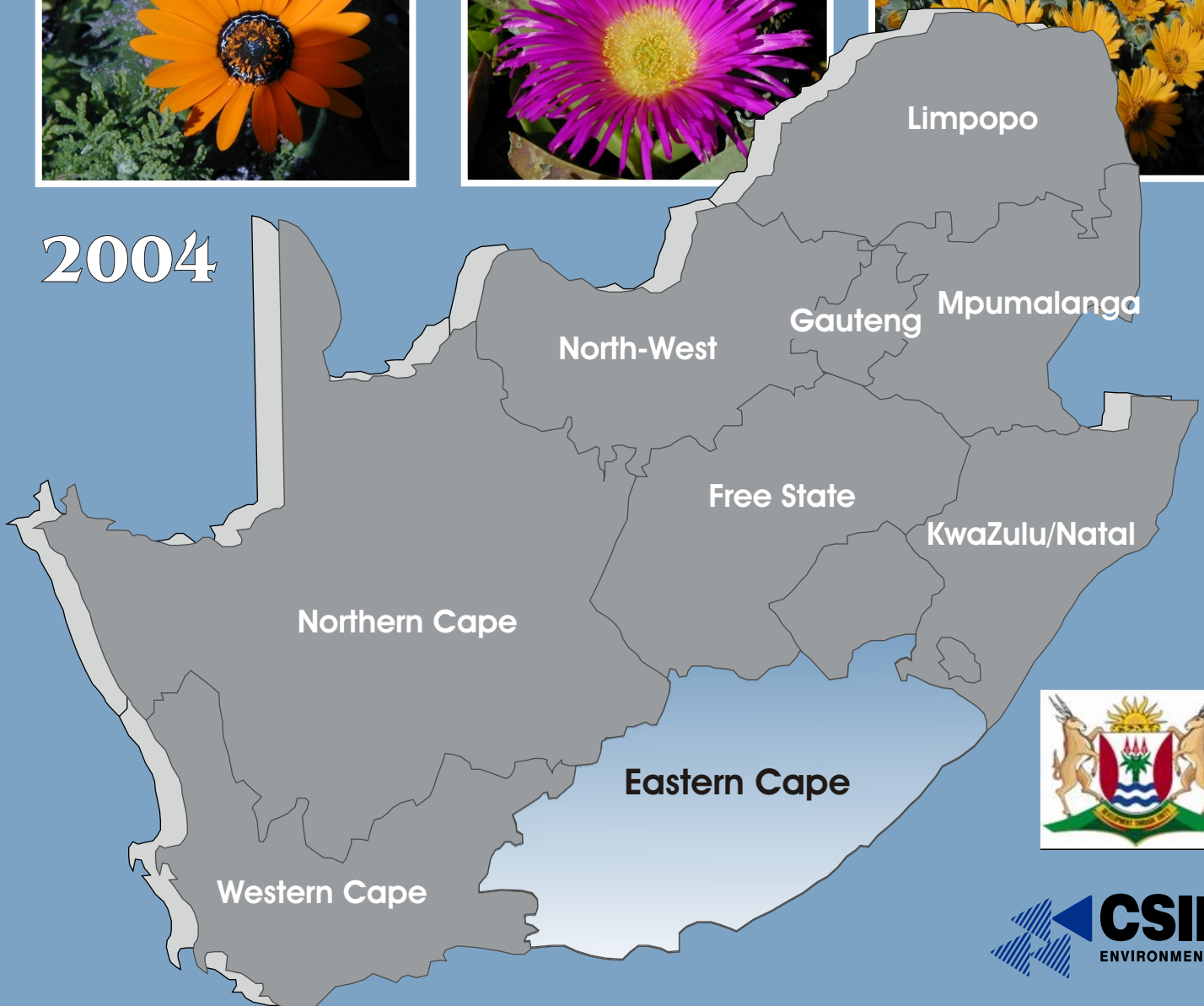
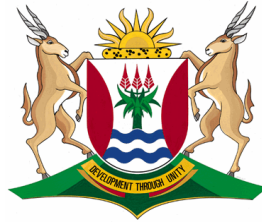


