SECTION 4

OUTLOOK

CHAPTER 13
THE FUTURE TODAY

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"Africans declare that we will no longer allow ourselves to be conditioned by circumstance. We will determine our own destiny and call on the rest of the world to complement our efforts."

NEPAD 2001

INTRODUCTION

Scenario analysis offers a way to consider long-range futures in light of uncertainties and to examine the requirements for a transition to sustainability. Scenarios are possible sets of future events which, unlike projections of trends in human affairs, may be legitimate over the short term, but not as time horizons expand over months and years to decades and generations (Gallopin and others 1997). They are stories about the future with a logical plot and narrative governing the manner in which events unfold (Schwartz 1991, Cole 1981, Miles 1981) and they illuminate long-range problems and possibilities.

Scenarios are indispensable tools for environmental management that focus on large-scale, long-term interactions between development and environment (Toth and others 1989). Scenarios have two particularly advantageous qualities:

- First, they provide a coherent framework for analysis of how various issues or sectors impinge on one another and interact; and
- Second, they serve as tools to foster creativity, stimulate discussion, and focus attention on specific points of interest for policy on environment and development, and for opening up a constructive analysis of future problems.

The integration of scientific knowledge helps scenario development, as a tool for "peeping" into the future, to look more closely into what types of development and environmental strategies are risky and how they can be avoided, as well as into which ones are plausible and need to be reinforced. A scenario approach can be valuable for stimulating analysis and sorting out urgent policy issues, and as a means of communication between scientists and policymakers. However, it should be strongly emphasized that scenarios are simulations: they make an effort to introduce analysis of different "what if?" developments and should therefore be distinguished from projections.

This chapter provides qualitative and quantitative documentation of the scenarios developed during the *Africa Environment Outlook 2* (AEO-2) process. It analyses four development scenarios adopted in the AEO-1 process (UNEP 2002a): *Market Forces*, *Policy Reform*, *Fortress World* and *Great Transitions*. Although different in nomenclature, these are similar to those used in the ongoing Global Environment Outlook (GEO) processes: *Market First*, *Policy First*, *Security First* and *Sustainability First* (UNEP 2002b). Both AEO and GEO highlight the environmental implications over the period 2005-25. The underlying assumptions of both sets of scenarios are also similar.

Developing scenarios

Comprehensive information on the future state of environmental elements is required to assess the social, economic and environmental consequences of policy and other development actions. Scenarios of environment and development issues have been developed to help assess possible effects of different biophysical, social and economic processes on the future state of the environment in selected themes and issues. The aim of this chapter is to provide guidance to the regional, sub-regional and national policy community for converting the threats to and opportunities for environment and development into practical policies and actions. They can be an important tool for defining strategies to achieve the aspirations of Africa's leaders and people:

> "We are convinced that an historic opportunity presents itself to end the scourge of underdevelopment that afflicts Africa. The resources, including capital, technology and human skills, that are required to launch a global war on poverty and underdevelopment exist in abundance and are within our reach. What is required to mobilize these resources and to use them properly, is bold and imaginative leadership that is genuinely committed to a sustained human development effort and the eradication of poverty, as well as a new global partnership based on shared responsibility and mutual interest" (NEPAD 2001).

Box 1: PoleStar and T21

PoleStar is a software tool for mounting economic, resource and environmental information, and for examining alternative development scenarios. It is an adaptable model-building framework designed to assist the analyst engaged in sustainability studies – not a rigid model reflecting one particular approach to environment and development interactions (SEI 1999).

T21, an integrated computer development model, is a quantitative tool for integrated, comprehensive development and policy planning. The model is transparent, collaborative, interconnected, valid and customizable. It supports the larger process of planning by facilitating information collection and organization, and analysis of development strategies. It can provide insight into the potential impact of development policies and strategies relative to desired goals and objectives (MI 2002). The existing T21-Malawi Model was customized to enhance its environmental modelling capability for the production of the case study. Malawi was chosen since it allowed the model to be easily customizable to address environment issues given the existing datasets.

Sources: Raskin and others 1999, MI 2002

The scenarios described in this chapter are based on qualitative narratives and quantitative back-ups that have been developed using the Stockholm Environment Institute's (SEI) PoleStar® system and the Millennium Institute's (MI) Threshold 21 (T21).

The four scenarios

The scenarios provide narratives about four possible futures that may result from different policy choices at the regional and sub-regional levels. All four scenarios are plausible but not equally probable. They have been considered because they incorporate alternative social visions and values, highlight significant causal processes and provide critical pointers for environmental responses. The narratives are also intended to provide a common framework for diverse stakeholders, including policymakers, to address the critical concerns related to the environment and development of our time, as well as a forum for discussion and debate on sustainable environmental management.

Scenarios since AEO-1

While it is too early to fully assess how these scenarios have played since the production of the AEO-1, selected regional trends are consistent with environmental implications which were highlighted in the scenarios of that report. For example, the expansion in use of genetically modified organisms (GMOs) has continued to be controversial, with countries divided over whether to welcome it as a necessary technology to help resolve Africa's food security problems or to reject it due to uncertainty about its impacts on environmental and human health . The AEO-1 report stated that the "release of GMOs threatens agricultural biodiversity in some areas, especially where farmers depend on maintaining a mix of species and races as a hedge against annual and seasonal variations in farming conditions" (UNEP 2002a). At the sub-regional level, in 2002, economic communities including the Common Market for Eastern and Southern Africa (COMESA) and the Southern African Development Community (SADC) developed policies for dealing with GMOs. At the global level, IUCN – the World Conservation Union (IUCN) declared a moratorium on the

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NEPAD 2001

use of GMOs (IUCN 2004) citing poorly understood human and environmental health risks. Concerns around environmental and human health were highlighted in the *Fortress World* scenario of AEO-1. The debate continues and so does the expansion of the use of GMOs. South Africa has become a leader in the use of GMO technology, and in 2004 passed legislation to regulate GMO use. In Egypt, the National Environmental Action Plan (NEAP) of Egypt 2002-2017 has proposals for legislation on the intentional and unintentional release of GMOs that need to be passed by the People's Assembly. These concerns have been identified as an emerging issue in AEO-2 and they are discussed in Chapter 9: *Genetically Modified Crops*.

However, in other instances the scenarios developed in AEO-1 have not been realized. Under the *Policy Reform* scenario, the AEO-1 report stated that the dependence on biomass by the majority of the people would be reduced, because there would be more energy choices available (UNEP 2002a). Although the issue is on the agenda of African Ministers for Energy, the region has yet to make significant progress in this area. Chapter 2: *Atmosphere* and Chapter 6: *Forests and Woodlands* of this report suggest that Africa's achievements in the field of renewable energy are modest while the rate of deforestation due, in part, to fuelwood demand and charcoal production, continues to be high; this is contrary to the AEO-1 report's assertion that this dependence would be "reduced considerably."

In other instances, one scenario has been played out and not another. The *Fortress World* scenario of the AEO-1 painted a negative picture concerning regional cooperation on transboundary water issues. It suggested that cooperation would be weakened further and strained by escalating tensions and conflicts, as openness and transparency are eroded. However, given the policy choices the region has made, a different trend is evident. Contrary to the *Fortress World* scenario, there have been increased efforts to promote regional cooperation in managing transboundary resources. For instance, after more than two decades of negotiations, in 2004 the eight states of the Zambezi River basin concluded an agreement establishing the Zambezi River Commission (ZAMCOM). Although not highlighted in the scenario narrative, Africa also has witnessed the birth of the African Ministerial Council on Water (AMCOW) in 2002. These developments mirror the narratives presented on two of the AEO-1 scenarios – *Policy Reform* and *Great Transitions*.

Different scenarios have been and will continue to play out in the region, combining and overlapping to chart a new course. The overlaps and contradictions, in and between different scenarios, are the essence of any narratives – they are not laboratory experiments with predetermined controls to achieve the desired results. Scenarios address the question "what if?" and the resultant narrative follows an "if...then" logic. In so doing, scenarios help in preparing for different possibilities, and in enabling policymakers to deal effectively with new challenges and minimize impacts on people and the environment. With this in mind, the chapter presents scenarios focused on the regional and sub-regional levels.

The AEO-2 scenarios presented here are founded on the commitments countries in Africa have made, along with the international community, to meet the targets of the Millennium Development Goals (MDGs). And they build on the analysis of this report which, among other things, demonstrates that the challenges faced in achieving the MDG targets are still real and will continue to demand prudent policy responses. The underlying assumptions of the four scenarios have been refined to reflect changes since AEO-1, and to purposively highlight a limited number of the environmental issues over the course of the next twenty years. The 20-year period has been chosen to allow meaningful assessment of the driving forces and indicators of the selected issues – over the ten years leading up to and the ten years following 2015, ie, the MDGs target year. The driving forces have also been refined to better address the more recent policy decisions contained in initiatives such as the MDGs and the New Partnership for Africa's Development (NEPAD) Environment Action Plan (NEPAD-EAP).

The future is uncertain, with many possible pathways.

Source: M.Chenje

THE CHARACTERISTICS OF THE FOUR SCENARIOS

THE MARKET FORCES SCENARIO

The *Market Forces* scenario is defined in terms of prevailing economic growth paradigms based on the experience of the developed countries, mostly of Europe and America, and it is premised on the belief that this model of development is appropriate for the rest of the world, or that it is the ultimate model that the whole world would rely on, or adopt for development. Central to the thinking of this paradigm is the existence of the invisible hand of market mechanisms, which control the allocation of resources and the distribution of the benefits of growth. Essentially, the operation of market mechanisms means the economy is increasingly privatized and that there is a gradual withdrawal of government as principal actor in the development process. Thus, in this scenario, the government provides the enabling environment for economic growth while the private sector is the impetus for this growth. Consequently, opportunities are defined by market mechanisms with no significant intervention from government. The private sector maximizes profits, always seeking out sub-regions with the cheapest labour to produce high-value or brand products. People's search for satisfaction is based on increased acquisition and therefore consumerism becomes the socially defining value. The world economic system responds by increasing production of goods and services with increased burdens placed on natural resources.

Under the *Market Forces* scenario, barriers to trade between countries and regions continue to break down, especially as a result of globalization and because countries agree to unhindered flow of trade and resources, including financial resources. The economic environment becomes very conducive to research and development (R&D) initiatives. People do their best to maximize the benefits of economic freedom and motivation arises from this. Motivated by the benefits of economic freedom, people exercise their utmost efforts to maximize their profits. All these factors continue to stimulate economic growth through greater and more efficient use of available opportunities and resources. The operation of the principle of comparative advantage becomes important in the organization of economic activities between and within countries.

Opportunities are defined by market mechanisms with no significant intervention from government.

As a result of the increasing trade between nations as well as the removal of obstacles to the flow of ideas, information, labour and capital within a context of the efficient use of resources, the need arises for the emergence of new institutions to manage the new economic order and the emerging political arrangement.

New economic and political groupings, such as the existing African Union (AU), Arab Maghreb Union (AMU), COMESA, Economic Commission for Africa (ECA), Economic Community of Central African States (ECCAS), Economic Community of West African States (ECOWAS), Indian Ocean Community (IOC) and SADC emerge and indeed become more fashionable and imperative. The new groupings share more characteristics, becoming economic and financial groupings in addition to being political associations. Democracy becomes the accepted form of governance in more countries and the involvement of civil society organizations (CSOs) and community groups increases people's participation. In this way, the dividends of democracy become internalized into the development process.

The Policy Reform scenario

The narrative of the *Policy Reform* scenario is in many ways similar to that of the *Market Forces* scenario. However, unlike the *Market Forces* scenario, there is the realization of the need to address the negative fallouts of the driving forces through concerted efforts by governments and civil society. Consequently, the impact of market mechanisms is tempered by the inclusion of programmes to mitigate the negative impacts of such development. The argument is that the socioeconomic and political considerations may make it expedient for governments to take actions that favour citizens, rather than wait for the operation of the market to correct these ills.

For instance, instead of allowing the redistributive arm of the market to address the increasing numbers of poor people within a long-time frame, policies and programmes are adopted to actively counter serious negative social and environmental impacts. In terms of this scenario policies are put in place and executed to address specific and anticipated problems that arise from the operations of the market. For example, the state can be expected to intervene through policy and planning development in the management of fragile coastal ecosystems and require the adoption of integrated coastal zone management (ICZM) programmes that directly affect the allocation of resources and the distribution of the benefits of growth.

Policy reforms focus on engineering development through positive and proactive interventions even on such issues as privatization.

Essentially, policy reforms focus on engineering development through positive and proactive interventions even on such issues as privatization. While accepting the desire for a gradual withdrawal of government as principal actor in the development process, government is not content with just providing the enabling environment for economic growth, and it puts in place a monitoring and evaluation system that ensures that these operators of the economy follow laid-down policies which are beneficial to the people.

As in the case of the *Market Forces* scenario, barriers to trade between countries and regions of the world break down under the *Policy Reform* scenario. This is the result not only of globalization and information and communication technology (ICT) but also of the deliberate efforts of governments and regional groupings. Nevertheless, new institutions are established to manage the new economic order and the emerging political arrangement or rearrangement of nations. Economic and political groupings such as the existing AU, AMU, COMESA, ECA, ECCAS, ECOWAS, IOC and SADC flourish and reorganize themselves as stronger economic unions. Many sub-regional and international research centres, such as the existing Centre for Environment and Development for the Arab Region & Europe (CEDARE), Network for Environment and Sustainable Development in Africa (NESDA), and the Southern African Research and Documentation Centre (SARDC) are established. The development of new initiatives and ideas is greatly stimulated.

The Fortress World scenario

The *Fortress World* scenario emerges as a result of the struggle for power between two or more groups of people in a nation, identified here as the elites and the masses. The elites have access to resources of economic growth and monopolize them for their own development, while the masses have few resources and are left at the mercy of the elites. The masses depend on the leftovers from the elites and are often not in a position to decide their own destiny. As a result of the need to protect themselves and their investments, the elites organize themselves into enclaves, strongholds or garrisons. These enclaves are connected through treaties and alliances with each other at the national and regional levels, and through networks of economic interaction at the global and international levels. They are often well connected with multinational companies which operate in these enclaves.

Two variants of the *Fortress World* scenario, with similar consequences, may occur in Africa. The first may result from conflicts around religion and ethnicity, while the second is based on global relations. The second is a

global fortress world where the forces of separatism derive from the collapse of the world economic, social and political systems. Organizations like the AU may easily adjudicate in the prevention of fortress worlds of the first type. However, certain clauses in the laws setting up the organization have to be more alive to the issues involved in the second type of fortress world, as these require economic restructuring and empowerment of the deprived class.

The *Fortress World* scenario is a crystallization of certain patterns of historical behaviour among peoples and nations where inequalities abound, and where efforts have not been taken or mechanisms put in place for the mitigation of effects of inequalities. In such areas, the struggle for power often leads to the existence of "protected areas" for the elite who hold on to power at all costs. The remaining persons are forced into enclaves that display different characters from those of the "protected areas." Thus, while amenities and technological development could be at maximum development in the areas of the elite, the areas of the marginalized masses are depressed, often lacking all amenities and are considered as the backwaters of development. Economic and social welfare are not directed at improving the general well-being of everybody, but at protecting the privileges of the rich and powerful elite. In this scenario there is a growing divide between rich and poor people. This situation paves the way for increasing disputes between individuals, institutions and governments over resources for production, particularly land, and increases the likelihood of tensions over issues of wealth and its distribution. It is the continued play of these situations that leads to the establishment of the fortress to avoid total breakdown of law and order.

Although the fortress world situation may not yet be a reality, its elements are rife in many countries in Africa. The fenced and highly-secured residences of elites in many cities in the region, described cynically as the "architecture of fear", are an indication of the possibility of its emergence, as is the high level of social inequity between rich and poor, men and women, rural and urban, and different regions. The degree of social inequity can be measured using various tools including the Gini coefficient, gender-related development index (GDI) and gender empowerment measure (GEM). Another indication is the are constant agitation over resources in different parts of Africa, including Sudan, Rwanda and Côte d'Ivoire. The ongoing unrest in the Niger delta in Nigeria over petroleum is also a good example of the seeds for the emergence of a fortress world situation, if not properly redressed.

The elites have access to resources of economic growth and monopolize them for their own development, while the masses have few resources and are left at the mercy of the elites.

The Great Transitions scenario

The *Great Transitions* scenario seeks to adapt the good aspects of the other scenarios to strengthen the three pillars of sustainable development – environment, society and economy. This scenario views neither the *Market Forces* nor the *Policy Reform* as sufficient to address the ills that economic growth has placed on the environment, but sees the need for the evolution of a new development paradigm in which the sustainability of the environment is not compromised. It is envisaged that behavioural patterns that characterize modern societies, such as consumerism, give way and that instead people define a new level of satisfaction that is not materialistic. Furthermore, in this scenario it is envisaged that there will be a cultural renaissance that de-emphasizes the current "craze" for imports of food items, consumables and luxury goods (UNEP 2002a).

The major paths through which the *Great Transitions* scenario evolves include a new set of strategies that differs from current strategies and approaches, and that approaches development at conceptual, methodological, institutional, operational and financial levels. The "African Renaissance" can represent a major conceptual basis for this scenario, as it (Achebe and others 1990):

- Argues that future development paths must be, unlike conventional approaches which are unilinear and crisis-driven, dialectic and crisis-free;
- Has a vision that is methodologically "surprise-rich, inductive and retroductive, as opposed to the conventional wisdom that is surprise-free, deductive and predictive";
- Is locally owned and initiated, and is supportive and nurturing of people and promotes people-intensive development; in this respect it departs from the donor-fed and controlled development paths that are directive and capital-intensive visions; and
- Departs from the existing institutional set-up that is state-centred, concentrated and monopolistic to promote an approach that is "grassroots-oriented, multiple, dispersed and pluralizing."

Central to the *Great Transitions* scenario is the general disillusionment with dominant societal values, such as

consumerism, and the prioritization of the economy over the environment with its negative impacts on human well-being, development, and the environment itself. In this scenario, a new generation of thinkers – scientists, leaders, civil society organizations (CSOs) and activists – come together and shape national and global dialogue and policy towards promoting the interlocked goals of environmental sustainability and development. Africans show disenchantment with present values and see that the only development that is acceptable is sustainable development that respects the environment. Against this development it assesses what remains of environmental resources and identifies the opportunities these present for development. The vision of Jeffrey Sachs, in *The Africa challenge: the mission – how Africa lit up the world*, echoes the promise of the *Great Transitions* scenario:

> "It is 2025, and Africa is booming. Conflict has been resolved, democratic leaders have established unprecedented calm. And as the fight against disease gains momentum, it is African scientists who offer salvation to the rest of the world" (Sachs 2005).

The attributes of the *Great Transitions* scenario are based on visions of a desirable and environmentally sustainable future. The feasibility of a *Great Transitions* scenario for Africa is supported by the body of ideas among great thinkers in Africa and beyond, and in the development of the Omega and Millennium Plans of Action. Many events in Africa since the turn of the century have already set the stage for such a possibility. The renewed determination of the leaders of Africa to advance pan-Africanism, and to reactivate and rejuvenate inter- and intra-African partnership, including partnership between Africa and the international community, within the principles enshrined in the Lagos Plan of Action (LPA), is historically very significant (Nyong'o and others 2002, OAU 1980). The strategy adopted by NEPAD for achieving sustainable development in the 21st century goes beyond all previous initiatives. The Revised Framework of Opportunities for the Implementation of the New International Order in Africa, produced by the ECA, postulates that a credible and appropriate development strategy for Africa must satisfy four basic principles:

- Self-reliance;
- Self-sustenance;
- The democratization of the development process; and
- A fair and just distribution of the fruits of development through progressive eradication of unemployment and mass poverty.

The *Great Transitions* scenario can be made to embrace the MDG, as a mechanism for turning around both strategy and methods of development. Using the MDG targets, the scenario can be made to actively and consistently adopt the targets as the minimum conditions to be met by the year 2025 in the case of the sustainability of the environment and earlier in the case of others. Achieving these targets necessitates constant and extensive interactions between all stakeholders, a process that, though cumbersome, becomes beneficial as it is inclusive and democratic.

There is general disillusionment with dominant societal values, such as consumerism, and the prioritization of the economy over the environment with its negative impacts on human well-being, development and the environment.

Africa beats its own drums for sustainability, addressing its environmental challenges and enhancing opportunities for its people.

Source: M. Chenje

DRIVING FORCES

The development of scenarios is based on the identification and articulation of some underlying factors – the driving forces. Driving forces are elements that cause change to occur and their unfolding and interaction is responsible for the trends envisaged in each scenario. Some driving forces are not directly controllable and these have to be addressed in the scenario. Controlled forces are those that can be shaped and these form the basis for the recommendations and means of implementation prescribed in the scenarios. Driving forces are sufficiently strong to direct the course of growth of the society and change in environment. They set the initial course for development, and their impacts are potent enough to change the course of development. Therefore, they define departure points for the environmental issues that they influence. Their effects can be short and sharp, or long-lasting. Furthermore, driving forces operate at different scales of intensity and magnitude, reverse direction, appear or disappear as the case may be. The major driving forces defined for the AEO-2 are demographics, health, economics, social issues, culture, technology, governance, peace and conflict. (An overview of these is given in Chapter 1: *The Human Dimension* and the relationships between them is further developed in Chapter 8: *Interlinkages: The Environment and Policy Web*.) To these drivers we may add climate change and natural disasters. Depending on the environmental or development issues, some of the driving forces may take the form of pressures and/or responses. This section highlights how each of these may influence environment and development in Africa, and establishes their significance for the scenarios. The specific influence of the driving forces on selected issues is discussed subsequently under the four themes identified for AEO-2 scenario analysis (land, freshwater, atmosphere, and coastal and marine environments). The overall trends and implications of these drivers for the state of the environment are considered in Section 2: *Environment State-and-Trends: 20-Year Retrospective*. As the driving forces have not changed since the AEO-1 report this discussion draws extensively on that report.

Demographics

Population remains a major factor for the growth of societies and a significant driving force for development and the future state of the environment. Changes in population numbers over time, demographic characteristics, including migration and urbanization patterns, health, and levels of skill are important considerations. Some of these characteristics are reflected in UNDP's human development indices (HDI).

The population of the region continues to grow rapidly (see Figure 1), changing from 221 million in 1950 to about 786 million in 2000 (UN Population Division 2003). At a rate of 2.1 per cent annually, Africa is the world's fastest-growing region and it is expected to have a population of 1 300 million in 2025 (UN

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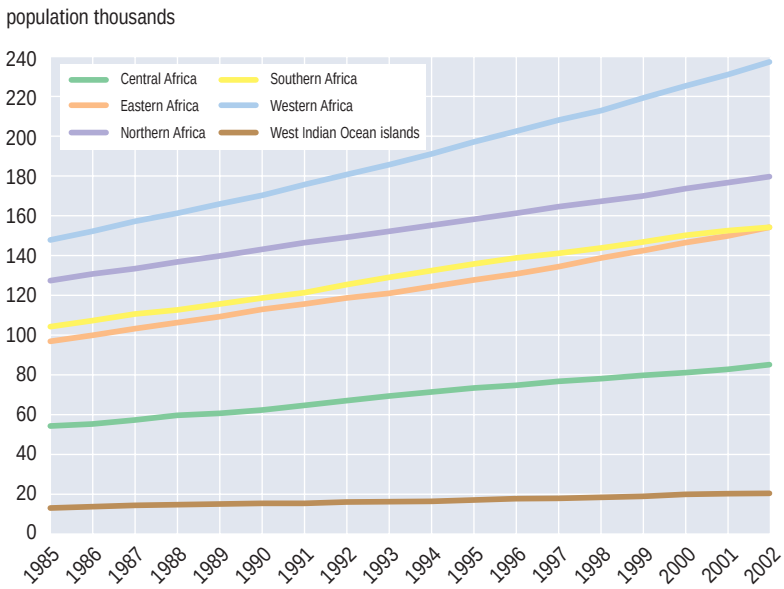
UN Population Division 2005

Figure 1: Population trends in the various sub-regions



Source: UNEP 2005; data from UN Population Division 2003

Population Division 2005, 2004). This phenomenal rise in population is due to high fertility rates and improved health, as a result of, among other things, improved medical access. This growth will continue to exert pressure on the environment in many ways.

The population of Africa is characterized by a large number of persons in the dependency age cohort of 1 to 14 years, and this has multiple implications for ongoing population growth and the direction and pace of development. Although estimates vary, about 43 per cent of the population is under the age of 15 and only 2.5 per cent over 65 (UNDP 2005). The 15-24 age group numbered 149 million in 1998, constituting about 20 per cent of the total African population, and represents a workforce bulge; this can be the basis for more investment, greater labour productivity and rapid economic development (see Figure 2 and Makinwa-Adebusoye 2000). However, youth unemployment is a major problem. At 21 per cent in sub-Saharan Africa (SSA) and 22.8 per cent in Northern Africa, the unemployment rate for youths aged 15-24 was twice that of the overall labour force in 2003 (ECA 2005). Therefore, if Africa does not generate more employment and opportunities, and invest in skills and capacity-building this group could place tremendous strain on the economy as well as environmental resources. Investment in human resources development is essential, and could help attract foreign direct investment (FDI).

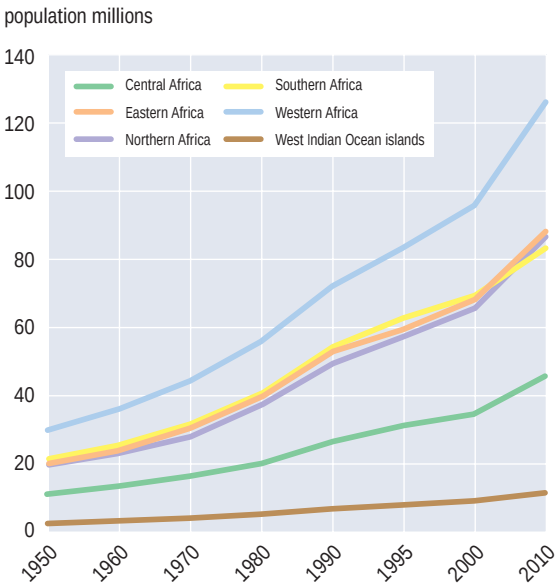
Rapid population growth and changes in demographic characteristics put pressure on African countries to improve standards of living and to provide essential social, economic and environmental services. These factors also limit their capacity to deal with the problem of poverty. Further, in the absence of cooperation, rapid population growth rates may lead to political and social conflicts among different ethnic, religious and social groups over environmental resources. However, in the long run, population growth rates are expected to decline, for multiple reasons including the HIV/AIDS pandemic and the fact that African countries are addressing issues of population growth in a purposeful and concerted way. In SSA, for example, population growth rate between 1975 and 2003 was 2.7 per cent, and it is expected to slow to 2.2 per cent for the period 2003-15 (UNDP 2005).

As discussed in Chapter 1: *The Human Dimension*, Africa is also the fastest urbanizing region of the world. In 2000 the urban population of 318 million was only 38.2 per cent of the total population, whereas, by 2025 the urban population is expected to have risen to 681 million, representing 50.67 per cent of the total population (UN Population Division 2005, 2004). If the shift in spatial distribution of population is not carefully addressed, governments will see the multiplication of poorly-serviced informal urban settlements which are the cradle of crime and in which human vulnerabilities are accelerated by limited access to water and sanitation as well as other social services. This would also result in environmental problems like pollution due to inferior waste management. These challenges are also highlighted in Section 2: *Environmental State-and-Trends: 20-Year Retrospective.*

Unemployment among youth is a particular problem in Africa. At 21 per cent in sub-Saharan Africa and 22.8 per cent in North Africa, the unemployment rate for youths aged 15-24 was twice that of the overall labour force in 2003.

ECA 2005

Figure 2: Africa's economically active population



Source: UNEP 2005; data from ILO 2005

Health

Health is a major issue and a critical driving force. It is particularly important in a developing country context.

Since independence many African countries have made significant improvements in health care. This includes expanding access to primary health care, increased spending on the health sector and addressing socioeconomic inequities associated with access to quality health care systems. Across Africa, there were improvements in key health care indicators, such as infant mortality rates and life expectancy. Across SSA, the 1970s saw significant increases in life expectancy, from an average 44 years to more than 50 years. The period of the 1980s and 1990s, however, witnessed cutbacks in health budgets and privatization of health services. These policies exacerbated poverty and thus provided a fertile ground for the spread of infectious diseases and nutrition-related illnesses. Life expectancy was 50 in 1990 and dropped to 46 in 2002 (World Bank 2005a). The current health priorities will continue to influence decisions that impinge on the environment and overall economic development.

Health as a driving force has a direct relationship with environmental management and development. As demonstrated by the impact of HIV/AIDS and malaria, among other diseases, ill health has economic costs, and contributes to increasing poverty. The two most debilitating diseases in Africa, malaria and HIV/AIDS, remain major health concerns. HIV/AIDS affects the economically active population, consequently negatively affecting the potential to realize development and environmental management goals. Given the links between these sectors, as discussed in Chapter 1: *The Human Dimension*, investments in environmental management may help achieve the health-related targets of the MDGs.

