



## Part 1

# Setting the scene

Chapter 1  
Sustainability in South Africa

Chapter 2  
What affects our environment?











# Chapter 1 Sustainability in South Africa

## At a glance

This introductory chapter commences by presenting the global debates on sustainable development since the 1970s. Against the background of environmental sustainability, it highlights our strong reliance on ecosystem services and the growing ecological footprint. The 2005 Yale Environmental Sustainability Index (ESI), which indicates a country's ability to preserve its ecological resources and avoid major environmental deterioration, is also featured. The chapter thereafter summarizes the main aspects of environmental reporting that have taken place at different scales, from local to global. This chapter shows that state of the environment reports – such as the South Africa Environment Outlook – set a benchmark by building on the analysis of past and current trends to outline policy options for the future. It ends by featuring the environmental priorities identified globally and in South Africa, indicating that better understanding of these issues helps policy-makers to adapt policy, programmes, and plans to meet mounting challenges.

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## 1.1 INTRODUCTION

South Africa, like other developing countries around the world, is faced with the task of promoting economic development that meets the needs of its population while ensuring that the environmental systems and services on which people rely are not seriously damaged or destroyed. Striking the balance between these two imperatives of human well-being is arguably the greatest challenge of all.

The complexities of achieving environmental sustainability become apparent when we explore international and regional debates and actions relating to sustainable development. Understanding them provides the context for South Africa's efforts to embrace a notion of sustainable development that is focused on poverty-centred development and resource conservation and management.

## 1.2 UNDERSTANDING SUSTAINABLE DEVELOPMENT

The progress and development of international environmental thinking can be traced back to the 1950s and 1960s, when the tensions between development and conservation began to manifest themselves<sup>1</sup>. Worsening environmental problems worldwide made western nations realize that industrialization and exponential growth in consumption and population numbers could jeopardize the continued existence of natural resources<sup>2</sup>.

At the United Nations Conference on the Human Environment (UNCHE) in Stockholm in 1972, scientists and technical experts reported on the global environmental

crisis. Reports such as *The Limits to Growth*<sup>3</sup> and *A Blueprint for Survival*<sup>4</sup> highlighted the fact that economic growth, if unchecked, would overshoot the Earth's capacity to renew the resources that sustain both life and development. They argued for approaches that would bring the global (eco)system back into equilibrium. These so-called 'green' approaches were criticized for being too authoritarian and top-down<sup>5</sup> and for placing unfair constraints on the quality of life of people in developing countries.

Against the background of mounting opposition from developing nations to western attempts to limit growth and protect the environment, the 1980s saw the emergence of sustainable development as a concept that integrated environment and development and recognized the need to improve people's quality of life. First presented in The World Conservation Strategy in 1980, the idea of sustainable development was popularized following its publication in the Brundtland Commission's report, *Our Common Future*, in 1987. Recognizing that sustainable development is a 'process of change', the Commission defined it as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs"<sup>6</sup>. This report raised the international community's awareness of the pressing need for action: it also served as an important foundation for the 1992 United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro and the release of Agenda 21, the global plan of action for achieving sustainable development in the 21<sup>st</sup> century.

Elevated to public discourse after the Rio Earth Summit,

*"Sustainable development is not something governments or international bodies do to people. It is something people do for themselves and for their children."*

**Cielito F. Habito, Secretary of Socio-Economic Planning, Philippines, 2002**



An Eskom wind trial plant, experimenting towards renewable energy for future use. *Photography: Eskom*





the concept of sustainable development has generated debate and has become a convenient hook onto which to hang divergent value systems. Simply put, it advocates behaviour that makes current development efforts to raise the quality of peoples' lives sustainable into the future. It has to do with adopting a long-term development path that improves life for current generations and that at the same time leaves future generations with the same capacity and options for development that we have at present. Sustainable development recognizes the interdependencies and links between the natural environment, economic stability, and social well-being. The pillars of sustainability are referred to as natural, physical, financial, social, and human capital (see Figure 1.1).

### 1.3 UNDERSTANDING ENVIRONMENTAL SUSTAINABILITY

The concept of sustainable development is founded on two major premises: equity within and between generations, and maintenance of the integrity of natural, financial, and human capital so as to balance economic and social development with environmental protection<sup>6</sup>. It is based on collective values, so related choices that determine the path to sustainable development are influenced by the political context and priorities.

In developing countries such as South Africa, where strong social and economic development agendas dominate, achieving sustainable development or progress towards it can be constrained. Trade-offs often occur at the expense of environmental integrity, as decision-makers attempt to reduce poverty and deliver basic services. Against this background, the notion of environmental sustainability becomes important, given its intricate links to economic stability and human well-being.

Environmental sustainability refers to the condition in

which the productivity and viability of ecological systems are maintained at healthy levels over time.

#### 1.3.1 Our dependence on ecosystem services

South Africa relies heavily on renewable and non-renewable natural resources and on the goods and services that ecosystems provide. The value of ecosystem goods and services to society is, however, often vaguely expressed, while the short-term benefits of environmental exploitation are presented in explicit and quantifiable terms.

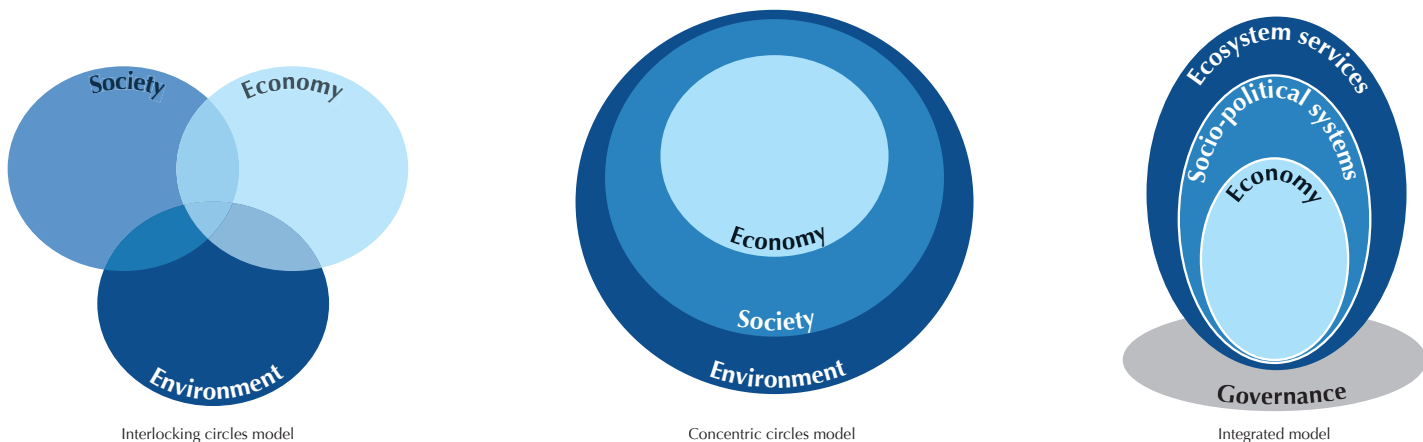
Ecosystem goods and services are the benefits that people derive from nature, and they include air, water, food, and other basics such as medicines and fuelwood<sup>8</sup>. These services are essential for human livelihoods and well-being, the relationships being particularly significant in rural areas and for the informal sector, where the dependence of people on the natural resource base is more direct. For example, it is estimated that South Africa's natural renewable water resource provides 1 156 m<sup>3</sup> of water per capita per annum, and that biomass supplies a total of 107.6 million tonnes of oil equivalent<sup>8</sup> (or 2.51 tonnes of oil equivalent per capita)<sup>8</sup>. Rural South Africans depend on natural water supply from rivers and other sources, biofuels (such as trees, shrubs, and cow dung) for cooking and heating, and marine and coastal resources and wild terrestrial plant and animal products for food and medicines. Urban centres, such as most of the province of Gauteng, are highly dependent on water and food from external sources<sup>9</sup>.

South Africans also derive substantial non-material benefits from their ecosystems, including recreational opportunities and aesthetic, cultural, and spiritual value. Specifically, wildlife and ecotourism play a large role in the country's economy. The revenue from nature-based tourism in South Africa in 2000 was US\$1 436 million<sup>8</sup>, for

*South Africa relies heavily on renewable and non-renewable natural resources and on the goods and services that ecosystems provide.*

*"I came to understand that when the environment is destroyed, plundered, or mismanaged, we undermine our quality of life and that of future generations."*

Wangari Maathai, 2005



**Figure 1.1: A conceptual representation of sustainable development**

Source: Barron and Gauntlett (2002)<sup>7</sup> and Department of Environmental Affairs and Tourism (2006)<sup>24</sup>

**Table 1.1: River ecosystem services and functions**

Ecosystem goods and services	Ecosystem functions	Examples
Gas regulation	Regulation of the chemical composition of the atmosphere	Carbon sequestration; oxygen and ozone production
Climate regulation	Regulation of temperatures; precipitation at local levels	Urban heat amelioration; wind generation
Disturbance regulation	Regulation of episodic and large environmental fluctuations on ecosystem functioning	Flood control; drought recovery; refuges from pollution events
Water supply and regulation	Supply and regulation of water flow	Provision of water for agricultural, industrial, and household use (spatial and temporal)
Sediment supply and regulation	Regulation of sediment supply to the estuary and marine environment	Maintenance of beaches, sand bars, sand banks
Erosion control	Retention of soil within an ecosystem	Prevention of soil loss by vegetation cover and by capturing soil in wetlands
Soil formation	Soil formation processes	Weathering of rock by water; accumulation of organic material in wetlands
Nutrient cycling	Storage, recycling, capture, and processing of nutrients	Nitrogen fixation; nitrogen cycling through food chains
Waste treatment	Recovery of nutrients; removal and breakdown of excess nutrients	Breaking down of waste; detoxifying pollution
Biological control	Regulation of animal and plant populations	Predator control of prey species; maintenance of population balance
Refugia	Habitat for resident and migratory populations	Nurseries; habitat for migratory fish and birds; regional habitats for species
Food production	Primary production for food	Provision of fish and plants
Raw materials	Primary production of raw materials	Production of craftwork materials, house-building materials, and fodder
Genetic resources	Unique biological materials and products	Genes for food and ornamental fish species; plant fibres
Nature appreciation	Opportunities for appreciating natural features and wildlife	Access to natural features and wildlife (for viewing and walking)
Sport fishing	Opportunities for sport fishing	Fly-fishing; conventional fishing
Water sports (in water)	Opportunities for sport in water	Swimming
Water sports (on water)	Opportunities for sport on water	Sailing; canoeing; skiing
Scenic view	Provision of scenic views	Residential houses, flats, offices, hotels with scenic views
Transport	Opportunities for water-based transport	Harbours; ferries; ski-boat launching
Culture	Opportunities for non-commercial uses	Aesthetic, educational, spiritual, intrinsic, and scientific value of ecosystems

Source: Mander and Quinn (1999)<sup>11</sup>

example, and increasing moves towards community-owned tourism ventures is improving the well-being of previously marginalized groups of people<sup>10</sup>. Nature-based tourism, which includes a variety of activities ranging from hunting to sun-bathing on a beach, depends on services such as clean air and water, unspoiled scenery, and attractive biodiversity, which are supported by underlying ecosystem processes<sup>8</sup> and environmental health. For example, nutrient cycling in soils and water purification provided by wetlands and watercourses improves human well-being (see Table 1.1). In the past, ecosystems have been managed to provide single economic services, without taking into account the trade-offs and consequent losses of other services<sup>9</sup>.

### 1.3.2 How environmentally sustainable are we?

Human well-being depends on ecosystem services, and sustainable development needs to be linked to the process of sustaining these services. Some kind of quantitative measure of the capacity of ecosystems to provide goods and services or, in a broader context, of environmental sustainability would greatly assist in judging how environmentally sustainable we are.

Many efforts have been made to develop quantitative indicators or indices of sustainable development and environmental sustainability, but there is currently no universally accepted set of indicators. Two initiatives, however, have gained popularity over the last couple of years: the Ecological Footprint (EF) and the Environmental Sustainability Index (ESI).

Measuring society's consumption of natural resources and waste output within the context of nature's renewable and regenerative capacity indicates the rate of progress towards environmental sustainability. One such measure is the Ecological Footprint, which measures people's natural resource consumption and quantitatively assesses the biological productivity (the amount of nature) required to produce the resources (food, energy, and material) and to absorb the wastes of any individual, city, region, or country. People consume resources and ecological services from all over the world, so the Ecological Footprint is the sum of these areas, wherever they are on the planet.

When humanity's footprint is within the annual regenerative capabilities of nature, that footprint is sustainable. From a global perspective, sustainability requires the world's population to live within the regeneration and absorptive capacity of the planet. If we remove more from nature than it can indefinitely provide, we are on an unsustainable track. In 2001, the global Ecological Footprint was 13.5 billion global hectares (gha)<sup>6</sup>, or 2.2 gha per person; the productive area of the biosphere (which provides us with environmental goods and services) translated into an average of 1.8 gha per person. In other words, in 2001, humanity's Ecological Footprint exceeded global biological

carrying capacity by 0.4 gha per person (that is, by 21%). This global overshoot began in the 1980s and has been growing ever since (see Figure 1.2): it means that we are spending nature's capital faster than it is being generated<sup>12</sup>.

The Ecological Footprint for South Africa is 2.8 gha per person, compared to the world average of 2.2 gha per person and the average for Africa of 1.2 gha per person (see Figure 1.3). South Africa ranks 42<sup>nd</sup> out of 148 countries. Because of its high carbon emissions, its energy footprint is particularly high compared to other countries in Africa (it is the second highest, after Libya at 2.1 gha per person). Whereas in low- to middle-income countries the

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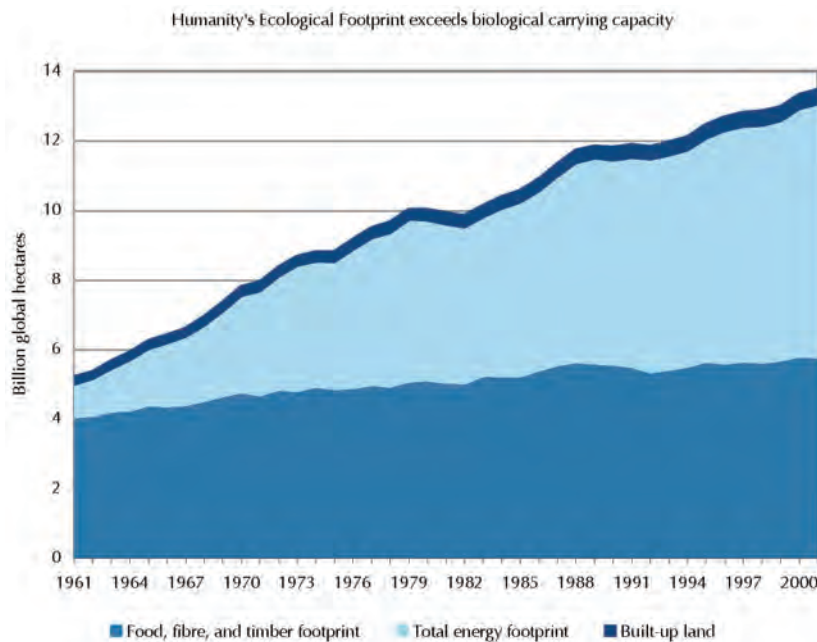
*"There are no passengers on spaceship Earth. We are all crew."*

Marshall McLuhan, 2002



Ecological Footprint. Illustration: Kim Heubner



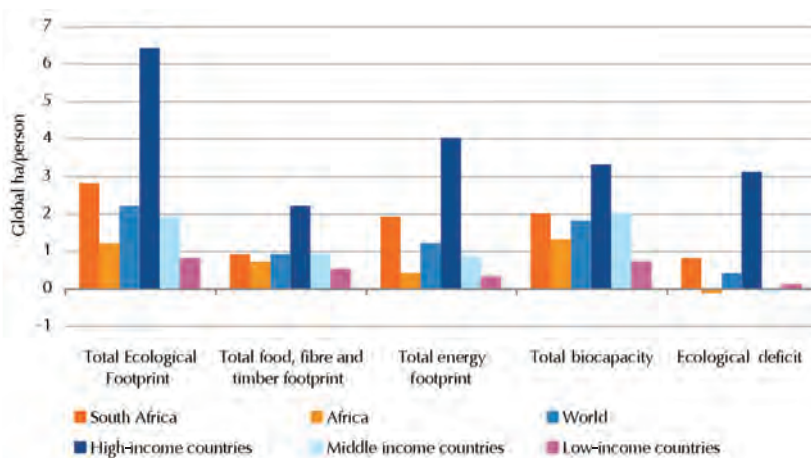


**Figure 1.2: Global Ecological Footprint, 1961–2001**

Source: World Wide Fund for Nature (2004)<sup>12</sup>

average person's footprint declined by 11% and 5%, respectively, between 1991 and 2001, the per capita footprint for South Africa increased by 2% over the same period and its biocapacity per capita decreased by 4%. The average footprint values for South Africa mask regional differences within the country as well as differences between rich and poor people, but the message is clear: we are eroding our natural capital.

A second measure of environmental sustainability, the ESI developed by Yale University, benchmarks the ability of nations to protect the environment over the next several decades. The index integrates 76 data sets – tracking natural resource endowments, past and present pollution levels, environmental management efforts, and the capacity of a



**Figure 1.3: Ecological Footprint and biocapacity**

Note: If the number for ecological deficit is negative, the country or region has an ecological reserve.

Source: World Wide Fund for Nature (2004)<sup>12</sup>

society to improve its environmental performance – into 21 indicators of environmental sustainability. These indicators allow comparison across a range of issues that fall into the following five broad categories:

- environmental systems
- reducing environmental stresses
- reducing human vulnerability to environmental stresses
- societal and institutional capacity to respond to environmental challenges
- global stewardship.

The ESI differs from Ecological Footprint analysis in that it focuses on a broader measure of environmental conditions rather than on a single dynamic. The ESI includes resource consumption, using the Ecological Footprint as a variable because of its obvious relevance to sustainability. In addition, the ESI also tracks many other aspects of environmental stewardship, particularly those associated with pollution and environmental public health<sup>13</sup>. The ESI score quantifies the likelihood that a country will be able to preserve valuable environmental resources effectively over a period of several decades. Put another way, it evaluates a country's potential to avoid major environmental deterioration. The higher the score, the more likely it is that a country can provide its citizens with high levels of environmental quality and services into the foreseeable future.

In 2005, South Africa managed an overall ESI score of 46.2, with a ranking of 93<sup>rd</sup> out of 146 countries. Compared to member countries of the New Partnership for Africa's Development (NEPAD), South Africa ranked 20<sup>th</sup> out of 40, with Gabon, the Central African Republic, Namibia, and Botswana in the first four places (see Table 1.2).

Even considering the individual components of the ESI, South Africa's ranking was lower than expected. For the ESI's 'environmental systems' component, South Africa was ranked 85<sup>th</sup> (with air quality and water quality and quantity contributing to the low ranking). For the component 'reducing environmental stresses', South Africa was ranked 111<sup>th</sup> (with reducing air pollution, reducing waste and consumption pressures, and reducing water stress contributing to the low score). South Africa's ranking for 'human vulnerability' was 80<sup>th</sup>. In contrast, South Africa's ranking (54<sup>th</sup>) in the component 'social and institutional capacity to respond to environmental challenges' was its highest, with only the indicators for eco-efficiency and science and technology pointing to areas of concern. The ranking for 'global stewardship' was 105<sup>th</sup>, with greenhouse gas emissions and transboundary environmental pressures contributing to the low ranking.

Because of uncertainties such as measurement error and missing data, both the EF and ESI should be seen as providing relative rather than absolute gauges of environmental performance. Nevertheless, South Africa's ranking in both of these measures has slipped over the last few years, indicating increasing pressures on environmental systems and current



**Table 1.2: Environmental Sustainability Index ranking and Ecological Footprints for New Partnership for Africa's Development (NEPAD) member countries**

Rank	Country	Environmental Sustainability Index	Ecological Footprint
1	Gabon	61.7	1.7
2	Central African Republic	58.7	1.1
3	Namibia	56.7	1.6
4	Botswana	55.9	1.3
5	Mali	53.7	1.1
6	Ghana	52.8	1.1
7	Cameroon	52.5	0.9
8	Tunisia	51.8	1.4
9	Uganda	51.3	1.5
10	Senegal	51.1	1.2
11	Zambia	51.1	0.8
12	Tanzania	50.3	0.9
13	Madagascar	50.2	0.8
14	Gambia	50.0	1.1
15	Malawi	49.3	0.7
16	Guinea-Bissau	48.6	0.7
17	Guinea	48.1	1.0
18	Benin	47.5	1.0
19	Côte d'Ivoire	47.3	0.9
20	South Africa	46.2	2.8
21	Algeria	46.0	1.5
22	Burkina Faso	45.7	1.1
23	Nigeria	45.4	1.2
24	Kenya	45.3	0.9
25	Niger	45.0	1.1
26	Chad	45.0	1.3
27	Rwanda	44.8	0.7
28	Mozambique	44.8	0.7
29	Togo	44.5	0.9
30	Democratic Republic of Congo	44.1	0.7
31	Egypt	44.0	1.5
32	Sierra Leone	43.4	0.9
33	Liberia	43.4	0.7
34	Angola	42.9	0.8
35	Mauritania	42.6	1.1
36	Libya	42.3	3.1
37	Zimbabwe	41.2	1.0
38	Burundi	40.0	0.7
39	Ethiopia	37.9	0.7
40	Sudan	35.9	1.0

Sources: *Esty, Levy, Srebotnjak and de Sherbinin (2005)*<sup>13</sup> and *WWF (2004)*<sup>12</sup>

*The most recent environmental assessments in South Africa and elsewhere show that the increasing pace of human-induced environmental change is altering the ability of the natural environment to provide services and may, in fact, impede our progress towards sustainable development.*

weaknesses in our ability to deal with these pressures. This has dire consequences for the state of the environment and environmental sustainability (which are discussed in more detail in subsequent chapters). By maintaining healthy and well-functioning ecosystems, decision-makers can limit environmental disturbances to people and their social systems. All too often, environmental sustainability is not considered when planning and implementing development projects, which raises the vulnerability of the poor to health risks and natural disasters.

Concerns are also increasing about the insecurity that individuals and groups (whether small communities or the whole of humankind) experience through environmental changes such as water scarcity, air pollution, and global warming. Environmental security/vulnerability is an important issue that warrants attention. Environmental shifts can threaten human security on both national and global scales, and contribute directly or indirectly to conflict by exacerbating other disruptions such as poverty, migration, and the spread of infectious diseases. This important issue is explored in greater detail in Chapter 10 of this report.