Eastern Cape State of the Environment Report



2004





Department of Economic Affairs, Environment and Tourism

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List of Acronyms

AIDS	Acquired Immune Deficiency Syndrome
ARI	Acute respiratory infection
Ca	Calcium
CDI	Combined Degradation Index
CFR	Cape Floral Region
Cl	Chlorine
CMA	Catchment Management Agency
CSIR	Council for Scientific and Industrial Research
DEAET	Department of Economic Affairs, Environment and Tourism
DEAT	Department of Environmental Affairs and Tourism
DLA	Department of Land Affairs
DWAF	Department of Water Affairs and Forestry
EC	Electrical conductivity
EC	Eastern Cape
EL	East London
F	Fluoride
GDP	Gross Domestic Product
GEAR	Growth, Employment and Redistribution
GGP	Gross Geographic Product
HIV	Human Immunodeficiency Virus
IDP	Integrated Development Plan
IDZ	Industrial Development Zone
IUCN	World Conservation Union
K	Potassium
MAP	Mean annual precipitation
Mg	Magnesium
Na	Sodium
NAP	National Action Plan
NBAL	National Biological Aliens Database
NBI	National Botanical Institute
NDA	National Department of Agriculture
NEMA	National Environmental Management Act
NePAD	New Partnership for Africa's Development
NH ₄	Ammonia
NMMM	Nelson Mandela Metropolitan Municipality
NO	Nitric oxide
NO ₂	Nitrogen dioxide
NO _x	Nitrogen oxides (atmosphere)
NO _x	Nitrates
O ₃	Ozone
PE	Port Elizabeth
PET	Potential evapo-transpiration
PM	Particulate matter
PSIR	Pressure – State – Impact – Response
SADC	Southern Africa Development Community
SDI	Soil Degradation Index
SDI	Spatial Development Initiative
SO ₂	Sulphur dioxide
SO ₄	Sulphate
SOE	State of the Environment
STEP	Subtropical Thicket Ecosystem Project
TAC	Total Allowable Catch
TAE	Total Allowable Effort

TB	Tuberculosis
TDS	Total dissolved solids
TIN:PO ₄	Total inorganic nitrogen to orthophosphate ratio
TSP	Total suspended particulates
UNCBD	United Nations Convention on Biological Diversity
UNCCD	United Nations Convention to Combat Desertification
UNCSD	United Nations Commission for Sustainable Development
UNEP	United Nations Environment Programme
US-EPA	United States Environmental Protection Agency
VDI	Vegetation Degradation Index
WfW	Working for Water
WHO	World Health Organisation
WMA	Water Management Area

Chapter 1: Introduction to the Eastern Cape Province

The Eastern Cape Province lies on the south eastern seaboard of South Africa. It is the second largest Province with an area of 169 580 km², representing 13.9% of South Africa's total land mass (Statistics South Africa, 2003). The capital, Bisho, is located 60 kilometres from East London. East London and Port Elizabeth are the two ports situated in the province. The Eastern Cape Province lies approximately equidistant from the major market centres of South Africa and is linked by a modern network of air, road and railway (Eastern Cape Business Information Service, 2001). Figure 1.1 shows the Eastern Cape Province and its Municipal boundaries.