Economic drivers

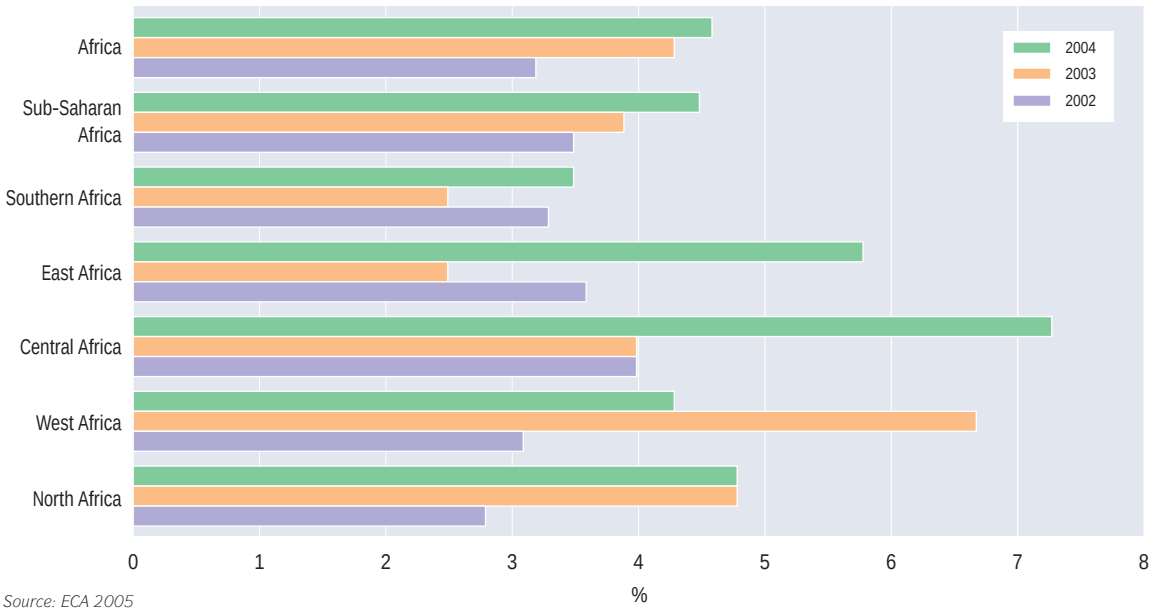
Although Africa is richly endowed with natural and human resources, it remains relatively underdeveloped. Nevertheless, there are significant indicators of improved economic performance. Economic growth rates have been improving steadily. In 2004, Africa grew at 5.1 per cent (OECD Development Centre and AfDB 2005), an increase from 3.7 per cent in 2003 (AfDB 2004), and a significant improvement over the average annual growth rates of 2.6 per cent between 1990 and 2003. However, this has not translated into a decrease in the percentage of people living on less than a dollar a day. This failure to ensure that economic growth contributes to poverty reduction may be attributed to various factors, including an inadequate rate of growth, low labour absorption into the primary growth sectors, and inequitable distribution of the opportunities created by growth (ECA 2005). The lack of access to other secure sources of income compounds the incidence of poverty (ECA 2005). If these patterns continue, then even with improved economic growth, Africa will not be able to meet key development targets and improve human well-being. This will in turn perpetuate the poverty-environmental degradation cycle.

The economies of most countries are characterized by dependence on the extraction and export of natural resources, and thus by a high level of vulnerability to global economic fluctuations, especially in mineral and

• The share of the total population living below the $1-a-day threshold of 46 per cent is higher today than in the 1980s and 1990s – this despite significant improvements in the growth of African GDP in recent years. •

ECA 2005

Figure 3: GDP growth by ECA sub-region



Source: ECA 2005

agricultural commodity prices. Chapter 8: *Interlinkages: The Environment and Policy Web* considers how global policy and practice in trade, aid and investment affect economic performance in Africa.

Many economies reflect a dualism, with a relatively small monetized structure, consisting of such sectors as government, commerce and industry, and a large subsistence and informal sector. Low levels of industrialization, characterized by relatively little value-adding, have environmental and development implications that impact on overall levels of human well-being. For example, although industrial emissions of greenhouse gases (GHG) are low, the per capita emissions per unit of industrial and manufactured output are relatively high because of the relatively old and inefficient equipment and technologies used by industry.

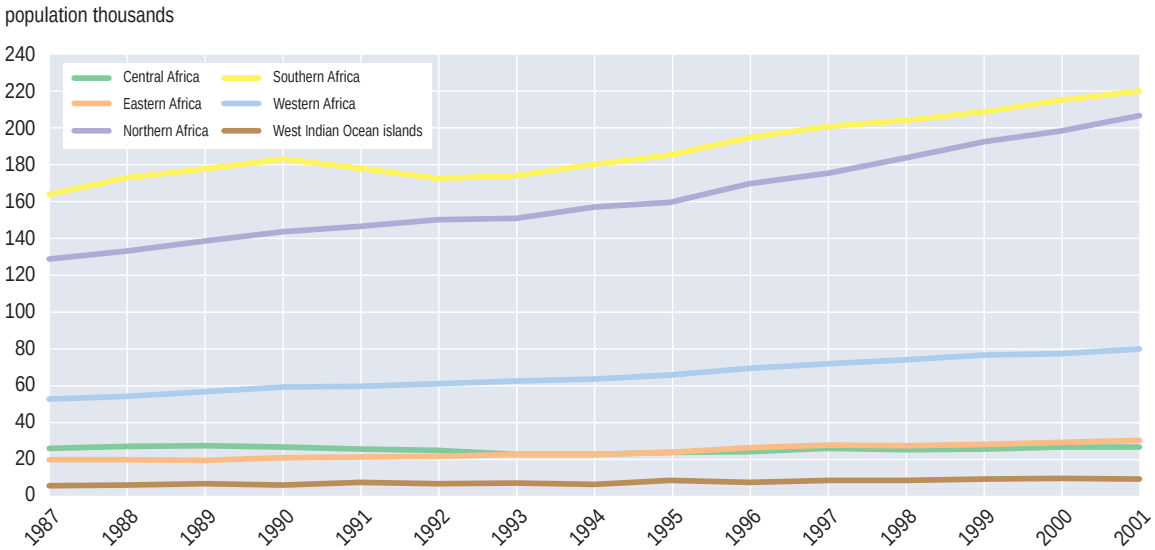
Africa's share in world trade remains small. It is being met with fierce competition from the other regions of the world that have faster and more sustained economic growth, particularly from Southeast Asia. Africa's share of world exports declined from about 6 per cent in 1980 to approximately 2 per cent in 2003 (ECA 2005). However, in 2004 trade performance improved and exports continued to grow at high rates: 8 per cent in volume and 23.5 per cent in value (ECA 2005). This is primarily linked to the growth of the oil sector. In other sectors Africa has continued to be severely marginalized in the global economy as it continues to face formidable barriers to northern markets. Given the small size of domestic markets, exports are essential for increased economic growth. However, trade has continued to be on unfair terms, primarily as a result of the rules governing world trade, which were set largely by the industrialized countries over the course of the 1986-94 Uruguay Round of WTO talks.

The economic underdevelopment of Africa partly reflects its history of economic and political colonization, and partly the economic and other policies adopted by governments since independence. The latter include wage and price controls, widespread subsidies of basic commodities, a burgeoning civil service, fixed currency exchange rates that lead to overvaluation of currencies, high tax rates, and disincentives for potential external investors. In the 1980s and 1990s, the World Bank and the International Monetary Fund (IMF) imposed Structural Adjustment Programmes (SAP) on some of the countries, often as a condition for being granted loans. The features of these programmes vary somewhat from country to country but common elements include:

- Strict controls on public expenditure;
- Reforms of the structure and functioning of the civil service;
- Reductions in barriers to trade;
- The removal of domestic subsidies;
- Opening up of the economy to external investment; and
- Allowing the value of the national currency to be determined by the operations of the market.

As discussed in Chapter 8: *Interlinkages: The Environment and Policy Web*, notwithstanding the appearance of burgeoning economies, SAPs led to rising prices of basic commodities, unemployment, increasing poverty and the breakdown in health-care systems. These impacts had significant environmental and social implications.

Figure 4: Gross Domestic Product by sub-region



Source: UNEP 2005; data from World Bank 2003

Debt, too, remains a major challenge. (See Chapter 8: *Interlinkages: The Environment and Policy Web*.) The burden of debt repayment is enormous, resulting in the diversion of funding away from, among other things, public services. Some countries faced with a huge debt burden spend all their earnings on servicing their debts rather than providing basic social services. A combination of internal and external factors continues to perpetuate the debt problem. Debt cancellation by the Group of 8 (G8) nations in favour of 13 selected poor countries (by the beginning of 2006) is still viewed as too insignificant to have an impact on environment and development in the region.

Social issues

Levels of human well-being affect the range of opportunities available to people and the kinds of choices they are able to make. Health and education, as well as access to material assets, directly affect capabilities and, in turn, impact on the environment (MA 2005). African nations rank, on average, lower than any other continent on the Human Development Index (HDI). In recent years there has been a decline in the quality of life, as measured by the HDI, in many African countries (UNDP 2005).

Although there has been an improvement in quality of life across the globe, Africa has lagged behind in some key areas:

- Half of the population in Africa lack access to health services. Health challenges are monumental in a region with the highest rates of fertility, maternal and childhood mortality, malnutrition, two-thirds of world's known AIDS cases, 90 per cent of world's yearly malaria fatalities, and where half of the female population is illiterate.
- In rural Africa, about 50 per cent of the population are without access to adequate water supply, and 70 per cent are without access to adequate sanitation (WHO and UNICEF 2004). In urban areas, about 20 per cent and 40 per cent of the population are without access to adequate water supply and sanitation respectively (WHO and UNICEF 2004).
- Although there has been significant progress in education in Africa over the last two decades, there is much to be done. Primary school enrolment in 16 countries is below 60 per cent, and there are more children between the age of 6 and 11 out of school than was the case in the 1990s. The average adult illiteracy stands at 43 per cent.
- Life expectancy at birth in SSA has been reduced from 50 in 1990 to 46 in 2002 (World Bank 2005a).

The incidence of poverty and the pervasiveness of inequities, as discussed in Chapter 1: *The Human Dimension*, remain major challenges for development and sustainable environmental management. Poverty is both a cause and effect of environmental degradation (MA 2005). Poverty can be reduced by either increasing economic growth or by reducing inequity. For Africa to halve its poverty level by 2015, as envisaged under the MDG, it will need to achieve an average annual GDP growth rate of 7 per cent (AfDB 2004).

Gender inequity remains a challenge. Although African women have made tremendous progress over the past four decades, there is still a significant gap between rhetorical commitment to gender equity and actual actions adopted to address this. Most African countries continue to rank very low on the GDI although there has been some improvement in GEM (UNDP 2005). GDI focuses on levels of development including life expectancy, literacy, education and income, whereas GEM considers the extent of social inclusion through measures related to parliamentary seats held by women, the percentage of female professional and technical workers, and the ratio of female to male income (UNDP 2005). Important gains have been made in political representation, with Africa leading the world with the highest proportion of women in parliament (UNIFEM 2002). Nevertheless, economic and legal barriers associated with social discrimination continue to prevent women in Africa from improving their status and productivity, and from achieving their full potential. In many countries women continue to face the denial of basic human rights and are often victims of violent crime.

Poverty is both a cause and effect of environmental degradation.

MA 2005

At independence, most African countries inherited a system where government was absolutely responsible for providing basic services and amenities almost at no direct costs to consumers. Over the years, the ability of government to meet the demands for providing basic services and utilities has decreased tremendously and the effect has been one of aggravating social conditions. Much has been said as to what is the right strategy for providing services in developing countries, particularly in Africa. The privatization of public services is a strategy being promoted in an increasing number of African countries. This involves the reduction of public subsidies and, in some cases, the introduction of cost-recovery measures. This development, while having some benefits, could present major causes for concern. For instance, access to clean water is a vital public health necessity and a basic human right and its privatization may lead to reduced access to safe water for poor communities. In Ghana, the recent moves towards water privatization

are opposed by CSOs for this reason. Already, according to the Ghanaian Ministry of Health, half of all clinic visits in Ghana are due to water-borne illnesses. Privatization may further reduce access to safe and affordable water in urban areas.

Culture

Cultural norms and values shape people's perceptions, aspirations and attitudes, and therefore their actions. Culture influences choice of livelihood activities, with direct and indirect influence on the pace of environmental change and development.

Among the many factors shaping culture are ethnicity and religion. As in some other parts of the world, religion in Africa has served as a strong unifying force in some areas, and as a potentially divisive one in others. Ethnic tensions in many areas, driven by historical animosities, themselves often exacerbated by religious, economic and social tensions, are also potentially divisive and inhibitory to development and may precipitate conflict over natural resources. However, this diversity is not always divisive. Chapter 12: *Environment for Peace and Regional Cooperation* considers this sensitive subject and how the environment can promote cooperation, which in turn may enhance good social relations (including social coherence) and other aspects of human well-being.

Africa, with its diversity of peoples and languages, has a rich and strong traditional culture that can serve both as a bulwark against outside influences and as a conduit through which new ideas can be assimilated (UNEP 2002a). Historically, indigenous systems of social governance, provision of services, maintenance of social cohesion, and even economic development, were based on the norms these cultures followed. But culture is not static, especially in this era of increasing economic and political globalization. People around the world are being increasingly exposed to the norms and values of other cultures, sometimes creating tensions within their own culture but in many instances resulting in substantial modification or replacement of some of its elements.

Other cultures have fundamentally changed African society. While western cultures dominate many economic and political spheres, at the more local level traditional norms often prevail. At the sub-national level, governance is increasingly shaped by "democratic ethics" intermingled with traditional values. The traditional support systems, which served as social securities for the aged, the homeless, the sick and the poor, have generally been displaced. However, these have not been replaced by efficient public structures. Similarly, in many places traditional environmental management systems have also been displaced or significantly modified (Mohamed-Katerere and van der Zaag 2003). In some instances new environmental values have begun to emerge and shape governance and management (Steytler 1997, Mohamed-Katerere 1997).

Consumption patterns increasingly mirror western-style consumer culture, and to a large extent this is a result of a shift to market-based development and globalization. This influences both trade and investment patterns, particularly by creating a demand for imported consumer goods while, at the same time, serving as an incentive for some of the multinational corporations to enter local markets directly through investment, partnerships or take-overs. In some instances these increasing consumer demands produce very direct threats to the environment, as discussed in Section 2: *Environment State-and-Trends: 20-Year Retrospective* and in relation to chemicals in Chapter 11.

As a driving force, western culture continues to play a central role in development in Africa. Changing lifestyles create demand for environmental goods-and-services that occasions change in environmental and natural resources exploitation. Increasing consumerism, for instance, can be expected to lead to overexploitation of resources to meet increasing wants. Depending on the measures of control put in place by societies, these developments may or may not be beneficial to the environment. Nevertheless, this consumer culture may be expected to reach a peak where people begin to see the differences between needs and wants, and lead therefore to a return to healthier and more holistic lifestyles that focus on the overall context of human well-being and the relationship to the environment.

Technology

African economies during pre-colonial times were able to avoid any large-scale environmental degradation, partly because the population was small and partly because the demands on the economy were small (UNEP 2002a). More importantly, the technology was appropriate and adequate, as the people learnt over centuries to adapt systems of extraction of natural resources to be commensurate with the dictates of the environment. In contrast, modern economic practices have introduced increased demands on human and natural resources and the available technology has proved inadequate. Africa needs to improve and diversify the range of technological options available if the demands of change are to be met (UN Millennium Project 2005a, UN Millennium Project 2005b). New technologies often come with new costs, including high demands for fuel and increased pollution, and new

• Africa needs to improve and diversify the range of technological options available if the demands of change are to be met. •

UN Millennium Project 2005a, UN Millennium Project 2005b

risks, such as uncertainty about the environmental and human health impacts of genetically modified (GM) crops and chemicals. Chapter 1: *The Human Dimension* considers the developments in the pharmaceutical sector, and the potential economic opportunities investment in genetic resource R & D can bring for Africa, particularly in rural communities. Section 3: *Emerging Challenges* considers the challenges and opportunities associated with GM crops (Chapter 9) and chemicals (Chapter 11).

In the 20th century, Africa's role in the development of science and technology remained small. Historical factors contributed to this. Colonization inhibited the development of indigenous technology and destabilized some of the existing processes of technical growth. Indigenous manufacturing capability was deliberately undermined to facilitate European exports for which captive markets were created. Further, Africa has not only been a user of technologies developed in the west, but has also served as a dumping ground for obsolete technologies abandoned in the west. Africa remains on the technological fringes, and in the absence of large-scale investment in this area this is not likely to change. Africa in general has a high dependence on imported technology. As the World Summit on Sustainable Development (WSSD) noted, addressing this is critical if development targets are to be met. Stimulating R & D in this sector requires not only an improved economic environment but also better infrastructure and efficient communications systems. Africa needs to increase investment in this area, and focus on the development of appropriate technologies (ECA 2005). The growth of ICT has been an important driver of economic growth and the diversification of opportunity in the economies of Southeast Asia. Chapter 1: *The Human Dimension* describes the current state of ICT and considers the opportunities this sector can bring for development. The Global System for Mobile Communication (GSM) technology offers significant opportunities. The introduction of GSM in many African countries and the deregulation of the telecommunications sector have energized private companies to embark on aggressive telecommunications development programmes across the region. This trend is expected to become a major catalyst for development through improvements in information access. Modern ICT will assist the emergence of micro-power technologies to revolutionize energy sources. While many African countries continue to see modern information technology and industrialization as principal agents for economic development, some countries will recognize the importance of sequencing in harnessing technology and integrate these into the process of development including environmental management. With the introduction of cleaner fuels, swift transition to renewable resources and greater concern for the environment, the impact of industrialization and technological advancement on the environment is reduced to the barest minimum.

Institutions and governance

Institutions refers generally to the set of instruments through which people, living in a state and believing in common core values, govern themselves and includes policy, laws, rules and regulations as well as custom. Governance refers to the processes through which these institutions are implemented. Governance is based on values and principles that a society – local, national, regional or global – holds. Governance invariably relies on interaction between the state, civil society and the private sector, although the relative roles of these sectors differ depending on the priorities and values of a given social system. For example, the extent of public participation in decision making is often a reflection of this.

In 2002, the AU noted that Africa was losing $150 000 million a year to corruption, which increases the costs of goods by as much as 20 per cent.

NEF 2005

Governance takes place within all domains including the economic, political and administrative, and its form affects development, including the potential for market efficiency, sustainable environmental management and the realization of rights. Good governance practices improve the potential for economic growth and create new opportunities for development and improving human well-being (WRI and others 2004, World Bank 2005b). Such measures may include elevating environmental management as a policy priority and allocating the necessary resources for the implementation of measures, assigning accountability for failures, and facilitating participation from civil society. It may, as proposed in Chapter 8: *Interlinkages: The Environment and Policy Web*, require linking the economic, political and administrative aspects of governance more directly with environmental policy and practice, and developing appropriate legal and management tools to ensure this. Or, as discussed in Chapter 9: *Genetically Modified Crops*, demand establishing better integration between science, public values and policy. It may also, as discussed in Chapter 12: *Environment for Peace and Regional Cooperation*, require improved regional cooperation, greater transparency and higher levels of accountability to avoid conflict and promote the fairer distribution of benefits, and costs, associated with environmental use.

It is impossible to achieve sustainable economic development without good governance, and peace and security are essential aspects of this (UN 1998). In many

countries poor governance practices have resulted in military coup d'états and electoral systems that were essentially symbolic and not designed to allow for changes in government. Military interventions have led to various forms of instability and the rise of insurgencies, riots and ethnic strife and rivalries. Military costs have placed an enormous strain on economies. Corruption, and the embezzlement and externalization of public funds remain critical problems, with estimates that such externalization amounts to as much as a quarter of GDP (NEF 2005). In 2002, the AU noted that Africa was losing $150 000 million per year to corruption, which increases the costs of goods by as much as 20 per cent (NEF 2005).

However, as the new millennium approached, once again "winds of change" blew across Africa, as people in many countries, as well as at the regional level, demanded greater accountability from their elected leaders. They called for fairer and more transparent public processes, and respect for human rights. With increasing social consciousness, new forms of organizations have emerged. Civil society organizations have emerged in large numbers and their influence is steadily increasing. These serve as important checks on government.

As poor governance practices have been called into question, citizens have demanded the right to be involved in decisions that affect their well-being, including in the environmental sector. Local participation in environmental decision making has increased considerably (Keeley and Scoones 2003). The opportunities increased public participation presents for development and good policy making are discussed throughout this report. Chapter 1: *The Human Dimension* examines the increasing role of civil society in the environmental sector and the chapters in Section 2: *Environment State-and-Trends: 20-Year Retrospective* consider the opportunities such involvement creates in specific environmental sectors, including forests, freshwater and coastal and marine environments. Section 3: *Emerging Challenges* considers the importance of public participation in developing policy responses in the critical areas of GM crops, invasive alien species, chemicals and conflict.

The opportunity for improving governance is constrained by several factors including weak states, weak democratic processes that feature personalized power and corruption, and inequity. Inequity and poverty shape the capacity to participate effectively in public life, as is evident from the marginal role that women still play in governance.

Nevertheless, in facing these governance challenges, a wide range of responses have been adopted by governments at the regional, sub-regional and national levels. At the regional level, these responses include the AU Convention on Preventing and Combating Corruption and the African Peer Review Mechanism (APRM) developed by NEPAD. For a full discussion of the APRM see Chapter 8: *Interlinkages: The Environment and Policy Web*. All efforts are made to reduce conflicts in countries where they presently exist through assistance to provide basic services and through the breaking of the poverty trap.

> Since 1970, more than 30 wars have been fought in Africa, and the vast majority of them were intra-state in origin.
>
> Kofi Annan, Secretary-General of the United Nations (UN 1998)

Peace and conflict

Conflict is a major driver of environmental change, and it has significant implications for development and human well-being (Ghobarah and others 2001, Rehn and Johnson Sirleaf 2002, Luckham and others 2001). Many of the conflicts in the region are internal and cross-border disagreements often relate to natural resource use. The challenges posed by conflict are discussed fully in Chapter 12: *Environment for Peace and Regional Cooperation*.

As discussed in that chapter, the implications of conflict are far-reaching:

- Conflicts have led directly and indirectly to the deaths of many thousands of civilians. In 1998, Kofi Annan, the Secretary-General of the United Nations (UN), noted that, "since 1970, more than 30 wars have been fought in Africa, and the vast majority of them were intra-state in origin" (UN 1998).
- Conflicts affect how the environment is used. For example, landmines and unexploded ordinance (UXO) make land inaccessible and pose a physical threat to people and animals.
- Conflict diverts financial resources away from development for the purchase of weapons and other military equipment.
- Conflict threatens human well-being by increasing food insecurity, ill health, violence and crime. It may also affect education and health opportunities. It reduces access to essential material assets, including natural resources, which are the basis of livelihoods and well-being. This may include access to land, markets and information.
- Conflict results in the destruction of infrastructure, and the deterioration of services due to neglect is common. Infrastructure such as roads, bridges, markets, clinics and schools are often targeted by combatants.
- Conflict results in displacement of people, and the breakdown of social cohesion. Cross-border movement of people impacts on host countries, for example in terms of increased demands on natural resources. Refugee populations are among the most vulnerable social groups in the world.

The impacts of conflict cannot be assessed in quantitative terms alone. For example, there are unknown opportunity costs in terms of possible avenues for development which are blocked by insecurity. Conflicts can result in the transformation of the social, political and economic space, and often have the result of "militarizing" many aspects of life. Violence occurs not just between combatants, but also in the domestic sphere: the pressures of life during wartime often result in an increase in gender-based violence (Rehn and Johnson Sirleaf 2002) and the abuse of children. Conflicts and peace breaches make it more difficult to achieve cooperation, including cooperation over the environment. Women, in particular, become vulnerable to attack as they access natural resources such as firewood and freshwater in periods of war. The cultural fabric that constitutes communities can be torn apart. Management of natural resources is an important part of this cultural fabric, and one which is also vital for the provision of basic needs such as food, warmth and shelter.

The regional impacts of conflict are in many ways an incentive for regional solutions and cooperation, and there have been multiple regional responses that seek to improve cooperation around the environment. The AU, along with sub-regional bodies, plays a critical role in peace-building and cooperation. There is enhanced openness on the part of many African governments to discuss problems of conflict which were previously treated as "internal" and to seek regional or international solutions.

Natural disasters and climate change

A disaster is said to occur when abnormal or infrequent hazardous events impact on vulnerable communities, causing substantial damage, disruption and casualties, and leaving the affected communities unable to function normally without external assistance. A disaster is therefore a severe disruption of the survival and livelihood systems of a society or community, resulting from their vulnerability to the impact of one or a combination of hazards, and involving loss of life and/or property on a scale which overwhelms the capacity of those affected to cope unaided (DfID 2000). Natural hazards may be hydrometeorological or geophysical and include floods, droughts, wild-fires, storms, cyclones, earthquakes, volcanic eruptions and landslides. Some of these hazards can lead to disasters. Disasters, whether natural, technological, biological or arising from internal conflicts within nations, are often shaped by anthropological factors.

Africa faces food insecurity that is a result of a combination of natural hazards and human factors (WFP 2006). Climate change and variability are being driven by various anthropological factors including increased demands for energy, and have impacts on environment and development, as well as land productivity. These impacts are discussed throughout Section 2: *Environment State-and-Trends: 20-Year Retrospective* and more specifically in Chapter 2: *Atmosphere* and Chapter 3: *Land*. Global warming will lead to higher temperatures estimated to be between 0.2 and 0.5 °C per decade for Africa (Hulme and others 2001). It is also likely that extreme events such as El Niño are being experienced more frequently, and have become more intense (IPCC 2001, Watson and others 1998), causing wide-ranging agricultural, hydrological, ecological, economic and health impacts (Adger and others 2002). Land degradation and vulnerability to erosion is directly linked to climatic factors. Extreme climatic events also lead to natural disasters like drought and floods which directly affect the health of the environment.

One effective response to address human vulnerability to environmental change is to strengthen mechanisms for early warning. Many actions can be taken to protect life and property if warning is received in time. While certain threats are inherently unpredictable, many of those arising from threats from environmental degradation and mismanagement, and from human activities, can now be anticipated with some precision. Early warning capacities are increasing steadily with technological advances in environmental observing, assessment and communications. Examples include the cyclone early warning systems that have been established in the Western Indian Ocean (WIO) islands.

Global warming will lead to higher temperatures estimated to be between 0.2 and 0.5 °C per decade for Africa.

Hulme and others 2001

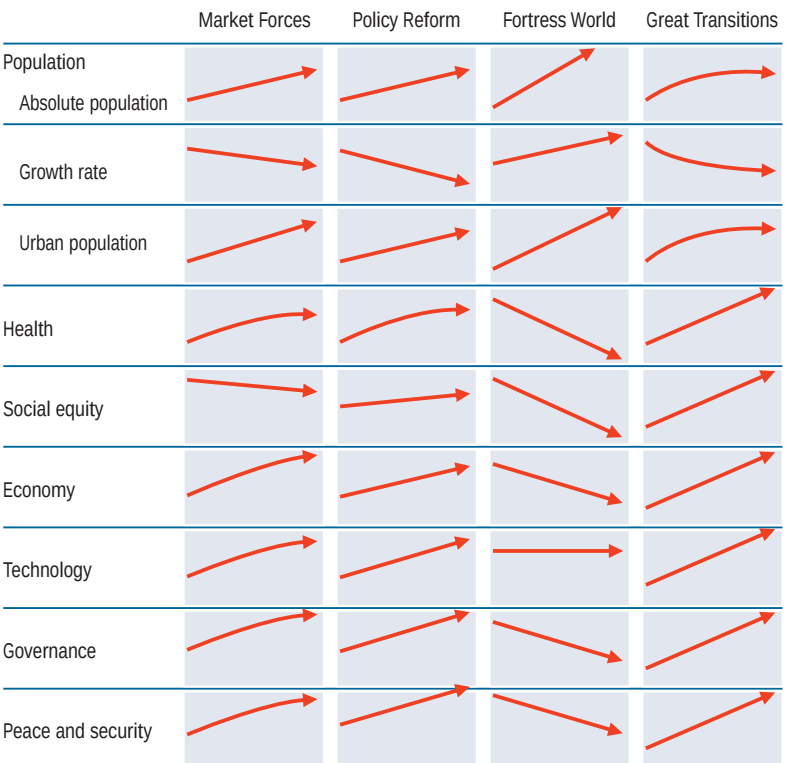
Which road to the future will Africa choose?

Source: Y. Katerere

REGIONAL SCENARIO NARRATIVES

The interfacing and changes in these key driving forces, as used in the narratives in this chapter, are assumed to take the patterns reflected in Figure 5. The narratives presented in the subsequent sections are based on these patterns of change in the main driving forces.

Figure 5: Illustrative patterns of the changes over time of key scenario assumptions



In order to provide a holistic storyline, the regional and sub-regional narratives have been integrated for some issues while stand-alone sections have been reserved for issues more directly relevant to specific sub-regions. The four regional narratives focus on transboundary aspects and ecosystems at sub-regional and regional levels, and discuss the implications of policy choices for meeting the MDG targets by 2025. The analysis is undertaken in the context of the Opportunity Framework (see Introduction). The policy lessons from the scenarios are closely related to the future state of the environment as presented in Section 2: *Environment State-and-Trends: 20-Year Retrospective*.

LAND

The future status of land resources has important development and human well-being implications. Therefore, the substantive analysis of land-use patterns and their implications for sustainable development is crucial. Such analysis requires a long-time frame and needs to incorporate uncertainty. Fundamental uncertainty is introduced both by our limited understanding of human and ecological processes, and by the intrinsic indeterminism of complex dynamic systems that characterize the environment. Outcomes are predicated on policy choices, which are yet to be made, and natural occurrences that are out of the control of humankind. Nevertheless, there is a huge

amount of temporal, spatial and socioeconomic land-use information that can form the basis of such analysis.

There are many environmental, technological and socioeconomic factors driving changes in land resources. How these factors evolve will shape the regional and sub-regional development and future opportunities. Box 2 presents a summary of the most important factors that influence the state of land and land-use change in the region. An analysis of how these factors will prevail under each scenario forms the basis of the narratives in this section. Among the factors that are especially important in Africa are agriculture, forestry, demography, market developments, environmental conditions, social context (including the history of a sub-region) and policies related to land-use planning.