Since the late 1980s, the international community has increased its efforts to respond to the challenge of diminishing resources, increasing environmental impacts, and growing vulnerability. The major environmental and development milestones include the adoption of Agenda 21 in 1992, the adoption of the Millennium Development Goals (MDGs) in September 2000 (see Box 1.1), and the World Summit on Sustainable Development (WSSD), which was hosted by South Africa in 2002. Not only did the WSSD raise South Africa's international stature in the area of sustainable development but, more important, the country played a key role in facilitating negotiations between developing and developed countries and in raising the profile of NEPAD. It was instrumental in altering the North-South attitude from one of development assistance to one of cooperation in protecting global environmental assets<sup>14</sup>.

The major WSSD outcome was the Johannesburg Plan of Implementation (JPOI), which outlined actions for further implementation of Agenda 21 and multilateral environmental agreements since the 1992 Rio Summit as well as for progress towards implementation of the MDGs.

The WSSD gave the concept of sustainable development greater prominence than ever before in debates and thinking among government and other stakeholders in South Africa. It also resulted in a renewed effort to develop a cross-sectoral National Strategy for Sustainable Development (NSDD), which will be an important tool for ensuring an integrated approach to the management of a range of environmental issues. At the time that this report went to press, it was envisaged that South Africa's NSDD will be completed in 2006<sup>5</sup>.

## 1.4 KEEPING THE ENVIRONMENT UNDER REVIEW

The most recent environmental assessments in South Africa and elsewhere show that the increasing pace of human-induced environmental change is altering the ability of the natural environment to provide services and may, in fact, impede our progress towards sustainable development. This section summarizes the main features of environmental reporting that has taken place at different scales, from local to global.

### 1.4.1 Environmental reporting and review in South Africa

Through its mandate of keeping the state of the environment under review, the Department of Environmental Affairs and Tourism (DEAT) has leveraged support for a wide-ranging set of collaborative processes for collecting, managing, compiling, analysing, and sharing data and statistics on the state of the environment at the national and sub-national level. Through these and other environmental assessment initiatives, such as the State of Rivers Project, we know more about the condition of our environment than we did ten years ago.

The 1999 National State of the Environment Report highlighted the fact that the relatively limited availability of environmental data and information seriously constrained the country's ability to monitor the state of the environment. Since then, the DEAT has initiated a comprehensive State of the Environment Programme, which includes support to provincial and local authorities to undertake environmental assessments and report on the state of their environments. Since 1999, 19 sub-national state of the environment reports have been published (see Annexure 1). During 2002, the DEAT also released a set of environmental indicators and developed a set of environmental performance indicators for local authorities. The State of the Environment Programme has also provided capacity to provinces and local authorities for developing environmental reports and products on the Internet.

### 1.4.2 Regional reporting and review

Keeping the environment under review is also important for the southern African region. A recent survey conducted by the Musokotwane Environment Resource Centre for Southern Africa identified the need to include a set of standardized, scientifically credible indicators in state of the environment reporting, both within individual countries at the national level and among countries at the regional level. For this reason South Africa, through the DEAT and the State of the Environment Programme, took part in a regional collaborative initiative to develop a core set of indicators for state of the environment reporting for southern Africa for use in future.



## Box 1.1 Key environment and development milestones

As with the concept of sustainable development, the process determining an international and regional agenda on environment and development is strongly contested and is reached through negotiation and political processes<sup>14</sup>. The interpretations of agenda principles and priorities by countries around the world are also political and often contested. These priorities, nevertheless, play an important role in defining South Africa's sustainable development agenda. This summary highlights some of the key global environment and development milestones of the past 15 years.

### The United Nations Rio Earth Summit and Agenda 21

The Rio Earth Summit in Brazil in 1992 brought together delegates from 178 countries, over 100 heads of state, and representatives from more than 1 000 non-governmental organizations<sup>15</sup>. The major output of the conference was the non-binding agreement, Agenda 21, which indicated the emergence of clear international consensus on a range of environment and development issues, including international cooperation, citizen participation, gender, poverty, sustainable agriculture, desertification, and land degradation. Principle 10 of Agenda 21 emphasizes access to information and environmental justice. South Africa has formally adopted Agenda 21 and initiated the development of a National Strategy for Sustainable Development (NSSD).

### The United Nations Conference on Human Settlement (Habitat II)

The Habitat Agenda was launched at the United Nations Habitat II Conference in Istanbul, Turkey, in 1996. It included goals, principles, and commitments to turn the vision of sustainable human settlements into reality, and was endorsed by South Africa in 1996. A sustainable human settlement is one in which all the people have adequate shelter, a healthy and safe environment, basic services, and productive and freely chosen employment.

### Millennium Declaration and Millennium Development Goals (MDGs)

At the United Nations Millennium Summit in New York in September 2000, world leaders agreed on a far-reaching plan to support global development objectives for the new century. The Millennium Declaration<sup>16</sup> set out the key challenges facing humanity and committed 189 states, including South Africa, to eight development goals containing 18 targets and 48 indicators. The Millennium Development Goals (MDGs) focus disparate development agendas on a set of global priorities, and serve as a powerful political tool to hold governments and international institutions accountable. The South African Government has committed substantial resources to meeting its MDGs.

### World Summit on Sustainable Development (WSSD) and the Johannesburg Plan of Implementation (JPOI)

In 2002, 10 years after the Rio Earth Summit, South Africa hosted the World Summit on Sustainable Development (WSSD), which brought the MDGs into the sustainable development arena and sought to find an effective balance between development, on the one hand, and economic, social, and environmental objectives on the other. A major outcome of the WSSD was the adoption of the Johannesburg Plan of Implementation (JPOI)<sup>17</sup>, which outlined actions for further implementation of Agenda 21, of the MDGs, and of international agreements since 1992. It included new targets for access to sanitation and for dealing with marine ecosystems, fish stocks, sustainable production and consumption, biodiversity, and desertification<sup>14</sup>. During the WSSD, a total of 251 voluntary partnerships were announced in support of sustainable development. Partnerships were forged around issues such as water and sanitation, energy, health, agriculture and biodiversity, and ecosystem management<sup>14</sup>. The JPOI also emphasized the importance of regional action-oriented initiatives for sustainable development

and recognized the New Partnership for Africa's Development (NEPAD) as a framework for promoting sustainability on the African continent.

### Global Environmental Outlook (GEO)

The Global Environmental Outlook (GEO) project of the United Nations Environment Programme (UNEP) was initiated in response to the environmental reporting requirements of Agenda 21. In May 1995, the UNEP Governing Council decided to produce a new comprehensive global state of environment report. Through a widely participatory process drawing on information from regional centres, UNEP produced three GEO reports from 1997 onwards<sup>18</sup>. The GEO project also provided capacity to regional, sub-regional, national, and sub-national institutions for developing environmental reports and products.

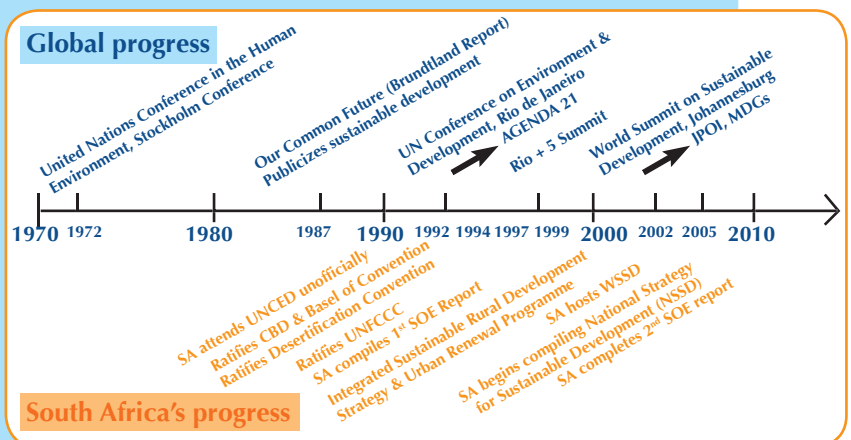
In 2002, UNEP presented the state of the world's environment in the GEO-3 report<sup>19</sup>. By identifying global issues (for example, land degradation, biodiversity loss, water demand, climate change, urbanization, human vulnerability) that affect environmental sustainability, the GEO-3 served as a foundation for the WSSD review in 2002 of policies for sustainable development.

### NEPAD and the Action Plan of the Environment Initiative

The JPOI recognized that sustainable development had proved elusive in Africa. In many African countries, poverty remained a major challenge to human development, and most of them had failed to benefit from globalization. Poverty has exacerbated environmental degradation throughout the continent<sup>20</sup>, while globalization and the regionalization of economies and associated technological improvements have eroded the symbiotic relationship between people and environment<sup>21</sup>. The combination of poverty, climate variability, natural disasters, institutional weaknesses, and unfair trading practices in developed countries have increased Africans' vulnerability to environmental change. As a result, increasing numbers of countries in Africa are facing water stress and scarcity as well as land degradation.

African countries have responded to these significant challenges. Through NEPAD, which was launched in 2002, African leaders pledged to eradicate poverty and to put the continent on the path to sustainable development<sup>22</sup>.

NEPAD's Action Plan of the Environment Initiative<sup>23</sup> focused on core areas including the following: combating land degradation, drought, and desertification; conservation of Africa's wetlands; conservation and sustainable use of marine, coastal, and freshwater resources; combating climate change; cross-border conservation and management of natural resources; health and environment; transfer of environmentally sound technologies; and assessment and early warning of natural disasters.





**Table 1.3: Priority environmental issues identified for South Africa**

Theme	Issue
Atmosphere	Indoor and ambient air quality
	Climate change
	Stratospheric ozone depletion
Biodiversity and ecosystem health	Over-exploitation
	Habitat degradation and loss
	Invasive alien species
	Sustainable management
Economy	Economic growth and unemployment
	Resource consumption
	Technology and innovation
Environmental governance	Institutions and laws
	Participation in environmental governance
	Corporate responsibility
Human settlements	Urbanization and migration
	Urban form
	Shelter and service provision
	Integrated waste management
Human vulnerability	Food security
	Exposure to hazards and disasters
	Coping capacity
Inland water	Water availability
	Water quality
	Degradation of aquatic ecosystems
Land	Land use and productivity
	Land reform and access to land
	Land degradation and desertification
Marine and coastal ecosystems	Over-exploitation of stocks and degradation of habitat
	Sea-level rise
	Protection and management
Population and well-being	Population change
	Poverty eradication
	HIV and AIDS
	Inequality

Source: National State of Environment workshop held November 2004, Department of Environmental Affairs and Tourism





The project, the first phase of which was completed in 2005, builds on existing capacity and experience, filling identified gaps in understanding, and strengthening technology and capacity. The aim is to bolster capacity in southern Africa in the selection and use of indicators, assessment of regional and global environmental trends, analysis of data, and state of the environment reporting. Such reporting processes will also be incorporated into global environmental assessments and reports such as the Africa Environment Outlook and the Global Environment Outlook (GEO).

### 1.4.3 Global reporting and review

Assessing progress towards environmental sustainability in South Africa cannot happen in isolation but needs also to take cognizance of regional and global assessment initiatives and approaches. One such development is the increasing emphasis on preparing regional, sub-regional, national, and city-level environment outlook-type reports, using the GEO as a benchmark (see Box 1.1). Such reports go beyond traditional state of the environment reports in that they build on the analysis of past and current trends to outline policy options for the future, leading to different outcomes over the next 20–30 years. This report follows the same approach, going beyond what was presented in South Africa’s State of the Environment Report of 1999 (refer to Chapter 11 and 12).

## 1.5 PRIORITIZING ENVIRONMENTAL ISSUES

By identifying global issues that affect environmental sustainability, the GEO-3<sup>19</sup> report provided a firm foundation for the review of policies for sustainable development that took place at the WSSD. Better understanding of environmental issues helped policy-makers to adapt global action so as to meet the challenges. The GEO-3 reported on a range of priorities including those summarized below:

- Land degradation, as a result of unsuitable agricultural use, poor soil and water management practices, deforestation and removal of natural vegetation, is exacerbating the threats to global food security.
- Biodiversity is being lost at a rate higher than natural extinction because of land conversion, climate change, pollution, invasion by exotic species, and over-exploitation.
- Increased water demand and climate variability results in the fact that a large proportion of the global population lives in countries suffering from water stress. For poor areas, consumption of untreated water and lack of sanitation have severe implications for health and, in turn, contribute to decline in economic productivity.
- Degradation of coastal and marine areas has intensified



The series of Global Environment Outlook reports.

because of global warming, population growth, increased industrialization, urbanization, and tourism in coastal areas.

- Concentrations of carbon dioxide have increased significantly through emissions of fossil fuels, mainly by developed countries. Air pollutant emissions have decreased in most industrialized countries but acid precipitation is a significant concern.
- Rapid urban growth is contributing to increasing unemployment, poverty, and inadequate service provision, and it is overburdening existing infrastructures. Inadequate waste collection is exacerbating urban health problems.
- The vulnerability of people to disasters and environmental change is increasing significantly.

At the start of the process of formulating the South African Environment Outlook (in November 2004), state of the environment stakeholders met to consider these and other relevant regional, national, and sub-national priorities. Table 1.3 presents the priority environmental issues that emerged at this national workshop and that form the basis for the analysis of the state of the environment presented in Part II of this report.

## 1.6 CONCLUSION

This introductory chapter has touched on the international debates from the 1970s onwards concerning ways to address mounting global environmental challenges. The emergence of sustainable development in the 1980s not

only integrated environment with development, but also challenged the dominant patterns of production and consumption and highlighted the need for international justice. This change of attitude is reflected in the environment and development priorities of the global community, which increasingly recognizes the interconnectedness of society, economy, and environment. This shift towards sustainable development has in turn influenced South Africa's development agenda (see Box 1.1).

International measures of environmental sustainability indicate that human activity has exceeded the planet's ecological carrying capacity. South Africa is no exception. The WWF Ecological Footprint analysis and the Yale Environmental Sustainability Index show that the country is experiencing increasing pressure on its natural resource systems, compounded by a weak response to the resulting adverse effects.

The chapters that follow detail the socio-economic contexts and causes of environmental change in South Africa (Chapter 2), the condition and trends in the different constituents and themes of the environment (Chapter 3–9), and our vulnerability to environmental change (Chapter 10). The report then looks ahead at alternative environmental futures (Chapter 11) and options for action (Chapter 12) for the country. These two concluding chapters identify areas of priority for making progress towards sustainability in South Africa.

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*There is enough for all.  
The Earth is a generous  
mother; she will  
provide in plentiful  
abundance food for all  
her children if they will  
but cultivate her soil in  
justice and in peace.*

**Bourke Coekran**



## NOTES

- a. One tonne of fuel oil equivalent contains 44 700 megajoules (MJ) of energy and is equivalent to about 2 tonnes of oven-dry wood (~20% moisture). (International Energy Agency).
- b. A global hectare (gha) is a hectare whose biological productivity (e.g. forest, cropland, pasture, fisheries, built-up land) equals the global average. In other words it is 1 ha of biologically productive space with world-average productivity.
- c. In mid-April 2006, the Department of Environmental Affairs and Tourism released the first version of the draft NSSD for public review. The strategy is currently being revised and will formally undergo another round of public review and comment before being presented to Cabinet. For further information refer to the NSSD website: <http://www.environment.gov.za>

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## REFERENCES

1. United Nations Development Programme (2003). *South Africa Human Development Report 2003. The Challenge of Sustainable Development in South Africa: Unlocking People's Creativity*. Oxford University Press Southern Africa, Cape Town.
2. Hattingh, J. (2002). On the Imperative of Sustainable Development: A Philosophical and Ethical Appraisal. In Hattingh, J., Lotz-Sisika, H., and O'Donoghue, R. (eds.) *Environmental Education, Ethics and Action in Southern Africa*. Human Sciences Research Council, Pretoria.
3. Meadows, D., Randers, J., and Behrens III, W.W. (1972). *The Limits to Growth: A report for The Club of Rome's project on the predicament of mankind*. Universe Books, New York.
4. Goldsmith, E., Allen, R., Allaby, M., Davoll, J., and Lawrence, S. (1972). A Blueprint for Survival. *The Ecologist*, 2(1), January.
5. Eckersley, R. (1992). *Environmentalism and political theory: Towards an ecocentric approach*. UCL Press, London.
6. World Commission on Environment and Development (1987). *Our Common Future*. Oxford University Press, Oxford.
7. Barron, L. and Gauntlett, E. (2002). *Sustaining Local Communities – International Local Agenda 21 Conference*. Housing and Sustainable Indicators Project, Western Australian Council of Social Service, Perth.
8. Scholes, R.J. and Biggs, R. (eds.) (2004). *Ecosystem Services in Southern Africa: A Regional Assessment*. Contribution to Millennium Ecosystem Assessment. Council for Scientific and Industrial Research, Pretoria.
9. Bohensky, E., Reyers, B., van Jaarsveld, A.S., and Fabricious, C. (2004). *Ecosystem services in the Gariep Basin*. University of Stellenbosch.
10. Carolus, C. (2004). Sustainable Development in South African Tourism. In *The Enviropaedia*, Networking Sustainable Development Solutions.
11. Mander, M. and Quinn, N.W. (1999). *Incorporation of economic considerations into RDM determination: A proposed conceptual approach*. Study undertaken by Institute of Natural Resources, Pietermaritzburg for Department of Water Affairs and Forestry.
12. World Wide Fund for Nature (2004). *Living Planet Report 2004*. Gland.
13. Esty, D. C., Levy, M.A., Srebotnjak, T., and de Sherbinin, A. (2005). *2005 Environmental Sustainability Index: Benchmarking National Environmental Stewardship*. Yale Center for Environmental Law & Policy, New Haven.
14. Department of Environmental Affairs and Tourism and United Nations Development Programme (South Africa). (2004). *Ten days in Johannesburg: A negotiation of hope*. Department of Environmental Affairs and Tourism and United Nations Development Programme (South Africa), Pretoria.
15. United Nations Conference on Environment and Development Collection (UNCED). <http://www.ciesin.org/datasets/unced/unced.html>
16. United Nations General Assembly (2000). *United Nations Millennium Declaration* General Assembly Resolution 55/2 adopted by the General Assembly of 8 September 2000. <http://www.ohchr.org/english/law/millennium.htm>
17. World Summit on Sustainable Development (2002). *Johannesburg Plan of Implementation*. [http://www.johannesburgsummit.org/html/documents/summit\\_docs/2309\\_planfinal.htm](http://www.johannesburgsummit.org/html/documents/summit_docs/2309_planfinal.htm)
18. United Nations Environment Programme, GEO Project. <http://www.unep.org/geo>
19. United Nations Environment Programme (2002). *Global Environment Outlook 3: Past, present and future perspectives*. United Nations Environment Programme, Earthscan, London.
20. African Ministerial Conference on the Environment/United Nations Environment Programme (2003). *Africa Environment Outlook*. <http://www.grida.no/aeo>
21. South African Development Community (2005). Draft Southern African Development Community Environment Outlook. Unpublished report.
22. New Partnership for Africa's Development official website: <http://www.nepad.org/2005/files/home.php>
23. NEPAD (2003). Action Plan of the Environment Initiative of the New Partnership for Africa's Development. <http://www.nepad.org/2005/files/documents/113.pdf>
24. Department of Environmental Affairs and Tourism (2006). South Africa's National Strategy for Sustainable Development. Draft Integrated Strategy for Review. Department of Environmental Affairs and Tourism, Pretoria. [http://www.deat.co.za/nssd\\_2005/nssd\\_11082005\\_new.htm#](http://www.deat.co.za/nssd_2005/nssd_11082005_new.htm#)





THE OFFICE TOWER

THE ROXY THEATRE

THE MINE X BRDG

LIVE! POOL

THE OFFICE TOWER

7-ELEVEN

GOGLA 2000

LIVE! POOL





# Chapter 2

## What affects our environment?

### At a glance

This chapter explores the socio-economic, political, and technological trends in South Africa and their impact on our environment. A number of factors or drivers that stem from socio-economic activities influence the environment, affecting ecosystem health and people's quality of life. The drivers, singly or in combination, are viewed from macro-level processes and activities that influence the environment positively or negatively in different ways. These in turn have an influence for better or worse on people's standard of living. Drivers range from globalization, global governance, and multilateral environmental agreements on international level to population growth, economic development, governance within the country and science and technology nationally. The "Governance" section focuses in particular on global environmental governance as a driver of regional and national policy and governance, setting the scene for the discussion in Chapter 3 on recent and ongoing legislative and institutional reform affecting environmental management in South Africa.

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## 2.1 INTRODUCTION

The environment is constantly in flux, with change driven by a variety of factors that influence and direct it in many ways – affecting the quality of our water and air resources, for instance, or the productivity of land. These factors, or ‘drivers’, arise mainly from a country’s socio-economic activities. When combined with changes in the condition of the natural environment, these drivers can and do have significant impact on the health and functioning of that environment, which, in turn, affects people’s quality of life and their ability to survive.

Several levels of drivers affect South Africa’s environment. This report is based on the view that the drivers are the macro-level processes and activities that influence the environment for good or ill. For instance, commercial and industrial development can pollute water and air through its waste products, but it can also contribute to raising people’s standard of living. Better living standards can bring about improvement in the quality of natural resources, provided society chooses to fund the protection of the environment.

Many drivers combine to affect the various receiving environments, but the influence that each exerts can differ widely. International drivers include globalization, global governance, and multilateral environmental agreements (MEAs), for example, while national drivers include

population growth, economic development, governance within the country, and science and technology.

This chapter explores the socio-economic, political, and technological trends in South Africa and their impact on our environment. The “Governance” section (section 2.4) focuses in particular on global environmental governance as a driver of regional and national policy and governance, setting the scene for the discussion in Chapter 3 on recent and ongoing legislative and institutional reform affecting environmental management in South Africa.

## 2.2 DEMOGRAPHY AND HUMAN WELL-BEING

Growing human populations can threaten the natural environment, in that people affect the environment, and numerous people affect it profoundly. The interface is complex, however. Population change and environmental change do not have a simple ‘cause and effect’ relationship.

Population structure and migration patterns, driven by social and political factors, are closely linked to inequality and poverty, and these conditions also influence the environment in important ways<sup>1</sup>. They define production and consumption patterns, and the manner in which natural resources are used. Resource use increases as populations



Rapid urban growth has placed significant pressure on the natural systems. Close to 58% of the population is urbanized. *Photography: South African Tourism*





grow and as their aspirations, values, and socio-economic status change. A rise in socio-economic status not only causes increased consumption, but also frequently results in the distancing of people from their natural resource base, which in turn, lowers their awareness of the consequences of over-consumption<sup>1</sup>.

This section gives an overview of relationships between environment, demography, and human well-being in South Africa.

### 2.2.1 Population growth

The first national population census for South Africa, in 1904, recorded the country's total population as 5.17 million people<sup>2</sup>. A century later, this figure had grown ninefold to 46.9 million<sup>3</sup> (see Figure 2.1). The growth rate peaked at around 2.9% per year in the early 1980s, declined to 2.4% in the mid-1990s, and has declined further in the decade to 2005.

