countries to facilitate analysis and monitoring of regional trends. But care will be needed to avoid the trap of collecting vast quantities of unnecessary information. Commissioning 'data needs assessments' for sustainable development would be a useful contribution in individual countries. Data should fit the needs of different target groups, e.g. decision-makers, technicians, the public, schools, etc., and should be accessible and shared. As a balance to this approach, it will be necessary to think creatively about accessing hidden and unconventional information sources as well as making obvious existing information more useful.

- **Support education**: It is clear from the analysis in this paper that education will play a pivotal role in ensuring not only sound environmental management, but also economic growth. Strong support is required to improve mass education. This should cover not only the formal and regular systems and curricula in schools, higher education establishments and training institutions, but also should embrace traditional knowledge and cultural values.

- **Commission research on livelihood strategies**: There is a clear need for research on livelihood strategies in individual countries, both in rural and urban environments. Ultimately, livelihoods are at the centre of most issues concerning the environment. Another key area which would benefit from research concerns the potential of small urban centres (population < 500,000) where more than half of the urban population will resident by 2015 (and dependent on agriculture or agriculture-related industries), focusing on their potential as catalysts for rural development. Efforts are needed to mobilize resources to promote secure livelihoods for people in rural areas, enabling them to stay there (should they wish) rather than migrate to urban areas. The whole issue of rural-urban linkages needs much more research attention and policy consideration.

- **Encourage and support drought-proofing and disaster preparendness planning**: Countries in southern Africa will need to invest effort in such approaches, both domestically and through regional cooperation (e.g. through SADC and other regional bodies). Donors should both encourage and support these efforts.

- **Seek to resolve inequity over land tenure and resource access rights**: As pointed out frequently in this paper, problems over lack of land tenure, inadequate rights, and lack of access to vital natural resources are key factors in the current trend of environmental degradation in the region. These are sovereign issues, but donors could promote debate on the links between these factors and encourage governments to address ways of overcoming the problems.

- **Facilitate the water-sharing debate**: SADC is currently promoting inter-governmental discussions on water-sharing. The success of these talks is vital if this key resource is not to become the source of conflict as water availability becomes acute (with chronic shortages in some countries) by 2015. Donors need to focus their attention on these efforts and assist them wherever possible. More emphasis is needed on water conservation, re-use and recycling.

- **Support pollution-free projects and assist the development of EIA capacity**. Governments should ensure that they promote (and donors that they support) projects which do not worsen the pollution burden and should encourage external industrial investments in the region to use environmentally-friendly technologies. Assistance should be given to governments to develop appropriate EIA legislation (i.e. not necessarily based on western models) backed by institutional capacity to manage processes and police regulations. There is an urgent need for research to assess the performance of existing EIA processes in the region, to identify areas of and reasons for successes and failures, and to provide guidance for improving the efficacy of EIA frameworks.

- **Promote resource-conserving agricultural practices**: Governments and donors should encourage and support the further development of a regional food security programme which adopts farming techniques which can be adopted by communities which are sustainable, and based on approaches which recycle nutrients, improve the land and reduce pollution.

- **Promote and support biodiversity conservation, and community-based approaches**: Clearly, biodiversity in the region is under threat. This is a serious issues in its own right. It also is undermining the future potential of the region for tourism. A range of measures to conserve and protect the region's biodiversity need to be supported. Particular support might be considered for community-based wildlife management schemes which, whilst still in their early days, offer considerable hope for the future. Research is needed on the impacts of such schemes, on whether they are actually delivering the benefits which are expected from them, and to determine the conditions under which they can work. There is also a need to document and undertake research on traditional conservation approaches.

- **Seek out policies and processes that work:** There is a need to reflect critically on policy formulation and implementation processes, seeking out and analyzing the kind of things that work and don't work in particular contexts. This will be a key route to determining the processes that can be effectively supported by aid. Research in this area should be supported.

Certain **over-riding factors** need to be borne in mind in considering responses to the challenges of development in the region over the next 20 years. First, the environmental trends are rarely the result of simple cause-and-effect relationships. Rather they are the consequence of complex (and sometimes obscure) linkages between a variety of factors. Secondly, economic development is crucial for environmental health and quality of life. But, trade-offs will be necessary between these three objectives and mechanisms will be needed to lead societies through the 'thicket' of trade-offs. Sustainable development strategies offer a route. Finally, investment is clearly needed in the following:

- **energy conservation**, including more efficient systems and less wastage on unnecessary processes or luxuries;

- the long-term **phasing out of fossil fuels**, which means the development of alternative and renewable energy sources and safer forms of nuclear energy. As Huntley *et al.* (1989) suggest, "for the first time in history, man will have to make do with less of one of his greatest discoveries - fire"; and

- **waste** recovery and disposal technology (particularly for hazardous and toxic substances).

Finally, this paper has raised many questions, but provided few answers. These will have to be addressed by the governments and people of the region. Donors can help by encouraging and assisting a **continuing debate** process at national and regional levels in the region to consider and take account

of the issues and challenges set out in this paper, and also by encouraging investors to engage in dialogue with the countries and the region over how they can best assist in building a sustainable future.

APPENDIX 1

ENVIRONMENTAL PROFILES AND STRATEGIES FOR SOUTHERN AFRICA

Hard copies of the publications listed below are located at IIED's Information Resource Centre in the Documentation Collection of the International Environmental and Natural Resource Assessment Information Service (INTERAISE). INTERAISE is a collaborative project undertaken by IIED, WRI and IUCN on behalf of the Working Party on Development Assistance and the Environment of the Development Assistance Committee (DAC) of the OECD.

Copies of most of these documents are also held by the India Musoktowane Environmental Resource Centre for Southern Africa (IMERCSA) - part of the Southern African Research and Documentation Centre (SARDC) based in Harare.

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