Chapter 3: *Land* considers the current state and major trends affecting land resources. These trends include:

- An increase in agricultural land, both arable and marginal, over the past three decades and a corresponding decrease in forest cover;
- A sharp increase in heavily degraded lands from a combination of drivers and pressures, including desertification, climate change, chemical pollution from industry and agriculture, and armed conflict;
- A diversification in the uses of land resources, including tourism and mining, with demonstrated increased earnings from these sectors.

Other land-use changes, such as increased urban and infrastructural development, have been minimal but will continue to play a significant role in land-resource availability and condition in many parts of Africa. Widespread problems also concern decline in soil fertility, soil contamination, land management and conservation, gender imbalances in land tenure, and conversion of natural habitat to agricultural or urban uses. The threat to land resources posed by invasive alien species (IAS) remains a challenge (see Chapter 10: *Invasive Alien Species*). Inequitable land distribution patterns remain a problem, as discussed in Chapter 3: *Land* and Chapter 12: *Environment for Peace and Regional Cooperation*, and this has implications for environmental management and human well-being. Land tenure policies will continue to have an important effect on environmental change. Assessing how these trends will be played out in future, and identifying appropriate responses to mitigate negative impacts, requires considering the major drivers and pressures. The core driving forces include demography; technology; economy; political and social institutions; climate and environment; culturally determined attitudes, beliefs, and behaviour; and information and its flow.

The most critical issues for scenario analysis include identifying opportunities for Africa to meet the MDG targets and effectively implement NEPAD-EAP programme areas, addressing desertification and food security. One such opportunity is the expansion of irrigated land, and this resonates well with attempts by Africa to achieve enhanced food security, eradicate poverty and increase the productivity of land-use management. These narratives focus on the opportunities of increasing irrigated land. The key threats addressed, as the storylines unfold, include land tenure and ownership,

Box 2: Factors influencing land-use change in Africa used in the scenario analysis

1. Former and current land-use systems and changes
   - Forestry and agriculture
   - Protected areas
   - Land tenure and ownership structure
   - Traditional land use
2. Economic context
   - GDP contribution (agriculture, forestry, industry and others)
   - Contribution to employment (agriculture, forestry, industry, others)
   - International market links and opportunities
   - Local markets for agricultural and forestry products
   - Production structure
   - Land holding size (including farms, forests and protected areas)
3. Environmental conditions
   - Climate, topography, soil characteristics and water availability
   - Environmental quality, including pollution
4. Social context
   - Demographic factors
   - Attitudes and values
   - Resource use conflicts
   - Regional and sub-regional geopolitical conflicts
5. Institutions
   - Development plans
   - Legal frameworks (land-use planning, land-use policy)
   - Policies (subsidies, taxes, agricultural pricing policies, special short-term measures, incentives for forestation, environmental incentives, etc.)

Sources: Raskin and others 1999, MI 2002

Box 3: Imagine...extreme land degradation in Western and Central Africa...

Over 60 per cent of Western and Central Africa's population depends directly on the land for survival. Extreme land degradation in the two regions may result from a complex interaction of several natural and anthropogenic processes: deforestation, rangeland deterioration, wildlife depletion, soil erosion, declining soil fertility, salinization, solution and desertification. The available cultivable area in the region would be greatly restricted. The issues which may hasten land degradation in the two sub-regions include unsustainable agricultural and livestock production practices, deforestation, land tenure systems and unsustainable land use and demographic pressures.

The effects of the degradation of agricultural land would include:

- Increased agricultural labour demand and material input for given levels of productivity;
- Declining animal productivity in the Sahel;
- Scarcity of non-timber forest products (NTFPs), such as fruits, nuts and mushrooms;
- Shortage of fuelwood;
- Landlessness in some areas;
- Declining water supplies with consequences for irrigated agriculture:
- Food shortages and famine in drought years;
- Disease and ill health; and
- Migration to urban areas or to more fertile farming areas.

The net effect of all the above is poverty and frustration. Future outcomes will be shaped by the policy paths these sub-regions choose, and whether they are able to address the environmental issues of land degradation and its root causes. A range of policy options are possible. One set could include policies such as:

- Reforming land tenure based on a refined understanding of the socio-cultural conditions and local politics of individual countries to ensure land security and encourage investment;
- Intensifying agricultural production systems through sustainable production practices;
- Pursuing rational population policies that realistically address issues such as birth control, primary health care delivery systems and population movement in order to ease pressure on land;
- Promoting alternative employment policies to reduce overdependence on land and land resources while addressing people's inadequate capacity to embark upon alternative livelihood activities; and
- Creating enabling social, economic and political environments for all reforms to operate and facilitate environmentally sensitive economic liberalization and good governance.

land degradation (soil fertility, water scarcity, desertification and erosion vulnerability, and salinization), poor agricultural practices, IAS and inundation of habitats as a result of damming.

Market Forces scenario

In the course of development, human activity alters the landscape. The dynamics of land change are complex, depending on settlement patterns, agricultural practices, economic growth and natural resource industries. Several key developments shape land use in the *Market Forces* scenario. These developments relate to human settlements, pastures and rangelands, cropland expansion and land degradation as well as the "built environment."

In the Market Forces scenario there unfolds greater than normal demand for agricultural products which in turn results in agricultural expansion, exposing more land to water erosion.

The "built environment" encroaches on natural environments (such as forests) and near-natural environments (such as agricultural and grazing land) as populations grow and economies modernize. The settled area per person has been increasing historically and is currently estimated at 0.14 ha per capita in Eastern Africa. However, in Southern Africa, per capita land access has dwindled from 20.09 ha in 1985 to 13.16 ha in 2000, and continues to decline. Given the current low population densities and horizontal, as opposed to vertical, settlement, population growth places significant pressure on agricultural lands and valued ecosystems. In the *Market Forces* scenario, the dominant change at the regional level, is the conversion of forest to grazing and pasture land. To a lesser extent, natural forest is lost to expanding areas of built environment, cropland and forest plantations.

The utilization of land for grazing livestock changes for several reasons. The intensity of livestock production (output per hectare) changes in response to changing pasturing practices and improved livestock characteristics from scientific developments. Despite the increased intensity of use, the extent of grazing areas

increases in all sub-regions. The increase is at the expense of cropland, forests, and marginal land. Changing pastureland requirements is indicative of trends in land degradation. New agricultural land comes from forest conversion, grazing and rangeland, with the shares varying by sub-regions. In addition, in some sub-regions, agriculture expands onto marginal land, and this requires considerable input and careful management.

Unsustainable land-use practices can lead to, or exacerbate, various forms of land degradation including wind and soil erosion, soil compaction, waterlogging, salinization and nutrient depletion. In the *Market Forces* scenario, in all the sub-regions severe degradation is witnessed with more and more agricultural land becoming degraded. This is the result of intensified agricultural practices driven by profit goals. Although attempts are made to protect and partially rehabilitate damaged ecosystems, this is outstripped by the high land degradation rates occasioned by the economic attractiveness of market-based production. The rate of land degradation in the region varies from 25-35 000 ha per year under this scenario. This rate varies from sub-region to sub-region and will intensify after 2015. The land degradation rates are higher than those registered in the past.

In the *Market Forces* scenario there unfolds greater than normal demand for agricultural products which in turn results in agricultural expansion, exposing more land to water erosion. A shift away from less intensive crop and livestock production to more intensive, but environmentally insensitive, practices leads to a greater risk of water erosion. A greater percentage of land converted to agriculture is evident in Central and Western Africa. The effects of population pressure are greatest in Southern and Eastern Africa. In the long term, the effects of land degradation are reflected in diminished yields and increased deforestation rates. The current upward swing in the quantity of land so severely degraded that it has to be removed from agriculture production continues under the *Market Forces* scenario. The combined effect of the various driving forces results in changes in land cover and the exposure of more and more land to degradation through erosion. In particular, the area under forest cover declines drastically during the 2005-2025 period.

Policy Reform scenario

The *Policy Reform* scenario is growth-oriented but assumes a comprehensive policy response to the environmental and social risks associated with land use. The scenario does not assume major deviations from the conventional development paradigm, values and institutional structures, but within those constraints incorporates rapid economic growth, greater distributional equity and vigorous attempts to protect the environment. The definitive reference for this vision is the Brundtland Commission's report, *Our Common Future* (WCED 1987).

Change under the *Policy Reform* scenario ushers in an era of economic growth, based on policies that sustain and expand the land resource base. Comprehensive and coordinated government action is taken in pursuit of this. In this context, an integrated set of land reforms and land management initiatives are crafted and implemented, including economic reform, regulatory instruments, land tenure system changes, social programmes, and technology development for sustainable land use.

The often conflicting goals of providing space for human settlements, protecting ecosystems, and feeding human populations are reconciled through a combination of measures all centred on policy-driven sustainable land use.

The main contours of a *Policy Reform* scenario comprise high income and economic growth, improving environmental conditions, greater equity and reduced conflicts over land. There is a far greater efficiency of land resource use, more reliance on renewable land resources and less environmental pressure. The often conflicting goals of providing space for human settlements, protecting ecosystems and feeding human populations are reconciled through a combination of measures all centred on policy-driven sustainable land use.

The transition to agricultural sustainability requires a "doubly green" revolution, in which agricultural productivity continues to improve but is coupled with practices that preserve the environmental foundation for the long term (Conway 1997). In this scenario, a campaign for sustainable agriculture is launched, resulting in a gradual shift towards ecologically sound practices rather than the replication of high-input farming. The challenge is to maintain yield improvements at something like *Market Forces* scenario levels, while avoiding degradation. As part of the pollution-reduction goals of this scenario, fertilizer and pesticide use per hectare decline. To maintain yields, the nutrient requirements of plants must be met and pests kept in check in other ways. Nutrient

recycling partly substitutes for fertilizer, for example, by using livestock manure in combined crop-livestock systems and through large-scale composting. The poverty alleviation goals of the scenario support these trends, as increasing income allows farmers to diversify their production (Scherr and Yadav 1996). Additional actions needed include the development and application of biotechnology and other research (eg, disease-resistant varieties), education and training of farmers, land reform, infrastructure development and reform of economic policies. Programmes for sustainable agriculture are carried out in cooperation with farmers and targeted to local needs.

Changes in grazing land for livestock production are the result of various trends. Economic growth pushes the demand for livestock products higher. Agricultural production expands to meet increasing livestock feed demand so as to reduce the need for grazing land, and this approach has the net effect of reducing pressure on forests and other ecosystems. In addition, some improvement in grazing land productivity is evident due to the adoption of modern practices. Similarly, increased investments in R & D leads to improvements in herd quality. At the same time, policies are adopted to ensure that grazing practices are more sustainable in order to reduce environmental destruction. The transition to sustainable livestock practices can be achieved through a variety of interventions, including by providing information through extension services, and by enforcing overgrazing laws. In arid lands, where the availability of forage can vary greatly from year to year due to climate fluctuations, policies to provide timely access to markets and land can allow producers to cope without overtaxing biomass resources.

Driven by the combination of food and feed requirements, regional cropland area expands by about 20 per cent between 2005 and 2025, a larger increase than the 11 per cent of the Market Forces scenario.

Driven by the combination of food and feed requirements, the regional cropland area expands by about 20 per cent between 2005 and 2025, a larger increase than the 11 per cent of the *Market Forces* scenario. However, because of land and water constraints in many sub-regions, there is considerable variation between and within sub-regions. The largest increases occur in where there are the least land and water constraints. This implies more extensive trade in food commodities. In Eastern Africa, where cropland grows by over 40 per cent, some of the increase is met by returning to production land held by the government. Regionally, a greater share of the cropland is on rain-fed land than in the *Market Forces* scenario. Expansion of irrigated land is discouraged by increases in water prices, as countries try to limit the incidence of water stress.

Consistent with the sustainability goals and livelihood strategies discussed in Chapter 1: *The Human Dimension*, the rate of land degradation slows between 2005 and 2015. Depending on the nature of the land and its use, degradation is reduced through different means:

- Improving drainage and delivery systems for irrigation water can restore irrigated land subject to waterlogging and salinization, and conserve water resources at the same time;
- Nutrient loss from shifting cultivation can be reduced by lengthening fallow periods; and
- Loss of land through water erosion can be reduced by building terraces and through conservation tillage.

Up to 2015, croplands are degraded at a rate assumed to be less than the *Market Forces* rate. This rate slows down further after 2015. Further opportunities available for redress include integrated land and water resources management; the sustainable management of wetland resources; sustainable agriculture and rural development; technology transfer; and the development of early warning systems and assessment of land degradation. The establishment of regional and sub-regional early land degradation warning systems are pursued under this scenario. Efforts by countries to implement NEPAD's initiatives to combat desertification and land degradation are reflected in land use and land reform policies. Land reform policies take the centre stage through attempts to modernize land use, especially in Southern Africa where obvious imbalances have persisted in land ownership and tenure.

The expansion of the built environment is curtailed in the *Policy Reform* scenario, as concerns for protecting productive cropland, forests and other ecosystems lead to urban planning policies that favour more compact settlement patterns. This is supported by a higher value being placed on arable lands, as a result of increasing domestic demands and, in some sub-regions, profitable opportunities for increased trade. The preservation of forests and other valued ecosystems is recognized as a key sustainability goal. Specifically, the rate of forest loss gradually decreases in the scenario to zero by 2025 and the extent of forest areas begins to increase thereafter. Between 2015 and 2025, there is net reforestation. This

is achieved through forest protection policies and land-use strategies that support more compact settlements, the contraction of grazing lands and land restoration. In this scenario, the amount of forest land set aside as protected areas increases. Increased emphasis is placed on the preservation of established forests and other ecosystems that support biodiversity. Also, opportunities are developed for encouraging the sustainable use of forest products among poor people, such as by granting secure land rights.

Unexploited grasslands and savannah are placed under grazing, especially in Southern Africa. The rapid expansion of the built environment and grazing land that occurs in the period 2005 to 2015 is slowed or reversed between 2015 and 2025. Eventually, agricultural land grows to supply the increasing food demands of countries facing land and water constraints.

The successful transition to sustainability requires:

- Widespread awareness of the issues and the conviction that action is necessary;
- Adequate institutions, policies and technologies; and
- Sufficient political will to accept the costs of carrying out the required actions.

Changes in the *Policy Reform* scenario are the same for all sub-regions except in Central Africa where the need for irrigation continues to be limited. The scenarios for Northern Africa show essentially the same trends, despite tying irrigation to rice production. In Northern Africa, in the *Policy Reform* scenario, water-conservation policies increase the cost of water, so irrigation water is increasingly diverted to higher-valued uses, leading to a decrease in the irrigated area. At the same time, the efficiency of application of irrigation water improves. Reduced production is made up in part through increased imports, a strategy often described as one of importing "virtual" water contained in the crops. In the *Policy Reform* scenario, irrigated area increases from 12.6 million ha in 2005 to 17 million ha in 2025.

Fortress World scenario

In the *Fortress World* scenario, a few powerful regional, sub-regional and international actors are able to rally together and secure control over land resources; they are sufficiently organized to protect their own interests and to create lasting alliances between them. Land-based wealth, resources and conventional governance systems for most are eroding. The elite retreat into protected enclaves. Outside the fortress, the majority is mired in poverty, denied access to scarce land resources and restricted in mobility and basic rights such as freedom of association and expression. The authorities employ active means of repression to guarantee exclusive access to needed resources (such as oil fields and key mines) and to stop further degradation of the regional and sub-regional land resources. Strategic mineral reserves, freshwater and important biological resources are put under strict control. Technology is maintained in the fortresses, with some continued innovation, but deteriorates elsewhere.

Outside the fortress, the majority is mired in poverty, denied access to scarce land resources and restricted in mobility, and basic rights such as freedom of association and expression.

Pollution within the fortress is reduced through increased efficiency and recycling. Waste is exported outside the enclaves, contributing to the extreme environmental deterioration induced by the unsustainable practices of the desperately poor and by the extraction of resources for the wealthy. However, favoured resort areas including nature and hunting reserves are declared ecological protection zones, from which poor people are excluded.

In this scenario, the major line of conflict is between rich and poor people, a new functional divide replacing the old North-South notion. Socioeconomic equity is very low, at the national and sub-regional levels, though it is higher within the fortress and outside. This social system is contingent on the organizational ability of the privileged enclaves to maintain control over the disenfranchized.

Land developments in the *Fortress World* scenario relating to human settlements, pastures and rangelands, agricultural land expansion, and land degradation paint a bleak future for the marginalized majority. The growing population of the underprivileged is not matched by an equivalent increase in requisite land resources. The "fortress dwellers" continue to have biggest share of land resources for settlement and agricultural production. Expansion of settled areas places significant pressure on agricultural lands and valued ecosystems. Proliferation of poorly serviced and densely populated urban settlements is witnessed as other settled areas expand into agricultural, forest, rangeland or other land types with the shares varying from sub-region to sub-region.

Larger tracts of rangelands are reserved for grazing livestock. Grazing areas increase in all sub-regions. The increase is at the expense of cropland, forest and marginal

lands and human settlements. Land degradation escalates subsequently. In some sub-regions agriculture expands onto marginal land, which requires considerable input and careful management. Poor people lack adequate input and resources to sustainably manage their land, which is predominantly in damaged environments; in contrast the rich own prime land and have an unparalleled share of resources. Pollution is rife and unsustainable land-use practices lead to various forms of land degradation, including wind and soil erosion, soil compaction, waterlogging, salinization, and nutrient depletion. The state of land resources deteriorates between 2000 and 2015 and continues to worsen at a faster rate in the 2015-2025 period. A larger proportion of the population is forced to produce food on increasingly less productive land. The risk of water erosion increases as more land is brought under intensive agriculture and there is a high rate of conversion of natural and semi-natural areas into built-up areas for industrial activities, infrastructure and tourism. Land remaining under agriculture is more vulnerable to water erosion.

In countries and sub-regions where the majority of farmers are smallholders, the rate of degradation is higher owing to the poor quality of available land and inadequate financial and human resources. Highly degraded agricultural land remains under production due to the lack of availability of alternatives as most land, including protected areas, forests, wetlands and woodlands, has been expropriated and managed by those in the "fortresses" and the few prosperous people from the minority enclaves. Human vulnerability to environmental change increases. The lower yields of traditional staple food crops, such as maize in Eastern and Southern Africa and yams in Western Africa, indicate continued production in degraded lands.

The Great Transitions scenario

In the *Great Transitions* scenario, regional, sub-regional, national and local society, rather than descending into cruelty and chaos, evolves to a higher stage as a new land-use paradigm emerges.

This transition requires structural rather than incremental changes in social practices and therefore a discontinuity with the current trajectory. Such transition may take two forms.

First, *Eco-communalism* envisions a patchwork of semi-isolated and self-reliant communities of land users. In this world, there are high levels of equity (with regard to land ownership), low economic growth, and low population growth.

Second, the *New Sustainability Paradigm* is a constructive and popular basis for social and environmental reconstruction, and redressing tensions. In this paradigm sensitive governments emerge to both express and stimulate the process of sustainable land management, balancing the three pillars of sustainable development: society, environment and economy. Science and technology form the backbone of land management. The values of simplicity, tranquillity and community begin to displace those of consumerism, competition and individualism. Slowly, these processes coalesce into a region-wide approach, with many people searching for new ideals, meaning and forms of social existence based on the pursuit of intergenerational equity. Equity and sustainability, rather than economic growth, come to define land development. Agricultural and industrial technology transfer and joint sustainable development initiatives usher in a new era of cooperation between all socioeconomic segments of the region and sub-regions. All sub-regions pioneer land-use technologies and development approaches that conform to their unique climate, geography, resources, demographics and religious and cultural traditions. In the new economic arrangements, markets are used to steer agricultural production and product distribution efficiency, but within the limits of market as required by defined social, cultural and environmental goals.

A variety of policy mechanisms are used to achieve the sustainability programme. These include a revised tax system and other market signals to discourage poor land-use practices. The polluter pays principle is implemented in all sub-regions. Antisocial corporate behaviour is discouraged by, among other methods, the public disclosure of information. Well-designed environmental, economic and social indicators measure the effectiveness of policies, giving the public an informed basis for seeking change. Devolved forms of governance evolve; land stewardship, and mechanisms for land-use decision making are established from local to regional scales. In this nested structure, Africa's sub-regions, nations and communities have considerable control over socioeconomic decisions including approaches to agricultural production and environmental conservation.

Regional governance is based on a federation of regions, which, through a rejuvenated AU and a truly regional civil service, effectively fosters cooperation, security and quality of land. Population growth slows and then stabilizes at relatively low levels as poverty is eliminated and women become equal participants in the life of communities. Inherited environmental problems are abating, though some effects linger for many decades. Land-based conflicts are resolved by negotiation, collaboration and consensus. The exhilaration of

pioneering a socially and environmentally superior way of life becomes a powerful attracting force for land users.

The main defining contours of the *Great Transitions* scenario are seen in positive indicators of human settlements, pastures and rangelands management, agricultural land expansions, the expansion of irrigated land, and the reduction in land degradation from water erosion, salinization and fertility loss. The socioeconomic and environmental impacts of these positive developments set in largely after 2015 and continue to be entrenched in land-use practices up to 2025. Economic growth ideals drive the demand for livestock and crop products higher but these are tempered by environmental concerns. Pressure on forests and other ecosystems, such as wetlands and rangelands, is reduced through careful land-use planning. Definite improvement in grazing land productivity can also be expected due to the adoption of sustainable livestock management practices and improvements in herd quality. Agricultural extension propels the transition to sustainable livestock practices.

Agricultural land expands by about 10 per cent between 2005 and 2025, a larger increase than the 5 per cent of the *Policy Reform* scenario. The increases in agricultural land are based on sustainable land-use principles, and land and water constraints at the sub-regional and country levels. In Southern and Eastern Africa, where agricultural land increases by about 20 per cent, some of the increase is met by returning to production land held by the government. Much of the increase in agricultural production is made possible through increase in irrigated land. Expansion of irrigated land is encouraged by decreases in water prices. More secure access to water is ensured in most sub-regions as regional and sub-regional structures are developed to facilitate cross-border water resources management. The rate of land degradation slows between 2005 and 2015. Loss of agricultural land due to severe degradation drops to 0.1 million ha per year over the first half of the scenario, 10 per cent of the rate assumed in the *Policy Reform* scenario. From 2015 to 2025, degraded agricultural land is greatly restored, leading to increased availability of land for agriculture, forests and other uses. More land is protected by local and national or sub-regional regulatory and governance mechanisms. Land degradation is greatly reduced through drainage, irrigation and land reclamation systems.

In this scenario, per capita consumption of agricultural products (meat, milk, grains) is lower, leading to a smaller area required for crop production and livestock grazing. This lowers the risk of water erosion, particularly after 2015. Efficient soil and water conservation systems are put in place to complement sustainable land management practices. Expansion of settlement areas is controlled and is less significant in conversion of natural and semi-natural systems. This is markedly different from the situation envisaged in the *Market Forces* scenario. The expansion of the built environment is contained as in the first half of the *Policy Reform* scenario, as concerns for protecting productive cropland, forests and other ecosystems lead to urban planning policies that favour more compact settlement patterns and limit the proliferation of poorly serviced slums.

Sensitive governments emerge to both express and stimulate the process of sustainable land management balancing the three pillars of sustainable development: society, environment and economy.

Containment of negative land-cover changes and forest-cover loss are key sustainability goals. The rate of forest loss gradually decreases in the scenario to zero by 2015 and forest areas increase thereafter. Forest protection policies and land-use strategies that support more compact settlements, the contraction of grazing lands and land restoration support the maintenance of the integrity of agro-ecosystems. The sustainable use of forest products is encouraged.

Policy lessons from the scenarios

An analysis and synthesis of the overall regional and sub-regional conditions, policies and initiatives in land resources demonstrates the value of appropriate policy responses, which can maximize development opportunities while ensuring environmental quality. An understanding of the driving forces, indicators and policy options under each of the four scenarios is a prerequisite for positive action. Policy responses are needed to alleviate, mitigate or suppress driving forces that may worsen land degradation.

The scenarios explored in the land theme show succinctly that different policy options exist. The scenarios are tools for integrating scientific knowledge about the consequences of anthropogenic pressures and natural processes, and for elucidating potential environmental options. The range of available opportunities, although affected by the magnitude and nature of the driving forces, depends mainly on institutionalizing sustainable land management practices.

The objective of achieving food security for a rapidly growing population, while maintaining the productivity of

Figure 6. Regional projections of land under irrigation in the four scenarios

area under irrigation (million ha)

agricultural land and forests and avoiding land degradation, presents numerous challenges. There is no simple recipe for achieving this. The scenario narrative presents a picture of how this might be accomplished under different development pathways. It reveals the multidimensional character of the problem, the variety of initiatives needed to address these problems, as well as the immense policy challenge. Concerted government action will be needed to build the required capacity for R & D activities and extension services, provide well-functioning markets and adequate infrastructure, counter the perverse subsidies in developed countries, and implement incentives for a shift toward more ecologically friendly agriculture, forestry, and land-use practices. The adequacy of water resources will play a critical role in achieving these goals. A substantial increase in irrigated land and availability of irrigation water will go a long way in helping achieve food security goals. This will demand prudent management of the freshwater resources.

Improving the distribution of wealth, access to resources and economic opportunities are key factors to the success of regional, sub-regional and national land policies (SARIPS 2000). The mitigation measures that would make land use environmentally sound revolve around improved conservation, and the effective use of marginal and low-potential agricultural lands. The measures to stem the increasing risk of water erosion must be revised in order to adapt to climate change, avoid the conversion to agriculture of other natural and semi-natural systems and address the consequences of agricultural intensification.

There is an urgent need to develop well coordinated country-specific and sub-region-specific land degradation monitoring programmes. These programmes would produce and share information needed for land-use decision making and policy development on degradation, and in particular for disaster preparedness, mitigation and management. The large differences in the estimated

Figure 7: Sub-regional changes in land use under the different scenarios

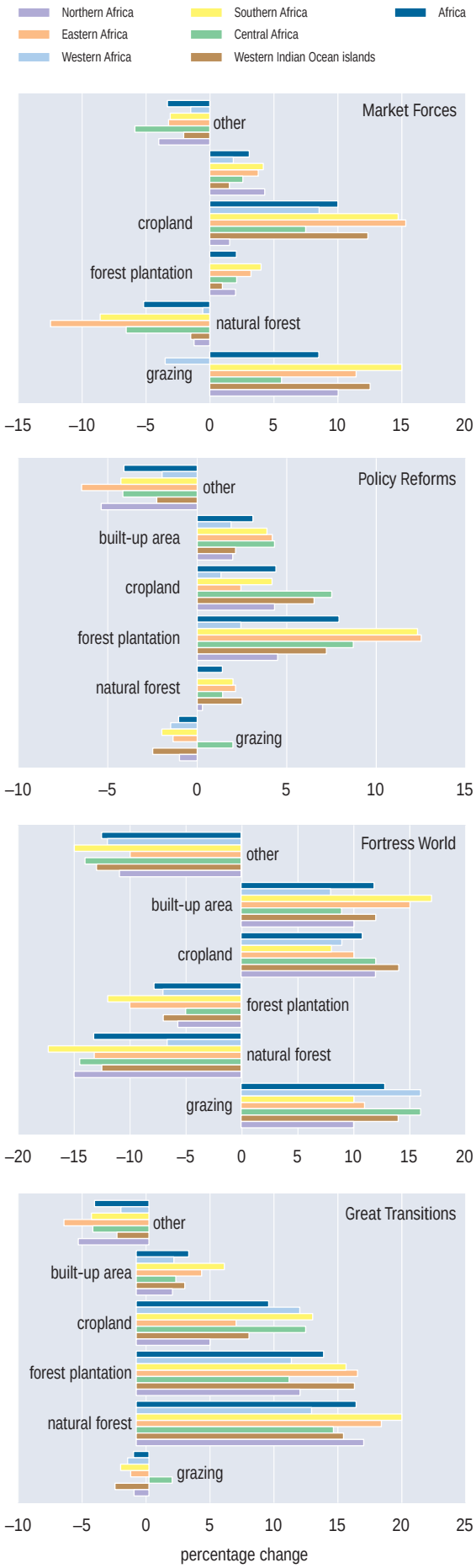
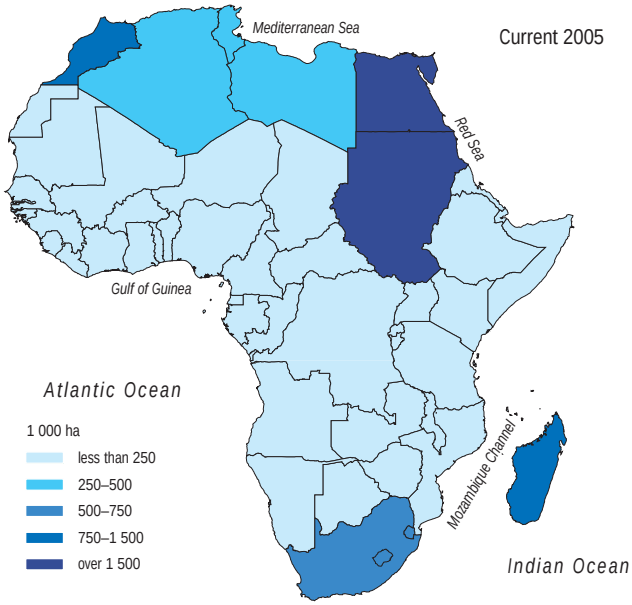
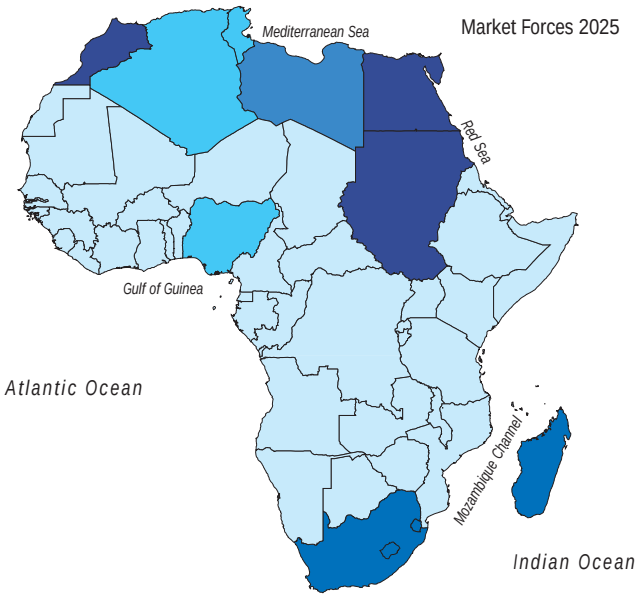
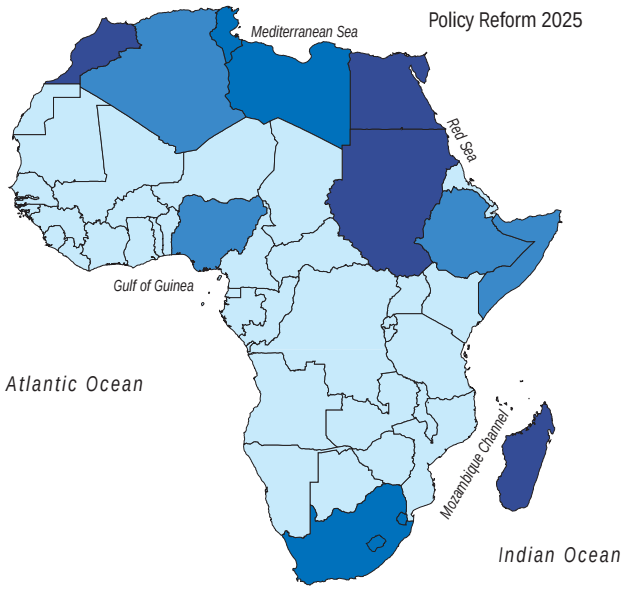