Overall population growth trends mask important regional and local variations. Historically, the most rapid growth has been characteristic of cities and their surrounding regions, although the populations of the former homelands have also swelled. Urbanization is the dominant population trend of the late 1990s and early 2000s and is likely to remain so for the near future.

KwaZulu-Natal has the largest share of the population (20.6%) followed by Gauteng (19.2%) and the Eastern Cape (15.0%)<sup>3</sup>. The Northern Cape remains the province with the smallest share of the population (1.9%). Internal migration patterns show a shift to three main areas. Gauteng, the Western Cape, and KwaZulu-Natal have positive net migration, with the largest number of persons expected to

migrate to Gauteng (about 520 000) for the period 2001–2006. The Eastern Cape and Limpopo are expected to experience negative net migration of approximately 320 000 for the same period.

South Africa's 46.9 million people require food, water, shelter, sanitation, clothing, energy, transport, education, employment, and provision for the future. These needs largely derive from or depend upon our environment. This dependence is hugely significant, as there are eight times as many people trying to survive on the same amount (and in some cases less) of natural resources as a century ago. Increased resource consumption and waste production have, in the meantime, impaired ecosystem functioning and productivity.

### 2.2.2 Growth scenarios

It is important to predict population growth on a variety of spatial scales (that is, on local, provincial, national, regional, and global scales). Such predictions help governments to anticipate, amongst other things, the resources that its citizens will require to meet their needs.

Large-scale population projections mask many other trends that are also very important to planners in the public and private sectors, however, including changes in the size and proportional representation of different age groups. Furthermore, projecting population growth trends in South Africa is made difficult by uncertainties about the precise effect of HIV and AIDS. (Box 2.1 presents some key factors influencing the prediction of South Africa's future population and summarizes some of the divergent population projections for the country.)

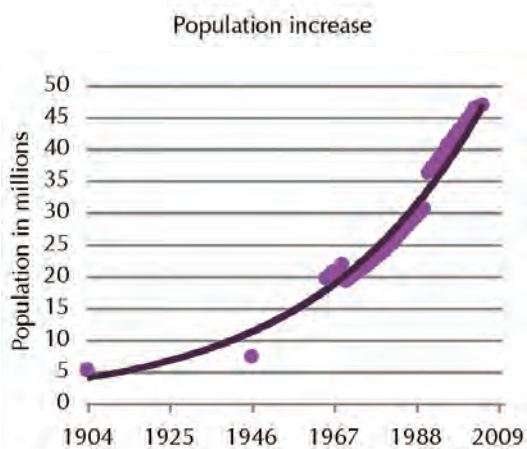
Most projections suggest a declining growth rate due to the impact of HIV and AIDS. The loss of economically active members of households means loss of income, which makes many rural households more dependent on natural resources for subsistence. Increased and unsustainable utilization of such natural resources could therefore exacerbate the cycle of poverty and environment degradation. (For details, see section 2.3.4.)

An additional complication is the changing structure of the population, which influences the composition and performance of the economy as well as its resource efficiency (see section 2.3). The sections that follow highlight some of the major demographic changes in South Africa's population as well as in its levels of human development and well-being.

### 2.2.3 The structure of the population

The declining rate of national population growth is expected to continue well into the 21<sup>st</sup> century, key contributors being steadily declining fertility and increasing mortality fuelled substantially by the spread of HIV and AIDS.

*South Africa's 46.9 million people require food, water, shelter, sanitation, clothing, energy, transport, education, employment, and provision for the future. These needs largely derive from or depend upon our environment.*



**Figure 2.1: Population growth in South Africa, 1904–2004<sup>a</sup>**

Source: Department of Environmental Affairs & Tourism (1999)<sup>2</sup>, South African Cities Network (2004)<sup>4</sup>, Statistics South Africa (2004)<sup>3</sup>

## Box 2.1 Predicting the future size of South Africa's population

South Africa, like many developing countries, is moving through a demographic transition, where dropping death rates are followed by declining birth rates, and the combined outcome is a declining rate of natural population increase.

The common wisdom two decades ago was that the population would grow steadily into the new millennium, albeit at a declining rate. HIV and AIDS has prompted a serious revision of earlier projections, however, with the prospect of a declining population becoming ever more likely. At best, population projections are based on assumptions and scenarios, and HIV and AIDS has added a layer of complexity to the calculations. For projections to assess the impact of HIV and AIDS, forecasts of prevalence are needed (that is, forecasts of the proportion of the country's total population that is infected at any particular time), as well as forecasts of when prevalence is likely to peak and trends in AIDS-related deaths.

The impact of HIV and AIDS in social and economic contexts is felt when household incomes fall through the loss of wage earners and rising costs, particularly of medical care and funerals. Members of both rural and urban households,

particularly women, have to allocate their time to producing food and meeting other household needs, childcare, and care for the sick. There is increasing pressure on grandparents to care for the sick and orphaned. Abuse and stigmatization of people living with HIV and AIDS prevails in many countries including South Africa, which makes it difficult to determine an accurate picture of the scale of the disease.

Recent statistics on the impact of AIDS on sub-Saharan Africa indicate that the HIV and AIDS epidemic will potentially have a devastating effect on the growth of the South African economy, especially in the longer term. Excessively high morbidity rates amongst the most productive segment of the labour force (especially 15–49-year-olds) impact on labour productivity, GDP growth rates, and cost burdens to the state in terms of health care and orphaned children.

Against this background, various organizations have produced divergent population projections for South Africa. Rehle and Chisana (2003) summarize some of them as follows:

### Total population (millions)

Organization	1996	2001	2005	2010	2015	2020
Human Sciences Research Council	40.6	43.6	45.1	46.1	46.9	47.6
Medical Research Council / Actuarial Society of South Africa	41.5	45.8	47.5	47.4	-	-
United States Census Bureau	40.7	42.6	42.6	40.6	38.0	35.9
World Bank	-	-	44.0	44.8	45.8	47.0
United Nations Population Division	-	43.8	-	-	-	44.0
Statistics South Africa*	40.5	44.8	46.9	-	-	-

\*1996 and 2001 data (respective Censuses) and 2005 data (Mid-Term Estimates)

In line with the United States Census Bureau, the US-based Population Reference Bureau estimates that South Africa's population will drop from 44 million in 2003 to 35.1 million in 2025, and 32.5 million in 2050. These projections would however be influenced by immigration (illegal as well as legal) of people.

The impact on the size of the country's population of people moving into South Africa is substantial, with immigration from Africa in particular to some extent counterbalancing downward trends in natural population growth. The number of those entering from outside the country is difficult to measure, because of illegal immigration into South Africa and because of insufficiently understood circulatory migration patterns of people moving between rural and urban areas. As an indicator, between the 1996 and 2001 censuses, the number of persons who indicated that they were born in Southern African Development Community (SADC) countries increased by 158 000, while

the number living in South Africa but born in other African countries increased by 21 800. Recent reports on asylum seekers show a similar upward trend. In 2004, 104 000 applications for asylum were received by authorities, more than double the figure for 2000.



Photography: South African Tourism



Dropping fertility is due partly to social and economic trends, including economic growth in South Africa, urbanization, social mobility, and migration. Empowerment of women in terms of education, family planning, and access to jobs has contributed to driving fertility down. In 1998, South African women had an average of 2.9 children. There was a notable difference between urban and rural populations, with urban women having an average of 2.3 children each, and rural women averaging 3.9 children each<sup>5</sup>. Fertility is likely to decline to an average of 2.8 by mid-2005.

Mortality patterns also showed a generally declining trend up to the mid-1990s, because of improvements in diet and health awareness as well as better access to health care and clean water. The increased life expectancy up to the 1990s reflects this declining mortality (see Figure 2.2).

More recently, however, life expectancy has declined dramatically, mostly because of the increased number of HIV and AIDS infections. Although average life expectancy peaked at 67 years in 1998<sup>6</sup>, it has declined dramatically since then. Dorrington *et al.* (2004)<sup>8</sup> predicted that average life expectancy in 2004 would fall below 50 years, with 48.5 years for men and 52.7 years for women. The average for the period 2000–2005 dropped to 46 years. It has been estimated that, by 2010, South Africa's life expectancy will be 48 years for those living with HIV and AIDS and 68.2 years for those who are HIV negative<sup>9</sup>. This situation mirrors trends in the southern African region.

Between 1997 and 2001, women were more likely to die from HIV-related infections such as influenza and pneumonia than men<sup>10</sup>. Strong links have been found between on the one hand gender and on the other hand the acceleration of the destructive cycle of HIV and AIDS, land and natural resource degradation, and poverty.

Women more than men possess indigenous knowledge about medicinal plants and are involved in natural resource use, so infection results in the loss of this knowledge and has a detrimental effect on the natural resource base. Research on the impact of HIV and AIDS on the environment in Africa has also shown that illness reduces women's capacity for sound resource stewardship: they may have less time because they are caring for the sick or because they are forced to harvest medicinal plants unsustainably to treat the side-effects of AIDS, such as diarrhoea and pneumonia; they may not be able to pass on to their children the indigenous knowledge they have to manage nature's resources<sup>11</sup>. HIV and AIDS has also caused loss of productivity in the conservation workforce and institutions involved in natural resource management in many African countries<sup>9</sup>.

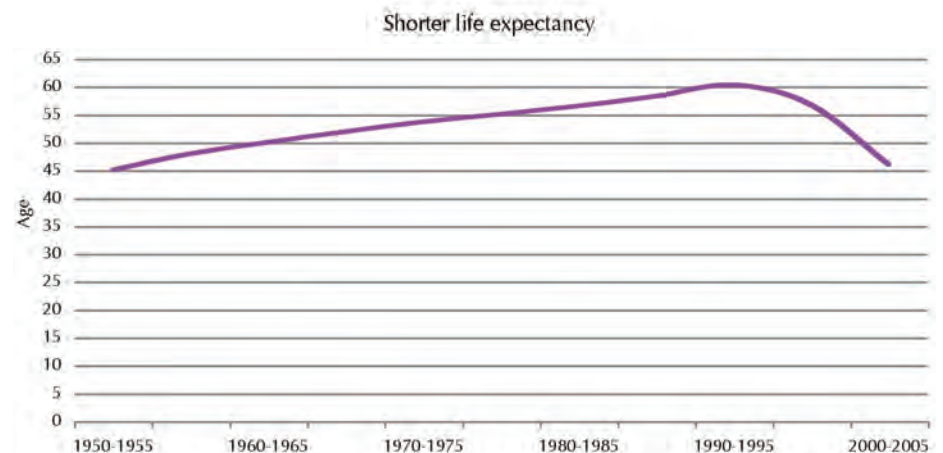
Mother-to-child transmission of HIV, coupled with poor environmental conditions, has increased infant and childhood mortality. The infant mortality rate was 56 per



Woman selecting medicinal plants at a trading stall.

Photography: Janet Peace

*Strong links have been found between gender on the one hand and the acceleration of the destructive cycle of HIV and AIDS, land and natural resource degradation, and poverty.*



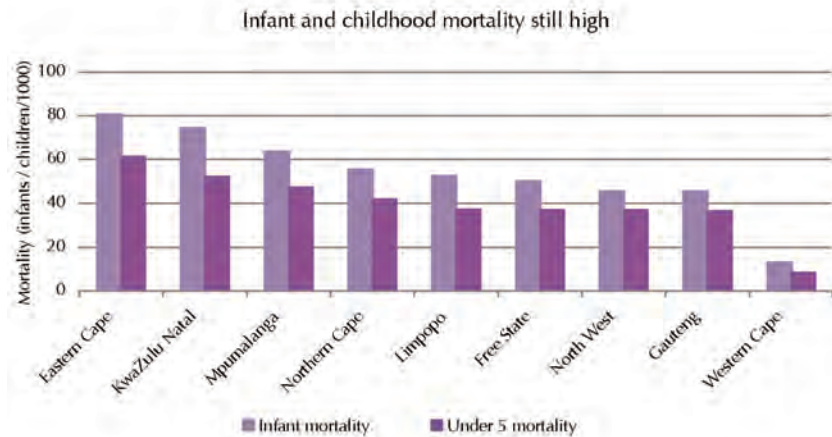
**Figure 2.2: Life expectancy of South Africans, 1950–2005**

Note: these figures are averaged over 5-yearly periods and so yearly peaks and troughs are not shown. Source: Department of Environmental Affairs & Tourism (2004)<sup>6</sup>, Rehle and Shisana (2003)<sup>7</sup>, Dorrington *et al.* (2004)<sup>8</sup>, Statistics South Africa (2005)<sup>3</sup>

1 000 live births in 2004<sup>8</sup>. Socio-economic factors play an important role in infant mortality rates. Children in households lacking access to safe water and adequate sanitation are most vulnerable to ailments such as diarrhoea, especially when they are HIV positive. Cooking and heating using open wood and coal fires increase indoor air pollution and promote and compound respiratory diseases.

Infant and childhood mortality are highest in the less developed provinces of South Africa. In 2001, the Eastern Cape, KwaZulu-Natal, and Mpumalanga had the highest infant mortality rates and the Western Cape, Gauteng, and Free State the lowest (Figure 2.3). This situation hampers South Africa's progress toward achieving Millennium Development Goal 4, target 5, which stipulates the reduction of mortality among children under five years old by two-thirds between 1990 and 2015.

*Women more than men possess indigenous knowledge about medicinal plants and are involved in natural resource use, so infection results in the loss of this knowledge and has a detrimental effect on the natural resource base.*



**Figure 2.3: Provincial infant and childhood mortality rates per 1 000 births, 2001**

Source: Department of Health (2002)<sup>12</sup>



**Figure 2.4: Population structure by age and gender, 2001**

Source: Statistics South Africa (2004)<sup>20</sup>

*Without the means to escape the cycle of poverty, many people remain confined to places that are economically marginalized and environmentally degraded.*

The age structure of the population reflects the changes in fertility and life expectancy. South Africa's current population pyramid is typical of a developing country, with a large proportion of people in the younger age groups and a relatively small proportion aged 65 years and over (see Figure 2.4). In 2001, 32% of the population was younger than 15 years, with blacks being the most youthful population grouping. Coloured, Indian/Asian, and white population groupings, to varying degrees, had age profiles typical of more developed countries. This demographic anomaly can be attributed both to the less urbanized character of the black population and to the inequalities that remain embedded in South African society. The largest age cohort is in the 10–14-year category; the younger age categories are smaller. This shows the consequences of declining fertility on the age

structure of the population, and, possibly, the effects of increased levels of infant and child mortality.

The changing age structure poses challenges for our country's social and economic development. An increasing youthful population imposes a further burden on social systems such as education and health care as well as entrenching poverty. Larger households with fewer economically active members contribute, in turn, to growing dependency. In addition to weakening the social and economic security of the household, it also puts pressure on young people to leave school to find work or to engage in subsistence activities. Without education or skills, it is more difficult to find well-paid employment (see section 2.2.4). Without the means to escape the cycle of poverty, many people remain confined to places that are economically marginalized and environmentally degraded. Such conditions reduce their well-being and their opportunities for further development.

## 2.2.4 Human development and well-being

### Human development

The term 'human development' refers to the extent to which people can develop their full potential and expand their choices, and 'human well-being' is defined as "having sufficient access to the basic material for a good life, health, freedom and choice, good social relations and security"<sup>13</sup>. In South Africa, high levels of poverty continue to constrain human potential and choices and to undermine well-being. This situation has fundamental implications for the environment, as well as increasing human vulnerability to adverse environmental conditions.

In South Africa, as in all countries, levels of human development vary spatially, in terms of location (where people live), population patterns and density, and among different population groups. It would be an over-simplification to view race as the sole reason for such stratification in South Africa, but an enduring facet of our society is the disparity in development among racially defined population groups.

The Human Development Index (HDI) measures economic and social well-being (see Box 2.2). The trend for South Africa shows a general improvement up to 1995, after which the HDI declined to pre-1980 levels (Figure 2.5), largely because of the dropping life expectancy discussed earlier. In 1995, South Africa ranked 67<sup>th</sup> out of 144 countries in terms of HDI, whereas in 2003 it ranked 120<sup>th</sup> out of 177 countries<sup>14</sup>.

HDI in South Africa also has specific spatial and social characteristics. Between 1990 and 2003, the Western Cape Province performed best (with an HDI of 0.77 in 2003) and the North West and Limpopo provinces worst (HDI: 0.61). Human development was higher in urban than in rural areas.





The 2005 Human Development Report indicates increased inequality between men and women in the period 1990–2003. In 2003, South Africa ranked 92<sup>nd</sup> out of 140 countries in terms of the Gender-related Development Index (at 0.65)<sup>14</sup>.

The decline in the HDI since 1995 has been paralleled by a worsening of the Human Poverty Index (HPI) figure for South Africa (see Box 2.2). The country's HPI increased from 16.4% in 1995 to 31.7% in 2002 – a growth of over 1.7 million people living at or below the globally recognized threshold of US\$1/person/day. The 2005 Human Development Report places the country's HPI at 30.9% in 2003. (For the changes in South Africa's HPI ranking, see Box 2.2). It must be noted that poverty is defined not only by levels of unemployment, but also characterized by a lack of access to, for instance, education, health care, and basic services including water and sanitation. Poverty has strong gender, race, family-type, and spatial dimensions. The Human Development Report, drawing on statistics from Adelzadeh<sup>15</sup>, profiles poverty in South Africa in 2001 as follows:

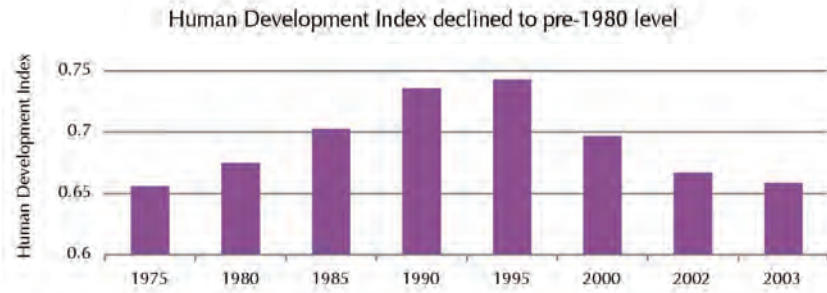
- Most poor people were women
- In rank order, the population groups most affected by poverty were blacks, coloureds, Indians/Asians, and whites
- One-third of poor females (35.5%) were impoverished single parents.

(For the nature and trends of poverty and inequality in South Africa, see section 2.3.4 below.)

## Health

The importance of reversing the spread of killer diseases, especially HIV and AIDS and malaria, is recognized in Millennium Development Goal 6. The Millennium Development Goals are an ambitious agenda for reducing poverty and improving lives that world leaders agreed on at the Millennium Summit in September 2000. For each goal, one or more targets have been set, most for 2015, using 1990 as a benchmark. Goal 6 has two targets, namely: by 2015 to have halted and begun to reverse the spread of HIV and AIDS; and by 2015 to have halted and begun to reverse the incidence of malaria and other major diseases.

Tuberculosis (TB), HIV and AIDS, and malaria are significant threats to human health in South Africa<sup>10</sup>. Furthermore, several notifiable diseases in South Africa have strong environmental links. Hepatitis and cholera are most often transmitted through contaminated water, whereas typhoid fever is often associated with lack of clean water supply and sanitation facilities, unplanned urbanization, and increased movement of migrant workers. Malaria has been restricted to the northeastern tropical and subtropical areas of the country and the number of cases has gone down since 2000, but infectious diseases including TB and



**Figure 2.5: Human Development Index, 1975–2003**

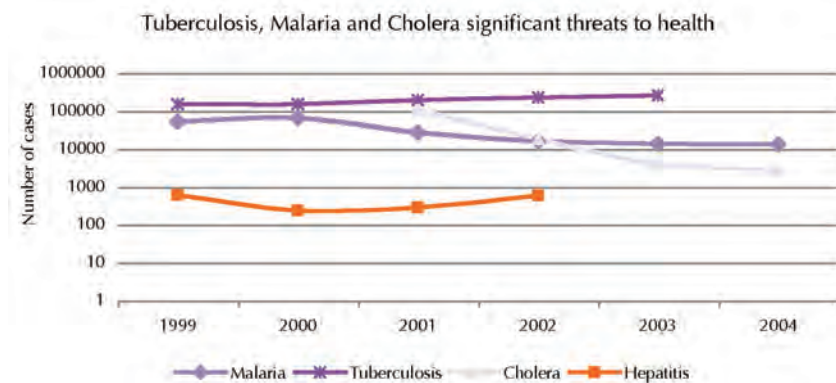
Source: United Nations Development Programme (2005)<sup>14</sup>

cholera are widespread and the number of recorded cases increased dramatically in 2001, possibly because of higher levels of reporting (see Figure 2.6). Statistics South Africa figures, however, show that TB (specifically respiratory TB) was the most dominant contributor to the growth in mortality between 1997 and 2002.

Commonly referred to as a 'disease of poverty', TB has the highest prevalence among South Africa's poor (who are also especially vulnerable to the effects of environmental degradation). Between 1997 and 2001<sup>10</sup>, TB contributed to 8% of deaths and was identified as one of the five leading underlying causes of death among South Africans. A total of 224 420 cases of TB were registered during 2002, representing an increase of 16% from 2001 and an incidence of 494 cases per 100 000 people.

South Africa established a revised National Tuberculosis Control Programme in 1995, based on the Directly Observed Treatment Short Course (DOTS) strategy supported by the World Health Organization. Although it is generally acknowledged that improvement rates are not reaching the national target of 85% cure rate, rates in health districts that have adopted the DOTS approach are consistently better than non-DOTS districts for new smear-positive patients. The main problems remain insufficient compliance to

*Tuberculosis (TB), HIV and AIDS, and malaria are significant threats to human health in South Africa. Furthermore, several notifiable diseases in South Africa have strong environmental links.*



**Figure 2.6: Trends in cases of notifiable diseases in South Africa, 1999–2004**

Source: Department of Health (2001–2004)<sup>19</sup>

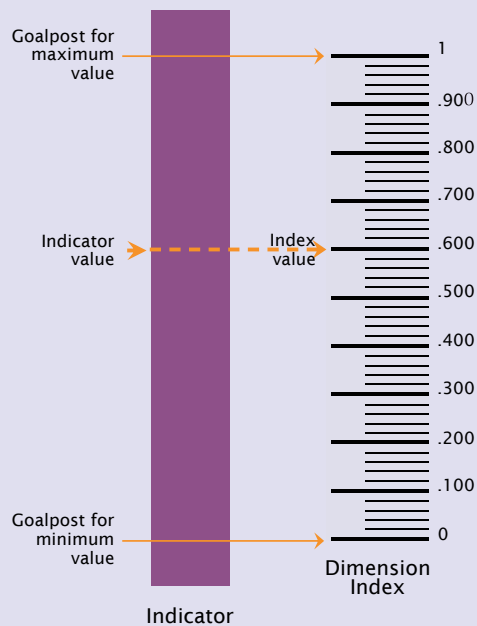
The Human Development Index (HDI), developed by the United Nations Development Programme (UNDP), focuses on three dimensions of human development:

- Living a long and healthy life (measured by life expectancy at birth)
- Knowledge (measured by the adult literacy rate) and education (measured by the gross enrolment ratios for primary, secondary and tertiary education)
- A decent standard of living (measured by gross domestic product [GDP] per capita).

Before calculating the HDI, it is necessary to create an index for each of the above dimensions. To calculate these dimension indices, i.e. the life expectancy, education, and GDP indices, minimum and maximum values for each underlying indicator are chosen.

Performance in each dimension is expressed between 0 and 1 as a value and the following formula applies:

$$\text{Dimension index} = \frac{\text{actual value} - \text{minimum value}}{\text{maximum value} - \text{minimum value}}$$



The HDI is then calculated as a simple average of the dimension indices.

**Goalposts for calculating the HDI**

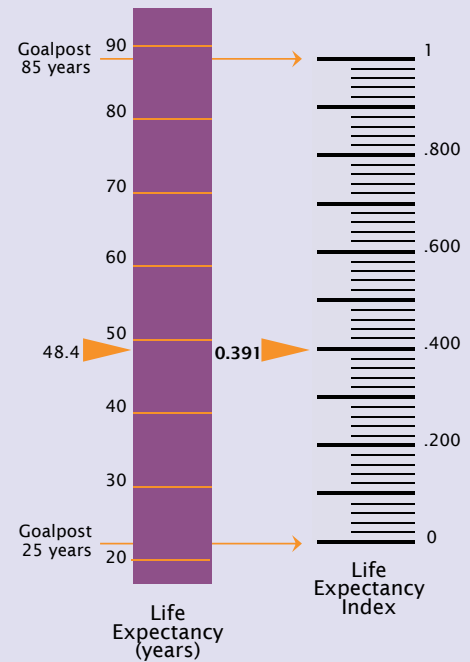
Indicator	Maximum value	Minimum value
Life expectancy at birth (years)	85	25
Adult literacy rate (%)	100	0
Combined gross enrolment ratio (%)	100	0
GDP per capita (PPP US\$)	40 000	100

**Calculating the HDI for South Africa**

**1. Calculating the life expectancy index**

The life expectancy index measures the relative achievement of a country in life expectancy at birth. For South Africa, with a life expectancy of 48.4 years in 2003, the life expectancy index is 0.391.

$$\text{Life expectancy index} = \frac{48.4 - 25}{85 - 25} = 0.391$$



**2. Calculating the education index**

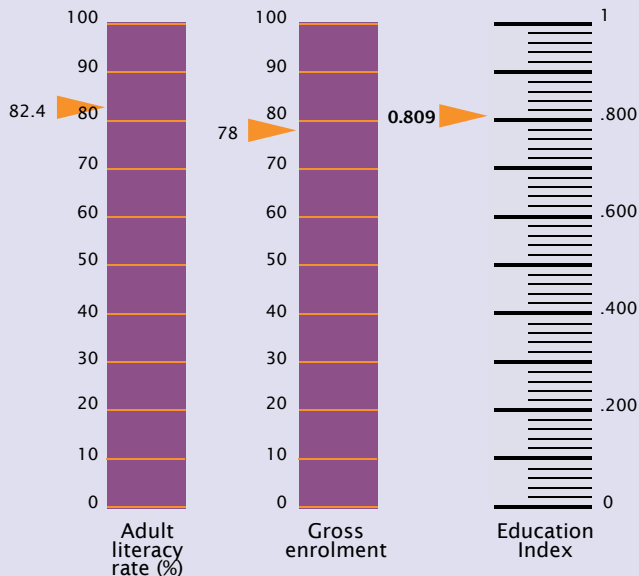
The education index measures a country's relative achievement in both adult literacy and combined primary, secondary and tertiary gross enrolment. First, an index for adult literacy and one for combined gross enrolment are calculated. Then these two indices are combined to create the education index, with two-thirds weight given to adult literacy and one-third weight to combined gross enrolment. For South Africa, with an adult literacy rate of 82.4% in 2003 and a combined gross enrolment ratio of 78% in the school year 2002/03, the education index is 0.809.

$$\text{Adult literacy index} = \frac{82.4 - 0}{100 - 0} = 0.824$$

$$\text{Gross enrolment index} = \frac{78 - 0}{100 - 0} = 0.780$$

$$\begin{aligned} \text{Education index} &= \frac{2}{3} (\text{adult literacy index}) + \frac{1}{3} (\text{gross enrolment index}) \\ &= \frac{2}{3} (0.824) + \frac{1}{3} (0.780) = 0.809 \end{aligned}$$

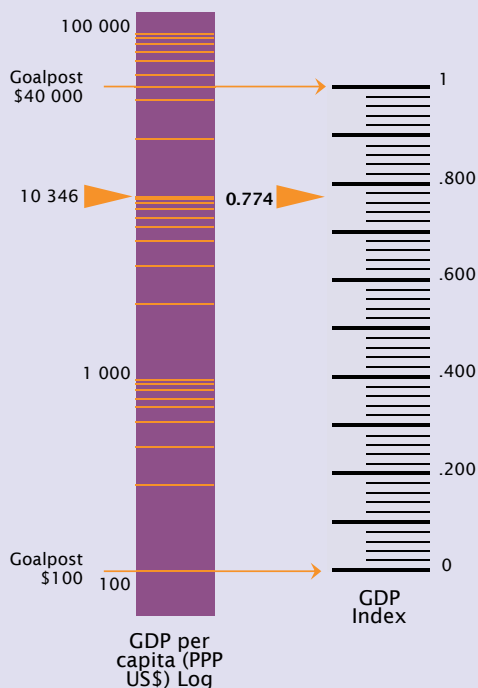




### 3. Calculating the GDP index

The GDP index is calculated using adjusted GDP per capita (PPP US\$). The HDI income serves as a surrogate for all the dimensions of human development not reflected in a long and healthy life and in knowledge. Income is adjusted because achieving a respectable level of human development does not require unlimited income. Accordingly, the logarithm of income is used. For South Africa, with a GDP per capita of \$10 346 (PPP US\$) in 2003, the GDP index is 0.774.

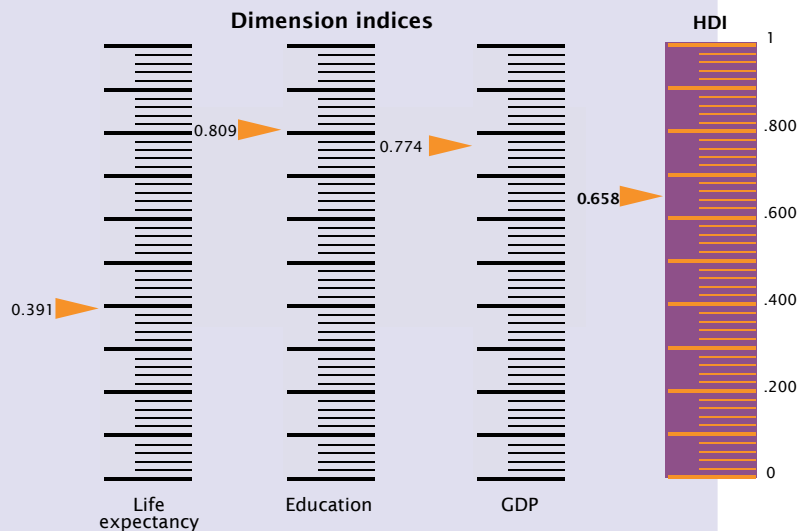
$$\text{GDP index} = \frac{\log(10346) - \log(100)}{\log(40000) - \log(100)} = 0.774$$



### 4. Calculating the HDI

Once the dimension indices have been calculated, determining the HDI is straightforward. It is a simple average of the three dimension indices.

$$\begin{aligned} \text{HDI} &= \frac{1}{3} (\text{life expectancy index}) + \frac{1}{3} (\text{education index}) + \frac{1}{3} (\text{GDP index}) \\ &= \frac{1}{3} (0.391) + \frac{1}{3} (0.809) + \frac{1}{3} (0.774) = 0.658 \end{aligned}$$



By combining measures of life expectancy, educational attainment, and gross domestic product, the HDI provides an overview of a country's development that is not limited to income patterns alone. HDI is measured on a scale of 0 to 1, with 0 being the lowest level of development and 1 the highest. In terms of the HDI there are three broad levels of human development:

- High level – between 1 and 0.8
- Medium level – 0.799 and 0.5
- Low level – 0.499 and 0.

Although the HDI is used as a broad, international indicator of the average progress in the human development of nations, it remains a blunt instrument and should be read in the context of a wider and, where available, more nuanced battery of tools for monitoring development.

The HDI cannot, for instance, capture all the aspects or complexities of a country's human development, or measure the ability of people to participate in decisions that affect their lives. In the South African context, it does not show the change that occurred when all citizens including those previously disenfranchised were able to participate in the election of the first democratic government in 1994. Similarly, it does not show the move by countries to 'green GDP' measurements. South Africa is one of a growing number of countries that are beginning to measure 'genuine' national savings by deducting, amongst other things, the cost of depleting natural resources and the damage caused by pollution.

Over the last decade, South Africa's HDI ranking has dropped 53 places to its current 120<sup>th</sup> position, a trend that can largely be attributed to the HIV and AIDS pandemic.

In the late 1990s, the UNDP supplemented the HDI with the Human Poverty Index (HPI), the Gender-related Development Index (GDI), and the Gender Empowerment Measure (GEM).

*(Continued on next page)*

“If the choice is to mislead with a single figure or to explain awkwardly with six, the latter should be professionally if not emotionally preferable.”

Jacob Ryten  
former Deputy Head of Statistics  
Canada

## Box 2.2 The Human Development Index: going beyond income (continued)

Introduced in the 1995 Human Development Report, the GDI measures inequalities in achievement between men and women, and the GEM reveals the extent to which women participate actively in a country’s political and economic life. South Africa has attempted to increase the number of women in decision-making positions. In 2003, South Africa ranked 18<sup>th</sup> in the world in terms of GEM, with women holding 27.9% of the seats in parliament.

The UNDP first introduced the HPI in its 1997 Human Development Report. The HPI focuses on the portion of people below a threshold level. The HPI-1 measures poverty in 95 developing countries based on the threshold of US\$1/person/day. In the 2005 Human Development Report, South Africa ranked 56<sup>th</sup> in terms of the HPI-1 value – a drop from 52<sup>nd</sup> in 2004. This suggests an increasing gulf between rich and poor in the country as well as deepening poverty.

Source: United Nations Development Programme (2005). *Human Development Report 2005*. United Nations Development Programme, New York. <http://undp.hdr.org>

treatment by patients and the development of resistance to drugs<sup>16</sup>.

Malaria transmission in South Africa is seasonal, with malaria cases starting to rise in October, peaking from January to February, then declining until May. The main malaria regions in the country are the border areas of

Limpopo province, Mpumalanga, and the northeastern parts of KwaZulu-Natal<sup>17</sup>. Occasionally, small malaria outbreaks develop in the Northern Cape and North West provinces.

The number of annual reported malaria cases varied between 2 000 and 13 000 during the period 1975–1995. In the late 1990s, however, reported infections rose significantly to a peak of 64 222 cases and 458 deaths in 2000. These increases have been attributed to climatic conditions; the influx of refugees (many of whom carried malaria parasites) from Mozambique, Zimbabwe, and, to a lesser extent, Botswana; drug resistance in humans; and the resistance of mosquitoes to insecticides<sup>18</sup>.

From 2001 to 2004 there was a sustained decrease in the number of nationally reported malaria cases and deaths, largely due to interventions including the use of combination drug therapy in KwaZulu-Natal and Mpumalanga, the reintroduction of DDT as an effective insecticide for indoor residual house spraying (its use had been suspended in 1996), and malaria-control efforts in collaboration with Swaziland and Mozambique. The national target for malaria-case fatality is to maintain a rate of below 0.5%. Although case fatality has mostly remained above

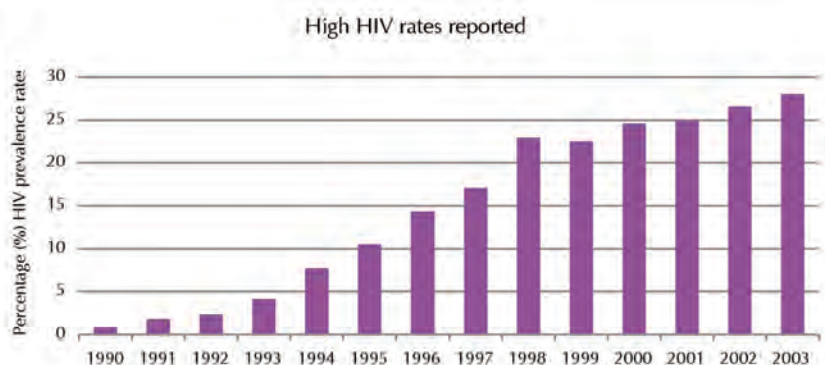


Figure 2.7: Prevalence of HIV among antenatal attendees aged 15 to 49, 1990–2003

Source: Government of South Africa (2005)<sup>16</sup>

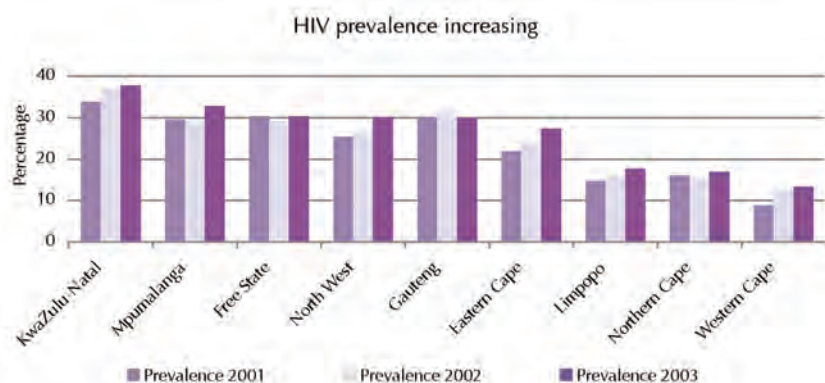


Figure 2.8: HIV prevalence per province

Source: Department of Health (2003)<sup>21</sup>



To control Malaria, DDT spraying was re-introduced for traditional structures in KwaZulu-Natal in February 2000. Photography: IMAGES24.co.za / Rapport / Brendan Cockcroft



this target over the last decade (exceptional years being 1997 and 2001), the Department of Health has set this goal as a strategic priority for the period 2004–2009.

HIV and AIDS has had a significant impact on South Africa’s population (see Box 2.1). Prevalence rates vary depending on the data source and methods of interpolation. Figure 2.7 shows that, after the almost exponential increase in HIV prevalence levels among antenatal care attendees between 1990 and 1998, there has been a gradual stabilization and slowing down of increases in HIV prevalence.

As with TB, however, poor communities have been hard hit by HIV and AIDS, which has compounded the effects of poverty as households attempt to cope with the consequences of the disease. Some estimates indicate an adult HIV and AIDS infection rate of between 16.3% and 16.7%<sup>7</sup> of the total population in 2005, which could erode the country’s developmental gains as increased numbers of economically active and productive people are affected by HIV. The Department of Health estimates that the total number of people infected in the South African population in 2001 was 4.74 million<sup>12</sup>.

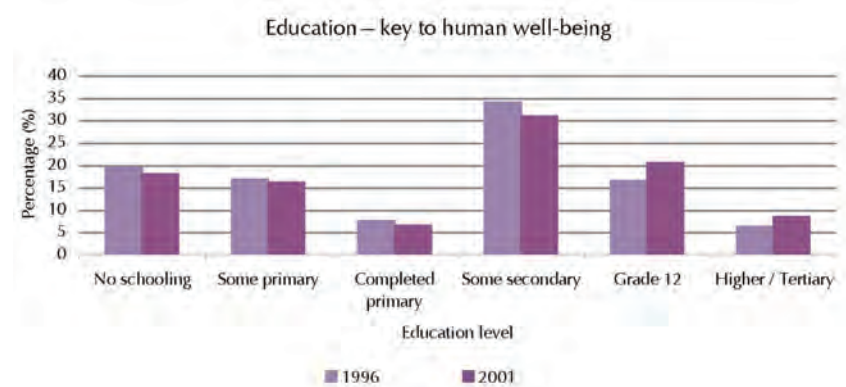
Most provinces showed increased prevalence between 2001 and 2003 (see Figure 2.8). High HIV rates have been reported in women aged 20–24 years (28.4%), 25–29 (31.4%), and 30–34 (25.6%) who attended antenatal clinics between 2000 and 2001<sup>21</sup>.

HIV-related disease caused 7.4% of deaths among both women and men between 1997 and 2001. This is a conservative estimate. Given the stigma associated with being HIV positive in South Africa, families are often reluctant to provide the HIV status of the deceased, and the secondary infection rather than the primary cause of death is most likely to be recorded. Between 1990 and 2004, 1.2 million people are estimated to have died of AIDS-related diseases, with growing numbers of AIDS sick<sup>9</sup>.

Increasing numbers of people in the advanced stages of AIDS are likely to become reliant on the extended family for care. This added financial burden on the family, coupled with the patient’s loss of income, prompts changes in livelihood strategies and results in households relying more heavily on natural resources, such as medicinal plants for symptomatic treatment of HIV and AIDS and the sale of wild foods (such as mopane worms and marula and bark products) for cash in local markets<sup>9</sup>.

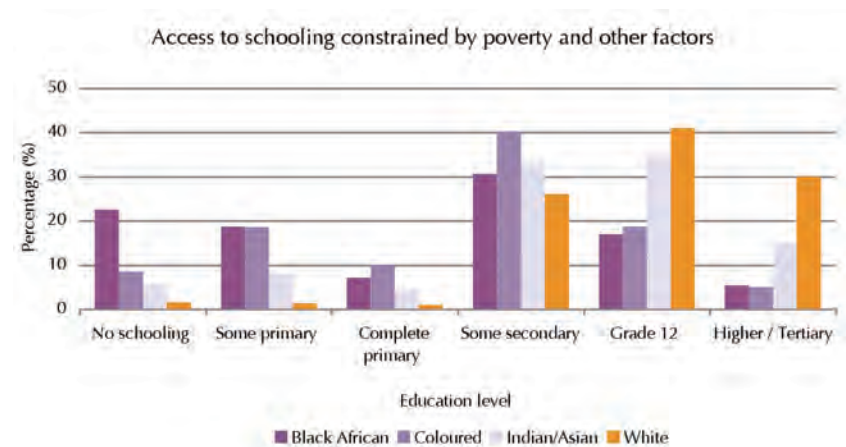
## Education and skills

Literacy, access to educational facilities, and skills development are key to human well-being, which, in turn offers opportunities to improve people’s livelihoods and reduces high dependency on the natural environment for subsistence. It is also likely to raise awareness about the importance of a healthy environment for people’s health



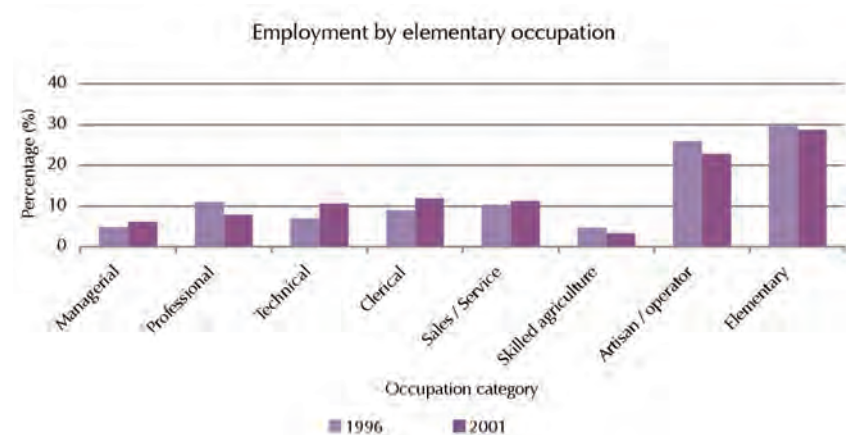
**Figure 2.9: Levels of education in people older than 20 years, 1996–2001**

Source: Statistics South Africa (2004)<sup>20</sup>



**Figure 2.10: Levels of education among those 20 years and older per population group**

Source: Statistics South Africa (2004)<sup>20</sup>



**Figure 2.11: Percentage of the employed aged 15–65 years by occupational category**

Source: Statistics South Africa (2004)<sup>20</sup>



*“If the countries of Southern Africa are to make any progress in just about any sphere of endeavour, there must be economic development. And yet that development must be sustainable if, in the long term, it is to be of any use at all.”*

Anon

and well-being. Education and skills also directly influence economic development and global competitiveness. Like other developing countries in a rapidly globalizing world, South Africa needs to develop a literate and technically skilled population. Recent statistics, however, indicate that much has to be done to realize this goal.

On average, fewer than one in ten South Africans over the age of 20 years possess tertiary education qualifications; one in three South Africans aged 20 and older either had not completed primary school or had no formal schooling<sup>3</sup>. There is some evidence, however, of encouraging trends although these tend to be unevenly spread. Between 1996 and 2001, for instance, the proportion of individuals completing high school increased from 16.4% to 20.4% of people over the age of 20 years, and the proportion of those reaching or attending higher education institutions had increased from 6.2% to 8.4% (see Figure 2.9).

Despite improving levels of education, access to schooling continues to be constrained by factors such as poverty, underqualified teachers, unresolved language issues that hamper learning, high dropout and repetition rates, and poor education facilities (see Figure 2.10). The overall quality of schooling, particularly in rural areas, leaves much to be desired<sup>22</sup>.