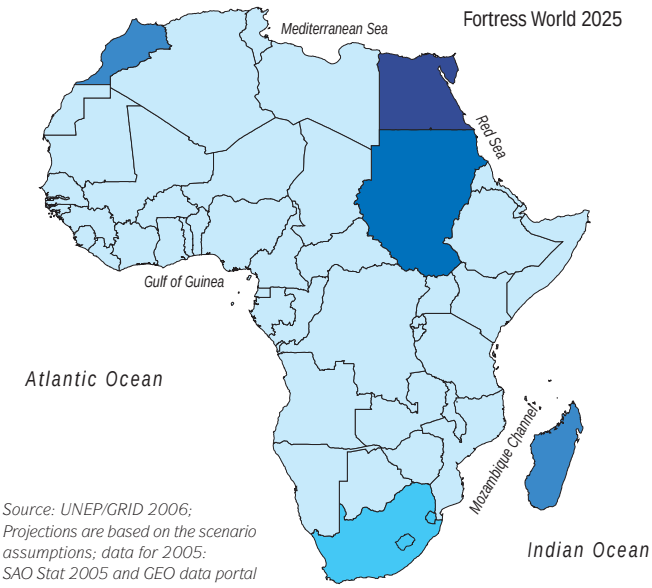
Figure 8: Changes in total irrigated land area

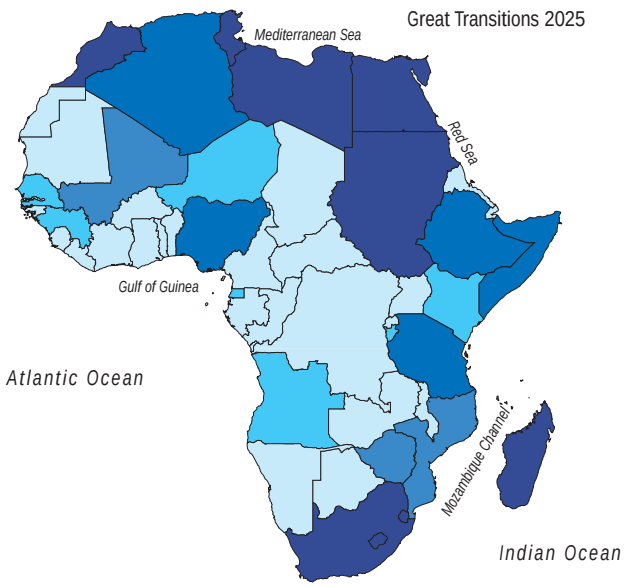


Irrigated area (million ha)						
Scenario	**2000**	**2005**	**2010**	**2015**	**2020**	**2025**
Market Forces	12.0	12.6	13.2	13.8	14.4	15.0
Policy Reform	12.0	12.6	13.5	15.17	16.84	17.0
Fortress World	12.0	12.0	10.5	9.0	7.5	6.0
Great Transitions	12.0	13.8	15.9	18.0	21.5	25.0









Source: UNEP/GRID 2006; Projections are based on the scenario assumptions; data for 2005: SAO Stat 2005 and GEO data portal

Figure 9: Sub-regional picture of degraded cropland by 2025 under the various scenarios

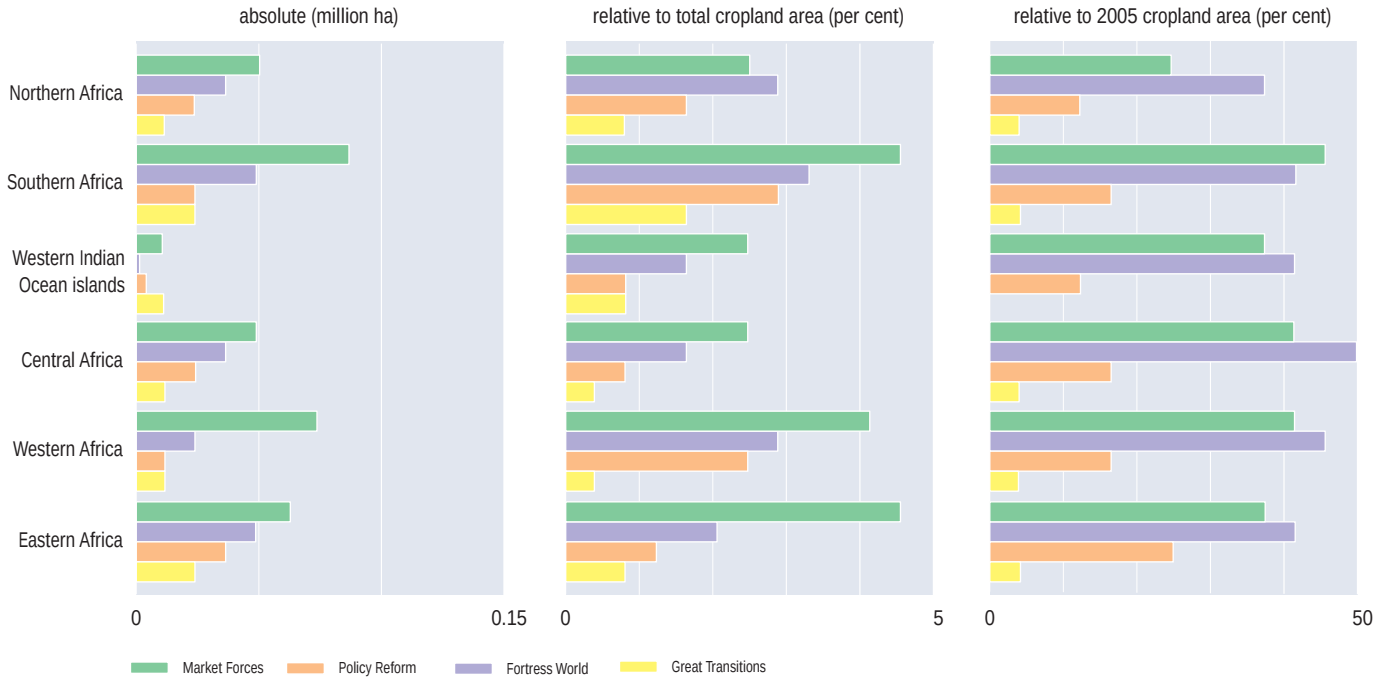
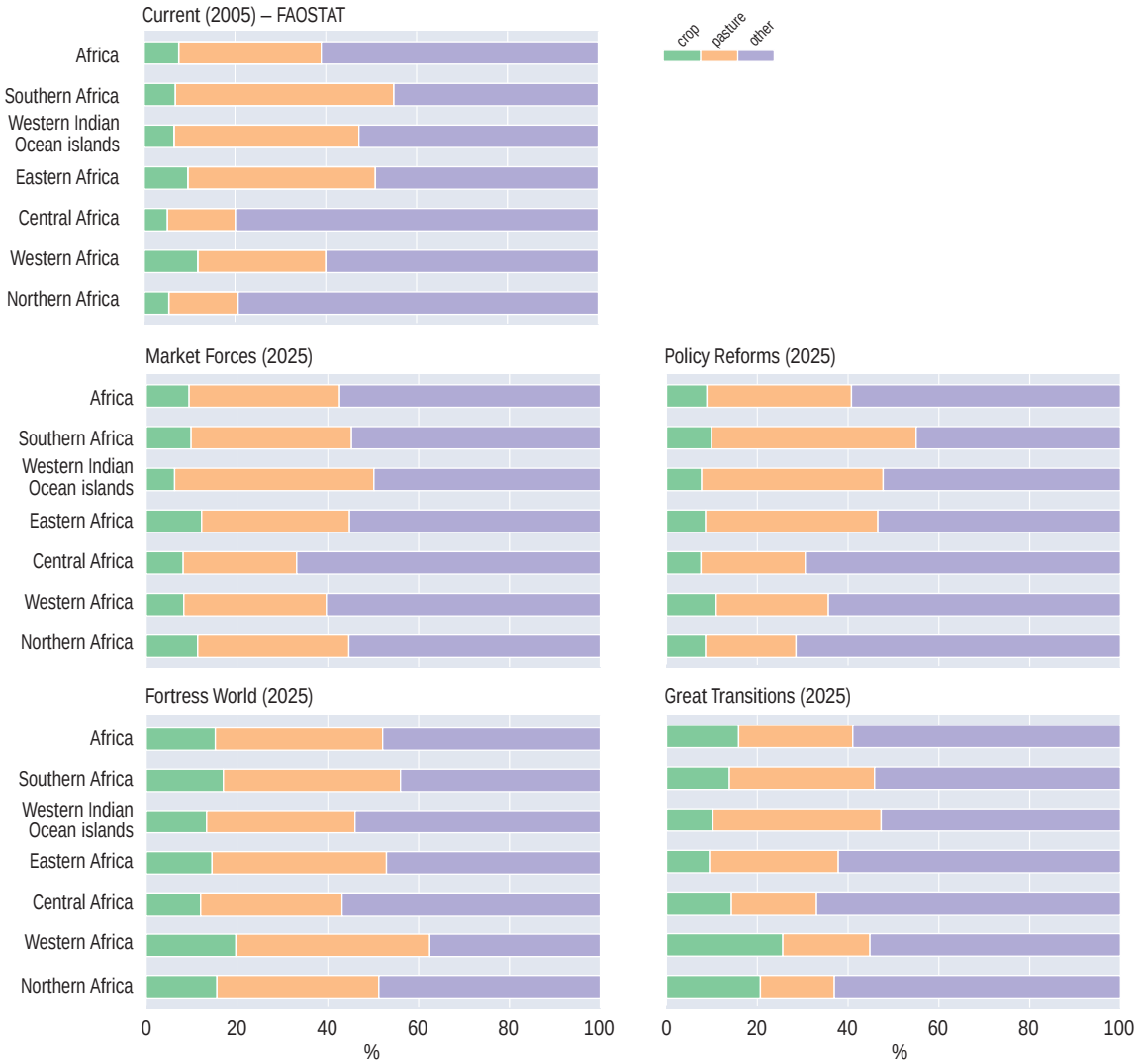


Figure 10: Estimated land use intensity based on crop and pasture under different scenarios



extent of land degradation under the different scenarios demand a policy-sensitive early warning system that is able to make quick and effective responses.

FRESHWATER

The key issues, for which scenarios have been presented under the freshwater theme, revolve around transboundary water resources management. As discussed in Chapter 4: *Freshwater*, the potential methods for increasing the opportunities associated with Africa's freshwater resources include the adoption of river basin or catchment management, improved regional cooperation, enhanced and more equitable distribution of water, better sanitation and the recognition of water as an asset for environmental management. Opportunities can only be harnessed if the issues and threats facing resource sustainability are understood and addressed. Issues regarding water quality and quantity, availability, variability and accessibility, low levels of investment in water infrastructure and technology, exploration and assessment of freshwater (including groundwater) potential, water-borne diseases (such as schistosomiasis (bilharzia) and onchocerciasis (river blindness)), invasive alien species (IAS) and competition (conflict) over resources are critical to sustainable management of Africa's water resources and achieving the MDG 7 targets of halving the proportion of people without improved drinking water in urban and rural areas, and halving the proportion of people without sanitation in urban and rural areas.

The main driving force and pressure for changes in the state of freshwater is population growth, although climate change is also a driver. This is evident in Chapter 4: *Freshwater* and it was also highlighted in the AEO-1 scenarios. The availability of water, both absolute and per capita, is a consequence of the growing number of people in Africa. There is growing demand for water for agricultural and industrial development, which can potentially lead to water scarcity. Population increases can also precipitate competition and conflict over available freshwater. Such conflicts may be between different economic sectors and, in some cases, between countries, or between communities which share common water bodies. Other drivers that affect the state of freshwater resources, and thus development opportunities, include climate, technological developments and socioeconomic and health factors. These driving forces are assessed in the following scenario narratives. The scenario narratives reveal the implications of different policy choices for realizing key objectives.

Market Forces scenario

Increasingly, Africa will be the home to environmentally-harmful industries, including the chemical industry (see Chapter 11: *Chemicals*). This trend is related to increased measures for environmental protection in developed countries and an increasingly active civil society (OECD 2001). In these circumstances, investors and industries target the still less restrictive legal systems, which are found predominately in the developing world. Northern Africa, given its strategic location close to Europe, and South Africa, with its more developed markets, become focuses of investment. Many new factories are established to manufacture the goods in Africa and then export them to Europe. The move appeals to and is welcomed by the local African governments, as it seems to be a magic solution to their struggling economies.

Rapid population growth does not seem to be a problem because the flourishing industry absorbs some of the unemployed population. However, the capacity of the African countries to develop their water resources and use them more efficiently still remains very low. Total annual water use amounts to 381 km^3, that is about 10 per cent of available resources. With the population reaching 1 766 million by 2050, per capita water share is very low at 216 m^3/year. However, large variations are witnessed among the sub-regions.

There is an increase in industrial water use (16 per cent) in order to produce and ensure continued FDI.

Competition over limited water resources rises between some sectors. Agriculture, the main water consumer, enjoys a large share of the resource (66 per cent of the total) as it feeds the industries with some raw materials and exports agricultural products to foreign markets. There is also an increase in industrial water use (16 per cent) in order to produce and ensure continued FDI. Domestic water use is 18 per cent of the total. Surface water is mainly used for irrigated agriculture, whereas industry and some urban areas rely more on groundwater.

Overharvesting of groundwater by the industrial sector poses a serious risk to the sustainability of the resource, but governments feel unable to impose strict regulations on that powerful sector. In response, the governments try to reduce water use in public irrigation schemes and reduce expenditure in water utilities by privatizing them or turning them over to the beneficiaries. This move is intended to improve resource-use efficiency and bring the costs of operation

and maintenance down. However, some of the utilities need large investments in order to rehabilitate them and make them profitable. The private sector makes those investments but also raises service fees. The prices of potable water in some urban centres and large cities become very high and unaffordable for many people. Therefore, although more people are connected to the water networks, the number of people who can afford to pay for it decreases. Alternative cheap, but unsafe, water sources emerge and the use of these increases. Many people are affected by water-borne diseases, which add to the strain on the national economies.

In this scenario, the economic and technological gap between urban and rural areas increases and there is a concentration of economic activities, particularly industry, around the urban areas. Typically, many people are attracted to move from rural to urban areas in search of better lives and incomes. However, because they are mostly unskilled labourers, they can only secure low-income jobs and hence find themselves unable to cope with the high living costs in the urban areas. Slums proliferate on the outskirts of the large urban areas. Services are very minimal and of low quality. Untreated sewage water poses a serious risk to those communities as well as to surface and shallow groundwater resources in the downstream areas.

Policy Reform scenario

In this scenario, there is a clear shift in the development policies of countries, with water, along with other environmental resources, taking a higher priority than before. The new policies are centralized around some main goals: better availability of and access to water resources, equitable distribution of the resources among all beneficiaries, and the sustainable use of water resources in terms of both quantity and quality.

The availability of better water supply without improved sanitation results in substantial health hazards as well as environmental risks, as people simply dump their increased volumes of untreated sewage water in watercourses.

Overall, Africa is not short of water resources, but it is the spatial distribution of the resource that is rather uneven. Some countries, notably in Northern Africa, the Horn of Africa, and Southern Africa are experiencing water stress, while others, in Central Africa for example, have ample resources that are as yet untapped (UNEP 2002c). This opens up opportunities for cooperation between different groups of riparian countries for the optimum use of the water resources for the benefit of all nations.

Nevertheless, until the above efforts materialize and start to achieve their goals, water availability is restricted by technical and financial obstacles. Despite a moderate increase in the population (1 678 million), total annual water use is only 292 km^3 or just 8 per cent of available resources. The per capita water share is therefore very low at 174 m^3/year.

In meeting policy goals attention is given to rural populations who have long been neglected. New water supply projects, financed by international donors and lending agencies, provide good quality and safe potable water to the rural populations. The objectives are two-fold:

- Safe potable water should improve population health leading to significant savings in expenditure on health care.
- Improving the quality of life in the rural areas should help reduce the tide of urbanization.

However, some difficulties are experienced. First, the cost of tap water is relatively high, and unaffordable for most people in the rural areas. Second, the availability of better water supply without improved sanitation results in substantial health hazards as well as environmental risks, as people simply dump their increased volumes of untreated sewage water in watercourses. The problems are well known to the governments, but they are unable to take timely action due to limited financial resources. Technocrats and environmentalists advocate that rural areas should be provided with sanitation first, whereas politicians believe that water supply should take the first priority as water is an essential requirement for life.

Similarly, urban areas also benefit from the new policies and more people are connected to water supply networks. More people have access to safe potable water. Water tariffs also increase, and they are higher than those in the rural areas. Water use for domestic purposes is at a record high of 27 per cent of total water use. As technical solutions are not available to protect the quality of water resources, governments adopt laws and regulations to protect water quality. It takes time, though, until the public begin to adopt sustainable water-use practices. Law enforcement along with public awareness campaigns, financial incentives and other economic instruments are among the tools used to promote more efficient and sustainable use.

The use of groundwater is rationalized through new policies, which target integrated water resource

management (IWRM). Water resources have become so vulnerable that any further misuse can lead to a state that will be extremely difficult to remedy. In response, priority for groundwater use is given to small communities and industries. Small communities mainly use shallow groundwater for domestic purposes, which can be easily contaminated if not properly protected. Industries rely more on deep groundwater, which requires good management to maximize the lifespan of the wells. Many countries acknowledge the fact that some of their deep groundwater aquifers are shared with their neighbours. For the first time, those countries sit together and draw plans for the sustainable utilization of this common resource, an act that has for long been limited to riparian countries only.

Fortress World scenario

In many developing countries the differences between rich and poor are phenomenal and growing. Wealth and poverty are closely related to dispossession and deprivation, and to the extent of capabilities people have to make livelihood choices they value (Sen 1999). In many countries, the middle class is gradually diminishing and this trend is expected to continue under this scenario. The gap between rich and poor people gets wider, increasing the potential for conflict over natural resources. Although much smaller in numbers, the rich have the upper hand and therefore manage to control almost everything; this is done at the expense of the environment and sustainable water resources management.

Water availability varies considerably across Africa (UNEP 2002c). In all societies, irrespective of social values or wealth, water is a vital resource. In the *Fortress World* scenario, the elite are very keen to maintain full control of this resource. Their control is not limited to the use and distribution of internal waters but goes beyond national boundaries, as a result of their influence on water management institutions in neighbouring countries. Transboundary technical and economic cooperation is minimal, with each country focusing on its own needs. In pursuit of huge profits, the elite focus on industry and trade with the West. They take advantage of the low cost of raw materials available in Africa and of abundant cheap labour. Water use by the industrial sector is high at 32 per cent of the total use, and is at the expense of the agricultural sector and domestic water use among poor people. Many industries produce environmentally-hazardous waste that is disposed of without any treatment, further threatening freshwater systems.

Potable water supply to the elite urban areas is secured. Domestic water use accounts for 11 per cent of the total annual water use of 312 km^3. Per capita water share is very low at 148 m^3 per year due to the large increase in population (2 102 million). However, water availability and distribution is skewed with the elite taking much higher shares than poor people. About 30 per cent of the population, mainly poor people, have inadequate access to water resources and are not able to meet their basic needs. This deteriorating situation is just one factor undercutting the opportunities available to poor people. Faced with no access to resources – natural resources, education, health care, among others – poverty increases. Agriculture is embarked upon primarily to meet subsistence needs, however the lack of water availability makes this a challenge. Water that is available is of poor quality, and the impact of this on the quality of agricultural products and soils, from salinization and other pollutants, is evident.

About 30 per cent of the population, mainly poor people, have inadequate access to water resources and are not able to meet their basic needs.

Domestic water availability for poor people, whether in rural areas or on the fringes of urban areas, is very limited. The shortage of potable water is so acute that people have to use low-quality water. Disputes on access to potable water arise almost daily with the stronger getting higher shares than the weak. Female-headed households are at a particular disadvantage. Used domestic and industrial wastewater is disposed of in open watercourses causing serious damage to ecosystems and biodiversity, as well as to the health of poor people living in downstream areas. There is an outbreak of water-borne diseases such as malaria, bilharzia and diarrhoea. Most affected are poor people, particularly children under five, due to inadequate access to good health care, and infant mortality is high.

Groundwater resources are not spared. The elite overharvest deep groundwater for their new modern urban compounds and leisure centres. Well-digging is neither regulated nor documented. No databases for the numbers and locations of wells exist. The exact amount of annual groundwater use is not known. The typical symptoms of groundwater degradation, such as declining water tables and increased well salinity, are evident. Many poor rural areas have to use shallow

groundwater for domestic purposes. This water is not completely safe, but it is of better quality than that from many surface sources. Shallow groundwater is polluted by both seepage from polluted surface water sources and the poor management of the wells by the users themselves. Many wells are in very bad condition and need urgent rehabilitation, but the users, who are poor, lack the required technical and financial resources.

Great Transitions scenario

In this scenario, African countries fundamentally transform their water management policies and practices. The reforms aim at ensuring the sustainable use of all natural resources while at the same time improving living standards and well-being.

Agricultural practices which adversely affect water sustainability are no longer tolerated as there is proper enforcement of the law. For example, the use of cheap and illegal chemicals is successfully prevented through better monitoring and law enforcement, and public education. Modern irrigation systems that are highly efficient in water use become common practice in most of the better-off countries. As an incentive to farmers, the governments set special energy tariffs for agricultural uses. The tariffs, however, are not so low so as to encourage unsustainable energy and water use. Agricultural water use is successfully controlled at only 56 per cent of the total water use, a significant reduction from current trends where as much as 85 to 90 per cent of water use is for agricultural purposes (UNEP 2002c).

The reform in the agricultural sector encourages many foreign investors to establish farms. The availability of good land and water resources, low-cost labour and enabling national policies and laws encourages this development. The industrial sector also flourishes in light of the reform in policies and availability of raw materials. Industrial water use therefore increases to 19 per cent of the total use. Improved regulations require that industrial waste must be properly treated before it is disposed of. Samples of industrial wastewater are collected randomly and analysed to ensure that they comply with the regulations and are safe for disposal, and systems for self-monitoring are also established. This level of monitoring and enforcement is made possible through increased investment in human resource capacity.

Special attention is paid to the rural population. International aid and donors focus on water supply and sanitation projects in these areas. The target is to develop sustainable means of water supply and sanitation, using appropriate technology, which meets the needs of rural people. Partnerships are developed with potential users, who provide in-kind contributions. As an integral part of this investment, public education activities are embarked upon that focus on maintaining the new systems and infrastructure, to ensure the sustainability of supply. These initiatives are complemented by national level reforms, including in supply and treatment of water resources. Privatization of the water supply utilities, especially those supplying water to the urban areas, is seen as a necessity if the efficiencies of those utilities are to be increased. However, privatization usually comes with a higher cost of services and tariffs to the users. The tangible improvements in the quality of the services justify the higher costs to the users. In addition, higher living standards as a result of economic reforms and growth mean that most of the population can afford the high service fees and tariffs.

Nevertheless, as more people are provided with safe potable water, and due to the higher living standards, domestic water use sharply rises to 36 per cent of the total use. This is not necessarily a good indicator of better water availability to more people, but is related to overuse of water among the more wealthy in urban areas. In fact, although rapid population growth is successfully controlled through better education of young people, 26 per cent of the 1 581 million people in Africa still have inadequate access to water. Public campaigns and awareness programmes target wasteful use of water. Every saved drop of water simply means better water availability to others in the same country and across the boundaries in downstream countries.

Many African governments adopt new policies or re-emphasize existing policies for stakeholder participation in management and decision making in water-resources-related issues. The rationale is that if the stakeholders are involved in water resources management, they will develop a sense of ownership and become key players in sustaining those resources. Formal and informal water-user associations are established to promote better communication and exchange of information between government and users. One of the lessons learned is that illiteracy is not a justification for excluding users from decision making. These associations are successful and are replicated at the national level.

Policy lessons from the scenarios

The different scenarios illustrate the potential for meeting agreed goals and targets, such as those of the Africa Water Vision 2025 (ECA and others 2000) and the MDGs under different policy options. In particular, opportunities for realizing the MDG targets related to access to water and sanitation are revealed. In addition,

the different scenarios hold distinct potentials for meeting economic and development opportunities. Similarly, as illustrated in Box 4, different governance choices will also affect opportunities.

Figure 11: Population experiencing inadequate access to water in the different scenarios

Figure 12: Water availability and use under the different scenarios

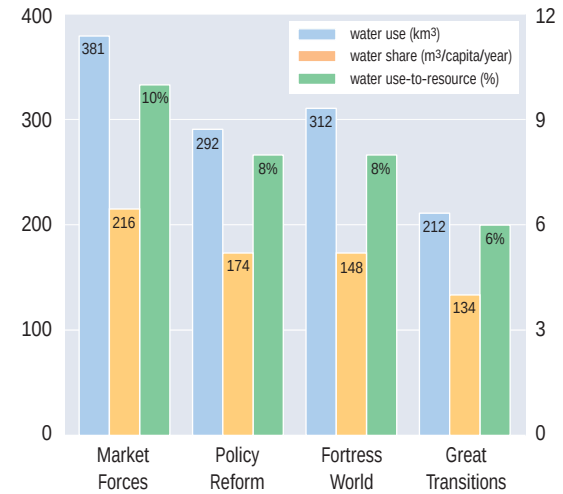
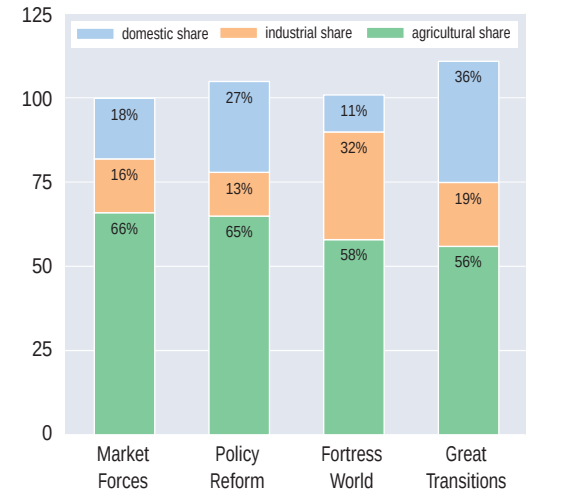


Figure 13: Water use by sector under the different scenarios



Taken as a whole, the scenarios demonstrate the complexity of the challenge of optimizing water use so as to meet human well-being and development targets, while ensuring the sustainability of the resource. One policy lesson that comes from various scenarios is the opportunities at all levels offered by

Box 4: Making the choice to increase stakeholder participation...

African governments follow the global move and start adopting policies to facilitate public participation in decision making regarding planning, development and management of the countries' water resources. The main objective of the reform is to adopt policies requiring open channels within the government agencies that provide for interactive two-way stakeholder participation in water development, management and decision making, and to describe mechanisms and procedures for implementing those policies.

Based on experiences from other leading countries in public participation, there is recognition that such participation in the decision-making process strengthens the fulfilment of public policies and contributes to the transparency of public and private action by providing opportunities for cooperation and coordination between government and stakeholders. This builds trust among the participants and leads to the creation of long-term collaborative relationships. This is particularly true in dealing with issues related to the environment and sustainable development and management of basic resources, such as water, which affect people from all segments of society.

However, the introduction of participatory decision making is a relatively long process within the context of the institutional, social and economic characteristics of the African societies and is faced with some difficulties. Lack of a clear distinction between the responsibilities and duties of government organizations and the private stakeholders causes some confusion to both. Low education percentages in some of the countries make it difficult for the larger sector of the public to grasp the concept. For many, having a say in decision making is seen as a tool for achieving personal benefits instead of aiming at the national scale. Training and public awareness programmes are started to help tackle some of these difficulties.

Some of the stakeholders are cautious when introduced to participatory decision making. They fear that their involvement in resource management will come at large financial costs to them. Infrastructure maintenance has been in many cases very poor under government spending. The stakeholders are worried that they will have to come up with the large sums of money required for maintaining the deteriorated infrastructure.