## Employment and incomes

Whereas trends in education influence skills development, skills, in turn, have a direct influence on a person’s

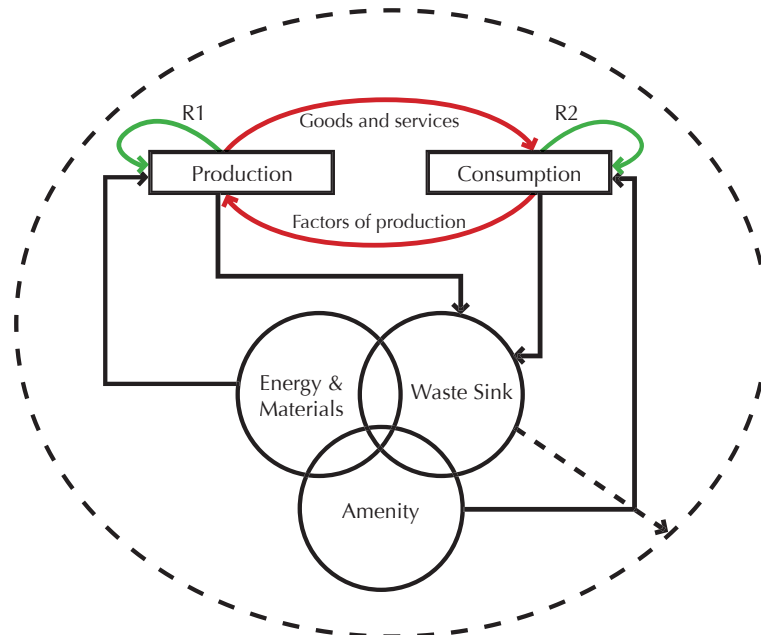
employment opportunities and income potential. In general, people with better education are likely to have the skills needed to secure a better-paid job. The recent statistics indicate a link between education, skills, employment, and income.

The largest proportion of South Africans is employed in elementary occupations in labour-intensive economic sectors, such as agriculture and mining, which tend to be sensitive to fluctuations in national and global markets (see Figure 2.11). From 1996 to 2001, for example, the proportion of people employed in elementary occupations declined from 29.3% in 1996 to 28.4% in 2001<sup>3</sup>. An increase in the proportion of people employed in sales/service, clerical, and technical occupations between 1996 and 2001 mirrors the growth in the trading and service sectors.

The labour market is normally measured by determining the number of people aged 15–65 years (both employed and unemployed) who are potentially economically active. The 2001 Census recorded 28.4 million people aged 15–65 years, of whom 9.6 million were employed and 6.8 million were unemployed<sup>3</sup>. A total of 12 million were not economically active (including students, home-makers, pensioners, the disabled, those too ill to work, and those not seeking work).

The same census showed that 3.2 million people (31.4% of all workers) in South Africa earned an income of less than R801 per month, 41.8% of whom were black<sup>3</sup>. The Labour Force surveys between 2000 and 2004 indicate that approximately a quarter of all workers earned less than R501 per month<sup>23</sup>, and the Labour Force Survey of September 2005 showed that the unemployment rate remained virtually unchanged at 26.7%, with the estimated number of people employed exceeding 12 million<sup>24</sup>.

These statistics reveal high levels of income poverty in South Africa. Although often dependent on the natural environment, and located in marginal degraded areas, poor households generally lack the means to protect these resources. Over-exploitation and pollution can, in turn, severely degrade the ecosystems on which people rely and heighten the impact of natural hazards such as droughts and floods. This human–environment relationship reinforces and deepens the cycle of poverty.



**Figure 2.12: Interactions between the economy and the environment**

Source: Hanley, Shogren and White (1997)<sup>25</sup>

## 2.3 ECONOMIC DEVELOPMENT

Economic development in South Africa focuses mainly on expanding economic activities, improving work skills, and creating jobs. The economy has profound impacts on the country’s environmental resource base. They arise from the nature and size of the economy and from the distribution of the wealth and income that it generates. This section argues that it is essential to integrate environmental factors into economic planning if South Africa is to become a more sustainable society.





### 2.3.1 Economy–environment relationships

Sustainable development is not simply an environmental issue that depends on appropriate economic development. Economic development depends on a sustainably managed environment and natural resource base. Agriculture and the associated food-processing industry in South Africa, for example, will not be sustainable unless soil is preserved and soil loss (which is occurring at eight times the rate of replacement) is reduced.

The linkages between the economy and the environment are summarized in Figure 2.12. A simplified view of the economy divides it into the two sectors of production and consumption, which are linked through the exchange of goods and services on the one hand, and factors of production on the other. The environment, typically ignored in conventional macroeconomic analysis, interacts with the economy in three ways: by supplying energy and materials, by taking up waste products, and by providing amenities.

The productive sector uses energy and material resources from the environment, transforming them into

useful goods and services and generating waste products. There is some recycling of resources within both the consumption and production sectors (represented in Figure 2.12 by the R1 and R2 loops). The environment, therefore, acts as a supplier of resources, a sink for waste resources (with a limited capacity to assimilate them), and as the provider of amenity (that is, of the qualities and facilities that make an area a pleasant and convenient place to live and work) and of spiritual and existence values to society.

Encompassing the whole economy are the global life-support services provided by the natural environment, which include maintaining a global atmospheric composition suitable for life, maintaining the right temperature and climate, and recycling water and nutrients.

### 2.3.2 South Africa's macroeconomic objectives

South Africa's macroeconomic objectives include economic growth, full employment, price stability, and balance of payments stability<sup>26</sup>, alongside the key political and economic objective of reducing inequality in the economy<sup>27</sup>.

*Sustainable development is not simply an environmental issue that depends on appropriate economic development. Economic development depends on a sustainably managed environment and natural resource base.*

## Box 2.3 The Accelerated and Shared Growth Initiative of South Africa

The Accelerated and Shared Growth Initiative of South Africa (AsgiSA) was officially launched in 2006 as a "limited set of interventions that will act as catalysts to shared and accelerated growth and development". AgsiSA proposes key economic interventions to unlock resources, mobilize robust public and private infrastructure investments, and develop certain economic sectors, in order to create a conducive economic environment for meeting the country's developmental goals.

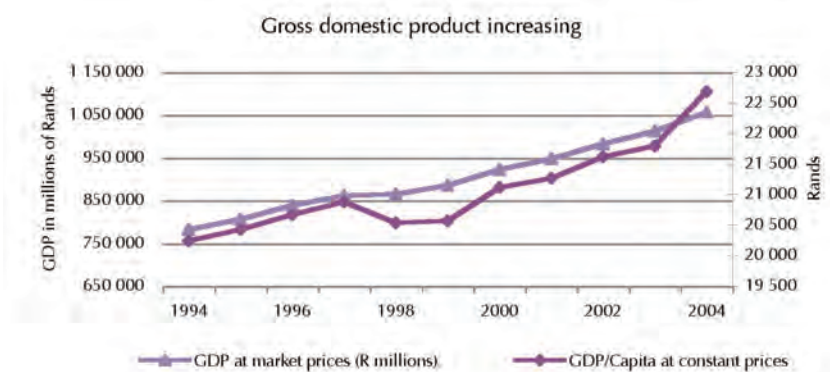
The ultimate aim of AgsiSA is to halve unemployment by 2014. AgsiSA builds on existing economic policy as well as taking advantage of a stable macroeconomic environment and economy that has been growing at over 4% in 2004 and 2005. It envisages an average growth rate of 4.5% from 2006 to 2009, rising to 6% from 2010 to 2015. Part of the R372 billion that will be spent through AgsiSA, will be spent on accelerated infrastructure investment in underdeveloped urban and rural areas through existing initiatives, such as the Municipal Infrastructure Grant and the Expanded Public Works Programme, to improve service delivery in the area of the second economy.

AgsiSA will add to existing government initiatives by focusing on the following selected interventions.

- *Infrastructure programmes:* AgsiSA will boost existing programmes by raising the level of investment in infrastructure, such as provincial and local roads, water supply networks, energy distribution, housing, schools and clinics, and government service centres including police stations. There will also be investment in special provincial projects that impact on employment, poverty eradication, and economic growth.
- *Sector strategies:* Sectors such as Tourism and Business Process Outsourcing that are competitive and able to meet the growth and sharing objectives of AgsiSA within a short time have been selected for special interventions.

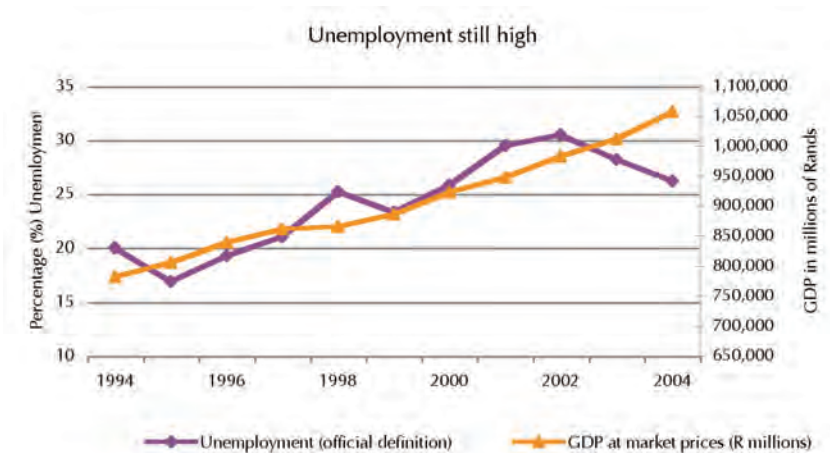
- *Education and skills development:* Key measures will be adopted to address the skills shortages (especially professional skills and artisans). AgsiSA will focus on priority and scarce skills through, for instance, special training programmes, employing retirees or South Africans who are working outside of South Africa, and drawing in new immigrants when necessary.
- *Interventions in the Second Economy:* The intention is to create sustainable bridges between the 1<sup>st</sup> and the 2<sup>nd</sup> economies to enable growth and graduation to a sustainable economy; to unlock dead assets in poor people's hands; to promote local economic development and local content; to grow cooperatives with a link to 1<sup>st</sup> economy markets; and to address the "missing housing stock" valued between R50 000 and R150 000. All priority sectors will have to provide a bridge to the 2<sup>nd</sup> economy. Interventions will focus on women and youth in urban and rural areas.
- *Macroeconomic issues:* Although AgsiSA focuses on microeconomic initiatives, these will take place in a broader macroeconomic context. The National Treasury and the South African Reserve Bank will engage on issues identified as binding constraints. A key challenge is to improve budgeting and expenditure management in government.
- *Public administration:* All spheres of government, State Owned Entities, and social partners will be engaged in the implementation of AgsiSA. It will support local government and service delivery by focusing on the skills problems identified in Project Consolidate. The AgsiSA task team includes ministers, premiers, and SALGA representatives, and is chaired by the Deputy President.

For further information visit <http://www.info.gov.za/asgisa>



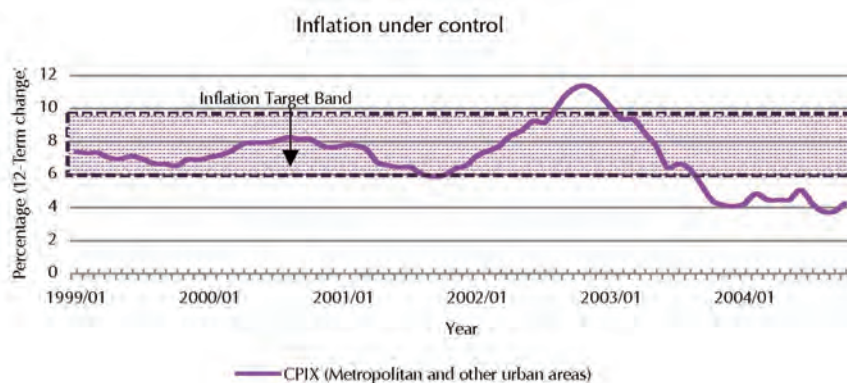
**Figure 2.13: Gross domestic product (GDP) and GDP per capita at constant 2000 prices, 1994–2004**

Source: Statistics South Africa (2004)<sup>29</sup>



**Figure 2.14: Unemployment trends and gross domestic product at market prices, 1994–2004**

Source: Statistics South Africa (1994–1999<sup>32</sup>), (2001–2004<sup>31</sup>), (2004<sup>29</sup>)



**Figure 2.15: Monthly inflation, Consumer Price Index (CPIX), 12-term change**

Source: South African Reserve Bank (2004, time series KBP7113A)

Achieving these objectives often means trade-offs. The following is a summary of the macroeconomic objectives.

- *Expansion of national production and income as a prerequisite for job creation, improved living standards, and economic development.* Unemployment is one of South Africa's main socio-economic problems, so increased employment is a central policy objective for the country<sup>28</sup>. The government's Accelerated and Shared Growth Initiative for South Africa (AsgISA) intends to give practical effect to this objective by increasing public sector investment in infrastructure development (see Box 2.3).
- *An inflation target of between 3% and 6%<sup>26</sup> to maintain price stability, which is currently the main objective of monetary policy in South Africa.* Inflation (or, an increase in the general or average price level in the economy), normally measured as the average annual price change of a standard 'basket' of consumer goods and services, is referred to as the Consumer Price Index (CPI). Inflation tends to lead to a redistribution of income from the elderly to the young and from the private sector to government. It has the greatest negative impact on those on fixed incomes and, typically, the poorer people in the economy. Price stability keeps inflation at acceptable levels.
- *Balance of payments stability, which is particularly important in a small, open economy like that of South Africa.* The South African Reserve Bank aims to avoid large deficits in the balance of payments (which could, for example, result in sharp depreciations in the international value of the rand).

The emphasis on growing the economy to provide employment has important consequences for the patterns of consumption and production, hence for the environment. Specifically, economies are driven and maintained by energy, the production of which causes serious pollution and degradation of the environment (see Chapter 9). Increased affluence through employment also leads to the increased consumption of natural resources and increased production of waste.

### 2.3.3 The size of the economy

Since 1999, each year has brought an increase in South Africa's gross domestic product (GDP)<sup>3</sup> as indicated by a positive economic growth rate, or rate of change in the GDP (see Table 2.1). (The respective values for some other developing countries are shown for comparison.)

GDP has increased steadily in real terms since 1994 (see Figure 2.13). Population growth has been accompanied by growth in the GDP per capita over the decade, from R20 239 in 1994 to R22 684 in 2004. This indicates that population growth has not outstripped economic expansion during this period.



**Table 2.1: Percentage change in gross domestic product per year**

Year	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
% Change in gross domestic product											
South Africa*	3.2	3.2	4.3	2.7	0.5	2.4	4.2	2.7	3.6	2.8	3.7
India**	7.5	7.7	7.4	4.5	6.0	7.1	4.0	5.5	4.4	-	-
Brazil**	5.9	4.2	2.7	3.3	0.1	0.8	4.4	1.4	1.4	-	-
Botswana**	3.6	4.4	5.6	6.9	6.0	6.1	8.6	6.3	3.5	-	-

Source: \* Constant 2000 US\$, Statistics South Africa (2004)<sup>29</sup>, \*\*Constant 1995 US\$, World Resources Institute (2005)<sup>30</sup>

The fact that population growth is slower than GDP growth may be due in part to the growth in GDP, but another likely cause is the impact of the HIV and AIDS epidemic<sup>20</sup> (see section 2.2 and Box 2.1). South Africa's unemployment rate remains very high, and GDP expansion has not reduced unemployment since 1999. According to the official definition, unemployment increased from 20% in 1994 to 26.7% in 2005<sup>31</sup> (see Figure 2.14). The expanded definition of unemployment for the same period increased from 28.6% to 41%. Growth without significant employment expansion (also called 'jobless growth') has significant implications for sustainable development in the country because it hinders the reduction in economic inequality and leaves a large proportion of the population dependent on informal sector activities, social welfare, and the direct use of available natural resources<sup>12</sup>.

Some of the difficulties in sustaining high growth in South Africa and in strengthening the economy's job-creating capacity are attributed by the Reserve Bank to the fact that the ratio of fixed investment to GDP in South Africa has remained low relative to that of many other developing countries and that investment levels are still too low for high growth. Higher levels of capital formation (that is, of the process of finding and making use of capital, which refers to whatever can be converted into money), allocated to economically efficient and sustainable ventures and projects, would go a long way towards addressing unemployment South Africa<sup>33</sup>. Reduced unemployment could reduce dependency on the natural environment and alleviate mounting pressure on ecosystem goods and services, but higher levels of employment would also bring increased consumption, which, if not accompanied by public awareness and environmental protection, could hasten the damage to the environment.

Despite difficulties in significantly reducing unemployment in South Africa, the Reserve Bank's monetary policy has successfully contained inflation (that is, the CPIX, which is the consumer price index minus mortgage interest rates) within its target band since September 2003 (see Figure 2.15). This success is seen as important for ensuring economic and foreign exchange stability.

### 2.3.4 Poverty and inequality in focus

Poverty and inequity are social problems with complex environmental impacts<sup>1</sup>. Not only do high-income groups use more resources and generate more waste, but they also set the standard of living to which many poorer people aspire. In South Africa, environmental impacts result both from large numbers of poorer people having access to and consuming relatively few resources, and fewer, more affluent people consuming large amounts of resources<sup>1</sup>.

The end of apartheid in 1994 left in its wake a population with great poverty and income inequalities, largely defined by racial groups. Using a poverty line of R322 per month (at 2000 prices), it is estimated that at least 58% of all South Africans lived in poverty in 1995<sup>34</sup>. A 2005 study reviewing poverty related datasets has found declining trends in poverty levels since 2000, particularly in the period between 2002 and 2004<sup>35</sup>. This is supported by the expansion in the black middle class especially at the upper end of the income spectrum. In addition, South Africa is one of the most unequal countries in the world in terms of the gap between rich and poor<sup>34</sup>.

The first Millennium Development Goal has two targets, namely to halve, between 1990 and 2015, the proportion of people whose income is less than US\$1 a day; and to halve, between 1990 and 2015, the proportion of people who suffer from hunger. Using national estimates of poverty and inequality in South Africa, in 2000, 11% of people were living on less than US\$1 a day and 34% were living on less than US\$2 a day. Using expenditure share measures, in 2000 the poorest 20% accounted for 2.8% of total expenditure. In contrast, the wealthiest 20% of households accounted for 64.5% of all expenditure in 2000. Income inequality, as measured by the Gini-coefficient<sup>4</sup>, in South Africa was at 0.59 when social transfers are excluded. It declines to 0.35 when social transfers are included. (Most European nations tend to have income inequality values of between 0.24 and 0.36, with the United States having greater inequality, at over 0.4. Countries such as Mexico, Chile, and several African countries including Zimbabwe, Zambia, Mali,

*Not only do high-income groups use more resources and generate more waste, but they also set the standard of living to which many poorer people aspire.*

**Table 2.2: Changes in household access to basic services by poverty group, 1995 and 2000**

Basic Service	Year	Percentage of households with access within each poverty group*		
		Less than US\$1/day (household per capita expenditure)*	Less than US\$2/day (household per capita expenditure)*	All households
Public electricity	1995	20	26	60
	2000	31	42	70
Piped water	1995	45	52	76
	2000	48	59	82
Sanitation facility	1995	57	68	85
	2000	57	67	85
Telecommunications	1995	1	3	26
	2000	5	10	36

Note: Poverty groups are categorized as households with per capita expenditure of less than (Purchasing Power Parity Equivalents) PPP US\$1/day or PPP US\$2/day.

Source: 'A Poverty Profile of South Africa between 1995 and 2000', Statistics South Africa (based on the 1995 and 2000 Income and Expenditure Surveys, 1995 October Household Survey, and the September 2000 Labour Force Survey).

and Niger have inequality values of between 0.5 and 0.6, with Namibia having one of the highest, at over 0.7). In 2004, the Gini-coefficient of expenditures was estimated to be 0.56. The black population displayed the highest within-group income inequality with a Gini-coefficient of 0.53<sup>36</sup>.

The focus on inequality is important since, at least over the next decade, growth alone will not suffice to raise the average poor household out of poverty. Some redistribution of income (including income generated from natural capital) and explicit poverty alleviation strategies (including improved access to education and health facilities and basic infrastructural services), together with economic growth, are required to eradicate poverty in the medium term. The challenges faced by southern Africa and South Africa in addressing poverty are highlighted in the most recent Human Development Report (2005), which states<sup>14</sup>:

"One consequence of economic stagnation for the region has been a rise in the growth rate required to achieve the MDG [Millennium Development Goal] target of halving poverty. Some countries – Ethiopia, Senegal, South Africa and Tanzania among them – need to grow at about 3% per capita a year to reach the target. However, analysis based on household surveys (in countries accounting for 78% of the region's population) suggests that the weighted average annual growth rate required to achieve the MDG for the region is 5% per capita for 10 years." (p. 66)

South Africa's growth rate in 2004 was 3.7%. This

illustrates the challenges that the country faces with regard to poverty. The burden of poverty, therefore, falls on the entire society. In so far as poverty also leads to reduced productivity through malnutrition, ill-health, and poor education and skills levels, it also acts as a general brake on the country's economic development.

Recent reviews of inequality indicate that poverty and inequality have not declined substantially over the last decade and, for some significant portions of the population, poverty has worsened. Real per capita household expenditures declined for those at the bottom end of the expenditure distribution between 1994 and 2004, increasing the rates of poverty, especially extreme poverty. Intra- and inter-racial inequality has also increased. For instance, in the periods 1995–2000 and 1995–2001, there was a marked jump in income inequality within the black population<sup>36</sup>.

In addition to racial inequality, poverty statistics also display geographic inequality, with substantial differences between urban and rural areas. In rural areas, 62% of the population is poor, in contrast with 13% in metropolitan areas and 25% in secondary cities<sup>16</sup>. There are also inter-provincial differences. In seven of South Africa's nine provinces, more than 50% of the population is in a state of poverty. Gauteng and the Western Cape had the lowest proportions of population living in poverty, while the Eastern Cape and Limpopo had the highest<sup>36</sup>. These latter two provinces, moreover, have seen increases in poverty levels between 1995 and 2000<sup>34</sup>.



Since 1994, the analysis of poverty and inequality in South Africa has included government expenditure and improvements in basic service delivery, both of which have been effective instruments of redistribution. For example, the old-age pension system, originally intended to provide benefits for white people, has been extended to elderly black people and to vulnerable families with children. In 2001, the payment was over 80% of the welfare budget. Transfers have helped to lower income inequality (South Africa's Gini-coefficient fell from 67 in 1991 to 59 in 2000). The payments have enabled households to secure credit and invest in productive activities and they have also resulted in tangible health gains. Among black children under the age of five years, these transfers have led to an estimated 8-cm increase in height – equivalent to six months' growth<sup>14</sup>.

Substantial progress was made between 1995 and 2000 in the area of access to basic services and the coverage of social transfers such as old-age pensions. South African households generally experienced improved access to electricity, piped water, telecommunications, and infrastructure between the two time periods (see Table 2.2). The only exception is sanitation, for which levels of access remained relatively constant. This can be attributed partly to rapid changes in demographics and migration trends<sup>15</sup>. Social sector expenditure, such as public education at 7% of

GDP, was among the highest in the world<sup>34</sup>. Table 2.3 shows the share of the national budget spent on social services. About 2.1% of GDP was spent on social assistance in 1999, well above the Western European average for 1980 of 1.54%, at a time when the United Kingdom's level was 1.75%<sup>16</sup>. Nevertheless, many households are still excluded from access to such assistance (see Chapter 9), which often makes them less able to cope with unhealthy environmental conditions.