Despite the slow progress in activating participatory decision making in the water resources sector, the positive results are both encouraging and promising. For instance, the negotiations between the various water-user sectors on their water allocations are now carried out by the stakeholders. The general public develops better understanding of the severe water shortage problem in the region and starts to come up with its own demand-management actions. Contacts and links between government agencies and the private sector are improved. The management and operation burden on governments is reduced leaving them to focus more on the environment.

adopting IWRM. Addressing and reconciling different needs in an equitable and productive manner will require policy and law reform, as well as investment in technology. Building human resource capacity also emerges, in several scenarios, as an invaluable means for enhancing opportunities. Further, establishing collaborative management regimes at the national as well as at the inter-state level is paramount to achieving sustainable water management.

ATMOSPHERE

Energy is essential for the effective functioning of human society; however, its production and use come with environmental costs. Energy plays a critical role in the development process, as a domestic necessity but also as a factor in production. The cost of energy directly affects prices of other goods and services, and the competitiveness of enterprises. The opportunities and challenges associated with this sector are discussed more fully in Chapter 2: *Atmosphere*. This section presents scenarios which focus on the different policy options in the energy sector and how this may impact on goals and the available resources.

The opportunities for creating a sustainable energy supply are closely related to investment in renewable energy, the development of appropriate energy technology, and the strengthening of existing energy resource monitoring programmes. The search for abundant and cheap energy could focus on rationalizing the territorial distribution of existing but unevenly allocated energy resources. Goals in the energy sector include:

- Developing cleaner energy sources;
- Improving access to reliable and affordable commercial energy supply;
- Improving the reliability, as well as lowering the cost, of energy supply to productive activities; and
- Reversing environmental degradation that is associated with the use of unclean fuels.

The main threat to achieving these goals is climate change and variability, and its impact on environment, health, food security and human settlements.

Improvements in energy infrastructure occur, including the development of pipelines and electricity grids, to ensure better supply to consumers.

Market Forces scenario

Under the *Market Forces* scenario, manufacturing accounts for more of Africa's economy and employment, and this results in an increase in air pollution. Additionally, under this scenario, there is an increase in available commercial energy resources. Improvements in energy infrastructure occur, including the development of pipelines and electricity grids, to ensure better supply to consumers. Per capita consumption of conventional energy resources increases as economic developments in the *Market Forces* scenario make inroads into widespread and severe poverty. This also results in a declining reliance on biomass.

As Chapter 3: *Land* shows, the region is rich in mineral resources; however, there is considerable variation between the sub-regions, and energy production patterns reflect this. Coal production is concentrated in Southern Africa (mainly South Africa). Natural gas production, on the other hand, is overwhelmingly concentrated in Northern Africa (mainly Algeria and Egypt). Crude oil production takes place in all sub-regions except Eastern Africa. Nevertheless, the top crude oil producers are concentrated in Northern Africa (Algeria, Egypt, and Libya), Western Africa (Nigeria) and Southern Africa (Angola and South Africa). In several countries, oil has been a significant driver of economic growth (ECA 2005). Against this backdrop, in the *Market Forces* scenario emphasis is placed on energy production, trading and transportation.

African carbon emissions from fossil fuel consumption (excluding natural gas flaring) have been growing rapidly, although from a very small base. However, as shown in Chapter 2: *Atmosphere*, contributions to carbon emissions are relatively small, with Africa contributing only about 3.6 per cent of total emissions (UNSTAT/CDIAC 2005). In this scenario, with a growing focus on renewable energies including natural gas, hydropower and nuclear energy, emissions of carbon from coal fall from 42 per cent of Africa's emissions in 1997 to less than 33 per cent in 2020.

Carbon emission levels generally mirror patterns of energy use; thus South Africa and Libya have among the highest emission levels, and Swaziland and Mauritania among the lowest (UNSTAT/CDIAC 2005). Under the *Market Forces* scenario, energy use increases more rapidly in some areas, as a result of higher levels of industrialization and increased domestic appliance use. However, the relatively high emissions from transportation decrease.

As shown in Chapter 6: *Forests and Woodlands*, woodfuel is the primary energy source in rural Africa.

This high dependence has implications for pollution and deforestation, which in turn impacts on the sustainability of other environmental goods-and-services, including land resources. As shown in Chapter 2: *Atmosphere*, the high dependency on biomass contributes to indoor pollution, which has direct implications on the health of women and children, particularly those under five (Gordon and others 2004). Under the *Market Forces* scenario, the fuels available to and use patterns by the poorest communities do not change appreciably, and thus patterns of environmental and human health deterioration continue. Consequently, finding alternatives to woodfuel becomes a concern under the *Market Forces* scenario.

Africa is home to the world's second-largest rain forest, in the Congo basin, and consequently plays an important global role as a carbon sink. Under the *Market Forces* scenario, this becomes the basis for increasing global interest in Africa.

As discussed in Chapter 8: *Interlinkages: The Environment and Policy Web*, gas flaring has considerable environmental and social costs. It not only contributes to GHG emissions but is a waste of potentially valuable energy sources. The gas is burned off rather than captured for use because of limited gas infrastructure. Under the *Market Forces* scenario, gas flaring gives way to gas utilization as a result of improved market conditions and improved opportunities for investment in advanced technology.

The key policy lessons from the *Market Forces* scenario include: the need to minimize the impact of the global economy by adopting more interventionist mechanisms; the promotion of entrepreneurship at the local level through the adoption of financing mechanisms and providing subsidies that encourage the adoption of sustainable energy options; and diversifying the economy. Integrating the economies of AU member states is seen as an important intervention to support sustainable energy approaches.

Policy Reform scenario

In the *Policy Reform* scenario, concern mounts over the impact of increased noxious and GHG emissions due, in part, to heightened industrial development and growing consumption. While in the *Market Forces* scenario, demographic, economic and technical factors drive energy use, in the normative *Policy Reform* scenario climate change mitigation targets drive the trends of the energy sector.

Governments introduce environmental and social policies to improve environmental stewardship and social equity. At the regional level, AU members agree to adopt legislation that requires energy and environmental audits. Consequently, this becomes one criterion for evaluating the performance of member states under the APRM. It also results in energy service providers improving efficiency and adopting demand-driven management projects, on behalf of clients mainly in the commercial, mining and industrial sectors, for a fee. The fee is based on the extent of reduction in energy consumption as indicated in the billing system. More consumers accept responsibility for environmental restoration, paying the private sector to undertake these activities. Payment is determined by the extent of environmental reparation. These initiatives have several important spin-offs, including job creation. This in turn makes a contribution towards the MDG target to halve by 2015 the proportion of people living on less than a dollar day and those suffering from hunger.

An Africa-wide environmental and social scorecard system is introduced in industries, the mining sector and commercial firms to accelerate the drive to balance the three pillars of sustainable development.

As a result of regional protocols introduced to control noxious and GHG emissions, tradable pollution permits are put in place to curb the emissions burden. An Africa-wide environmental and social scorecard system is introduced in industries, the mining sector and commercial firms to accelerate the drive to balance the three pillars of sustainable development. The scorecard provides credit points to industries and mining and commercial firms that undertake noteworthy environmental and social projects. The credit points are taken into account during the awarding of government contracts. Non-governmental organizations (NGOs) take the scorecard issue further by educating and urging civil society to base their patronage of firms on accumulated credit points. In this context NEPAD publishes accumulated credit points every six months to facilitate access by the public. The public continues to show a keen interest in the scorecard by making regular phone calls to a dedicated hotline set up for this purpose.

Meanwhile a recommendation of a NEPAD task team, established to ensure the adoption of programmes and institutions in support of sustainable development targets, which identifies the achievement of sustainable energy systems as a major driver to economic development is adopted. The recommendation includes practical and implementable measures for the efficient use of energy,

energy supply, the adoption and development of cleaner technologies, and the use of new and renewable sources of energy. These strategies are similar to those already being promoted to address increasing energy demand, from economic and population growth, such as use of a mix of fuels, technology improvement, the alteration of energy prices, and abatement measures (UNEP 2002a).

Improved technologies for domestic use in rural areas are also an important focus; these include investing in the development of energy-efficient charcoal kilns, and in improved and environmentally-sound stoves. In this scenario, all countries move towards using sustainable energy sources and systems – in particular those pertaining to new and renewable sources of energy, cleaner energy technologies and energy-efficient practices. Countries introduce legislation to discourage the supply of energy from unclean sources, including those that are carbon-intensive and contribute to the burden of global climate change. Given the unsustainable harvesting of trees for charcoal production, governments put in place incentives to turn marginal lands into plantations for use as fuelwood and for production of charcoal.

Simultaneously, legal measures that promote more efficient energy use and cleaner production, and discourage consumption are adopted. These measures encourage FDI and donor support for the development of home solar energy systems, wind turbines, geothermal energy, tidal wave energy, bio-energy and small hydropower schemes. To encourage investment and the development of cleaner technologies governments waive duties and taxes on new and renewable energy equipment and machinery.

Legal measures that promote more efficient energy use and cleaner production, and discourage consumption are adopted.

Considering the fact that finance plays a major role in the adoption and roll-out of technologies, member states of the AU introduce innovative policies, after consulting financial institutions, to facilitate the granting of loans to projects on energy and environment.

At the request of the AU, governments enact regulations concerning the practice of bush burning for hunting game and also slash-and-burn agriculture. This contributes to improvements in air quality and a decrease in the emission of GHG. As a result farm owners begin to explore the opportunity of earning carbon credits under the World Bank's Community Development Fund of the Prototype Carbon Fund. Some of the farmers apply directly to the Designated National Authorities in the various countries to register projects under the Clean Development Mechanism (CDM) with a view to monetizing their share of accrued carbon credits.

The policies that governments introduce under the *Policy Reform* scenario contribute to improvement in environmental accountability and reduction in poverty. To curb rising pollution from increasing industrial activity, governments enact environmental regulations. Government officials study the costs-and-benefits of the polluter pays principle as a tool to control pollution. Governments become proactive and focus on improving the performance of their own energy facilities. Sustainable energy technology transfer begins to show results, as home solar energy systems are increasingly being installed in the region.

Fortress World scenario

Under the *Fortress World* scenario, atmospheric quality does not improve. Environmental policies are inward-looking, and focus predominately on improving the immediate opportunities available to the elite.

Under this scenario, there is little investment in alternative energy, and Africa continues to rely on biomass for its energy needs. Consequently, deforestation persists with run-on problems such as erosion and decreasing availability of non-timber forest products (NTFPs), which in turn impacts negatively on rural livelihoods. Negative health effects increase, due to the smoke generated in the use of woodfuel. Since the availability of medical facilities is restricted to elites, the average life span continues to decline. Meanwhile, the production of energy using established fuels is insufficient to satisfy rising demand and, in the absence of alternative fuel, the poorest communities rely more heavily on forest resources thus perpetuating the cycle of environmental degradation.

Under the *Fortress World* scenario, addressing global climate change is not a top priority. Deforestation continues unabated and there is little interest in the implications of this for global warming. Gas flaring continues to be practised. Increasing climate variability has environmental and human well-being impacts. Decreasing rainfall places stress on already fragile subsistence agriculture that forms the basis of many rural livelihoods, increasing food insecurity and ill health. These areas are poorly resourced, and most people are unable to mitigate, adapt to or cope with climate change. For example in Uganda, in the absence of temperature-resistant coffee varieties, a temperature increase of 2° C can lead to the devastation of most of

the coffee plantations, severely impacting on the macro-economy of the country (UNEP 2002b). Forest cover and agricultural activities continue to suffer due to adverse impacts of climate change, particularly in the areas outside the walls of the enclaves.

Demand for renewable energy technologies declines. Investment in energy-supply strategies based on equity and increasing rural opportunities, such as national electrification programmes, also declines. As poverty increases in the rural areas the disposable income of domestic consumers decreases, and this, along with decline of public sector energy budgets, results in the declining use of solar energy in rural electrification. Despite the fact that in Africa hydroelectric power is the only significant grid-connected renewable energy source, hydroelectricity's share of total installed electric capacity declines as inadequate maintenance causes installations to become less efficient. Unexploited hydropower potential in the Congo, Nile and Zambezi basins is not developed.

Under the *Fortress World* scenario, the concentration of businesses and commercial concerns in the hands of the relatively small elite, who erect strong entry barriers against outsiders, continues to prevail. Frustration, despair and gloom continue to define the fate of the disadvantaged majority whose lives are characterized by a vicious cycle of poverty. Continued emissions, mainly from combustion of fossil fuels in internal-combustion engines, exacerbate air pollution problems, especially in urban areas. Given the focus on the needs of a minority, investment in vehicles for public transportation and the lower end of the market is not a priority. Therefore, vehicle age increases and maintenance standards decline.

Great Transitions scenario

In this scenario, an increased emphasis is placed on the opportunities that scientific and other forms of knowledge and technology offer for improved environmental management. This includes ensuring that proper systems are developed for the collection, coordination and dissemination of data.

Increasing attention is paid to finding alternatives to carbon-intensive energy given its contribution to climate change and environmental pollution. The supply of new and renewable energy resources becomes the norm as consumers reduce patronage of goods and services produced using so-called dirty fuels and inefficient energy systems. Consumer action is based on improved awareness of negative environmental impacts, and a growing commitment to the ideals of sustainable development. This development takes place against the backdrop of governments mainstreaming the environment in all development policies and programmes. With the growing importance of the global media, consumers are wary of the increasing incidence of floods, drought, extreme weather conditions, malaria and other diseases, and the loss of coastal resorts and recreational facilities due to sea level rise. Meanwhile the insistence of the West on patronizing of goods from Africa which are manufactured by cleaner production and sustainable energy accelerates the drive towards the harnessing of new and renewable sources of energy.

Sustainable energy strategies focus on the needs of rural communities and in particular poor people.

The fact that energy systems underpin economic, social and cultural growth leads to investment in sustainable energy. Achieving equity and eradicating poverty are widely accepted goals. Consequently, sustainable energy strategies focus on the needs of rural communities and in particular poor people. Reducing dependence on biomass in rural areas is an important objective, and clear targets are established as the basis for monitoring progress in this area.

Meanwhile, advocacy and education by NGOs and government-led interventionist strategies in partnership with the donor community continue to bring good results. Throughout the region, cleaner production methods, lower consumption, and supply and demand management become commonplace. Financial institutions adopt green policies, including, for example, reducing interest rates on loans that are used to fund sustainable energy and environmental reparation activities. This triggers a deluge of applications for loans for such activities, which results in more investments flowing into this sector. The public shows support for efforts to provide sustainable energy by agreeing to pay premium prices for it. Existing bagasse-fired power stations undergo revamping to increase their installed capacity as more investments flow into the sugar-cane industry.

The effect of these actions leads to improvement in air quality, considerable reduction in transboundary air pollution, effective mitigation of GHG emissions and improvements in health. Premium electricity tariffs are reinvested in modernizing existing power plants. Workers join newly formed safety, health and environment associations in their places of work, while

education authorities make energy and environment studies compulsory in schools and colleges. Energy and environmental management in industries, mining and commercial operations are made mandatory for AU member states under the auspices of a newly formed regional sustainable energy and environment accountability agency. The use of aerosol sprays that harm the ozone layer is discontinued due to availability and application of cheaper ozone-friendly substitutes. Incidences of acute and mild respiratory illness among workers and schoolchildren continue to decline resulting in less worker absenteeism, enhanced productivity and increased attendance at schools.

Natural resources accounting, in particular cost-benefit analysis of GHG and noxious gas mitigation measures, continues to inform GDP calculations among environmentally conscious AU member states. This increases GDP, facilitating budgetary allocations to areas of the economy previously deemed not quantifiable. A regional commission for economic analysis is established under NEPAD to support the inclusion of natural resources accounting. There are various regional and sub-regional initiatives focusing on building the capacity of additional AU members to undertake natural resources accounting. Additionally, these AU member states invest in peer learning from those already using these accounting techniques. Business leaders in collaboration with intergovernmental regional organizations establish a company to buy carbon credits from Africa-wide NEPAD projects. This results in the establishment of a secretariat at the Head Office in Addis Ababa to administer the exchange, with local offices in various AU member countries. Governments set up monitoring systems to ensure that investors comply with directives to transfer

Box 5: Opportunities offered by planting woodlots on marginal land…

Women and girls in rural areas spend a considerable amount of time searching for woodfuel for cooking, space-heating and warming. This leaves these women little time to engage in commercial activities, other household chores and recreation. Environmental degradation results from unbridled harvesting of trees for use as woodfuel and perpetuates the cycle of poverty. Rural communities have less access to modern energy sources like electricity, liquefied petroleum gas and kerosene. As a consequence of government concerns about the energy demand situation in rural areas, including its effect on the well-being of women and girls, they contact NEPAD for assistance in finding a solution to this problem.

NEPAD tasks its research and development arm to conduct intensive research into finding appropriate energy for use mainly in rural areas. The idea of woodlots crop up. However, the problem with this is the fact that many countries grapple with drought for a considerable length of time in the year. One researcher identifies a drought-resistant species, *memuna*, which requires relatively less water to grow, and matures within two years of planting. Pilot farms are established on marginal lands in six climatic zones and produce remarkable results within two years. Governments put in place policies motivating the use of marginal lands for planting *memuna*. *Memuna* is regarded as a means for poverty alleviation and an antidote to environmental degradation, particularly in rural areas. *Memuna* catches the attention of rural communities who work with NGOs and donor agencies to develop plantations on marginal lands. The NGOs are sponsored by donor agencies to undertake courses in silviculture, including proper harvesting methods and making of charcoal from *memuna*. The skills are imparted to some of the rural dwellers. A thriving industry is established in which *memuna* is used to make charcoal and for direct use as woodfuel. Residues from harvesting *memuna* are found to contain wood alcohol which is then used in industrial applications.

Entrepreneurs in the communities form cooperatives to export *memuna* to markets in Europe, earning a lot of foreign exchange. The communities set up artisan shops to sell crafts made from *memuna*. Furthermore, small-scale biomass-fired power stations are established, using *memuna* as the feedstock. These power stations provide heat and power to the communities. Environmental degradation resulting from unbridled harvesting of trees is reduced to the barest minimum due to the planting of *memuna* on marginal farms and its use as an energy carrier. The creation of jobs helps to alleviate poverty and extreme hunger – a contribution towards achieving the MDGs.

The United Nations Environment Programme (UNEP) bestows a prestigious award on NEPAD for instigating the research leading to the discovery of the drought-resistant *memuna*, with its manifold but important uses on the African continent. More importantly, the award recognizes use of marginal lands that would otherwise have been left fallow for the cultivation of *memuna*.

appropriate technologies on renewable energy systems and improvement in energy efficiency of goods and services. Additionally, operating obsolete and inefficient energy systems attracts surcharges.

Improvement in sustainable energy supply leads to significant reduction in transboundary pollution, improving health. There is continued commitment to promoting and developing new and renewable sources of energy. Globally, there are reports of energy shortages. Corporate Africa, concerned with the impact of energy shortages on their businesses, invests in new and renewable sources of energy. Furthermore, corporate Africa begins to use eco-friendly cars and patronize companies producing and marketing bio-fuels. The assembly of eco-friendly cars increases to meet the rising demand. The proactive harmonization of energy policies and legislation across African countries lead to cross-border energy trade, providing the best opportunity for sharing the region's energy resources. This is noteworthy, considering the uneven endowment of energy resources across Africa.

Policy lessons for the *Great Transitions* scenario include encouraging and mobilizing public-private-partnerships to uplift and empower poor people, creating an enabling environment to facilitate the development of sub-regional energy pools, integrating economies and promoting trade in energy, attracting private-sector investments in the energy and transport supply, and involving poor people in the decision-making process.

Policy lessons from the scenarios

Given the multiple impacts of unsustainable energy use at different spatial levels (local, national, regional and global) and for different sectors (industry, human settlements, health, agriculture biodiversity, especially forests, and climate) within in various time frames, this must become a key policy focus. The scenarios offer multiple lessons for addressing the energy issues.

As the impacts of unsustainable energy use are not restricted to the country where such practices occur but are felt globally, this is an area where transboundary cooperation is essential. Without successful global cooperation the measures adopted in one country are unlikely to have a significant impact. Africa needs to focus on the opportunities for such global cooperation, while at the same time taking action at the regional, sub-regional and national levels. In all scenarios economic growth is a priority; however, the form of this growth will have important implications for atmospheric integrity. Adopting policies which promote the adoption of cleaner technologies is an important aspect of this. The scenarios offer various opportunities for this, including the use of market mechanisms, increased investment in R & D, and increasing engagement with the public.

COASTAL AND MARINE ENVIRONMENTS

Coastal and marine environments are important to the overall development of Africa in general and to some countries in particular. Chapter 5: *Coastal and Marine Environments* considers the opportunities and challenges these resources offer for development. The condition of coastal and marine resources is an indicator of overall environmental health. As the interface between the land and the ocean, it will always be prone to interferences from man and nature, the sources of the main driving forces and pressures affecting the coastal environment. Coastal and marine resources have a marked potential for tourism, biodiversity conservation, energy generation through tidal waves, oil and gas. These resources are threatened by coastal erosion, sea-level rise, destruction of coral reefs with the accompanying loss of coastal and marine biodiversity, solid waste management, pollution, salt intrusion in low-lying areas, and uncontrolled urbanization. The scenarios presented here look at the interplay between various drivers and how they influence the state of coastal and marine resources and the storylines offer options for policy packages that address these issues and threats in the region.

The condition of coastal and marine resources is an indicator of overall environmental health.

Market Forces scenario

In this scenario, the current trend of migration to the coast (UNEP 2004c) is likely to continue, and therefore coastal areas will continue to be areas for economic production. Coastal areas by their very nature are centres for commerce and trade. As economic centres, and because of the rich mosaic of environmental goods, coastal areas attract more and more people seeking to take advantage of those opportunities. Increasing concentrations of people live within 100 km of the coast. They migrate to these areas not only to exploit the available coastal and marine resources but also to explore the increasing opportunities for economic development being concentrated along the coastal areas. Coastal areas offer employment opportunities,

economic prosperity, new industries, improved regional infrastructure, enhanced educational opportunities and increased tax revenues. However, as coastal populations grow, so does the stress placed on the environment. A major assumption of this pattern of development is that an economic base is developed from which funds can be provided to ameliorate the impacts of growth.

As a result of this growing population, there is likely to be increasing demand for both marine and land-based resources. Demands for energy and natural resources promote offshore exploration, drilling and mining. These activities impact on marine habitats and water quality through physical disturbances, introduction of pollutants and suspension of sediments in the water.

The growing populations result in the conversion of open land and forest for activities such as commercial development, agriculture, forestry and other activities that provide economic growth. In addition to physically altering the habitat, coastal development reduces permeable surface area, thereby increasing the rate of run-off and impacting on water quality by transporting sediments, toxic chemicals, pesticides, herbicides, pathogens, nutrients and other pollutants to local waterways. With the loss of biodiversity, and other damage to the ecosystem, the self-cleansing properties of water will be reduced (MA 2006).

Fewer and fewer original coastal people have direct access to the resources that these coastal environments provide, as tourist establishments "privatize" the coast.

The demand for water, especially for agricultural, industrial and urban domestic uses, increases. In an attempt to meet these demands, more dams are built and more groundwater is extracted, and this affects coastal environments such as wetlands and mangrove forests. In the *Market Forces* scenario, attempts to correct these imbalances are made through the introduction of new water pricing systems. These are used to recoup the costs of supply and establish a mechanism for the economically efficient allocation of a limited resource. It is also plausible that as water is more highly valued, water recycling will be encouraged. To complement these market tools, regulations to control pollution of water bodies by agricultural, industrial and domestic effluents are introduced. As urbanization and inland activities increase, so do the volumes of municipal and industrial waste discharged into local waterways. This impairs water quality, while at the same time demands for potable water and wastewater treatment increase. Whether from run-off or discharges, excessive nutrients, sediments, pathogens and toxic chemicals can impair water quality which in turn results in the reduction or loss of fishing opportunities, changes in wildlife populations, a reduction in the value of wetlands and estuaries, decreases in wetlands available for water treatment and decreased protection from storms. The problem of waste and litter further exacerbates the situation. The impacts of pollution worsen through eutrophication of coastal waters and the intensification of hypoxia and anoxia.

In bustling centres of development, both fisheries and tourism grow and these place severe pressure on coastal areas. Important impacts on the environment include the degradation or loss of coral reefs, mangroves and coastal flats. Fewer and fewer original coastal people have direct access to the resources that these coastal environments provide, as tourist establishments "privatize" the coast. Coastal erosion is also often related to patterns of human settlement. However, if properly managed, tourism can create incentives and generate the money needed for managing these coastal and marine resources. The need for careful management of these resources emerges as a concern but it will not necessarily be attended to. In other areas, where careful coastal zone planning is implemented and maintained, the high environmental qualities of these ecosystems are maintained and sustainable benefits accrue.

Increasing demands for shellfish and commercial fish spur competition and technology improvements to increase fishing capabilities. Overexploitation, in concert with impacts from pollution, habitat degradation, habitat modifications such as dams, and by-catch waste, results in a depletion of fish stocks, placing some ecosystems on a path towards unsustainability, and threatening the viability of the fishing industry. The deliberate introduction of IAS to promote economic interests results in unexpected ecological impacts to the coastal and marine environments, with longer-term socioeconomic impacts. Predation and competition by these non-indigenous species results in the eradication of some native populations and the drastic reduction of others. The colonization of ecosystems by IAS results in the degradation and loss of wetland vegetation and other submerged aquatic vegetation. When these problems arise, the market sets in motion mechanisms for their correction.

The operation of the *Market Forces* scenario leads to major modifications of the coastal and marine environment through, among other things, development of dams, flood control channels, dredging, water

diversions and development in wetlands. These modifications have profound impacts on coastal and marine habitats, changing the natural flow, timing and volume of freshwater inflow and sediment depositional patterns in bays and estuaries. Alteration of flow impacts on marine systems by transporting pollutants and resuspending sediments and toxic chemicals and consequently increases the potential for concentration of toxins in marine organisms, and in people.

Policy Reform scenario

In this scenario, coastal areas will remain important centres of human activity. Massive tourist enterprises interspersed with coastal and marine industries are evident along the coast. Policymakers faced with the degradation of coastal and marine environments, including the loss of coastal flats and sand-dune degradation, focus on reclamation of intertidal and sub-tidal mudflats and sandbanks and damage to coral reefs. The increased use of coastal resources for tourism and recreation alongside human dependence on the coastal and marine zone for development, trade and food will be sufficiently high to make ICZM a priority. The goal of ICZM is to "attain sustainable development of coastal and marine areas, to reduce vulnerability of coastal areas and their inhabitants to natural hazards, and to maintain essential ecological processes, life-support systems and biological diversity in coastal and marine areas" (Cicin-Sain and Belfiore 2003). It is "multipurpose-oriented; it analyses implications of development, conflicting uses, and interrelationships among physical processes and human activities, and it promotes linkages and harmonization between sectoral coastal and ocean activities" (Cicin-Sain and Knecht 1998).

The coastal and marine areas, especially those of the WIO islands, are prone to natural disasters such as tropical cyclones and tsunamis. These disasters will continue to occupy a focal point not only for discussion but also for the institution of mechanisms for their prevention. While many of these disasters may not be averted, their effects can be reduced considerably through the institution of early warning systems. In the *Policy Reform* scenario formalized early warning systems will be instituted and many of these will be based on inter-state cooperation.

There is a cautious approach to creating new policies, and attempts are made to harmonize existing initiatives. There are concerted efforts to revitalize existing MEAs and establish systems to promote the realization of agreed objectives. At the same time countries develop more forceful policies and will put in place mechanisms for realizing the goals of government policy. The *Policy Reform* scenario integrates environmental objectives into economic development plans at different levels. Institutions are empowered to effectively enforce and monitor the implementation of environmental laws, sub-regional and regional protocols, as well as MEAs. Sub-regional organizations undertake environmental audits of their member states to determine whether or not they are implementing their own set environmental policies. This is incorporated in the APRM. Assessing progress towards achieving the MDGs takes into account environmental, social and economic interests. Efforts are made to take into account gender dimensions in articulating policy reform at different levels and, pursuant to this, an African gender and development index is introduced in all 53 African countries.

At the national level, policies and activities are adopted to address the plethora of problems, but these will have varying levels of success:

- Policies to help people to adapt to the potential marine inundation of low-lying areas from sea-level rise are adopted.
- Policies and action for reducing marine pollution include developing infrastructure for treating wastewater before it is disposed of in the sea are introduced.
- Laws and regulations are issued or revised in order to protect the coastal areas and water bodies from unplanned development and the associated environmental impacts. Environmental impact assessments (EIAs) are routinely carried out for projects with potential impact on the coastal and marine resources. Field inspection by specialized government agencies ensure that these projects follow the mitigation measures proposed in their EIAs. New coastal areas and inland water bodies will be protected by means of laws and good policies for the management of coastal areas.
- Pollution and waste management laws to reverse the current tend of dumping solid wastes on beaches and in the sea are adopted. International conventions against the dumping of hazardous wastes are respected.
- Appropriate laws for the control of erosion become instituted to reduce overall levels of loss of coastline from development, including the ever-expanding tourism sector.
- Re-establishing inshore fishing proves more protracted than envisaged due to continual infringement of close season rules and the use of fine nets for coastal fishing in small boats.

- Deep-sea protection arrangements prove satisfactory but the region is slow to respond to the opportunities, with continual haggling over the internal division of the territory and the sharing of protection and development costs.

Fortress World scenario

In this scenario, urbanization and migration to coastal areas will increase, placing new demands on coastal and marine resources for food. Tourism grows, as the elite aggressively markets coastal areas for tourism through multinational companies. Increasing tourism opportunities, particularly in the ecotourism sector, contribute to better management of environments, such as forests and wetlands, that are integral to tourism. However, as a result of increasing population and tourism, there is overfishing and fish stocks are depleted.