### 2.3.5 The composition and resource efficiency of the economy

Inequalities in the economy contribute to significant unemployment and poverty. A closer look at the composition of the economy, however, points to other likely impacts on sustainability.

#### The informal sector

Many South Africans make a living on the periphery of the modern formal economy. Substantial numbers of people participate in the informal sector and as domestic workers (see Figure 2.16). Many rely on subsistence agriculture and state welfare grants such as old-age pensions. About 55% of

*Substantial progress was made between 1995 and 2000 in the area of access to basic services and the coverage of social transfers such as old-age pensions.*

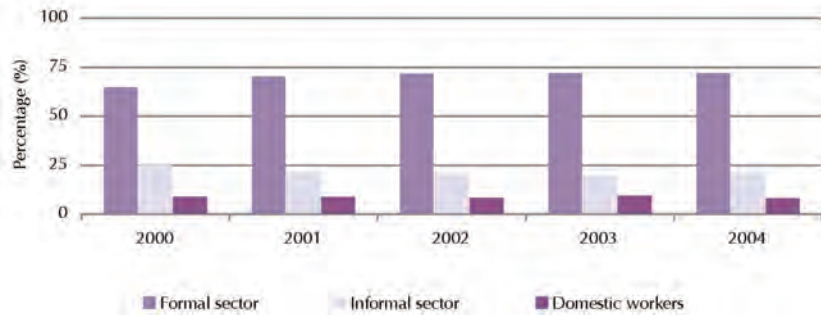
**Table 2.3: Share of national budget expenditure (%)**

	2001/02	2002/03	2003/04	2004/05
Central government administration	11.4	12.7	14.1	15.9
Financial and administration services	9.2	9.2	9.7	9.9
Social services	18.3	16.3	16.9	18.0
Justice and protection services	41.8	42.2	40.1	37.2
Economic services and infrastructure	19.3	19.6	19.2	19.0
<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>
Central government administration include: The Presidency, Parliament, Foreign Affairs, Provincial and Local Government, and Public Works				
Financial and administration services include: Government Communication and Information System, National Treasury, Public Enterprises, Public Service and Administration, Public Service Commission, South African Management Development Institute, and Statistics South Africa				
Social services include: Arts and Culture, Education, Health, Labour, Social Development, and Sports and Recreation South Africa				
Justice and protection services include: Correctional Services, Defence, Independent Complaints Directorate, Justice and Constitutional Development, and Safety and Security				
Economic services and infrastructure include: Agriculture, Communications, Environmental Affairs and Tourism, Housing, Land Affairs, Minerals and Energy, Science and Technology, Trade and Industry, Transport, and Water Affairs and Forestry				

Source: National Treasury (2005)<sup>38</sup>



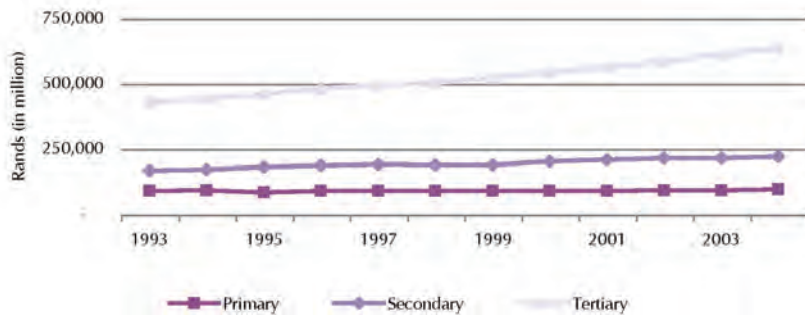
Small change in proportion of people employed



**Figure 2.16: Employment by sector, 2000–2004**

Source: Statistics South Africa (2000-2004)<sup>23</sup>

Service sector is the highest contributor to gross domestic product



**Figure 2.17: Sectoral shares of gross domestic product at constant 2000 prices**

Source: Reserve Bank (2005, time series: KBP6630Y, KBP6633Y, KBP6637Y)



A large number of people depend on informal trading for an income.

Photography: Janet Peace

rural households are dependent on remittances, pensions, and grants as basic sources of income<sup>27</sup>. Their lack of access to formal services and cash income often make these households directly dependent on natural resources such as indigenous and wild plants and medicines, coastal ecosystems, and fuel from biomass resources (such as wood).

The proportion of people employed in the formal sector, in the informal sector, and as domestic workers changed little in the period 2000–2004. In 2004, 71.4% of working people were employed in the formal sector, 20.4% in the informal sector, and 7.5% as domestic workers. Statistics for the informal sector are difficult to verify and this sector is likely to provide more employment opportunities than are officially recognized. Informal-sector employment coupled with self-employment helps to cushion – to some extent at least – the socio-economic impact of unemployment on the country.

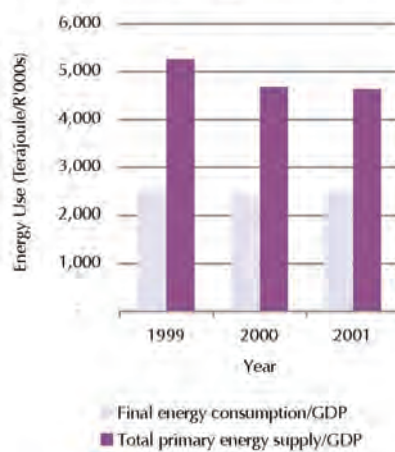
A useful indicator of relative levels of employment and unemployment is the labour absorption rate, which denotes the proportion of the working-age population that is employed. This rate has shown a drop in employment and corresponding increase in unemployment in recent years.

### From a primary to a tertiary economy

In the formal economy, demand by consumers in South Africa and internationally drives changes in the productive base of the economy, which, in turn influences the use of

*Their lack of access to formal services and cash income often make rural households directly dependent on natural resources such as indigenous and wild plants and medicines, coastal ecosystems, and fuel from biomass resources (such as wood).*

Increased energy efficiency



**Figure 2.18: Total and final energy consumption per gross domestic product, 1999–2001**

Source: Energy Balance Data. Department of Minerals and Energy (2005) <http://www.dme.gov.za>





the environment and natural resources. The changing composition of the formal economy provides insights into the nature of environmental change.

Traditionally, South Africa's economy has been resource-based and largely dependent on the extraction of minerals. The economy has changed, however, to one in which manufacturing and financial services contribute the bulk of GDP. The service industry is the largest contributor to the GDP, and has shown strong consistent growth since 1993 (see Figure 2.17).

### Resource efficiency

In the context of a growing economy, it is important to understand the relationships between economic output and resource use and degradation.

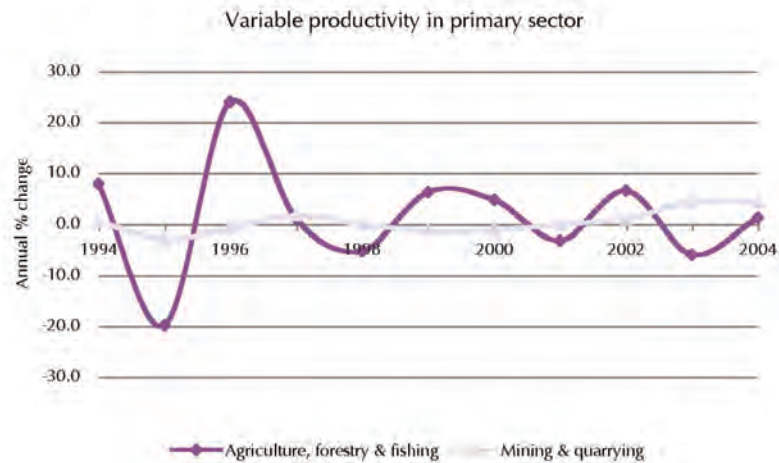
The resource utilization of an economy is determined by the following: the efficiency of production technologies, environmental management practices, and the composition of the economy. This utilization includes the exploitation of natural resources and the degradation of environmental 'sinks' (that is, the environment's facilities for redistributing, storing, processing, and absorbing waste created by humans) – such as water and air.

Given the limited data available, it is difficult to present a thorough picture of South Africa's resource intensity of production. It is possible, however, to draw an outline of the important area of energy use. Since 1999, final energy consumption<sup>e</sup> has remained relatively stable, while primary energy consumption<sup>f</sup> has declined (see Figure 2.18). While the energy efficiency of the economy has not changed, indications are that the efficiency of translating primary energy sources into end-use energy has improved.

### 2.3.6 Trends in sectoral growth and environmental implications

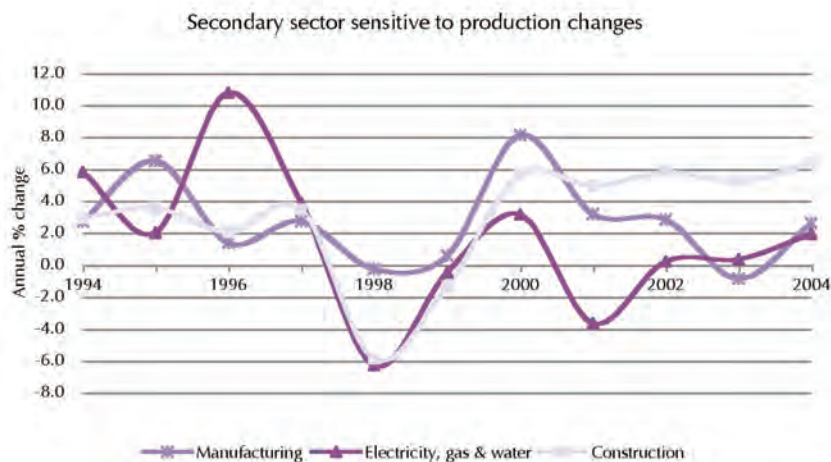
An economy can be described as having three sectors: the primary sector, the secondary sector, and the tertiary sector. An industry in the primary sector collects and brings in materials (for example, mining and farming). A secondary industry is one that uses the materials provided by the primary sector industries in order to produce commodities that people can use, either as consumer goods or as capital goods. A tertiary industry is one that does not produce articles or commodities, but performs a service (for example, trade, banking, administration, or the professions).

The relative growth rates of the sub-sectors within the primary, secondary, and tertiary sectors of the economy point to the environmental impacts of activities associated with them (see Boxes 2.4–2.8).



**Figure 2.19: Primary sector: annualized (%) change in the gross domestic product (GDP) by industry at constant 1995 prices**

Source: Statistics South Africa (2004)<sup>29</sup>



**Figure 2.20: Secondary sector: annualized (%) change in the gross domestic product (GDP) by industry at constant 1995 prices**

Source: Statistics South Africa (2004)<sup>29</sup>

### Primary sector

The primary sector is the portion of the country's economy devoted to the exploitation of basic materials, such as mining, agriculture, fishing, and forestry. The productivity of these primary resource sectors is variable (see Figure 2.19), especially in agriculture, forestry, and fishing, partly because of the reliance of these sub-sectors on weather patterns and on the carrying capacity of their respective resource bases (for example, arable soils and fish stocks). They are also sensitive to exchange rate movements and international commodity cycles, especially mining. Mining remains an important foreign-exchange earner, with gold accounting for over one-third of exports. South Africa is

## Box 2.4 How agricultural, forestry, and fishing activities affect the environment

### Agriculture

- Of South Africa's land, 80% is used for grazing and cultivation; 12.76 million hectares (ha) of natural habitat have been cleared for cultivation, which has led to the severe fragmentation of the grassland biome.
- Irrigation agriculture is the largest user of water in South Africa (nearly 62%).
- Livestock is an important source of greenhouse gas emissions and in this way contributes to global warming.
- Overgrazing and overstocking in many areas, as well as other damaging land-management practices, lead to severe land degradation.
- The type of livestock production system in operation determines the level of influence on the environment. Mixed systems, where livestock and cultivation are integrated, are potentially environmentally friendly because the by-products of one often serve as an input into the other. On the other hand, in industrial systems (in feedlots, for example), where animal concentrations are high, land and water are polluted through waste from production and processing.
- Modern commercial agriculture cultivates crops as single species stands. This method decreases biodiversity. This, in turn, increases the biotic and abiotic vulnerability of the agro-ecosystem, leading to pest infestations that require the application of pesticides and herbicides.
- The use of pesticides and fertilizers can damage the environment. Pesticides lead to bioaccumulation and death in non-target organisms. Fertilizers used to boost production or compensate for poor soil nutrients increase the nutrient content of water (eutrophication), resulting in algal blooms that reduce water oxygen levels and kill aquatic organisms. The use of fertilizer ignores soil chemical and biological processes and can lead to soil degradation rather than improved fertility.

### Forestry

- As much as 1.71 million ha of natural habitat, mainly grassland and fynbos, have been cleared for plantation forestry. This has greatly threatened the biodiversity resources offered by these biomes.
- Water use by plantations is probably rated as having the most serious environmental impact. Despite the relative efficiency of water use (85%–100%) by the forestry sector, absolute water use remains high. Plantations demand 3.3% of the available water resources in South Africa (1.5 million m<sup>3</sup> per year). The major concern is that plantations reduce the instream flow (that is, the amount of water in streams and rivers) during drier, low-flow periods when there is less rainfall (for example, during winter in inland areas and during summer in the Western Cape).
- Forestry can lead to soil erosion through poorly managed roads, unsustainable harvesting activities, and forest fires, which can result in stream bank instability. Consequently, water quality deteriorates through sedimentation of rivers.
- Owing to the need to maximize production, fast-growing alien tree species are planted that come from Australia (gums and wattle) and America and Europe (pines). Such species spread rapidly through the lack of natural predators in their South African environment and in areas disturbed by increased human activity, degrading riparian and wetland habitats through invasion.

- Forestry offers opportunities for improving the state of the environment and human well-being. For example, smallholder forestry benefits local communities and soil fertility can be improved through the use of nitrogen-fixing trees (that is, those that do not deplete the nitrogen levels in the soil but that introduce nitrogen to the soil).
- Afforestation acts as a sink for carbon dioxide, thereby reducing the levels of this gas in the atmosphere.

### Fishing

- South African commercial and recreational fishers exploit over 250 marine species: fewer than 5% of these are actively targeted, however, and the targeted species comprise 90% of the total catch.
- The demersal trawl fishery is a non-selective fishery, yielding a high percentage by-catch and causing extensive environmental degradation of the seabed.
- The uncontrolled exploitation of linefish has caused significant stock depletion – of the top 27 targeted linefish species, 18 are classified as 'collapsed', one as 'overexploited', six as 'optimally exploited' and only two as 'underexploited'.
- The collapse of fish stocks have resulted in a loss of livelihoods and food resources.
- Overexploitation of natural resources (wild stocks) from the ocean and coastal zone still has the single, most threatening impact on the marine environment.
- These and other effects of fishing have resulted in the implementation of strong management measures over the past decade.



More than 250 marine species are exploited by commercial and recreational fisheries. *Photography: Tony van Dalsen*



## Box 2.5 How mining affects the environment

- Over 200 000 hectares (ha) of natural habitat have been transformed by mining activities.
- Mining produces many wastes including solid waste, air emissions, and liquid effluents. Slimes dams and waste rock dumps in South Africa cover nearly 47 000 ha.
- In 1997, approximately 470 million tonnes of mining waste (general and hazardous) were generated, of which gold contributed almost half.
- Tailings dams are a major problem as they generate dust and pollute water through acid mine drainage.
- The mining sector (together with bulk industrial activities) consumes close to 6% of the available water in South Africa and, as such, has an important role to play in the judicious utilization and preservation of South Africa's scarce water resources.
- Mining lowers the quality of surface water by releasing many chemical contaminants, which, in turn, affect all living biota in the water.
- Some of South Africa's largest mines are located in or very near to the dolomite rocks of the Transvaal Sequence, which is our most important aquifer. This is of great concern for the urban populations that rely on it for their water supplies.
- Large-scale mining in Gauteng and surrounding areas, for instance, has made the dolomite rock subside, causing localized sinkholes and earthquakes.
- More than 50 000 tonnes of salts seep out of tailings dams in the Vaal region annually. This severely contaminates not only the water but also the soil and vegetation.
- Mining results in the extraction and depletion of non-renewable mineral resources.
- Mining has a high energy demand.
- Coal mining in South Africa is one of the primary ways in which the greenhouse gas, methane, is emitted into the atmosphere.
- Recent legal action was taken against mines in Limpopo and the Northern Cape, after deterioration had been identified in people's health due to the dust from old asbestos mines.
- Different phases of the mining cycle affect the environment in different ways:
  - Exploration activities may have the following results: the removal of vegetation for survey lines; vegetation degradation and soil erosion from vehicle tracks; soil and water pollution and contamination through spillage and leakage of fuels, oils, and drilling fluids; site wastewater; sewage disposal; and heavy metal and sediment drainage from waste rock dumps.
  - Mining and milling may result in irreversible changes to ground and surface water. They also accelerate erosion and change topsoil characteristics through, for instance, increased acidity, salinity, and loss of vegetation cover. The release of previously immobile pollutants is another possible effect of mining and milling, and can contaminate water, soil, flora, and fauna.
  - Air pollution can also cause damage to health and have ecosystem impacts from greenhouse gas emissions and the release of dust and particulates.
  - Surface mining methods change topography and surface drainage, increasing the potential for greater soil erosion, long-term compaction, subsidence, and reduced agricultural productivity.
  - Smelting and refining processes primarily affect soils, water courses, and food chains through leaching and transportation of pollutants.
- Environmental damage can persist for a long time after a mine is closed. Rock dumps, tailings dams, and old shafts that have not been rehabilitated can have long-term effects, and polluted waters and solid waste can continue degrading the environment. Other possible impacts include: loss of productive land, air pollution, and river regime changes, as well as risks to safety associated with shafts and pits.
- Collectively, the environmental effects of mining can put the health and safety of nearby settlements at risk.
- Mining is an important foreign exchange earner, with gold accounting for one-third of all exports. Mining therefore contributes significantly to the country's GDP and provides direct and indirect employment.



More than 200 000 hectares of natural habitat have been transformed by mining activities. *Photography: South African Tourism*

also a major producer of coal, manganese, chrome, platinum, and diamonds. Agriculture (even though it contributes only about 3.6% to the GDP) is an important provider of direct and indirect employment<sup>39</sup>.

Given its reliance on renewable and non-renewable resources, the primary sector has wide-ranging impacts on the environment. Agriculture has contributed to the degradation of soils and vegetation across South Africa<sup>40</sup>

and has affected water quality through, amongst other things, the use of fertilizers and pesticides<sup>41</sup> (see Box 2.4). Commercial fishing has had a significant impact on marine and coastal ecosystems and research indicates that there has been over-exploitation of pelagic and linefish species<sup>42</sup> (see Chapter 7).

Mining changes the topography and visual character of the land and destroys natural habitats, causes pollution

## Box 2.6 How manufacturing affects the environment

- Industries in and around the country's large metropolitan centres produce liquid, solid, and gaseous waste by-products.
- Manufacturing is one of the largest users of energy, and contributes to the emission of pollutant greenhouse gases such as carbon dioxide, methane, and nitrous oxide.
- South African petrochemical refineries (which contribute substantially to national emissions) are permitted to emit up to 82 tonnes of sulphur dioxide a day (in contrast with industrialized countries abroad, which are allowed to emit only about 2 tonnes of sulphur dioxide per day).
- The industrial sector is responsible for approximately 81% of South Africa's coal consumption.
- The iron and steel industry uses the greatest amount of coal (30% of total South African consumption in 2000). Other large consumers of coal are the chemical and petrochemical, food and tobacco, pulp and paper, and non-metallurgical industries.
- In 1997/1998, non-metallurgical manufacturing industries, metallurgical and metal industries, and service industries produced more than 42 million tonnes of hazardous waste.
- Manufacturing is one of the country's primary water users, which is cause for increasing concern because South Africa is a water-stressed country. (At current growth rates, the country's water resources will be fully utilized by 2030 – all the water will be accounted for, demand will eclipse supply, and there will be a water deficit.)
- Manufacturing also generates other forms of air, noise, and soil pollution.
- In recent years there has been a movement towards higher value-added manufacturing that makes use of technology (such as automated assembly lines, information technology, and telecommunications). This trend could benefit the environment by being more resource-efficient and emitting less pollution than at present.
- The 'high tech' corridor in Midrand, Gauteng, is the most rapidly developing area in South Africa. This results in loss of open space (made up of natural highveld grassland) between the two cities.



More than one-third of the country's population relies on fuel wood for daily energy needs. *Photography: Wilma Strydom*

from mining contaminates, depletes surface and groundwater resources, and degrades soils. In 1997, mining was the largest producer of waste in South Africa, creating over 376 million tonnes of hazardous and general waste<sup>43</sup>. (See Box 2.5 for the main impacts of mining activities on the environment.)

### Secondary sector

The country's secondary sector comprises economic activities (such as manufacturing, electricity generation, and construction) that process basic materials obtained by the

primary sector. Cheap electricity, which contributes to the competitiveness of many important manufacturing industries, such as aluminium smelting and energy production, also depends on large and easily accessible coal resources.

The secondary sector has grown at a variable pace since 1999 (see Figure 2.20), but its contribution has shrunk from 25% of GDP in 1991 to 19% in 2004<sup>44</sup>. Within manufacturing, there have been various economic shifts. Labour-intensive sub-sectors (such as food and beverages, textiles, clothing, and footwear) have grown slowly at around 0.2% per year, but declined from 23% of manufacturing value-added in 1990 to 20% in 2000 of the secondary sector as a whole. At the same time, basic metals, wood products, and chemicals were the fastest-growing manufacturing sub-sectors. Basic metals and wood production activities grew by more than 4% per year, thereby increasing their contribution to the value added to total manufacturing<sup>45</sup>.

Electricity, gas, and water sub-sectors have fluctuated markedly over the past 10 years (mirroring similar changes in the manufacturing and construction sub-sectors). They appear to be sensitive to changing patterns in economic production and consumption. In contrast, the construction sector has performed very well since 1999, growing between 5% and 6% per year, probably because of the boom in residential and commercial property development.