Growing human settlements generate new sources of pollution and waste. Coastal and marine pollution increases, as investment in public sector services, including the treatment of sewage, declines. Valuable coral reefs and mangrove forests become increasingly vulnerable and threatened as a result of poor environmental management, development and tourism. Despite the existence of laws controlling the exploitation of coastal resources (mangrove swamps, fishing), development activities continue and contribute to increasing coastal erosion.

Coastal and marine pollution increases, as investment in public sector services, including the treatment of sewage, declines.

Infrastructural and service development is concentrated in the tourism sector and inadequate attention is given to non-elite settlements. The rate of infrastructure development is much slower than the rate of population increase, leading to growing incidence of slums and pollution. People in the fortresses take some care to minimize or mitigate the magnitude of the adverse environmental impacts on new tourism developments. However, to support the construction industry, the elite overexploit the soil along the coasts, contributing to coastal erosion and damaging coastal ecosystems. Many rare marine species are threatened or become extinct. The current practice of groundwater abstraction increases, which in turn increases the incidence of seawater intrusion, which renders many wells unusable.

Coastal and marine areas are seriously affected by military operations, piracy and overfishing using fine nets, dynamite and seabed trawling. Oil pollution from major tanker spills and accidents at deep-water oil wells have scarred coastlines and caused irretrievable damage to marine stocks. These trends continue.

Great Transitions scenario

In this scenario African countries recognize the importance of their coastal and marine environments, not only for their intrinsic value but as valuable resources capable of transforming lives and economies. Consequently, there is general agreement that these environments must be well protected and managed.

Regional organizations increasingly come to view the problems of coastal and marine environments as those of both landlocked countries and coastal counties. Organizations for managing shared waters are formed and work actively to identify the full suite of challenges faced in coastal areas throughout Africa. They also identify and reach consensus on practical steps necessary for cooperative management of coastal and marine resources. This positive development leads to the formulation of laws about resource conservation and utilization along coastal areas. The links between freshwater and coastal systems are acknowledged, and there is increasing cooperation with catchment management authorities around issues of discharge of water, and pollution from sediments and nutrients. Collective responsibility for pollution and waste management becomes the basis for action. These developments lead to decreases in the overall pollution of coastal and marine environments and to an increase in the breeding of fish and the growth of the fishing industry. Furthermore, the harbours become more environmentally friendly.

The formation of international cooperation initiatives also improves relations between adjacent states with contiguous coastal lands. For instance, coastal lands in Western Africa are treated as one long continuous zone requiring integrated planning and development. The current trend of creating transboundary natural resource management areas, such as the Benguela Current Large Marine Ecosystem (BCLME) established by Angola, Namibia and South Africa in 1999, continues and new joint-management areas and marine parks are established.

There is the realization in all coastal countries that these environments are clearly under serious stress and in need of an integrated and effective planning and management regime. Consequently, ICZM has gained growing acceptance as the logical approach to facilitate vertical and horizontal integration within governments

and ensure multi-stakeholder involvement in developing solutions. Therefore, as an aspect of the management of coastal and marine areas, planners work with coastal communities, state coastal zone managers, NGOs and other stakeholders. Effective integrated management leads to sustainable use and management of coastal and marine resources. Under the *Great Transitions* scenario, coastal and marine zone management involves:

- Strengthening inter-sectoral management through improving training, legislation and staffing;
- Preserving the biological diversity of coastal ecosystems by preventing habitat destruction, pollution and overexploitation;
- Promoting the rational development and sustainable use of coastal resources;
- Prohibiting or controlling developments in sensitive areas along the coasts;
- Prohibiting the direct disposal of all types of waste, including chemical and toxic wastes, into the sea;
- Refusing licences for projects that affect sedimentation or erosion of shorelines; and
- Issuing guidelines to boats, divers and fishers regarding safe practices in territorial waters and protection of marine life.

Policy lessons from the scenarios

Coastal and marine environments are particularly sensitive. They face increasing pressure and threats from development and economic activities. These areas also have a high level of vulnerability to climate change and sea-level rise, and natural phenomenon and disasters. Consequently, coastal and marine areas require a high level of care.

The scenarios presented here have shown how coastal and marine areas will fare under the assumptions of the *Market Forces*, *Policy Reform*, *Fortress World* and *Great Transitions* scenarios. It is clear that to promote sustainable development in these environments, the "business as usual" approach of the *Market Forces* scenario is not feasible. Responses under the *Fortress World* scenario exacerbate stress rather than mitigate it. The choice for Africa is to be guided in its developmental efforts by either the *Policy Reform* or the *Great Transitions* scenarios.

The *Policy Reform* scenario has its attractive qualities for development in general and coastal and marine areas development in particular. First, it adopts an incremental approach to planning and decision making. It will usually involve the periodic setting of objectives and goals on aspects of the environment, and then putting in place mechanisms for attaining these goals. For much of the history of African development, this has been the approach taken. The fact that environmental problems, especially along the coasts, have neither been eradicated nor seen to be decreasing at acceptable rates is an indication that a *Policy Reform* scenario for coastal and marine area management is inadequate. The *Great Transitions* scenario seems to offer better opportunities for development that is consistent with Africa's aspiration. The challenge is how to translate the charts of the *Great Transitions* to viable policies for the development of the coastal and marine areas.

The adoption of the Great Transitions scenario implies the acceptance of the need to define a sustainable future on the one hand and to institute the mechanisms for attaining this future on the other.

The adoption of the *Great Transitions* scenario for coastal and marine environments implies the acceptance of the need to define a sustainable future on the one hand and to institute the mechanisms for attaining this future on the other. This requires major shifts in current practice. Very few coastal countries in Africa have embarked on ICZM, and the practice in many countries is to concentrate on exploiting coastal resources such as petroleum and fishing. The implementation of MEAs remains a challenge. Nevertheless, there are some promising trends including the adoption of the NEPAD-EAP and the MDG 7. We can expect such a move to achieve some or all of the following objectives necessary for sustainable coastal and marine development:

- Integrate environmental issues into national development frameworks, especially in respect of poverty reduction efforts, including those of the MDG targets.
- Strengthen the decentralization of the management of coastal and marine areas and the role of civil society.
- Reduce environment-related conflicts between estate developers, civil society, industry and tourism.
- Enhance access to environmentally-sound and appropriate technology.
- Strengthen resource rights along the coasts and marine areas to reduce the vulnerability of poor people.

The doors we open and close are our choice.

Source: J.C. Mohamed-Katerere

SUB-REGIONAL SCENARIOS

EASTERN AFRICA

Energy and high levels of dependency on biomass in Eastern Africa present special challenges for human well-being and development.

Sustainable energy is about using energy wisely. This includes increasing use of energy produced by clean technologies or from renewable sources. Renewable energy sources (RES) include all sources of energy that are captured from natural processes, including water, solar, wind, geothermal and biomass. Some of these alternative energy sources are discussed more fully in Chapter 2: *Atmosphere* and Chapter 4: *Freshwater*. The scenario analysis reveals the different trends and opportunities associated with different policy choices.

Market Forces scenario

In this scenario, the sub-region focuses on the modernization of the industrial sector and greater integration into the regional and global economy. This is complemented by international commitments to investing in the transfer and development of sustainable energy technologies in order to improve the quality of life in developing countries, as agreed to at WSSD in 2002. Achieving this requires the commercialization of renewable energy technologies through innovative financing mechanisms, targeted subsidies and financing to reach the grassroots. Privatization is a key aspect of this. There is increased support to small and medium enterprises (SMEs) to help them become involved in the provision of rural energy and the maintenance of equipment. This improves levels of efficiency in the energy sector, and has the added benefit of freeing government funds, which can now be invested in the provision of social services.

There is increased support to small and medium enterprises to help them get involved in the provision of rural energy and the maintenance of equipment.

Policy implementation and reform is driven by the desire for economic growth. Agricultural modernization policies result in increasing agricultural commercialization and export-orientated production. This results in increased demand for energy to support production. Rural energy services adequately support improved productivity and reduce post-harvest losses through better preservation. There is marked expansion in the processing and export of commodities such as coffee, fish and cut flowers. The requirements set out by EIAs and environmental audits are enforced but only so as to avoid costly mistakes, such as in the Hola irrigation scheme along Tana River in Kenya that collapsed in 1989 due to a change in the course of the river (Blank and others 2002).

Land reform seeks to empower women and strengthen women's land rights, so as to make them

more effective producers. Improved land rights will be helpful for women seeking small loans or other support, and this may help increase investments in agriculture and thus productivity. Increased support to agricultural extension services, including powered irrigation and water supply, results in improved food production and this has positive implications for household nutrition and food security at the national level.

Improved regional cooperation leads to an improvement in the overall security situation in the sub-region. This along with the economic boom results in increased tourism. It is hoped that this may help reduce the conflict between communities and wildlife, for example in Il Ngwesi and the Trans Mara area in Kenya where they have been experimenting with a range of community and private enterprises. Chapter 3: *Land* discusses these tensions.

Industry and service sectors grow and opportunities for employment are rife. In order to reduce costs and profit losses due to climate-induced power shortages, energy-intensive industries like sugar and cement manufacturing increasingly employ strategies for co-generation of electricity using by-products of the agro-processing industry like bagasse, ethanol and coffee husks. Increasingly, China is looked to for lessons in mitigating climate extremes and achieving remarkable economic growth, based on its successes over the last decade.

Policy Reform scenario

Ensuring the availability of energy for development and improving the capacity for adaptation to climate change and variability are key focuses in this scenario.

Energy strategies to improve the opportunities available to poor people are incorporated into the national development frameworks. In particular, almost all the national Poverty Reduction Strategies explicitly state that improved energy services are required to achieve their poverty reduction goals. In one country, a target to increase access to energy by 10 per cent by 2012 is set. Although the government is committed to a programme of gradual substitution of woodfuel (which constitutes 96 per cent of domestic energy supply) by rural electrification, the associated costs mean that this process will be slow. The national target is not met. Given the continued dependence on biomass, deforestation increases and water catchment areas are degraded. This also impacts on the availability of water and thus the achievement of development targets to increase access to safe water. The water table recedes further, and, consequently, harnessing groundwater requires deep drilling, which in turn has cost implications for using groundwater. It is predicted that the target of reducing by half the number of people without access to safe water will only be met by 2025.

Governments invest in the development of large dams and reservoirs on the various river bodies to provide energy to the growing urban centres. This helps support increased economic activity and a middle class that can afford electricity begins to emerge. This has positive impacts for the environment as pressure on forests for charcoal for urban areas is reduced.

Energy strategies to improve the opportunities available to poor people are incorporated into the national development frameworks.

With climate change models indicating that lead time to GHG stabilization is at least 50 years, the governments of the sub-region realize that adaptation is just as important as mitigation. And although the sub-region is not a major contributor to the causes of climate change, the issue of implementation of the CDM takes centre stage. Countries of the sub-region prepare to cooperate with industrialized countries in order to enable them to comply with the emissions reductions requirement of the Kyoto Protocol. The planned adaptation projects are "climate-friendly" and designed to reduce the vulnerability to climate change by increasing the opportunities currently available. Collaborative rural electrification programmes are developed to increase access in rural areas to energy supplies through grid extension, independent power producers and solar or renewable energy. The emphasis is on small-scale projects in the renewable energy sector, such as solar photovoltaic (PV) systems. These are installed in rural areas, and distributed to ensure energy supply for clinics and hospitals, water pumps, schools, communications and domestic lighting purposes. In one country, the distribution of energy-efficient stoves gradually replaces the traditional stoves.

Fortress World scenario

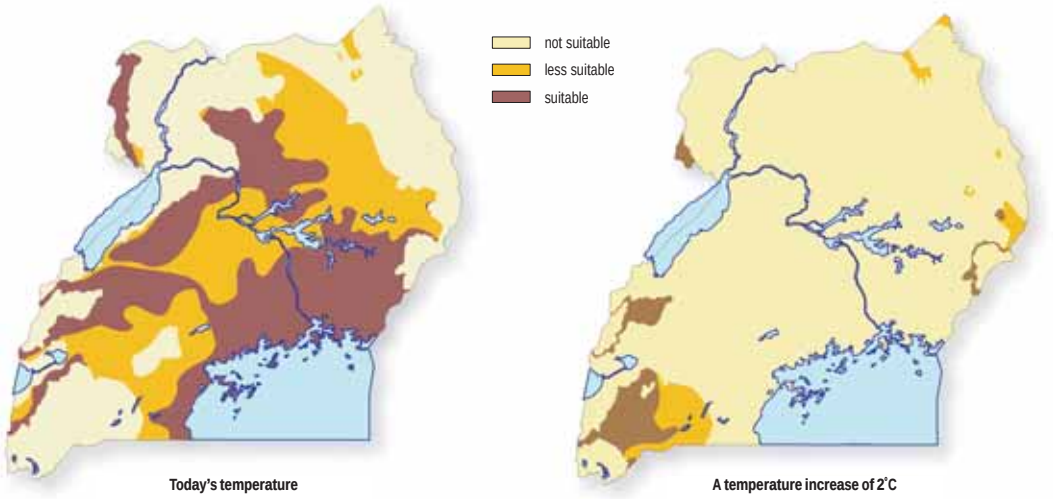
The ever-growing population will increase pressure on the environment, and many of these changes will have multiple effects on development and livelihood opportunities. Land resources will be particularly hard-hit. For example, there will be negative impacts on soils including increased loss through erosion, decreasing soil fertility and poor moisture retention. The changing soil quality further destabilizes the equilibrium of the

Box 6: Imagine an increase in temperature in the sub-region...

Current temperatures and rainfall permit growing of coffee in most parts of Uganda. Over the next decade the country experiences an increase of 2º C. This has a significant impact on the coffee-growing areas and on the whole economy. Ethiopia is the most important centre of genetic diversity for Arabica coffee, sorghum, finger millet, perennial cotton, castor bean, sesame and other crops (UNEP 2002a).

In the absence of appropriate technologies to mitigate the effects of climate variability, investments are made in biotechnology. Coffee varieties that are able to withstand increasing temperatures and reductions in rain are developed and grown. This biotechnology is also extended to other plantation crops grown in the sub-region like tea and sugar cane.

Global warming could shrink Uganda's coffee growing areas



Source: UNEP/DEWA/GRID 2005. Based on Simonett 1989

natural hydrological cycle. In an attempt to curb the impending population explosion, strict population control policies are enforced.

Policies in the water, land and forestry sectors are reviewed in a bid to address the impacts of climate variability, but are not wide-reaching and focus primarily on the needs of the elite. Land reform policies, meant to improve tenure through individual ownership and thus encourage people to manage their land responsibly, result in poor landholders being bought out by the rich. Increasingly, poor people are squeezed into fragile and marginal lands. In the many mountainous areas in the sub-region this leads to mudslides, increased soil erosion, and increased flood run-off. This decline in environmental quality leads to a decline in overall quality of life.

The majority of the population cannot afford to invest in technologies that support the more efficient use of energy and therefore biomass resources are increasingly depleted.

Indigenous people are pushed off their traditional grazing lands. Conflicts over freshwater resources increase as the landowners fence off their land, including the water sources on them which traditionally acted as dry-season watering holes for migratory and pastoral peoples, undermining their established coping strategies. Given the increasing pressures on and conflicts over land, water and forest resources, strict measures are adopted to protect the remaining resources. These are based on exclusion, and command-and-control strategies. However, this exclusion exacerbates the situation.

In another country, the charcoal trade continues to be a source of finance for local warlords and factions, despite the fact that export is banned. The politically unstable situation makes the enforcement of regulations difficult. This trade fuels more conflict, because militias can spend the profits on arms and a vicious cycle sets in. These patterns have been evident in some countries in the sub-region, such as Somalia, where port towns like

Kismayu are fought over by rival groups keen to control the charcoal trade (UNEP 2005). Negative impacts of deforestation are seen along coastal areas which are now affected by creeping desertification. At this rate, land degradation, loss of biodiversity and the degradation of freshwater, coastal and marine resources are likely to continue beyond 2015.

Due to poverty, the majority of the population cannot afford to invest in technologies that support the more efficient use of energy and therefore biomass resources are increasingly depleted. As a result of deforestation, there is increased sediment in rivers and consequently there is a silting up of dams. This affects reservoir capacity and undermines the generation of hydropower energy. Biomass resources such as animal waste, which have traditionally been used to enhance soil fertility, are not ploughed back into the land since they are being utilized as sources of energy. The impacts of climate variability, declining crop yields, the spread of diseases and pests and reduced economic potential threaten food production and security, human health, economic growth, lives, livelihoods and infrastructure.

In this context, power rationing is adopted, further threatening already dwindling economies. This trend is expected to continue. In nearly all countries, the manufacturing sector has been growing at a rate of 10 per cent annually; however, this growth is now under threat from the declining energy situation. In this scenario the cost of energy is about 45 per cent of the total cost of production. The sub-region may therefore experience declining levels of FDI.

Some countries in the sub-region decide to focus on large-scale electrification policies based on the development of hydropower. This hydropower development results in the displacement of riparian communities and has negative impacts on dry-season availability of water.

Great Transitions scenario

In this scenario there is an increasing focus on good governance and this results in significant political developments. Inclusive democracy within the sub-region means that there is an independent judiciary, an open civil society and a free media as well as a broad commitment and respect for human rights, sustainable development and transparency in government. Development assistance recognizes that "one size does not fit all" and that development initiatives must be tailored to the needs of specific groups, and their interests and priorities need to be specifically taken into account. Also, an increased emphasis is placed on broad participation in defining solutions. Therefore, poor people are included in policy processes designed to meet their energy needs and provide long-term solutions. Governments become more interested in the well-being of their people, ensuring among other things that affordable energy services are made more accessible.

To forestall the looming energy crisis, the power sectors in the different countries are integrated to more effectively share the available energy resources in the sub-region. A protocol is adopted under which a master plan for the sub-region is developed. Cooperation with other sub-regions is also promoted.

The power sectors in the different countries are integrated to more effectively share the available energy resources in the sub-region.

Bilateral trade and aid policies in the energy sector, which currently focus on fossil fuel technologies, are reoriented towards sustainable energy and seek to encourage investment in the renewable energy sector. Although industrialized countries are at the forefront of this sector, governments address the need to support the development of local technical skills and knowledge. The private sector – particularly in the technology and banking sectors – is encouraged to form partnerships with SMEs for the supply of energy services which are accessible to and appropriate for poor people. For example, increased access to and availability of energy increases ICT usage at schools, opening up additional educational opportunities like distance learning. Empowered by their raised literacy levels, women are able to use reliable energy to improve scope for their enterprises, creating opportunities for employment and income generation.

There is increased investment in more efficient biomass energy technologies. This has a number of positive impacts. It reduces the share of household income spent on cooking, lighting and keeping warm. Additionally, it reduces the time women and children spend on collecting wood, leading to an increase in the number of girls attending school (WRI and others 2005). It also has some positive health impacts, including the reduction of indoor pollution (Gordon and others 2004). Previously, the heavy loads of fuelwood carried by women and children affected their health. There are environmental benefits too: as pressures on forests start to decrease, catchment areas are preserved and this contributes to better quality of water. Improved grazing areas and availability of water

leads to reducing conflict between pastoralists, and between migratory peoples and permanent settlements.

Encouraged by their shareholders, multinationals, such as the cement industry, undertake restoration activities, including site restoration, for example through tree planting or conversion of non-productive mines into nature reserves. These attract large numbers of tourists and contribute to the livelihoods of communities in their immediate environment through the provision of jobs, while also supporting the learning objectives of schools. Waste products like bagasse and coffee husks are also used in the generation of electricity.

Existing monitoring programmes, for example the IGAD Climate Prediction and Applications Centre (ICPAC) (formerly the Drought Monitoring Centre – Nairobi) in Kenya, continue to be expanded and the development of sub-regional databases for early warning purposes is supported. At national level, disaster preparedness improves. Past experiences become an important factor in shaping policy responses. For example, experiences around drought and changing rainfall patterns become the basis for new early warning system. Programmes that promote the integrated management of transboundary resources, such as the Nile Basin Initiative (NBI), take on renewed importance.

Box 7: Possible policy messages

Market Forces

- Develop grassroots financing mechanisms.
- Target trade and aid support to sustainable energy options for poor people.
- Diversification of the economy.

Policy Reform

- Ensure energy is incorporated into poverty reduction strategies.

Fortress World

- Policy reform processes should be more inclusive and allow for equitable access, control and use of the resources.
- Conflict avoidance, resolution and management methodologies should be actively employed as part of environmental governance.

Great Transitions

- Encourage private sector and other partnerships to target the poor.
- Create an enabling environment that will facilitate the development of regional energy. pools, cross-border trade in energy and attract private sector investors in the energy supply industry.
- Give a voice to poor people.

Policy messages from the scenarios

Policy messages of the four scenarios are presented in Box 7. From each of these scenarios, positive lessons for policy choices can be identified.

CENTRAL AFRICA

Forest and woodland resources in Central Africa are an important environmental resource that can play a central role in economic development. Owing to its vastness, the protection of this resource is not only significant to the countries within the sub-region, but also to the rest of Africa and the world (WWF 2005). Central African forests and woodlands play a crucial role in carbon sequestration. The full costs of deforestation for the sub-region are not completely understood. Deforestation has multiple negative impacts: it threatens biodiversity, water and energy resources, and contributes to trace-gas emissions. It may contribute to changes in ecosystem function including biogeochemical cycles and climate patterns through altering local rainfall and hydrological processes, and desertification. The degradation of vegetation cover has caused some parts of Central African countries that were previously under forest to change to savannah grasslands and degraded savannah (WCMC 1992). It will also have direct economic costs including the loss of future wood for forest industry and loss of biological diversity. The current and future state of the Congo basin forest reserves will reflect the overall environmental health in the sub-region, and will affect the development opportunities available.

This resource, however, is under threat from a variety of socioeconomic factors. Deforestation in the sub-region is closely tied to demographic conditions; the highest levels of deforestation have occurred in countries with higher population growth rates and higher population densities (FAO 2005b). Human settlement and economic activities result in infrastructural development (roads), increased agriculture, bush fires, overharvesting of timber and NTFPs; all these activities impact on environmental change. Chapter 6: *Forests and Woodlands* presents an overview of how forest cover is changing in Central Africa, and the most important drivers of this change. As discussed in Chapter 12: *Environment for Peace and Regional Cooperation*, conflict and poor governance have exacerbated environmental change, and improved cooperation offers important opportunities for environmental sustainability and expanding the range of available opportunities.

Since AEO-1, there have been several conservation-focused initiatives that have significantly contributed to forging a new vision within the Congo basin on

development and implementation of transboundary conservation programmes. Some of these initiatives give snapshots of scenarios presented at the time. The main milestones have been:

- A strategic plan called the "*Plan de Convergence*" for the implementation of the Yaoundé Declaration was finalized and endorsed by the Central Africa Forests Commission (COMIFAC). This involved the compilation of the different action plans identified by the member states. Priority activities were later identified from the *Plan de Convergence*.
- Sustainable financing of conservation work has become a priority for Central African governments and partners.
- The Congo Basin Forest Partnership (CBFP) was launched to help conserve 29 protected areas, and promote sustainable forestry and community-based conservation in 11 priority landscapes spanning the Congo basin. Figure 14 shows areas of conservation importance.

The following scenario exercises help make an assessment of how future trends may be affected by policy choices.

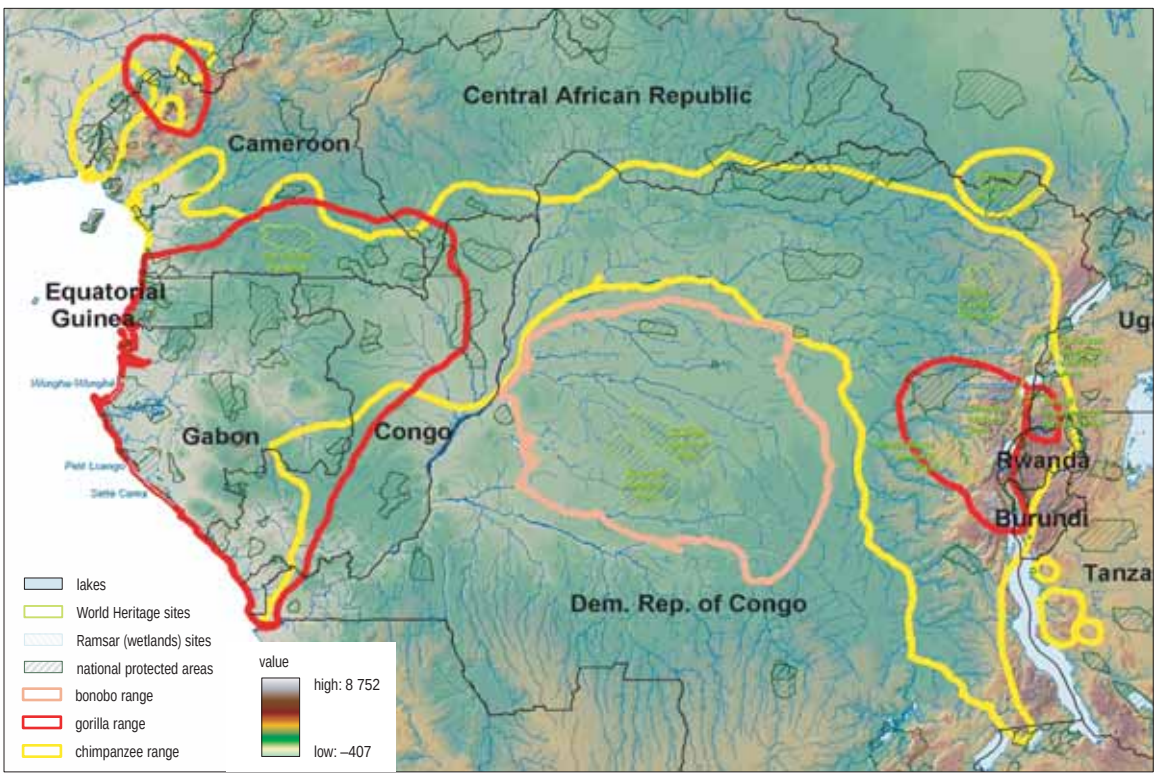
Market Forces scenario

In this scenario, the existing trend of deforestation and degradation of forest areas continues, as a result of both the need for more land for human settlement and agriculture, and the drive to exploit forest resources (mainly timber) to boost economic development, particularly export earnings.

The rate of deforestation and land conversion, however, slows down, due to forestation initiatives and the gradual implementation of existing MEAs to use forests in a sustainable manner. Increased investment in the tourism sector, and in particular in ecotourism, provides additional incentives to conserve forests, though this is offset to some extent by the increase in land pressures. In order to secure the future of forested areas, as well as to spread the benefits of their conservation more widely, communities living in the forests and surrounding areas are encouraged to take part in their management, sustained use and conservation. This, too, contributes to slowing down the rate of deforestation. The world market demands for medicinal plants and other NTFPs increase and this too

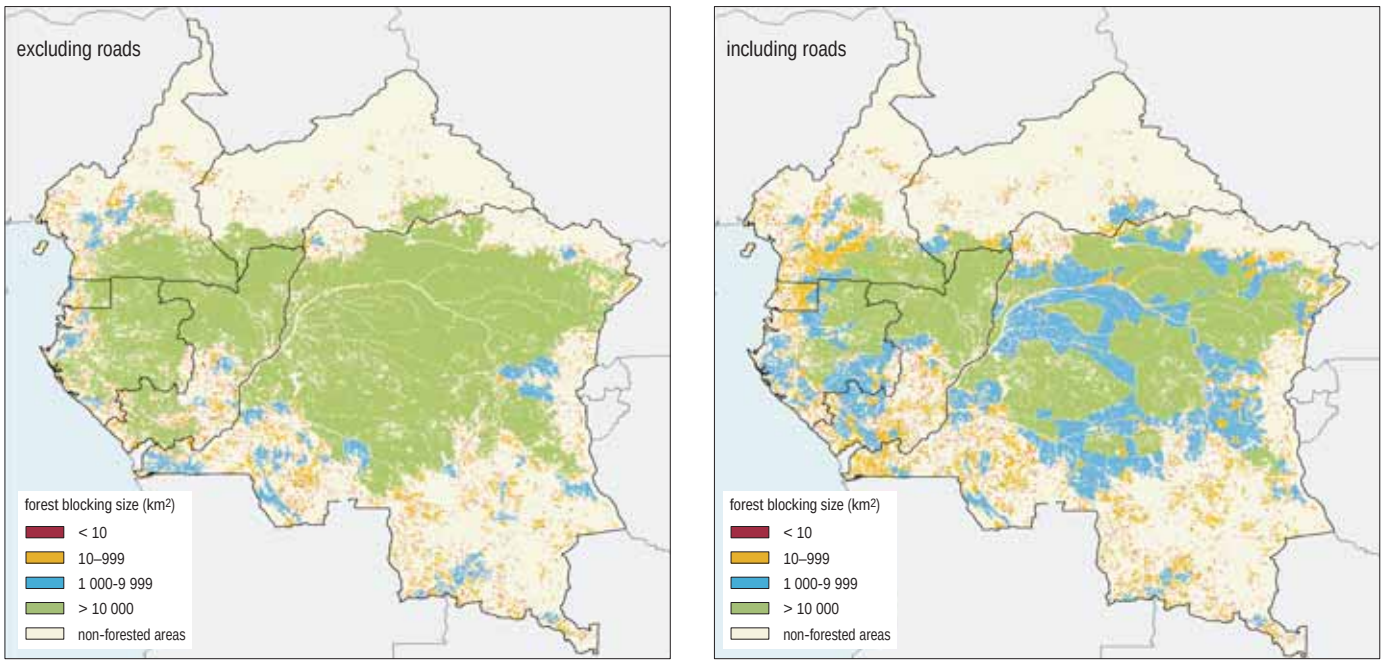
The expansion of physical infrastructure is an important aspect of this, and it has the added benefit of bringing new opportunities to forest dwellers. However, road development also leads to fragmentation of forest.