These sub-sectoral shifts within the secondary economic sector have had significant implications in terms of resource use and pollution profiles. The above activities are among the largest consumers of primary resources such as minerals, energy, and water. Manufacturing and electricity production generate a range of solid, liquid, and



## Box 2.7

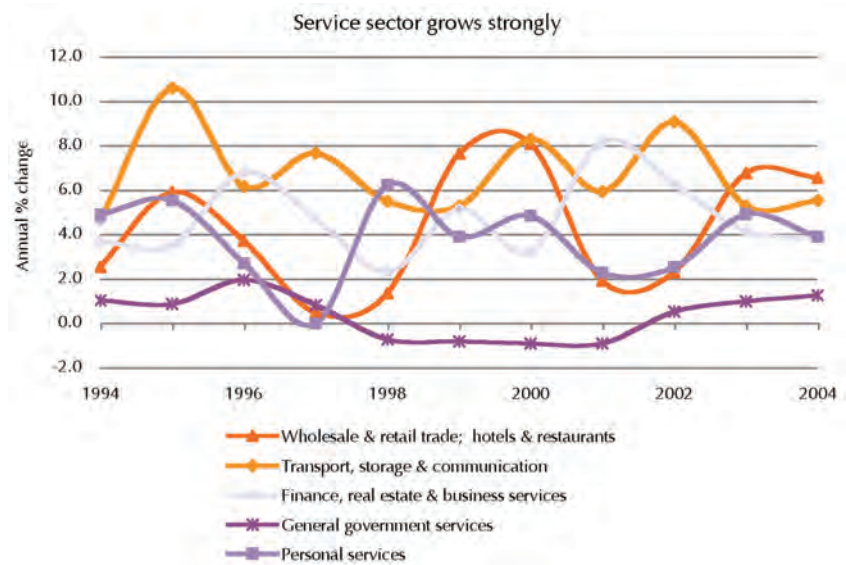
### How electricity production affects the environment

- Energy use causes significant environmental change – taking the form of air pollution, water pollution, biodiversity loss, and land use change.
- Coal is the predominant fossil fuel for energy use in South Africa, accounting for approximately 75% of the total energy used. The burning of fossil fuels for energy releases approximately 80% of all human-induced greenhouse gas emissions in the country.
- In 2002, large coal power stations producing electricity for the national grid were the largest producers of sulphur dioxide (70.5%) and nitrogen oxides (54.9%) in the country; they accounted for 36% of the total particulate levels in the air.
- Research shows that ambient air pollutant concentrations are highest in areas with high concentrations of industrial and power generation activity, namely: Tshwane; Johannesburg; Mpumalanga Highveld; Vaal Triangle; eThekweni, and Cape Town.
- More than 40% of South Africans are exposed to 80% of the anthropogenic pollution emissions.
- Air pollutants occur not only as greenhouse gases but also in the form of smog, mercury, soot, and ash.
- Acid deposition may affect water quality, thereby affecting human and ecosystems that rely on water.
- South Africa is the third-largest exporter of coal in the world, and coal is our second-largest foreign exchange earner after gold. Coal is used for many energy sources, with electricity being the predominant one (responsible for 43% of national coal consumption in 1997).
- Fuel wood is the most widely used renewable energy source in South Africa. More than one-third of the country's population relies on it for daily energy needs.
- Alternative energy supplies are currently being investigated. These include solar, wind, natural gas, and hydroelectricity. Economic reasons play a vital role when considering the use of these renewable resources, as their commercial exploitation requires significant financial and technological investment.

gaseous wastes that affect the country's environment (see Boxes 2.6 and 2.7 and Chapter 8).

### Tertiary sector

The tertiary sector consists of a range of service activities (for example, retail and wholesale operations, government



**Figure 2.21: Tertiary sector: annualized (%) change in the gross domestic product (GDP) by industry at constant 1995 prices**

Source: Statistics South Africa (2004)<sup>29</sup>

services, real estate, finance), and has grown strongly in South Africa since 1994 (see Figure 2.21). Among the top performers have been services related to transport, storage, and communication; finance, real estate, and business services; and wholesale and retail trade. General government services, although displaying less erratic fluctuations, have showed the lowest growth over the past decade. The growth in the hospitality industry, represented by hotels and restaurants, indicates the growing importance of tourism in South Africa.

The developing tourism sector, including ecotourism, has significant potential to generate jobs and contribute to the GDP. It grew by 3% between 1998 and 2002. In 2002, 6.4 million foreign tourists (of whom 4.4 million were from the African mainland) visited South Africa, in contrast with the 650 000 foreigners who visited in 1994. The industry is also estimated to have created 512 000 jobs in 2003<sup>45</sup>. Although it is defined as a tertiary sector activity, tourism in South Africa depends directly on the country's natural resources and its conservation and biodiversity base, reinforcing the need for management practices that conserve the nation's environment.

Although little comprehensive data exists about the overall resource efficiency of the tertiary sector in South Africa, it consumes less energy and natural resources and produces less waste per unit of GDP than the primary and secondary sectors. Some service sectors, such as ecotourism, may bring net environmental benefits through increased expenditure on conservation and environmental protection. Over-exploitation and poor management of natural and cultural assets can, however, result in environmental degradation.

*Tourism in South Africa depends directly on the country's natural resources and its conservation and biodiversity base, reinforcing the need for management practices that conserve the nation's environment.*

## Box 2.8 How transport affects the environment

- Transport networks show little regard for ecosystems and natural habitats, causing fragmentation and changes in microhabitats.
- The transport sector is responsible for 74% of South Africa's petroleum consumption and approximately 60% of imported crude oil is used for national petroleum production.
- Over the last six years the number of vehicles (including cars, trucks, motorcycles, and taxis) has increased by 14%, contributing to already high ambient air pollution concentrations in South Africa's cities.
- Increased reliance on vehicular transport, coupled with long commuting distances, contributes to traffic congestion and air emissions (for example, emissions from petrol and diesel vehicles have been identified as a major contributor to brown haze over the country's metropolitan areas).
- In the absence of adequate controls, and relative to the base year of 2002, vehicle emissions are predicted to increase by 27% by 2007 and by up to 44% by 2011.
- The transport industry is a major contributor to air pollution, emitting greenhouse gases such as carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), and nitrous oxide (N<sub>2</sub>O) into the atmosphere. In 2002, vehicles contributed 21.3%, 4.7%, and 2%, respectively, to the total nitrogen oxide, particulate, and sulphur dioxide emissions in the country. Other pollutants emitted by vehicles include lead and manganese.
- During 2000, diesel consumption increased by 4%. Diesel engines emit more CO<sub>2</sub> and N<sub>2</sub>O per unit of energy input than do petrol engines.
- Pollution from sulphuric acid (which is produced to similar levels by petrol and diesel engines) affects forests, lakes, crops, wildlife, and buildings. It damages ecosystems and even corrodes building structures.
- Surface run-off from tarred roads usually contains a mixture of oil, diesel, and petrol, which can flow into water courses, causing pollution and damaging aquatic ecosystems.
- Initiatives to reduce reliance on motor vehicles in Gauteng are under way. These include the Gautrain Rapid Rail Link that will connect Pretoria, Johannesburg, and Johannesburg International Airport, and that is expected to reduce Gauteng's motor vehicle volumes and associated air pollution.

Services that require the use of transport, especially road vehicles, contribute to atmospheric emissions such as sulphur, lead, benzene, and particulates (see Box 2.8 and Chapter 8).

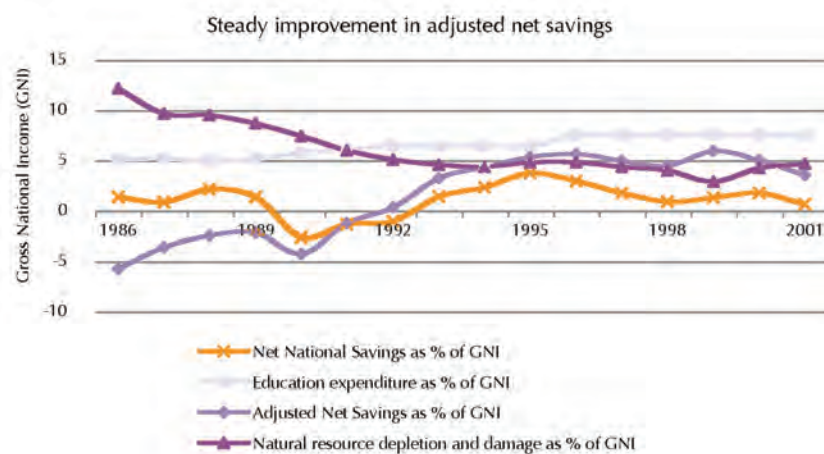
### 2.3.7 Adjusted net savings and 'Green GDP' measurements

Adjusted net savings (also called 'genuine savings') is a sustainability indicator that builds on the concept of 'green national accounts'. Adjusted net savings measure the true rate of savings in an economy after taking into account investments in human capital (that is, educational spending), depletion of natural resources, and damage caused by pollution. The adjusted net savings measure departs from standard national accounting by explicitly deducting the value of depletion of the underlying resource asset<sup>46</sup>.

While a full, adjusted net savings analysis has not yet been carried out for South Africa, initial applications of this type of analysis are useful for understanding the sustainability aspects of the country's economic development. It reinforces the need to boost domestic saving and, hence, the need for sound macroeconomic policies. (See Table 2.4 for South Africa's adjusted net savings, based on World Bank analyses<sup>47</sup>.)

Although no measures are available yet of local pollution damage, adjusted net savings analysis begins to demonstrate how elements of the national accounts can be adjusted to provide a fuller picture of the sustainability of the economy. Since 1994, South Africa's adjusted net savings have been higher than the net national savings as conventionally measured (see Table 2.4). This is because of the large share of Gross National Income (GNI)<sup>48</sup> spent on education. Thus, if the country's high public expenditure on education were to be factored out of the equation, it would result in a negative adjusted saving, suggesting that more needs to be done to reduce the depletion of, and damage to, environmental resources. It should be noted, however, that the benefits of education are longer-term and their aim is to enable people to make appropriate and informed choices.

Figure 2.22 gives a modified picture of adjusted net savings. It covers the period 1986–2001 and, for clarity, consolidates adjustments to net national savings into the two areas of education expenditure and natural resource depletion. Adjusted net savings climbed above net savings only from 1991 onwards. This was driven by increased education expenditure and by a decline in measured resource depletion and damage. Although Figure 2.22 shows a steady improvement in adjusted net savings since the early 1990s, it does not necessarily mean that the state of our natural environment has improved. On the contrary, the chapters that follow (for example, Chapters 4, 5, 6, and 8) indicate a general decline in the health or quality of our environment. Improved measurement of adjusted net savings would require the collection and analysis of data on pollution damage.



**Figure 2.22: Adjusted net savings as % of gross national income (GNI) for South Africa, 1986–2001**

Source: World Bank (2005)<sup>47</sup>



**Table 2.4: Adjusted net savings for South Africa, 1994–2001**

Parameter	1994	1995	1996	1997	1998	1999	2000	2001
Gross National Investment as % of GNI	15.9	17.1	15.9	14.7	14.0	14.4	14.9	13.9
Consumption of fixed capital as % of GNI	13.6	13.4	13.1	13.0	13.1	13.2	13.2	13.3
Net national savings as % of GNI	2.3	3.7	2.9	1.8	0.9	1.3	1.7	0.6
Education expenditure as % of GNI	6.4	6.4	7.5	7.5	7.5	7.5	7.5	7.5
Net forest depletion as % of GNI	0.3	0.4	0.4	0.4	0.2	0.2	0.3	0.3
Mineral depletion as % of GNI	1.3	1.2	1.1	1.0	1.0	0.9	0.9	1.0
Energy depletion as % of GNI	1.5	2.0	2.1	1.7	1.3	0.3	1.3	1.3
Carbon dioxide damage as % of GNI	1.3	1.2	1.3	1.3	1.5	1.5	1.7	2.0
Adjusted net savings as % of GNI	4.3	5.3	5.6	4.9	4.4	5.9	5.0	3.5

NOTE: Adjusted net saving = Net saving + Current education expenditure – Resource rents (Depletion of energy, minerals and forest) – CO<sub>2</sub> damage

Source: World Bank (2005)<sup>47</sup>

### 2.3.8 Policy trends

A range of policy processes under way are addressing the interactions between the economy and the environment as a means of supporting sustainable development in South Africa. The following are among the key initiatives.

- The National Treasury has embarked on a process of environmental fiscal reform, largely aimed at reforming government's revenue-raising approach in line with environmental economic principles of higher taxes for environmentally harmful activities than the normal taxation of productive activities in the economy. So-called 'green taxes' seek both to raise revenue and alter behaviour, encouraging less environmentally harmful activities by increasing taxes on environmentally harmful goods, such as pesticides, or practices that can damage the environment, such as electricity consumption<sup>48</sup>.
- Statistics South Africa is undertaking an ambitious exercise to develop "natural resource accounts" for the country. Natural resource accounting is defined as 'an accounting system that deals with stocks and changes in stocks of natural assets, comprising biota (produced or wild), subsoil assets (proven reserves), water and land with their aquatic and terrestrial ecosystems<sup>49</sup>'. The general purpose of natural resource accounts is to

provide policy-makers with an information base on natural resources, and to contribute to awareness of environmental issues at each level of decision-making and among the general public<sup>50</sup>. The following sets of natural resource accounts and discussion documents have been prepared: mineral accounts<sup>50</sup>; energy accounts<sup>52</sup>; land use and land cover accounts<sup>50</sup>; and water accounts<sup>51</sup> (which deal with the availability of water).

- A further policy trend is the increasing focus on the use of environmental economic instruments for natural resource management and environmental protection. New legislation, such as the National Environmental Management: Air Quality Act (No. 39 of 2004) of the Department of Environmental Affairs and Tourism (DEAT) allows for the use of charges and/or taxes in pursuit of environmental management objectives. Other departments, such as the Department of Water Affairs and Forestry, are actively pursuing the use of pollution charges for environmental management purposes<sup>53</sup>. Greater focus on the use of such instruments has the potential to harness market forces in the management of environmental resources, and it can assist in developing greater awareness of the value of resources and the costs of pollution. Although not significant on a macroeconomic scale, the requirement implemented

*“Suit the action to the word, the word to the action; with this special observance, that you o’erstep not the modesty of nature.”*

William Shakespeare, Hamlet



by the DEAT that retailers sell plastic carrier bags to customers rather than provide them free of charge, has had a widespread effect in developing consumer awareness of how they use their resources – highlighting the problem of litter, for example, and encouraging the practice of recycling.

## 2.4 GOVERNANCE

Governance is both a response to environmental issues and a driver of environmental change. It refers to actions, processes, traditions, and institutions by which authority is exercised. It is most often associated with governmental bodies at the national level and with regional and global institutions<sup>54</sup>, but civil society and the private sector also play an important role. Participation, accountability, transparency, and corruption all influence the management of environmental resources. Despite differences in governance around the world, certain trends are evident.

One tendency is towards greater individual freedom and decentralization of authority. Individuals' rights relating to environmental health, access to information, and public participation are enshrined in South Africa's Constitution as well as in sectoral laws and policy. Cooperative governance and the role of local government in economic development, regulation, and service delivery are also entrenched in South African law.

A second trend is towards greater regional integration and global governance through mechanisms such as environmental agreements. This section, therefore, focuses on international environmental governance (IEG), and, in particular, on South Africa's engagement with multilateral environmental agreements (MEAs), which, in many cases, have triggered national environmental action.

### 2.4.1 International environmental governance

Over the past 20 years, global environmental problems such as ozone depletion, climate change, and deforestation have resulted in an increase in regimes<sup>h</sup> governing the global environment. To fix transboundary problems that seemed beyond the scope of any single national government (for example, clean air), the international community has devised pacts, conventions, and protocols based on a common commitment to sustainable development. Efforts to manage the environmental impacts of human development on the Earth's natural systems are directed by more than 500 MEAs and their corresponding secretariats, which are managed by more than a dozen international agencies<sup>55</sup>.

The United Nations Environment Programme (UNEP) has the challenging task of catalysing and coordinating global environmental efforts, with financial backing from organizations such as the World Bank (which manages the Global Environmental Facility, or GEF) and various donors.

Together, UNEP/GEF projects build the capacity of countries to manage their environments. For example, the UNEP/GEF global biosafety programme is building capacity in 138 countries to implement the Cartagena Protocol on Biosafety of the Convention on Biological Diversity<sup>56</sup>. National support for, and implementation of, MEAs is encouraged through financial and technical assistance from multilateral and bilateral development agencies. Some environmental regimes offer incentives for the transfer of clean technologies to developing countries, financial aid, or differential sets of obligations. For example, the Montreal Protocol on ozone-depleting substances imposes stricter obligations for developed than for developing countries. It also establishes a multilateral fund to compensate developing countries for complying with the protocol<sup>57</sup>. This assistance remains limited however, and many countries with the most pressing needs often lack the resources to implement global agreements.

In addition to providing some material incentives for cooperation, global governance regimes also shape the ways in which those who implement them define their interests. Governments can, for example, choose long-term political credibility by committing themselves to environmental policies rather than trying to maximize short-term financial benefits. International governance institutions have also helped to build trust between governments and bolstered capacity to carry out effective policies.



Minister van Schalkwyk accepting the United Nations 2005 "Champions of the Earth" award on behalf of the President and all South Africans.

Photography: Department of Environmental Affairs and Tourism

*Since its reintegration into the international community in 1994, South Africa has engaged fully and actively in multilateral international forums, especially in the arena of environmental cooperation.*





Since its reintegration into the international community in 1994, South Africa has engaged fully and actively in multilateral international forums, especially in the arena of environmental cooperation. It has involved itself in sustainable development in forums such as the Commission on Sustainable Development, the Commonwealth of Nations, the Non-Aligned Movement, and the African Union. Its involvement with, and hosting of, the World Summit on Sustainable Development in 2002 raised the country's profile in global debates and processes on environmental governance, in particular in the restructuring of the UN.

In the first decade of democracy, South Africa has paid serious attention to MEAs<sup>57</sup> (see Chapter 3), which provide a global framework for many areas of national environmental governance towards sustainable development. This indicates the country's support for international governance and for joining forces with surrounding countries in managing common transboundary natural resources.

Uneven compliance by international signatories with the reporting requirements of MEAs reflects weaknesses relating to the ways in which specific agreements link to national interests and development priorities<sup>58</sup>. Like other developing countries, South Africa's implementation of ratified MEAs has been variable. Institutional fragmentation and capacity constraints have, for example, delayed the development of a National Action Programme on Land Degradation required in terms of the Convention to Combat Desertification, which South Africa ratified in 1997. On the other hand, there has been movement on agreements such as the Convention on Biological Diversity (ratified in November 1995) and the Kyoto Protocol. (For the range of MEAs to which South Africa has acceded and/or that it has ratified, see Chapter 3.)

## 2.4.2 Thinking regionally and locally

Regional environmental regimes, defined by geographical features such as seas and river catchments rather than political boundaries, may offer opportunities to tackle problems at the appropriate implementation or governance level. Setting and implementing global policies can be effective only if they are based on regional solutions and if full account is taken of regional priorities. These solutions need to consider geography, specific environmental and socio-political conditions, cultural heritage, traditions, and local practices.

Africa's special development needs make it a priority for the UN. South Africa, together with Nigeria, has actively championed the continent's cause and the objectives of the New Partnership for Africa's Development (NEPAD) in forums such as meetings of the European Union and the G8 countries (that is, the Group of Eight, or, the world's eight leading capitalist countries: the United States, the United Kingdom, Germany, Japan, Italy, France, Canada, and Russia). Such high-level engagement has prompted action,

including the drafting of environmental action plans under the auspices of NEPAD's Environment Initiative<sup>59</sup>.

The importance of local implementation is also acknowledged by many MEAs. For example, Chapter 28 of Agenda 21 (drawn up at the United National Conference on Environment and Development [UNCED], 3–14 June 1992, in Rio de Janeiro) recognized the part to be played by local government in 'educating, mobilising and responding to the public to promote sustainable development'. The process known as Local Agenda 21 (LA21), used worldwide to translate Agenda 21 into local action, is important because local authorities commitment to work in partnership with their communities is essential for implementing more than two-thirds of the proposals and programme areas in Agenda 21<sup>60</sup>.

In South Africa, implementation of LA21 is supported through the involvement of key cities in the Model Cities Programme, where local authorities and civil society collaborate in projects to advance sustainable development through environmental planning at the local level. Although the concept of LA21 has waned nationally in recent years, the key principle of community participation in planning is reflected in the Integrated Development Planning process, which is statutorily required of local authorities in terms of South Africa's Municipal Systems Act (No. 32 of 2000), and which signifies local government's proactive support of Agenda 21.

## 2.5 SCIENCE AND TECHNOLOGY

Science and technology continue to transform production and associated patterns of work and leisure, and significantly affect society and the environment. On the one hand, science and technology have contributed to human well-being by advancing food production, developing pharmaceuticals, and preventing disease – on the other hand, they have enabled ever greater exploitation of natural resources and increased production of waste. Science and technology thus form critical links with sustainable development.

As a developing country in a rapidly globalizing world that has a looming energy crisis, South Africa must harness science and technology to promote its global competitiveness, create wealth, improve the lives of its people, develop human resources, and work towards environmental sustainability<sup>61</sup>. Innovation<sup>6</sup> in research and development (R&D) is crucial in this process. Sufficient funding and competently trained scientists, engineers, and technologists are fundamental to South Africa's economic and human development.

This section outlines some of the key indicators of science and technology in South Africa and their influence on the environment.

### 2.5.1 Funding research and development

Funding and innovation in the research and development sector can significantly affect people's quality of life (health-care sector), business performance (new products and processes), and the use of the nation's natural resources. In contrast with developed countries, where more than 50% of economic growth is attributable to technical progress<sup>62</sup>, many developing countries remain cut off from the benefits of technological development. This can be due to the fact that technical expertise and financial resources in developing countries are too limited for them to be able to access, use, and benefit fully from scientific knowledge and technologies that are readily available in developed countries. This situation often disadvantages countries such as South Africa in managing the use and protection of natural resources.

South Africa's R&D is constrained by insufficient funding. In 1990, R&D expenditure represented 1.1% of GDP, dropping to 0.7% of GDP in 1994. Reductions in military spending and in spending on energy self-sufficiency contributed, amongst other things, to the decline in R&D expenditure. The country's gross R&D expenditure increased to 0.81% of GDP in 2003, placing South Africa at a comparable level with Portugal, Poland, and Hungary<sup>44</sup>. In real terms, this represented an increase from R7.5 billion in 2001 to over R10 billion in 2003/2004<sup>63</sup>. This increase is however partially attributed to wider coverage by national R&D surveys, which have been expanded to include more participants and categories. In the 2003/2004 financial year, the business sector accounted for 55.5% of R&D expenditure followed by the government (including the science councils) at 21.9% and higher education at 20.5%<sup>65</sup>. Some 10% of funding came from foreign sources.

South Africa's National System of Innovation (NSI), adopted under the auspices of the 1996 White Paper on Science and Technology, promotes science and technology realignment with the new national priorities of education, communication, health, and trade. New funding mechanisms, including the Innovation Fund (piloted in 1997) and the National Research Foundation (NRF) established by act of parliament in 1998, support the NSI priorities. These have shifted research funding in the direction of the competitive realities of a globalizing economic environment, with incentive-driven funding designed to create new research relationships. For example, R&D expenditure by socio-economic objective is divided as follows: economic development (60.26%), advancement of knowledge (12.69%), society (12.15%), defence (9.31%), and environment (5.6%)<sup>44</sup>. This shift, however, has the potential to weaken the country's ability to measure and monitor changes in the natural environments that crucially form its resource base – information that is valuable to decision-makers in drafting and implementing policy, programmes, and plans that are appropriate to address the country's needs and challenges.

### 2.5.2 Human resources to support research and development

Globally, educational institutions lie at the forefront of research and development. The numbers of institutions, researchers, and academics contributing to R&D in South Africa are useful indicators of the amount of research taking place in the country, and of technical and human resource availability. (Table 2.5 shows the number of institutions in the science and technology system as at March 2002. Government funds all of them except the commercial research houses and research NGOs, which are funded by donors and contract work.)

In 2002, about 30 000 people were employed in R&D in South Africa. An international comparison of full-time equivalent (FTE) researchers per 1 000 of the total employed in 2003 found that South Africa fared poorly (with 2.22 FTE researchers per 1 000 total employed). It was better off

**Table 2.5: Institutions in the science and technology system, as at March 2002**

Type of institution	Number
Universities	21
Technikons <sup>i</sup>	15
Science Councils <sup>ii</sup>	8
Other science, engineering & technology institutions & government units <sup>iii</sup>	35
Commercial research houses <sup>iv</sup>	45
Research non-government organizations <sup>v</sup>	80+

<sup>(i)</sup> Institutions of tertiary education that focus on applied science and technology and industry-related teaching and research.

<sup>(ii)</sup> Statutory government-supported institutions, all performing research except for the NRF, which is a research funding agency.

<sup>(iii)</sup> Organizations such as the Africa Institute of South Africa that work in close association with government departments.

<sup>(iv)</sup> A wide range of research groups in the business sector, ranging from mining house research laboratories to market research organizations.

<sup>(v)</sup> These organizations render services primarily to communities and commit more than 25% of their activities and resources to research.

Source: National Advisory Council on Innovation (2002)<sup>64</sup>



than Argentina (1.8) and China (1.1), but significantly lower than Spain (5.1), South Korea (6.8), and Australia (7.3). Sweden fared best at 10.6<sup>63</sup>. In fact, over the last decade, the number of FTE researchers has remained more or less steady at around 10 000. There are currently not enough researchers in the system to increase the output. To put this into perspective, our level of GERD:GDP is close to where South Korea was in the mid-1980s<sup>44</sup>. South Korea's GERD:GDP is now 2.68. Much needs to be done in South Africa to train, attract, and retain additional FTE researchers.

Scientific papers published in peer-reviewed research journals can also indicate a country's R&D output. South Africa's R&D output (as measured in terms of such published papers) has remained static over the past decade (at about 3 300 per annum in the natural sciences, engineering, and medicine), which is a clear indication that the research capacity of academia has not grown over that time<sup>63</sup>. South Africa's research publications represent approximately 0.5% of the world's R&D output. This means that, although we do well in comparison with the rest of the African continent, we still lag far behind many of the more developed countries. The field of engineering sciences is the leader in R&D research in South Africa, comprising 24.8% of the total. This is followed by natural sciences, at 21.9%, and, third, medical and health sciences at 13.5%<sup>63</sup>.

Many of the country's universities (such as the universities of Cape Town, KwaZulu-Natal, North-West, and the Witwatersrand) offer courses on environmental management, training new environmental professionals and also developing the skills and capacity of existing mid-career practitioners.

### 2.5.3 Towards cleaner technology

Cleaner technology (better known as 'cleaner production'), demonstrates how technological innovation can influence the cycle of production in ways that protect and benefit the environment. It shows the potential to reduce resource usage and pollution, increase competitiveness and the quality of goods and services, and improve people's health and well-being. This preventive environmental approach aims to increase resource efficiency and reduce pollution and, as such, departs from the 'traditional' response to environmental degradation, which is to mitigate the effects of pollution once it has occurred. Cleaner production includes measures to conserve raw materials and water, and acts to reduce at source the quantity and toxicity of emissions and wastes that pollute air, land, and water.

In South Africa, over the past decade, there has been growing activity in this area of cleaner production, driven by promotion, research, or demonstration projects, and the success of these initiatives is most evident in the private sector. For instance, Danish-funded projects in the fish, textile, and metal finishing industrial sectors in South Africa

not only resulted in large savings in resource use (up to 70% water savings in the fishing industry in the Western Cape), but secured the support of owners, managers, and workers for the sustained implementation of interventions<sup>65</sup>. Growing awareness has prompted further investments in cleaner production projects in these industrial sectors, and cleaner production has also taken root in areas such as food processing, wine production, and the automotive, pulp and paper, and mining industries. This process has contributed to the establishment of a small pool of technical expertise on cleaner production in a number of research institutions and consulting firms throughout the country, but the level of expertise and capabilities in the field still need to be expanded<sup>66</sup>.

Further impetus came from the establishment of the CSIR-based National Cleaner Production Centre in 2003 and its training activities. Funding to support cleaner production research is being directed through agencies such as the Water Research Commission. The national and international success of cleaner production projects has also prompted their inclusion in public institutional arrangements and national policy: the DEAT has established a sub-directorate



The wind turbine at Klipheuwel in the Western Cape demonstrates the generation of renewable energy.

Photography: Eskom

dedicated to cleaner production; cleaner production-related aspects have been included in national policy and legislation on waste management, pollution control, water management, and energy; and several local authorities promote waste minimization clubs. Cleaner production is likely to be one of the primary drivers of the National Air Quality Programme being undertaken under the auspices of the recently promulgated National Air Quality Act (No. 39 of 2004). Its effective implementation has the potential to reduce air and water pollution in places of high industrial concentration (see Chapter 8).

As we have seen, economic activities in agriculture, fishing, forestry, mining, and energy production remain vital to South Africa's economic development. The existing capacity in these sectors (that is, their skilled staff, specialized equipment, and financial resources) also makes them attractive catalysts for further innovation and development in the country, especially in the area of cleaner technology. Ensuring that an adequate number of people is appropriately trained in these resource-based sectors is imperative for their continued sustainability. South Africa's standard of invention and creativity in the resource sector is fairly high, especially in the scientific areas of geology as it relates to deep mining. Furthermore, indigenous knowledge and technology (that is, collective knowledge of evolving natural systems and the indigenous environment that has been passed down through generations of communities) are prime sectors for technological and institutional innovation and should be further developed within South Africa.

## 2.6 CONCLUSION

A number of factors affects the condition of the country's ecological and social systems, with South Africa's population and economic development being the principal drivers of environmental change.

Population change profoundly affects the environment: demographic trends such as natural population growth and urbanization have increased the pressure on land, air, water, and energy resources. High levels of poverty and unemployment contribute to further heavy reliance on natural resources. Deteriorating environmental quality (such as land degradation and declining water quality) leads to poor health for many South Africans.

The country's economy has shifted its emphasis towards the service sector, but the relative scale of the primary sector continues nevertheless to affect environmental quality. Growth in the primary sector leads to greater impacts on the environment – even though as a sector it is making a smaller contribution than before to total economic activity. For example, although mining has a smaller share of the economy than a decade ago, in absolute terms it has grown in extent and value. Similarly, despite a decline in the scale of commercial farming in

South Africa, the intensification of agricultural production through, amongst other things, the use of fertilizers and pesticides has had (and continues to have) detrimental effects on the environment<sup>41</sup>.

Given current growth rates, it will be impossible to bring the average poor household out of poverty within the next decade without accelerated redistribution of income; increased provision of basic services and welfare; and improved access to and ownership of natural resources by the poor. Despite higher public expenditure on education and social welfare and the provision of basic services, the South African economy is not yet meeting the basic needs of the current generation. This situation could thus reinforce people's dependence on environmental resources for their livelihood and increase their vulnerability to environmental change.

Governance and science and technology also guide society's use of environmental resources. The international environmental governance system directs multilateral efforts in addressing global environmental problems. Despite challenges in implementing and enforcing international agreements, they have provided a global framework for African, southern African, and South African policy and governance initiatives aimed at achieving sustainable development. While governance regimes attempt to prevent serious environmental damage through better management of shared resources, science and technology help to shape the nature of production. It is imperative for South Africa to harness scientific and technological innovation to promote global competitiveness, create wealth, and improve the lives of its people.

Increased attention to environmental fiscal reform, cleaner production, energy efficiency, and renewable energy indicates a growing understanding of the need to manage the country's environmental and natural resources better. Although political support for science and technology promotion has increased, state expenditure on R&D remains low compared to developed countries. South Africa's base of skilled technical professionals and researchers must grow – and it must grow in ways that represent better the demographic realities of the country.



## NOTES

- a. The official Census figures are not always reliable. Between 1980 and 1991, for example, the populations of the former homelands were excluded. Earlier censuses are believed to have undercounted the black African population.
- b. The size of the economy is normally measured by gross domestic product (GDP), which reflects the total value of all final goods and services produced in the economy during a year. 'Final' goods and services are those that are actually used or consumed by individuals, households, firms, or the government. It fails, however, to measure important changes in the natural resource and environmental assets of the country.
- c. The *official* measure is defined as the proportion of economically active people who are not employed, who want to work, and who have actively sought work during the previous four weeks. The *expanded* measure is defined as those who want to work but have not taken active steps to look for work or to start some form of self-employment in the four weeks prior to the Labour Force Survey. This expanded measure includes job seekers who have become disillusioned or discouraged from actively looking for work.
- d. The Gini-coefficient is a common measure of inequality. It ranges from 1 indicating perfect income inequality, and 0, perfect income equality. See <http://www.answers.com/topic/gini-coefficient>
- e. Energy consumption is expressed as a ratio in terajoules of energy used per R1 000 of GDP. One terajoule (TJ) is equal to  $1 \times 10^{12}$  joules.
- f. Consumption of energy used in the same form as in its naturally occurring state (as, for example, the consumption of crude oil, coal, or natural gas), before it is converted into electricity.
- g. Gross National Income measures the total income of all people who are citizens of a particular country, whereas GDP measures the total output of all persons living within that country's borders.
- h. 'Regimes' refers to the collection of legal, institutional, and political processes through which governance is carried out (Economic and Social Research Council, 2000, Swindon).
- i. The Global Environment Facility helps developing countries and those with economies in transition to meet the agreed incremental measure designed to achieve the global benefits in six focal areas: biological diversity, climate change, international waters,

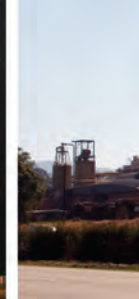
ozone layer depletion, land degradation, and persistent organic pollutants.

- j. For example, the Convention on Biological Diversity, United Nations Framework Convention on Climate Change, and the United Nations Convention to Combat Desertification.
- k. Innovation is the chief process by which products, processes, and services are created and by which businesses generate jobs and wealth. Its social applications play a key role in reducing poverty and improving people's quality of life.

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## REFERENCES

1. Department of Environmental Affairs and Tourism and Council for Scientific and Industrial Research (2001). Unpublished research papers on the drivers of environmental change.
2. Department of Environmental Affairs and Tourism (1999). *National State of the Environment Report for South Africa*. Department of Environmental Affairs and Tourism, Pretoria.
3. Statistics South Africa (2005). *Key findings: Mid-year population estimates, 2005*. Report P0302. Statistics South Africa, Pretoria. <http://www.statssa.gov.za/publications/P0302/P03022005.pdf>
4. South African Cities Network (2004). *State of the Cities Report 2004*. South African Cities Network, Johannesburg.
5. Department of Health (1998). *South African Demographic and Health Survey*. Department of Health, Pretoria.
6. Department of Environmental Affairs and Tourism (2004). *Environment data on South Africa*. Department of Environmental Affairs and Tourism, Pretoria.
7. Rehle, T. and Shisana, O. (2003). Epidemiological and demographic HIV/Aids projections: South Africa. *African Journal of AIDS Research* 2(1), 1–8.
8. Dorrington, R. *et al.* (2004). *The Demographic Impact of HIV/AIDS in South Africa*. *National Indicators for 2004*. The Centre for Actuarial Research, South African Medical Research Council and Actuarial Society of South Africa, Cape Town.
9. Africa Biodiversity Collaborative Group (2002). *HIV/AIDS and Natural Resource Management Linkages*. Workshop organised by Africa Biodiversity Collaborative Group, hosted by WWF-EARPO, and facilitated by the College of Africa Wildlife Management, Tanzania, 26–27 September 2002. Nairobi.
10. Statistics South Africa (2002). *Causes of death in South Africa 1997–2001: Advance release of recorded causes of death*. Report PO309.2. Statistics South Africa, Pretoria. <http://www.statssa.gov.za/publications/P03092/P030922001.pdf>
11. Oglethorpe, J. and Gelman, N. (2004). *HIV/AIDS and Environment*. WWF and The World Conservation Union.
12. Department of Health (2002). *Department of Health Annual Report 2001/02*. Performance against objectives. Department of Health, Pretoria.
13. Biggs, R., Bohensky, E., Desanker, P.V., Fabricius, C., Lynam, T., Misselhorn, A.A., Musvoto, C., Mutale, M., Reyers, B., Scholes, R.J., Shikongo, S. and van Jaarsveld, A.S. (2004). *Nature Supporting People – The Southern African Millennium Ecosystem Assessment – Integrated Report*. Council for Scientific and Industrial Research, Pretoria.
14. United Nations Development Programme (2005). *Human Development Report 2005*. United Nations Development Programme, New York. <http://hdr.undp.org/statistics>
15. Adelzadeh, A. (2003). Measurement of poverty and deprivation in South Africa. Background submission for the South African National Human Development Report 2003.
16. Government of South Africa (2005). *South Africa Millennium Development Goals Country Report 2005*. Unpublished report approved by Cabinet.
17. Sharp, B.L. and Le Sueur, D. (1996). Malaria in South Africa – the past, the present and the selected implications for the future. *South African Medical Journal* 86, 89.
18. Department of Health (undated). Trends and statistics of malaria in South Africa. <http://www.doh.gov.za/facts/index.html>
19. Department of Health (2001–2004). *Annual Reports 2001/02 and 2003/04*. <http://www.doh.gov.za/facts/stats-notes/2004/malaria.htm>
20. Statistics South Africa (2004). *Mid-Year Population Estimates South Africa 2004*. Statistical Release P0302. Statistics South Africa, Pretoria.
21. Department of Health (2003). *National HIV and Syphilis Antenatal Sero-Prevalence Survey in South Africa*. Directorate: Health



- Systems Research, Research Coordination and Epidemiology, Pretoria.
22. Chisholm, L. (2005). The State of South Africa's Schools. In Daniel, J., Southall, R., and Lutchman, J., *State of the Nation South Africa 2004–2005*. HSRC Press, Cape Town.
  23. Statistics South Africa (2000–2004). *Labour Force Survey (LFS)*. Annual Statistical Release P0210. Statistics South Africa, Pretoria.
  24. Statistics South Africa (2005). *Labour Force Survey (LFS) September 2005*. Statistical Release P0210. Statistics South Africa, Pretoria. <http://www.statssa.gov.za/publications/P0210/P0210September, March 2000, 2005.pdf>
  25. Hanley, N., Shogren, J., and White, B. (1997). *Environmental economics in theory and practice*. Macmillan, London.
  26. South African Reserve Bank (2005). Various time series data from the South African Reserve Bank website, SARB, Pretoria. <http://www.reservebank.co.za/internet/Publication.nsf/>
  27. Bignaut, J. and de Wit, M. (2004). A perspective on the South African economy. In Bignaut, J. and de Wit, M. (eds.), *Sustainable Options: Economic development lessons from applied environmental resource economics in South Africa*. University of Cape Town Press, Cape Town.
  28. Department of Finance (1996). *Growth, Employment and Redistribution: a macroeconomic strategy*. Department of Finance, Pretoria.
  29. Statistics South Africa (2004). *Gross domestic product 4th Quarter 2004*. Report P0441. Statistics South Africa, Pretoria.
  30. World Resources Institute (2005). *Economics, Business and the Environment*. <http://earthtrends.wri.org>
  31. Statistics South Africa (2001–2004). *Comparative Labour Statistics: Labour Force Survey*. Statistics South Africa, Pretoria.
  32. Statistics South Africa (1994–1999). *October Household Surveys*. Statistics South Africa, Pretoria.
  33. South African Reserve Bank (2004). *Annual Economic Report for 2004*. South African Reserve Bank, Pretoria. <http://www.reservebank.co.za/internet/Publication.nsf/>
  34. Hoogeveen, J. and Ozler, B. (2004). *Not Separate, Not Equal: Poverty and Inequality in Post-Apartheid South Africa*. The World Bank, Washington, DC.
  35. Van der Berg, S., Burger, R., Louw, M., and Yu, D. (2005). *Trends in poverty and inequality since the political transition*. Economic Working Papers, 1/2005. Paper commissioned by German Agency for Technical Co-operation. Bureau for Economic for Economic Research and Department of Economics, Stellenbosch University, Stellenbosch.
  36. Simkins, C. (2004). *What happened to the distribution of income in South Africa between 1995 and 2001?* University of the Witwatersrand, Johannesburg.
  37. National Treasury (2003). *Socio-economic and demographic profiles of provinces*. National Treasury, Pretoria.
  38. National Treasury (2005). *Estimates of National Expenditure 2005*. National Treasury, Pretoria.
  39. Economist Intelligence Unit (2004). *South Africa Country Briefing*. Economist Intelligence Unit, London.
  40. Hoffman, M.T. and Todd, S. (2000). A National Review of Land Degradation in South Africa: the Influence of Biophysical and Socio-economic Factors. *Journal of Southern African Studies* 26(4), 743–758.
  41. Laker, M.C. (2004). Challenges to Soil Fertility Management in the “Third Major Soil Region of the World” with special reference to South Africa. CEIC paper.
  42. Griffiths, M. H. (2000). Long-term trends in catch and effort of commercial linefish off South Africa's Cape Province: snapshots of the 20th century. *South African Journal of Marine Science* 22, 8–110.
  43. Department of Water Affairs and Forestry (1998). *Waste Generation in South Africa: Baseline Studies*. Waste Management Series. Department of Water Affairs and Forestry, Pretoria.
  44. Kahn, M. and Blankley, W. (2006). The state of research and experimental development: moving to a higher gear. In Buhlungu, S., Daniel, J., Southall, R., and Lutchman, J. (2006), *State of the Nation South Africa 2005–2006*. HSRC Press, Cape Town.
  45. South African Tourism (2004). *2003 Annual Tourism Report*. South Africa Tourism Strategic Research Unit, Sandton.
  46. World Bank (2005), Lange, G. (2003). *Policy Applications of Environmental Accounting*. The World Bank, Environment Department, Washington, D.C.; and Bolt, K., Matete, M., and Clemens, M. (2002). *Manual for calculating adjusted net savings*. The World Bank, Environment Department, Washington, DC. <http://www.worldbank.org/data/countrydata/countrydata.html>
  47. World Bank (2005). World Bank Country Data, ‘At a Glance’ Tables for South Africa, Botswana, Brazil and India. <http://www.worldbank.org/data/countrydata/countrydata.html>
  48. Obermeyer, I. (2005). Personal communication. Department of National Treasury, Pretoria.
  49. System of Integrated Environmental and Economic Accounting (SEEA) (2003). *Integrated Environmental and Economic Accounting, final draft circulated for information prior to official editing*. Series F, No. 61, Rev. 1. United Nations, European Commission, International Monetary Fund, Organization for Economic Co-operation and Development, World Bank. <http://unstats.un.org/unsd/envAccounting/seea2003.pdf>
  50. Statistics South Africa (2004). *Natural resource accounts: Mineral accounts for South Africa 1980–2001*. Report 04-05-02. Statistics South Africa, Pretoria. <http://www.statssa.gov.za/publications/Report-04-05-02/Report-04-05-02.pdf>
  51. Statistics South Africa (2004). *Natural resource accounts: Water accounts for nineteen water management areas*. Report 04-05-01. Statistics South Africa, Pretoria. <http://www.statssa.gov.za/publications/Report-04-05-01/Report-04-05-012000.pdf>
  52. Statistics South Africa (2005). *Natural resource accounts: Energy accounts for South Africa, 1995–2000*. (Discussion document). Statistics South Africa, Pretoria. <http://www.statssa.gov.za/publications/DiscussEnergyAcc/DiscussEnergyAcc.pdf>
  53. Department of Water Affairs and Forestry (2003). *Towards a strategy for a waste discharge charge system*. Water quality management series. Department of Water Affairs and Forestry, Pretoria.
  54. United Nations Environment Programme (2002). *Global Environmental Outlook 3: Past, present and future perspectives*. United Nations Environment Programme, Earthscan, London. <http://www.unep.org/GEO/geo3/english/pdf.htm>
  55. United Nations Environment Programme (2001). *International Environmental Governance: Report by the Executive Director*. United Nations Environment





Programme, Nairobi. [http://www.unep.org/dpdl/IEG/Meetings\\_docs/index.asp](http://www.unep.org/dpdl/IEG/Meetings_docs/index.asp)

56. United Nations Environment Programme (2005). *UNEP 2004 Annual Report*. UNEP, Nairobi. <http://www.unep.org/AnnualReport/2004>
57. Economic and Social Research Council (2000). *Who governs the global environment?* Economic and Social Research Council Global Environmental Change Programme, Brighton.
58. Department of Environmental Affairs and Tourism (2002). *Sustaining Development in South Africa: An analytical review of progress towards sustainable development in South Africa (Draft 3.0)*. Department of Environmental Affairs and Tourism, Pretoria.
59. United Nations Environment Programme (2003). *Action Plan of the Environmental Initiative of the New Partnership for Africa's Development (NEPAD)*. United Nations Environment Programme, Nairobi. <http://www.economicswebinstitute.org/essays/nepad-environment.pdf>
60. Urquhart, P. and Atkinson, D. (2000). *A Pathway to Sustainability: Local Agenda 21 in South Africa*. Department of Environmental Affairs and Tourism and Environmental Evaluation Unit, University of Cape Town, Cape Town.
61. Department of Arts, Culture, Science and Technology (1996). *White Paper on Science and Technology – Preparing for the 21st Century*. Department of Arts, Culture, Science and Technology, Pretoria.
62. Government of the Republic of South Africa (2002). *South Africa's Research and Department Strategy*. Department of Science and Technology, Pretoria.
63. Department of Science and Technology (2005). *National Survey of Research and Experimental Development (R&D) 2003/2004 Fiscal Year*. Department of Science and Technology, Pretoria.
64. National Advisory Council on Innovation (2002). *South African Science and Technology: Key Facts and Figures 2002*. Department of Arts, Culture, Science and Technology, Pretoria.
65. Hanks, J. and Janisch, C. (2003). *Evaluation of Cleaner Production Activities in South Africa*. Evaluation Mission Report produced for Danish International Development Assistance. Royal Danish Embassy, Pretoria.
66. Department of Environmental Affairs and Tourism (2004). *Assessment of Status Quo*

*of Cleaner Production in South Africa (Draft Two Report)*. Department of Environmental Affairs and Tourism, Pretoria.