Figure 14: Priority areas for conservation



Source: UNEP/DEWA/GRID 2001; Data sources: Great apes ranges: Instituto Ecologia Applicata (IEA) Rome 1998, African Mammals Databank (AMD) for the Directorate-General for Development (DGVIII/A/1) of the European Commission. Project No, B7-6200/94-15/VIII/ENV; Ramsar sites, World Heritage sites and national protected areas: UNEP-WCMC; Digital Elevation Model of the Land: Environmental Systems Research Institute (ESRI) Base maps (country boundaries, lakes and rivers): Digital Chart of the World. Projection: Geographic

Figure 15: Fragmentation of forests by infrastructure such as roads



Source: WRI 2005

serves as a conservation incentive. The emergence of global carbon markets encourages Central African countries to protect forest resources and to make economic benefits from these resources.

However, in order to seize the opportunities in these new sectors (including tourism, pharmaceuticals and NTFPs) and increase profits, a new level of investment in forest areas is required. The expansion of physical infrastructure is an important aspect of this, and it has the added benefit of bringing new opportunities to forest dwellers. However, road development also leads to fragmentation of forest (see Figure 15). Trade liberalization, with appropriate technologies, improves the quality of logging. The industrial and artisan exploitation of wood increases the pressure on forest resources. The strategies to protect the forest, and ensure rational management of forest resources, are difficult to apply, in spite of the number of conventions and initiatives developed to this effect.

Policy Reform scenario

In the *Policy Reform* scenario, dependence on biomass, the traditional fuel in Central Africa which supplied 60 per cent of all energy requirements at the end of the 20th century (WRI and others 1994), is reduced, because people have more energy choices. Public and private power utilities compete to provide electricity to both urban and rural areas, making such services more reliable. The result is that the rate of deforestation due to fuelwood demand and charcoal production is reduced considerably.

Policy and legal reforms promote involvement of the local population and defines, with their participation, the conditions of their involvement. Local populations participate in the conservation of forest resources, and obtain a share of benefits from this. Forest industries have to utilize forests resources within this new legal framework. New technologies are developed and are introduced in logging.

A close relationship between knowledge and policy evolves. Research work takes into account the concerns of local users and other stakeholders, including managers of forest, through inclusive priority setting. New protected areas are created as a result. Also, there is an increased focus on the opportunities that markets for environmental services can bring. Governments recognize and set up policies to encourage benefits from carbon commoditization. There is a deliberate effort to strengthen the existing forestry management programmes such as Central Africa Regional Programme on the Environment (CARPE), COMIFAC and Central African Protected Areas Network (RAPAC) for regional cooperation in transboundary forest management.

Fortress World scenario

In the *Fortress World* scenario, deforestation and degradation of forest areas generally continue at high rates. However, there are pockets of restoration.

The elite, tempted by the high demand for forest products in the global market, act as resource extractors, and overexploit the forest resources.

Ironically, they safeguard some forest areas under international pressure. Some of the remote forest areas, away from population pressure, are also saved. Commercial exploitation of medicinal plants contributes to accelerated deforestation. Given limited opportunities, poor people fall back on extensive use of the forest resources to which they have access, as a source of energy, food and shelter. Forest wood is also used commercially for the production of crafts for trade.

The increase in the poverty of farmers, and the fall in prices of agricultural produce, leads to more pressure on the forests, which are the primary sources of revenue. Unregulated logging increases. Industries which are involved in logging do not take the regulations into account and, engage in illegal logging activities. The export of roundwood means that the full potential earnings of timber products are not realized. There is a boom in the development of NTFPs, as well as an increase in their domestic use.

The consequences of deforestation and desertification are disastrous for the Sahelian areas (northern Cameroon, Central African Republic and Chad). The creation and strengthening of forestry training institutions at the national and sub-regional levels, to provide qualified human power and technology to the forestry department, is an emerging challenge for Central African countries, but this is not a priority for the elites. The option of strengthening forestry sub-regional cooperation by harmonizing legislation and creating and managing transboundary protected areas for sustainable development is not taken up and in general environmental and human well-being continue to deteriorate.

Great Transitions scenario

In the *Great Transitions* scenario, real recognition is given to sustainable uses of forest resources for medicinal and other purposes, and opportunities for improving livelihoods are directly sought. This is balanced with environmental objectives. Consequently, sensitive and important habitats are protected, and systems for the sustainable use of biodiversity outside these protected areas are established.

Stakeholders, including users and owners, are brought into management. Education and the promotion of a shared value system are key focuses. Communities are environmentally aware, and are empowered to care for the Earth. This is made possible by moving from a restrictive legal regime that focuses on command-and-control regulations to one that is more empowering and consistent with the Convention on Biological Diversity and promotes the fair and equitable sharing of benefits arising from the use of biodiversity. Areas of forests increase and forest quality improves, as a result of the realization of the true value of forest resources, and improved forest management. Integrated and sustainable development management ensures minimal degradation of the human environment system. Human and environmental vulnerability are minimized. The capacity of NGOs and civil society is enhanced, and they are empowered to play a more significant role in environmental management. Higher protection of the environment and of fragile ecosystems is a prime focus for all stakeholders in the forest industry.

This sub-region continues with the development and use of light technology by trained people, in order to make rational use of forest resources. The existence of research institutes, and training in forestry (wood-based occupations), makes Central Africa a specialist in forestry training and research. All countries ratify and implement the main conventions regarding sustainable management of the environment and local, national and sub-regional actions reflect policies directly targeting NEPAD environment initiatives.

There is a move from a restrictive legal regime that focuses on command-and-control regulations to one that is more empowering and consistent with the Convention on Biological Diversity, promoting the fair and equitable sharing of benefits arising from the use of biodiversity.

Policy lessons from the scenarios

The Central African forest basin is undergoing fundamental change as a result of, among other things, logging. Governments of Central Africa, donor agencies and private forestry companies must act urgently to address the rapid acceleration of forestry operations in the basin and the negative impacts provoked by these activities.

Investment now in establishing systems of proper forest management will avoid huge costs in the future, including the forgone benefits of squandered forest resources, the costs of resource restoration and rehabilitation, the loss of wildlife and its potential for alternative revenue generation, and the social costs associated with all of the above. From the various scenarios, a mix of policy actions may be appropriate. Specific policy action may focus on:

- Establishing forest zoning through an assessment of concessions based on zoning categories which

include protected areas, sustainable use areas, zones designated for agriculture or other land uses.

- Promoting transparency in the allocation of forestry concessions and revenue generation.
- Improving forestry practices to reduce undue damage to the remaining forest, reduce timber waste, and protect the regenerative capacity of the forest.
- Institutionalizing measures, especially on government land, to ensure that endangered species are protected on their lands, and that export of wildlife products from their concessions is not facilitated by their operations.
- Enhancing local participation in forest management, in which local interests and cultures are safeguarded.
- Designating new protected areas in the forest, especially in light of the uncertainty of the sustainability of logging practices, and ensuring effective management of these.
- Accelerating research on the sustainability of forestry operations in the basin (including autecology – the characteristics of individual species, the life history of commercial species, regeneration dynamics).

The window of opportunity to improve management is very short. In five years it will be difficult to establish sustainable management schemes in Central Africa. In much of the forest, it will simply be too late.

A monetary value can be attached to environmental benefits coming from forestry activities aimed at reducing carbon emissions. Central African countries can find secure opportunities to convert this into monetary gains at the carbon world markets. There is a need to strengthen capacity-building in the assessment of the economic value and potential of Central African forest resources to this end.

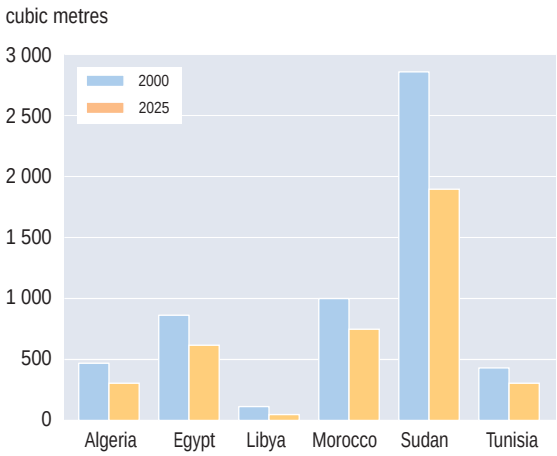
Making these changes a reality requires political will of all governments in Central Africa. Donor agencies must assist in providing technical and financial support. Private companies must commit to responsible, sound practice and assume more of the costs of their impacts. With these stakeholders working in concert, the forest of the Central African basin may continue to yield biological, economic and social benefits well into the future. The window of opportunity to do this is very short. In five years it will be difficult to establish sustainable management schemes in Central Africa. In much of the forest, it will simply be too late.

NORTHERN AFRICA

The scenarios for this sub-region focus on the future trends of freshwater resources, as the challenges associated with the availability of freshwater are likely to increase in the future. The current and estimated 2025 levels of renewable water resources in the countries of the sub-region are as illustrated in Figure 16.

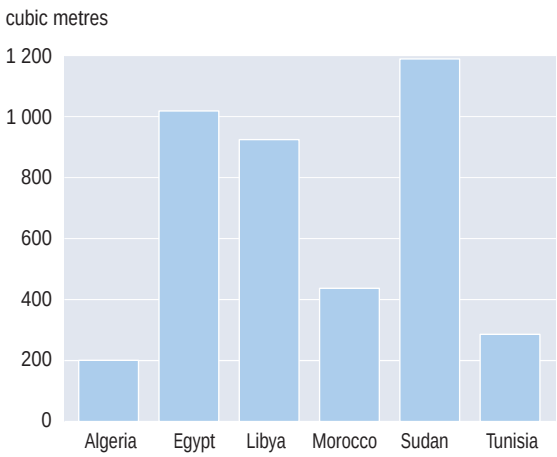
Water stress and scarcity is a growing problem. The available annual water resources per inhabitant vary substantially between different countries, as shown in Figure 18. In terms of internal water resources, it is the poorest sub-region in Africa, accounting for only 1.2 per cent of the region's total internal water resources, but it is also the sub-region with the highest access to external water resources (63 per cent) due to the Nile (FAO 2003). Agriculture is the main water consumer, accounting for more than 88.2 per cent of water uses (FAO 2003). Chapter 4: *Freshwater* examines the current state and trends of these resources, and the key pressures placed on them.

Figure 16: Per capita renewable water resources in Northern Africa



Source: UNEP 2005

Figure 17: Water use per capita 2000



Source: UNEP 2005; data from FAO 2003

Figure 18: Impact on selected water indicators in Africa as per AEO-1 scenario model

Source: UNEP 2002a

The AEO-1 report presented the impacts in key water resource indicators: water use, domestic share, agricultural and industrial share, and water use-to-resource ratio (Figure 18).

Market Forces scenario

In the context of globalization and the opportunities international trade brings, Northern Africa seeks to export more goods to Europe and to the rest of Africa. Agricultural products are among the goods identified for increased exports, but they must meet the standards of the target markets. The private sector takes the lead in opening up new foreign markets. New product standards require regulation of the quality of irrigation water as well as fertilizers and other chemicals used in agriculture. This has positive impacts on the quality of soil, shallow groundwater and drainage water.

Competition for water resources between the production of food for local consumption and export increases. The private sector, with larger landholdings, bigger investments and stronger influence on local government, competes with poor small farmers for the limited water resources. The private sector is encouraged to adopt IWRM focusing on conjunctive use of surface and groundwater resources. However, there is overharvesting of groundwater resources, leading to accelerated decline in the groundwater table and salinization of underground water.

Similar competition exists between the other main water users, namely industry and municipalities. The industrial sector increasingly focuses on exports, as greater profits can be made through these markets than in the local market. The large volumes of untreated industrial wastewater pose high risks to the environment, and in particular heavy metals and noxious chemicals are the main lethal pollutants. Increasing levels of water and air pollution create new levels of environmental and social stress, especially because many are dependent on the re-use of water. The vulnerability of poor people and urban dwellers increases.

As part of their economic reform, the Northern African governments privatize some of the public services, including water supply and sanitation. The private companies who run the services cannot offer these at the same low tariffs as were offered when the facilities were under public operation, as these had been highly subsidized. The tariffs for water supply and sanitation increase and many low-income people

The private sector, with larger landholdings, bigger investments and stronger influence on local government, competes with poor small farmers for the limited water resources.

can no longer afford these. This reform, that was intended to increase the availability of safe water, has the opposite effect. The qualities of the services have not improved significantly as a result of privatization, due to low investment and the absence of effective regulation through monitoring and enforcement. Despite these problems the pressure on some Northern African governments to treat water as an economic good is increasing. The agricultural sector is under continuous threat to have some of its "free" water allocated to other sectors that pay for water. The governments continue to oppose water pricing to protect small and poor farmers, but this policy is more rewarding to the private estate farms that enjoy the use of the free vital resource while selling their agricultural products at high market prices.

There are at least three ongoing problems as a result of this policy approach:

- Pollution of water from poorly treated industrial effluents, untreated sewage, run-off of agricultural chemicals, and mining wastes constitute a growing problem.
- Unsafe drinking water, combined with poor household and community sanitary conditions, is a major contributor to disease and malnutrition, particularly among children.
- Contaminated wastewater is often used for irrigation, creating significant risks for human health and well-being.

Policy Reform scenario

Given the critical role water resources play in development and the increasing problems of water scarcity and stress related to high population growth, the sustainable management of water resources becomes an important policy focus. This is particularly important as the potential for finding new water sources is very limited. The reality is that most of the water required to meet the new demands must come from water saved from existing uses, and consequently demand management is adopted

Demand management focuses on physical water savings and also economic savings, through increasing water-use efficiency, reducing water pollution and minimising irrecoverable water losses. Most countries adopt comprehensive reforms of water policies. Such reforms are not easy because long-standing practices, and cultural and religious beliefs, have treated water as a free good. Additionally, powerful interests benefit from the existing system of subsidies and administered allocations of water.

One policy reform aimed at improving efficiency is the increased and active participation of users in the management and planning of water resources. Some Northern African countries have already established water-user organizations, but this has not been the case with all users (El-Fattal 2006). The activities of these organizations are continuously reviewed, building on the experiences gained, with a clear target of promoting more rational and efficient use of this vital resource. The improved and fairer access to water resources results in higher levels of social equity, and better opportunities for poor farmers.

Institutional reform of the public sector, which has become overly bureaucratic, receives increasing attention and promises long-term progress in improving performance and hence water-use efficiency. Reforms include reorganization of irrigation agencies into a semi-independent or public utility mode, applying financial viability criteria to irrigation agencies, franchising rights to operate publicly constructed irrigation facilities, and strengthening accountability mechanisms. Following the success of other countries, control of water demand through pricing is adopted by some countries in Northern Africa, but with some caution. The internal conflict and unrest in some countries make this issue very sensitive. Nonetheless, the results are encouraging. Urban and industrial water consumption is reduced, resulting in saving some valuable freshwater. The reduction in water consumption and consequently the reduced quantities of sewage and wastewater relieves the pressure on the water treatment plants. Because many countries still dispose of treated and untreated wastewater in the northern lakes and in the Mediterranean Sea, improving the quality of this water can have positive impacts on the biodiversity dependent on these water bodies.

But the high prices of urban water and sanitation leave many poor people more vulnerable and insecure. Savings made by the state in privatizing this service are negated by increased costs in the health sector. Consequently, further reforms are introduced. Scaled tariffs are applied to reduce the costs to small consumers and make large consumers pay more. Savings in industrial water use are also achieved through restrictive water licences, the introduction of

The improved and fairer access to water resources results in higher levels of social equity, and better opportunities for poor farmers.

water-saving technologies and subsidized financing for investment in water-saving processes. In addition, industries are encouraged to use more recycled water.

The value of groundwater is recognized and tighter controls are imposed on its use. Quantity-based control mechanisms include well and pump permits that grant the right to install and operate a well of a particular capacity, and pumping quotas that specify a fixed annual rate of extraction for each water user. Pumping permits for new wells also impose size and spacing specifications to attempt to optimize extraction rates. The overall objective is to benefit from water resources while at the same time preserving their quality and sustainability.

The subsidies on energy prices (eg electricity, diesel, gasoline) are gradually reduced; the aim of this is to discourage overpumping of groundwater due to cheap energy costs. In countries where farmers pump water from canals to their fields this also discourages unnecessary or wasteful use of surface water. There are some disadvantages, though. The increased prices of diesel raise transportation costs which in turn raise commodity prices in the local markets.

Some general trends are evident in this scenario:

- Some countries seek to increase the use of Nile water and they focus on integrating their development projects and improving cooperation. Groundwater-recharging schemes are adopted in some while in others there is a focus on drought management.
- New laws are passed which set penalties for quantitative and qualitative water misuse.
- Extensive public campaigns are launched to educate the people about the water resources problem.
- A legal basis for controlling water pollution already exists in all Northern African countries, but the laws and regulations have mostly been unenforceable. The regulations are amended to be more realistic and to rely on incentives rather than restrictions. More industries comply with the amended regulations, leaving industrial waste cleaner and less polluted.

Fortress World scenario

This scenario is characterized by pronounced social, economic and environmental inequities between various groups of people. The elite, wealthy and generally better-off groups enjoy monopoly and full control of all services, resources and important economic activities. Poor people are deprived of the most basic services and resources, and generally lack opportunities to improve their quality of life.

At the national level, all Northern African countries focus on utilizing their internal water resources without paying much attention to external resources. This does not seem to cause a serious problem to the Maghreb countries, whose water resources mostly originate from inside their boundaries with very limited transboundary exchanges. Egypt and Sudan continue relying heavily on the Nile waters. Lack of cooperation with the rest of the Nile riparian countries threatens the sustainability of the river flows, and peace within the sub-region. With external technical and financial support, the upper Nile countries embark on building large numbers of small dams for utilizing some of the river's water. The dams have limited capacities, yet any reduction in the river flows reaching downstream countries could have huge negative impacts on development.

Despite increased demand for water, the opportunities for developing new water resources or adopting demand management techniques are not explored by the dominant wealthy groups, who do not feel the strain of the problem. The distribution of resources per capita is skewed among the various groups, with the wealthy taking the lion's share of the resources, especially land and water. Water allocation to the various water-user sectors follows a similar pattern. Being industry-driven, the elite allocate more water to the industrial sector, depriving irrigated agriculture from a much needed vital input. Urban water supplies are concentrated in the areas of the wealthy groups. Water use in those areas is wasteful, generating large volumes of sewage and wastewater. Groundwater use is dominated by the wealthy groups in the society who can afford the costs of extraction. Overuse of fossil groundwater depletes those resources and endangers their sustainability. Large declines in the water tables are observed and well salinization becomes a problem. Accordingly, the cost of groundwater extraction rises and this is translated into similar increases in the costs of the final products for which this water is used.

Municipal water supplies in the poor areas are largely unsafe, creating high risks for the majority who cannot afford good health care.

Low-income activities, such as subsistence agriculture and basic industries, are forced to use marginal and unsafe water. Municipal water supplies in the poor areas are largely unsafe, creating high risks for the majority who cannot afford good health care. The low-tech industries in the poor areas are forced to

recycle and re-use water. But with very limited financial and technical resources, they are unable to recycle and re-use water safely. The food industries are the most vulnerable as the use of unsafe water in their products can lead to food-transmitted diseases.

The quality of agricultural drainage and sewage water deteriorates due to repeated re-use of the water. Industrial waste also adds to the acuteness of the problem as industries dispose of mostly untreated wastewater. Weak monitoring and enforcement of laws encourages the wealthy industry investors not to treat their industrial waste before disposing it in watercourses and public sewage networks. Water heavily polluted with industrial waste is sometimes re-used in downstream areas, creating serious environmental damage and health risks in those areas.

Investment in water-development projects is directed towards meeting the needs of elite groups, who make the investments. These projects usually have limited scope and target small groups of people. The general public do not benefit from these projects, apart from income earned as a result of supplying cheap labour. State-run utilities and services suffer from underinvestment, causing the services to further deteriorate and the infrastructure to run down. This is evident in the rapid silting-up of the reservoirs of the large number of dams in the Maghreb countries. But the larger cost to the economies is the lost resources from leakages, high water evaporation in large reservoirs and pollution.

In summary, freshwater shortages continue to be experienced in most Northern African countries, albeit with varying degrees. The key aspects of this scenario are:

- A focus develops on using internal water resources with little attention being given to exploring the potential of external resources.
- The improper management of water increases pollution, resulting in the degradation of surface water and increasing the incidence of soil erosion and salinization.
- Water shortages and pollution limit development and perpetuate economic and social inequities, leaving many people increasingly vulnerable.

In Great Transitions intergovernmental cooperation in the management of the Nile waters is improved, and extended beyond existing users to include all riparian countries.

Great Transitions scenario

The water scarcity problem currently existing in Northern Africa is given the full attention and consideration of the governments of the sub-region. As a result a variety of measures to ease the problem are adopted. Besides carefully managing the conventional water resources in a sustainable way, non-conventional techniques such as rainfall harvesting, desalination and water recycling are employed. Increased industrialization helps lower the cost of these new techniques and they become affordable to many sectors.

In addition, all the countries adopt IWRM programmes to effectively manage all available water resources. They are implemented through developing national legislative and institutional frameworks. Intergovernmental cooperation in the management of the Nile waters is improved, and extended beyond existing users to include all riparian countries. The NBI achieves remarkable goals, planning and implementing win-win water resources development projects to most riparian countries. Water master plans are drawn around IWRM as the key solution to the problem. Integrated water resources management frameworks which integrate the technical, hydrological, economic, environmental and social aspects are formulated and implemented under the appropriate institutional frameworks. There is also increased sharing of best practice. Experiences gained by the Northern African countries in implementing IWRM are shared at the sub-regional level, and this increases the use of adaptive management which has important gains for sustainable management.

National plans are prepared for rehabilitating the ageing agricultural system, the main water user. Groundwater abstraction is controlled. Water re-use is abandoned and is replaced with water recycling. Due care is given to the problem of loss of agricultural land due to soil salinization, erosion and degradation. Soil rehabilitation schemes include banning of the use of chemicals and replacing them with organic fertilizers. A switch to cash crops for export assists the move to organic fertilizers. Research focuses on producing new crop varieties that are more drought- and salt-tolerant, have shorter life cycles and require less water. The water-use efficiency of the agricultural sector is closely monitored. As a result, less agricultural drainage water is generated, reducing the pollution it causes to the Mediterranean Sea and the other water bodies where drainage water is disposed of.

Food security is no longer a key issue in government policies. As the economies of many Northern African countries improve, their ability to

Box 8: Facing the challenge of limited groundwater resources...

Groundwater resources constitute a major part of the total water resources of many Northern African countries. Apart from Egypt and Sudan, the Maghreb countries rely heavily on groundwater. The majority of this water is fossil water from deep aquifers that are mainly non-renewable. Renewable groundwater resources are in the form of shallow alluvial aquifers recharged from the main rivers in the sub-region or directly from precipitation in limited coastal areas. These include the Nile valley and its delta, tropical areas in Sudan and scattered strips along the Mediterranean coast.

According to the current practices, the use of groundwater resources in Northern Africa is neither safe nor sustainable. Overmining of the fossil aquifers and overabstraction from the renewable shallow aquifers result in accelerated decline in groundwater levels and rapid deterioration of groundwater quality due to saltwater intrusion. This interferes with well productivity affecting yield levels and shortening their lifespan, thus raising the cost of groundwater. In addition, overuse of groundwater is usually coupled with overuse of energy for water pumping, which in turn causes more pollution and gas emissions from power plants.

Some of the large groundwater aquifers in the region are shared by many countries. For example, the Nubian Sandstone Aquifer, which is a non-rechargeable basin, is shared by Egypt, Libya and Sudan and the Eastern Erg aquifer is shared by Algeria and Tunisia. This makes the issue of managing and controlling the use of these aquifers sensitive and complicated.

Building on the success of the NBI between the Nile riparian counties and responding to the critical situation of groundwater resources in Northern Africa, a groundwater sustainability initiative is launched by all the countries in the region. The key target is to work toward achieving safe and sustainable use of the vital resource. The move is supported by large donor and lending agencies by providing the technical and financial support required for implementing some of the proposed projects.

Several actions are taken and agreements are reached through this initiative:

- Some countries cooperate and develop joint groundwater recharge schemes and conjunctive use models.
- The transboundary use of water resources is based on cooperation. All countries who share transboundary groundwater reservoirs agree on applying and enforcing new regulations for control, management and protection of those reservoirs.
- A groundwater monitoring network is established in all the countries. The information is reviewed periodically and is made available to the general public through a dedicated web site.

This initiative helps increase the awareness of the Northern African people of the importance and value of groundwater for the future development of their region. Public participation in achieving sustainability of groundwater resources is achieved through demand management. For instance, irrigated agriculture which depends primarily on groundwater is only allowed to use modern irrigation techniques. Industry is highly encouraged to recycle water. The volumes of water supplied to urban areas are controlled (eg by not making the water supply available throughout the day). Stopping the rapid deterioration of the quantity and quality of groundwater resources in Northern Africa, while at the same time meeting the increased demands for water, signals the success of the Initiative.

import food from the global market increases without the need for debts or loans. Water allocations to the various sectors are reviewed, with more shares allocated to the industrial and municipal uses. The flourishing industry is more efficient in water use in terms of economic returns per unit of water. Agricultural reform through land consolidation proves to be beneficial to all those involved:

- Larger landholdings for the farmers change the nature of their agriculture from subsistence to commercial. Consequently, they are able to invest more in their irrigated agriculture by buying better inputs and hiring more experienced labourers or moving to mechanization. The end result is a more efficient irrigated agriculture. The whole rural community also benefits from higher agriculture returns. More children in the rural areas now attend school to the secondary level. The services in the rural areas noticeably improve, with more people having access to safe drinking water and sanitation, better health care, etc.
- Large numbers of the unskilled labourers who used to work in agriculture are absorbed by the growing

industry. They receive on-job training which raises their skills and make them a more productive force in the society. Their living standards also improve, with their family members benefiting from better education, health care, housing, access to safe drinking water and sanitation, etc.

Water pumping is still a major environmental concern in many of the Northern African countries as the majority of the pump sets are diesel-driven. Gas emissions, water and soil pollution by fuel and oil, and noise pollution are some of the negative impacts. The use of electric motors for water pumping is promoted in order to ease the problem. Incentives include reduced motor and spare parts prices and low electricity tariffs. There are fears, though, that such policies could encourage overuse of water resources, especially groundwater. Control and monitoring of groundwater use ensure that such fears do not become reality.

Policy lessons from the scenarios

Given the hydrological status of Northern Africa the management of freshwater resources will remain a challenge, with major implications for the overall prosperity of the sub-region – in terms of the opportunities for both economic growth and improving human well-being. All the scenarios point to the need for management approaches that are based on IWRM and acknowledge the links between surface and groundwater. Closely related to this is the transboundary nature of the available resources. Here the policy lessons are clear: to improve opportunities throughout the sub-region and to reduce the possibility of conflict, cooperative approaches must be adopted.

All economic development choices are dependent on a reliable water supply. The scenarios reveal various policy options for promoting this including market mechanisms, management focused on improving efficiency, more equitable access rights and increased

Box 9: Harnessing the opportunities of participatory management...

Even though there are currently various management practices that create the opportunity for interactive participation by stakeholders in water development and management decision making, such participation is not mandatory and there is no clear designation of responsibility for integrating such participation into cohesive programmes. Consequently, such participation takes place only in isolated activities such as the formation of water-user organizations and one-way public awareness activities.

Based on experiences from other countries in public participation, there is increasing recognition that participation in the decision-making process strengthens policy making processes and provides an avenue for ensuring transparency and accountability in public and private actions. This builds trust among the participants and leads to the creation of long-term collaborative relationships. Northern African governments start adopting policies to facilitate public participation in decision making regarding planning, development, and management of the countries' water resources.

However the introduction of participatory decision making is a relatively long process given the institutional, social and economic context in Northern Africa and some difficulties are experienced. The lack of a clear distinction between the responsibilities and duties of government organizations and the private stakeholders causes some confusion. Low levels of education in some countries make it difficult for the larger sector of the public to participate effectively. For many, having a say in decision making is seen as a tool for achieving personal benefits instead of aiming at the national scale. Training and public awareness programmes are started to help tackle some of these difficulties.

Some of the stakeholders are cautious when introduced to participatory decision making. They fear that their involvement in resource management will come at large financial costs to them. Infrastructure maintenance has been in many cases very poor under government spending. The stakeholders are worried that they will have to come up with the large sums of money required for maintaining the deteriorated infrastructure.

Despite the slow progress of achieving participatory decision making in the water resources sector, the positive results are both encouraging and promising. For instance, the negotiations between the various water-user sectors on their water allocations are now carried out by the stakeholders. The general public develops better understanding of the severe water shortage problem in the sub-region and starts to come up with its own demand management actions. Contacts and links between government agencies and the private sector are improved. The management and operation burden on governments is reduced.

public participation. Each of these policy options has opportunities and costs.

WESTERN AFRICA

Western Africa is made up of two eco-geographical areas: first, the Sahel countries, including Burkina Faso, Cape Verde, Gambia, Guinea-Bissau, Mali, Mauritania, Niger and Senegal, which make up the dry region of West Africa, and, second, the countries of the Gulf of Guinea, including Benin, Côte d'Ivoire, Ghana, Guinea, Liberia, Nigeria, Sierra Leone and Togo, which make up the humid region of Western Africa.

The climatic characteristics of the sub-region are discussed in Chapter 2: *Atmosphere*. It is subject to tropical climatic variations, resulting in high annual temperatures and heavy rainfall which steadily decline towards the Sahara Desert. Rainfall is of vital importance in determining climate in tropical areas in general, and in Western Africa in particular, because it varies so widely from area to area and season to season it represents a limiting factor for rain-fed agriculture, which provides the economic base of the countries. In the Sahel region, there is one rainy season, lasting between two and five months, while the Gulf of Guinea countries have two rainy seasons. Western Africa is characterized by four types of climate (GRAIN 2002):

- Sahelian climate: the rainy season lasts no longer than three months; rainfall is irregular and does not exceed 500 mm;
- Sudanian climate: rainfall does not exceed 800 mm in northern Nigeria, and is no more than 1 000 mm in southern Mali; and
- Humid tropical climate: distinguished by a bimodal rainfall pattern, with average annual rainfall of 1 500 mm;
- Equatorial climate: localized essentially along the Gulf of Guinea, where rainfall can exceed 2 000 mm.

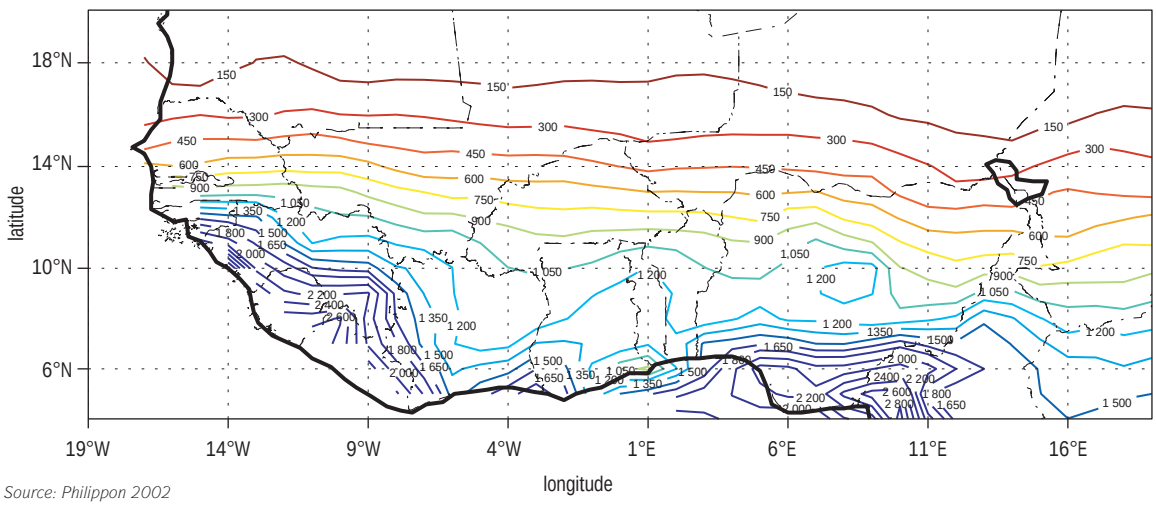
Market Forces scenario

In this scenario, agricultural production prevails over the other sectors. This results in a market economy that does not take environmental matters into account and undermines government initiatives. Growing trade, driven by the forces of globalization, results in more extensive farming and an increase in the area of cultivated land. Food production levels rise at the cost of environmental considerations. Where necessary, technology is brought into play to meet international trade demands and production requirements. As a consequence, soil erosion due to overproduction worsens, and this situation is exacerbated because of the increasing incidence of droughts.

Deforestation associated with high levels of GHG emissions could cause acid rain, further contributing to soil erosion. These changes have implications for food security in Western Africa, particularly in the most vulnerable region of the Sahel. Increasing concentrations of GHG emissions in the atmosphere affect climate variability, including shorter rainy seasons, and lead in the long term to climate change.

Locust invasions increase due to climate change continue to cause food deficits as no action is being taken to reverse this. Consequently, the food situation worsens in certain areas of Burkina Faso, Chad, Mali, Mauritania, Niger and northern Senegal. The invasion of the desert by locusts is a consequence of climate variability. The unexpected rains provoke a proliferation of locusts, which are normally in a state of dormancy (FAO 2004). The changing climate (in this case an upsurge in rainfall) cause the disruption of this dormant

Figure 19: Average cumulative rainfall (mm) in Western Africa 1968–1998



Source: Philippon 2002

state. Damage to millet crops and grazing land attributable to such agro-climatic conditions has been recorded throughout Cape Verde and on a more localized scale in Burkina Faso, Mali, Mauritania, Niger and Senegal (FAO 2005a). This trend is likely to worsen.

Accordingly, the overall production of cereals (millet and sorghum), the largest food crops of this part of Africa, declines, increasing food insecurity and affecting prices for consumers. Even the coastal countries (Gulf of Guinea, humid Western Africa), which have until now enjoyed a certain measure of climate security (abundant rainfall), see their resources dwindle under the influence of environmental degradation and they too become vulnerable. Decreased rainfall and increased evaporation linked to high temperatures leads to water shortages and deterioration in water resources. Hydrological imbalances cause the collapse of certain economic activities. Reduced river flows have a negative impact on hydroelectric production. And, hydroelectric energy production is affected in Benin, Côte d'Ivoire, Ghana and Togo. This is a replica of the events of February 1998, when Ghana faced an energy crisis caused by a drop in the water level of Lake Volta (Niasse and others 2004). Successive years of drought continue to reduce the size of humid zones in many regions. Despite some patchy rains, the general decline in rainfall continues. Sporadic droughts affect river systems, agricultural production, supplies of drinking water and hydroelectric production.

Policy Reform scenario

In this scenario, politicians become increasingly aware of environmental concerns. At the international level, a common will to correct development options emerges. As a result, MEAs on water, humid zones, climate change and desertification are ratified and implemented. At the regional level, these include the African Convention on the Conservation of Nature and Natural Resources (ACCNNR), for the use and conservation of soils, water, fauna and flora, the Abidjan Convention for Cooperation in the Protection and Development of the Marine and Coastal Environment of the West and Central African Region, and the Bamako Convention on the Ban of the Import into Africa and the Control of Transboundary Movement and Management of Hazardous Wastes within Africa, which aim to protect the marine environment, coastal zones and domestic watercourses shared under the jurisdiction of the countries of Western and Central Africa.

The revitalization of African agriculture is central to all efforts to alleviate the impacts of climate variability and change.

Countries continue to be affected by climate variability and the productivity of marginal lands continues to decrease. In response, adaptation initiatives are launched to address increasing levels of vulnerability. Measures are taken to increase agricultural production with the aim of maintaining a satisfactory level of food security. These measures include the setting up of IWRM programmes and, in the agricultural sector, the selection of drought-resistant species. The creation of water reservoirs makes an increase in agricultural production, despite climate uncertainties, possible. Thus, the availability of food and the level of food security are maintained.

Facing up to climate change also involves strengthening climate forecasting and early warning systems. Climate change will cause changes in rainfall distribution (Watson and others 1998) and will affect the availability of water for food production. To avoid this happening, as a preventive measure, systems are set up to collect water for irrigation and even for domestic use. Sub-regional institutions, such as the Permanent Inter-state Committee for Drought Control in the Sahel (CILSS), establish and strengthen their early warning systems and cooperate with other initiatives in the Famine Early Warning Systems Network (FEWS-NET), in order to pool their results. Policies are adapted to fit in with efforts to strengthen local means of subsistence and poverty reduction.

Cooperation in the management of transboundary waters enables the demand for water to be better managed and regulated while promoting regional development activities. Such cooperation is a potential conflict-prevention tool.

The revitalization of African agriculture is central to all efforts to alleviate the impacts of climate variability and change. It involves taking into account the traditional responses of rural communities to climate crises and integrating the necessary technological innovations to increase the agricultural potential of the land and to tighten control of water resources. Opportunities provided by the use of biotechnology are considered. Improvements in science and technology can bring new opportunities to farmers, allowing them to produce improved varieties of corn, cassava and rice. Investment in this sector is increased and complemented by a regulatory framework for the protection of intellectual property rights and biosafety.

Fortress World scenario

The current global situation is redefined by the international fight against terrorism. New economic dynamics initiated by the most powerful countries, prioritizing their own social and economic needs to the detriment of the environment, influence policy under this scenario. As policies are increasingly geared to meeting the needs of a few, a general rise in poverty is evident. This feature of social inequity has been evident for some time (World Bank 2005b). Growing inequity leads to increasing environmental and human vulnerability. Some countries face an increasing risk of food insecurity.

Given weak environmental policies globally and at the sub-regional level, climate variability continues unabated. Environmental degradation leads to increasingly frequent extreme climate events, such as sandstorms, drought and floods, especially in the Sahel. Rainfall levels decline and more intense climatic extremes (droughts and floods) become the norm. The drought in the Sahel worsens and extends, covering a vast area of land and posing a grave climate danger to agriculture, water supplies and ecosystems. As droughts become more frequent, widespread and lengthy, the viability of the sub-region's crop systems is severely undermined. As previously, people move to more drought-resistant areas and land that was previously used for grazing and left to lie fallow is now under permanent cultivation, causing serious damage to crop systems (Watson and others 1998). There are very heavy agricultural losses due to the vagaries of the climate.

Coastal areas are threatened by erosion, floods and exceptional atmospheric phenomena. Floods pose particular dangers for sea-level cities such as Banjul, Abidjan and Lagos: these become particularly vulnerable (Watson and others 1998). In Gambia, it is expected that floods will cause the loss of 92 km^2 of land following a one-metre sea-level rise. The coastline is likely to recede by 6.8 metres in steep areas and around 880 m in areas that are flatter and more sandy (Jallow and others 1996). With a sea-level rise of one metre and in the absence of any protective measures being taken, the entire city of Banjul, capital of Gambia, would disappear over the next 50 to 60 years as most of the city is lower than one metre of altitude. According to the Intergovernmental Panel on Climate Change (IPCC), the rise in temperature could be as high as 1.6° C in the Sahara (Watson and others 1998) and the semi-arid regions of SSA (Hernes and others 1995; Ringius and others 1996). As a result, food security is seriously jeopardized by the risk of famine, leaving people more vulnerable and causing conflicts linked to the use of the few remaining natural resources. The more wealthy countries invest in agricultural technologies to the detriment of those countries that have already been affected by the extreme climate events.

The rise in sea level will also cause the disappearance of large areas of mangroves in humid coastal zones. These humid coastal areas are ecologically important as they provide unique habitats for species of migratory birds and a variety of local species. Changes in sea level will cause the habitats found in these humid areas, including all the mangrove forests, to disappear. In addition, these areas are a main source of food supply for the sub-region and so environmental change threatens food security. Coastal and offshore zones, together with estuaries and lagoons, are an important source of livelihood for small-scale and industrial fisheries, and in the *Fortress World* this dependency increases to more than 75 per cent of the sub-region's catch.

The drought in the Sahel worsens and extends, covering a vast area of land and posing a grave climate danger to agriculture, water supplies and ecosystems.

As well as reducing the area of cultivable land, the rise in sea level could have serious consequences for human settlements, causing the loss of residential areas and economic infrastructure. A large proportion of the urban population of Western Africa lives in coastal towns and cities. In Nigeria, for example, around 20 million people (22.6 per cent of the total population) live in the coastal zone (UNCHS 2001, Chidi Ibe 1996) and in Senegal, around 4.5 million people (66.6 per cent of the total population) live in the coastal zone around Dakar, where approximately 90 per cent of industry is located (Watson and others 1998). In Benin, Côte d'Ivoire, Ghana, Nigeria, Sierra Leone and Togo, most of the activities related to the production of goods and services, which are the linchpin of the economies of those countries, take place in the coastal zone.

Increased social vulnerability is also to be expected as high levels of acid rain may jeopardize agricultural production and food security. Added to which, people use biomass as their sole source of energy, thereby contributing to the decrease of forested and wooded areas and promoting deforestation. This will also lead to a lessening of carbon sequestration. Deforestation also leads to an increase in the phenomenon of desertification. In

some countries, such as Niger, trees also serve to keep dunes in place and prevent sandstorms.

Other serious impacts linked to climate variability and extreme weather events include those on health. These include, among others, emerging and re-emerging diseases linked to water and climate variations, such as meningitis and malaria.

Great Transitions scenario

The *Great Transitions* scenario is characterized by the will to achieve sustainable development. It is based on a new balance between a market economy that is strong and a policy context in which environmental concerns are taken into account by decision-makers and improving human well-being is a priority.

Policy measures are adopted to ensure the effective implementation of MEAs and to strengthen existing early warning systems. The loss of human life and economic disruption caused by extreme weather events are considerably reduced due to the strengthening of early warning systems. Measures to combat drought are aimed first and foremost at ensuring the livelihood of households and improving the resilience of people to cope with environmental change. Measures are adopted to alleviate the effects of reduced rainfall. Recent scientific progress in understanding the climate and forecasting seasonal droughts is used in defining strategies for reducing human vulnerability. Seasonal rainfall forecast systems are set in operation in a number of countries and provide forecasts for periods of over three months. The possibility of longer-term forecasts exists and research results make possible drought-related forecasts in the management of agriculture, water and energy.

To prepare people to adapt to the increasing incidence of droughts, numerous research organizations introduce programmes to monitor climate, agriculture, plant life and natural resources. They also focus on the elaboration of early warning systems and participate in multidisciplinary research while encouraging the establishment of action plans. International agencies and national and sub-regional organizations develop more effective partnerships for addressing these challenges. At the sub-regional level, the Centre for Agrometeorology and Operational Hydrology (AGRHYMET), a specialized CILSS institution, located in Niamey, Niger, was created in the wake of the devastating droughts experienced in the Sahel in the 1970s. The institution also has an early warning system which includes the artificial production of rain. Institutions such as these are strengthened.

The loss of human life and economic disruption caused by extreme weather events are considerably reduced due to the strengthening of early warning systems.

Increased attention is given to developing systems for more effective participatory management of natural resources and the environment. This involves many different areas including forestation programmes and R & D programmes in areas such as carbon sequestration and clean technologies.

Water management is essential for addressing the threats posed by climate variability to food security. Consequently, there is investment in establishing water reservoirs, to strengthen food security and boost income-earning opportunities. More consideration is given to agricultural planning. Crop area and yield are determined entirely by prices, investment in irrigation and technological innovations. Production and stocks are replenished and demand for food is satisfied.

Policy lessons from the scenarios

With the support of the international community, countries must undertake the adoption of new practices and legislation, and give consideration to scientific and technical aspects. Under its climate change strategy, NEPAD should without delay implement the various projects that it has proposed, namely:

- Elaboration of decision-making tools to evaluate climate vulnerability;
- Promotion of renewable energy initiatives and strategies; and
- Evaluation of the synergetic effects of adaptation and mitigation activities through agroforestry pilot projects, including in the areas of land stabilization, income generation, improving water storage and biodiversity conservation (NEPAD 2003).

Where receding coastlines and coastal erosion are concerned, mitigation techniques might include the construction of floodwalls and the relocation of vulnerable human settlements and social and economic infrastructure. Technology related to genetically modified organisms and its application should be the subject of extensive research and all the countries of the sub-region should develop and strengthen their biosafety legislation.

New environmental policies and legislation should be adopted and applied in poverty-reduction efforts. Furthermore, if sustainable development is to be assured, climate evolution parameters must be incorporated in

national and regional policies. Taking climate change into account will prove to be a determining factor in a future vision for the development of the sub-region.

WESTERN INDIAN OCEAN ISLANDS

The management of coastal areas in the WIO presents special challenges, as these are a vital resource underlying the development of all countries, and opportunities for improving human well-being.

The scenarios in AEO-1 (UNEP 2002a) made the following projections for the WIO islands:

- *Market Forces* scenario: coastal waters become increasingly polluted and overfished, and deep-sea fishing is industrialized and internationalized with the region failing to take advantage of its legitimate rights in extended territorial waters;
- *Policy Reform* scenario: the loss of coastal land due to coastal erosion, as a consequence of natural processes, is reduced but expanded coastal development continues to exert pressure on resources. Deep-sea activities prove satisfactory but the sub-region is slow to respond to opportunities;
- *Fortress World* scenario: coastal and marine areas are seriously affected by overfishing. The negative effects on marine resources as a result of overexploitation by foreign vessels are compounded further by major tanker spills;
- The *Great Transitions* scenario: a regional integration movement is revived to save the marine and coastal livelihood of onshore fishers and interest in deep-sea fishing is reawakened with new technologies to detect fish shoals and ensure the sustainable exploitation of living and non-living resources.

Since AEO-I, various policies have been implemented and legislation promulgated to reverse the trend in coastal degradation. These include:

- In Mauritius, legislation in force as from October 2001 banning sand extraction in the lagoon has started to bear fruits. A survey in 2004 shows that ex-sand sites are slowly recovering and new coral and sea-grass colonies have reappeared. As at June 2003, about 3 300 households have been connected to the Baie du Tombeau wastewater treatment plant in the northwestern part of the island to reduce the discharge of untreated effluents in the lagoon. Further expansion in this connection is ongoing in other regions (Government of Mauritius 2005).
- The Seychelles has established 11 sites for water quality and coastal erosion monitoring to obtain vital data to address beach erosion and coastal degradation issues (IOC 2004);
- Comoros has established a Marine National Park at Moheli and plans are underway to establish another one at Coelacanthé (Ahamada and others 2004);
- In Madagascar, ecotourism to relieve the pressure on coastal resources is being promoted. Public awareness on the vulnerability of coastal resources is being enhanced and public participation in coastal zone management encouraged with the establishment of appropriate structures to facilitate the integration process.

However, in spite of the above measures, coastal and marine degradation continues. The rate of investment in coastal development to cater for the growing tourism industry has accelerated with limited consideration for the environment. Urbanization of the coastal region is increasing. In Seychelles for instance, coastal population density on the east coast of Mahé is expected to grow from 161 to 203 persons per km2 by 2015.

The following narratives consider the implications of policy choices for the future condition and health of coastal and marine resources and the consequences of this for development.

Market Forces scenario

As the world becomes increasingly integrated, economically and culturally, the globalization of products and labour markets catalysed by free trade agreements prompts the WIO islands to export more goods, especially to countries in the developed world. The manufacturing industry is the main benefactor, as countries in the sub-region take advantage of the African Growth and Opportunity Act (AGOA) opening new markets for textiles in the USA. Cheap labour, particularly in Madagascar and Comoros, encourages an increase in FDI, and this results in building more factories to cope with the flourishing market. Labour is exchanged freely between the countries, but at the same time, skilled labour from countries in Asia, including China and India, makes up for the increased demand in workforce. Many textile dye industries are established. These developments, however, give rise to increasing discharge of effluents, which pollute the lagoon environment.

Massive investment from foreign companies, particularly from China and Japan, to establish tuna factories and gear development make the region a seafood hub.

The fishing sector is another industry which is intensively solicited for development. Massive investment from foreign companies, particularly from China and Japan, to establish tuna factories and gear development make the region a seafood hub. Development of offshore fishing is intensified but without much consideration to its sustainability for future generations. Some countries sell the fishing rights to their exclusive economic zones (EEZs), complicating regional cooperation. Governments in the sub-region invest increasingly in education and health care to provide the necessary skilled and healthy labour to support the developing economic sectors. Regional groupings emerge to establish centres of excellence for regional training, with external assistance, in areas such as offshore fishing, canning industries and shipping crew.

Employment is created; the standard of living of all the islands is increased and there is a substantial decrease in poverty. However, with the increase in cash flow, consumerism and materialism prevail. Imports of foreign goods increase, and there is increasing adoption of western lifestyles with gradual erosion of traditional cultures and their environmental values. Uncontrolled deep-sea fishing depletes fish stocks. Oil slicks from increased shipping activities further degrade the marine environment. These give rise to a decrease in fish catch resulting in substantial fall in FDI.

Policy Reform scenario

Confronted with increasing coastal and marine degradation and loss of marine biodiversity, the WIO islands take drastic measures to address the issues.

The sewage treatment system is expanded over all the islands, and all coastal hotels and private bungalows are connected to the public sewage systems.

Wastewater management is given urgent attention. The sewage treatment system is expanded over all the islands, and all coastal hotels and private bungalows are connected to the public sewage systems. Strict regulation for hotels and bungalows to thoroughly treat wastewater so that it can be re-used for irrigation purposes is enforced to limit coastal pollution. These measures improve the water quality of the lagoons and there are positive impacts on marine life.

On all the islands, ICZM is promoted. Native coastal plant species are reintroduced along the beach. Pathways are created to avoid walking on coastal vegetation and the use of beach areas by vehicles is banned. Increased active stakeholder participation in the management and utilization of coastal and marine resources is encouraged through meetings and committees with the public sector as facilitator. All coastal development projects are discussed with all the actors and civil society before implementation, and this increases support for these activities. The fishing communities, among the poorest communities, benefit considerably from these measures.

Soft engineering solutions such as beach nourishment and forestation to address coastal erosion are resorted to. The use of hard engineering structures – seawalls, groynes, revetments and breakwaters – is generally discouraged. Their use is only allowed where it is absolutely necessary. New building regulations are developed including the obligation to set buildings back at least 40 m from the high-water mark. This is rigorously enforced in erosion-prone beach sites. These measures reduce coastal erosion and overall levels of loss of coastline. The number of marine parks and marine protected areas is increased. New beach-clearing schemes are established and additional licences for pleasure boats are granted. These measures encourage the creation of jobs, including some for sand extractors who have lost their jobs as a consequence of new regulation on sand mining.

However, the arrival of more tourists, in line with government policies to increase revenue in this sector, without adequate consideration of the islands' carrying capacity exerts more pressure on coastal resources. In spite of political will to avoid further degradation of the coastal zone, with the promulgation of new laws and legislation, ill-planned littoral development and ever-expanding tourism increasingly affect coastal ecosystems and boost coastal pollution. These effects undercut local livelihoods, especially those of the fishing community.

Fortress World scenario

With the increase influx of tourists, due to this becoming a preferred tourism destination as a result of the higher vulnerability of southeastern Asian islands to tsunamis, the elite and multinationals seize the opportunity to invest massively in hotel construction. Aggressive marketing at global scale is done through multinational companies. The price of coastal land goes up significantly, making it affordable only to the rich. Poor people in these coastal areas are displaced,

effectively forced inland and onto marginal lands to make room for coastal development to accommodate a flourishing tourist industry.

The rich, having financial resources and political influence, bribe public officials and bypass restrictions imposed in the EIA for coastal construction. Coastal vegetation is removed, buildings are constructed near the shoreline to satisfy tourist aspirations to be on the seafront, and a series of breakwaters are placed to protect the coast from erosion. Such measures give rise to conflict between the elites and fishers, who increasingly find obstacles in reaching their fishing grounds, and the public who are deprived of free access to the beach. The best sandy beaches are appropriated by the elite, in connivance with officials with high political influence, to construct luxurious villas and bungalows for sale to overseas millionaires and retired people with very high income. Several enclaves are thus created. In the face of growing social breakdown, violence and crime increase. Much pressure is exerted on the police force to protect a disproportionately few people, on account of their influence, to the detriment of law and order at national level.

The construction of hotels and private bungalows on the beachfront, which had provided unobstructed views of the lagoon, gives rise to increasing erosion. Hard engineering measures are taken to protect the eroded beaches with seawalls and groynes. Climate change and sea-level rise exacerbate the erosion problem. The protection measures adopted are of short duration and further erosion takes place, necessitating further protection. Eventually, a long wall costing millions of dollars is built, depriving the public and fishers of free access to the beach. In the worst scenario, the bungalows and hotels are abandoned, leaving the beach, deprived of its sand and vegetation, rocky and barren.

Mass mortality of fish occurs in the lagoons as a consequence of pollution from effluents discharged from the hotels and bungalows. Coral reefs are massively bleached and mangrove forests are threatened. The fishing community are deprived of their livelihoods, thus exacerbating further social decay and resulting in unrest. The offshore fishing industry is controlled by multinationals. Local fishing companies are unable to compete with the foreign investors who employ most of the professional fishers, offering them better pay packages. The local fishing companies become bankrupt and are forced to abandon fishing. The EEZs of the islands are exploited to the maximum without any regard to the renewal of fish stock.

Great Transitions scenario

The sub-region is fully conscious of the coastal degradation problems and decides to give them full attention and consideration, and a holistic approach replaces the hitherto piecemeal solutions.

National and sub-regional surveys are conducted to collect data and information in order to identify the root causes of the problems rather than just giving consideration to the symptoms. Discussion is held with all stakeholders – public, private, NGOs, civil society and experts – at national and sub-regional level to decide on the most appropriate global solutions.

Discussion at the national, sub-regional and regional level is facilitated though a network established within the UNEP Africa Environmental Information Network (AEIN) programme, which all the countries are implementing fully. Data collection and analysis are now harmonized at the sub-regional level with the use of the UNEP Africa Environment Outlook – Environmental Information System (AEO-EIS) toolkit. The ICZM programme is further developed and strengthened in each country of the sub-region. A sub-regional approach is adopted. It is implemented within the necessary legislative and institutional framework. A sub-regional steering committee with high officials involved in decision making is established with regular annual meetings to discuss activities of mutual interest, exchange views and experience on ICZM and review progress.

National plans are prepared for the two most promising economic sectors, namely tourism and fishing, clearly articulating strategies with sound policies to keep them sustainable, taking into account the health of the environment.

National plans are prepared for the two most promising economic sectors, namely tourism and fishing, clearly articulating strategies with sound policies to keep them sustainable, taking into account the health of the environment. For coastal hotels and other development infrastructure, setback distance based on reliable data and extensive fieldwork is enforced. The height of buildings is limited to two storeys. The Creole architecture most suited to local conditions is adopted, minimalist architectural patterns are recommended and developers follow this guidance. There is a general recognition of the importance of coastal vegetation in controlling beach erosion and its upkeep and replantation is promoted.

Publicity for the tourism industry is shifted from the traditional sea-sun-sand focus to the promotion of cultural dimensions. Tourism activities are oriented more towards the discovery of local cultural diversity. Small musical groups formed to give shows in hotels and public places proliferate and the number of "*table d'hôte*" (modestly-priced local cuisine) restaurants increases. More people become conscious of the traditional cultural richness of the sub-region, leading to a decrease in influence of western lifestyle and a preservation of traditional environmental management rules and values.

The fishing industry is revitalized. Incentives such as loans with low interest to procure vessels and fishing equipment are provided by governments to encourage offshore fishing. Training is provided through government-initiated projects to artisanal fishers to entice them to indulge more in open-sea fishing. These steps relieve the overfished lagoon from fishing pressure and polluting activities. Consequently, coral reefs and sea-grasses start to thrive. The diversity of fish species increases and the lagoons become repopulated. More people are employed in the fishing industry. Access to income and other material resources is secured and this has implications for the overall improvement in the quality of life in fishing communities, including in health and education. Energy sources from the sea are exploited. New technical breakthroughs in the conversion of wave energy to electricity enable the sub-region to take advantage of this new source of energy. This makes the sub-region less dependent on fossil fuels, and foreign currency savings are directed towards other development programmes.

The management framework adopted integrates technical, economic, environmental and social aspects. It is discussed with all stakeholders – public, private, NGOs and civil society – and implemented under an appropriate institutional framework only after a consensus has been reached. Conflict of interest between and within communities is as far as possible avoided. In response to sound policies implemented, and effective measures taken, the economies of all the countries flourishes. A mechanism for free exchange of trade and labour is put into place.

Policy lessons from the scenarios

The management of coastal and marine resources presents special challenges related to the high vulnerability of these resources and people living along the coast. The interface between the human and environmental systems is very sensitive to changes in either. The scenarios, in examining this complex interaction, point to the importance of ICZM, and the need for inter-state collaboration in managing marine resources and developing early warning systems. The *Market Forces* and *Fortress World* scenarios indicate minimal opportunities for meeting these challenges.

The *Policy Reform* and *Great Transitions* scenarios both demonstrate the positive effects of wise policy interventions. A key policy lesson is the need for management and planning systems which recognize all three sustainable development pillars and the importance of good governance practices to ensure this. Policy opportunities from the scenarios include more accountable and transparent decision making and increasing public participation.

The importance of R & D as well as investment in human capacity to complement and support management is also evident.

Dawn to dusk… the possibilities are endless.

Source: A. Mohamed

CONCLUSION

From the scenario narratives it is clear that contrasting yet plausible stories can be created as to how Africa and its sub-regions will develop in the next 20 years. Each has fundamentally different implications for the environment. The scenarios constructed here are based on the understanding of current conditions and driving forces, a vision of the future and a coherent story of a process of change, leading to that future. Specific assumptions have been made across a range of dimensions and issues: economic growth and structure, population, technology, resources and the environment. The alternative possibilities that emerge are significant as points of departure that can guide policy for the harnessing of environmental resources for sustainable development. Although there can be marked delays between human actions, including policy decisions, and associated impacts on the environment, positive long-term impacts of the policy decisions obviously outweigh the cost of inaction. The achievement of widely-agreed environmental, economic and social goals will require dramatic and coordinated action, starting now and continuing for a number of years. Steps must include proactive policies based on prevention and adaptation that address issues of development and human vulnerability.

The scenarios presented here demonstrate the importance of interlinkages between the environmental, social, economic and political spheres, both within and across sub-regions. Environmental and sustainable development policy must look for the synergies or "co-benefits" and conflicts between policies must be avoided. The establishment of strong institutions for environmental governance, as policy, is a prerequisite for almost all other policies. The political will and vision of governments and other authorities determine, above everything else, whether environmentally sustainable development comes within reach of countries in the region. The mainstreaming of environmental issues in the development process will demand that timely access to accurate information is ensured as this in itself is a robust policy. The achievement of environmental goals will require decisive action, will encounter unforeseen eventualities and will not happen overnight. AEO-1 noted that, "Fortunately or unfortunately, much of the success or failure of this endeavour is in our hands. The four scenarios show that the future is not something that we should wait for passively" (UNEP 2002b). The choice is up to us, in the words of Nelson Mandela, first president of democratic South Africa:

> "Sometimes it falls upon a generation to be great. You can be that great generation."
>
> NELSON MANDELA,
> SPEAKING IN TRAFALGAR SQUARE, LONDON,
> 3 FEBRUARY 2005 (MAKE POVERTY HISTORY 2005).

Fortunately or unfortunately, much of the success or failure of this endeavour is in our hands. The four scenarios show that the future is not something that we should wait for passively.

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