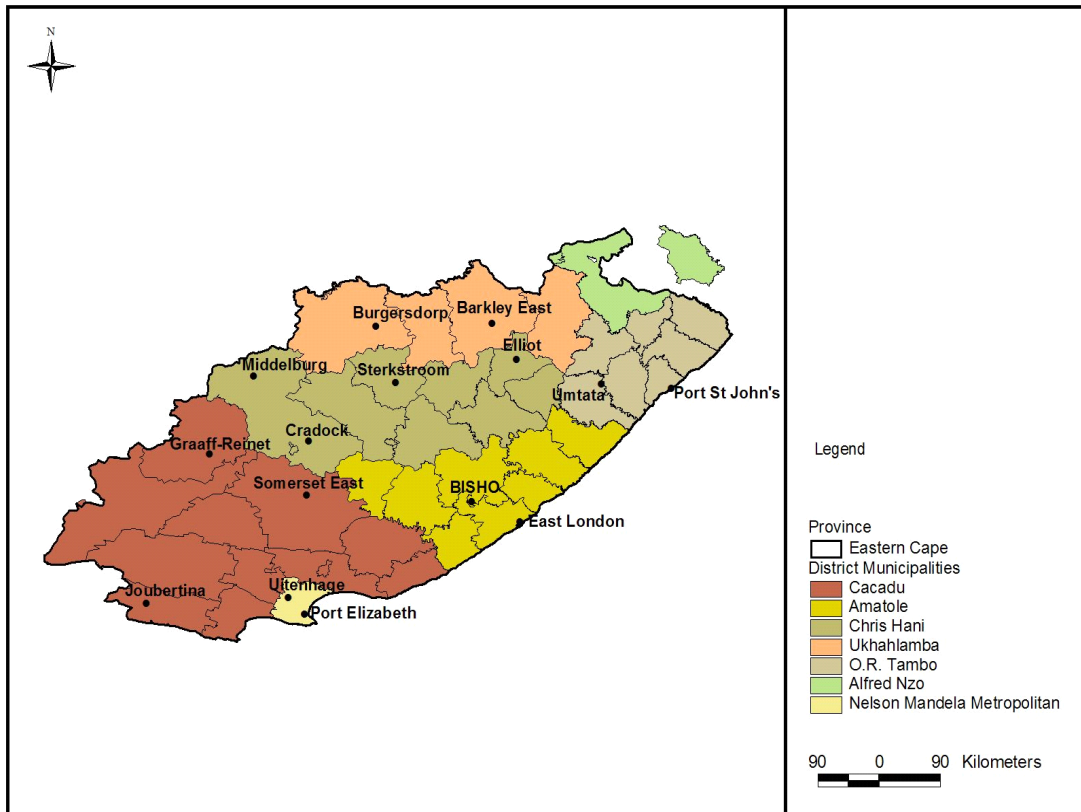


Figure 1.1: Map showing the municipal boundaries in the Eastern Cape Province

There are six district municipalities in the Eastern Cape Province, and one metropolitan area. The district municipalities are named Cacadu, Amatole, Chris Hani, Ukhahlamba, O.R. Tambo and Alfred Nzo; and the metropolitan area previously known as Port Elizabeth and Uitenhage Municipalities, is now named the Nelson Mandela Metropolitan Municipality (Municipal Demarcation Board, 2003).

1.1: Climate

The climate varies according to the distance from the ocean. Coastal areas enjoy mild temperate conditions ranging between 14 and 23 degrees Celsius, while the inland areas experience slightly more extreme conditions with temperatures of 5 to 35 degrees Celsius. Inland mountain areas experience winter snows and summer rainfalls (Eastern Cape Business Information Service, 2001).

1.2: Demography

The population of the Eastern Cape Province was approximately 6.4 million in 2001, representing 14.4% of the total South African population, making this region the third largest Province in South Africa (Statistics South Africa, 2003). The proportion of the population aged between 15 and 65 is now 56.9%, compared with the national average of 63% (Statistics South Africa, 2003). In addition, 36% of the province's population is under the age of 15, compared to the South African average of 32%.

The Eastern Cape Province has the second highest percentage of the population who are females (53.8%). The predominant population group is African (88%), with smaller groups of coloured (7%), white (5%) and Indian/Asian (0.3%) populations (Statistics South Africa, 2003). There are 11 official languages in South Africa, 3 of which are predominant in Eastern Cape. While English is the main business language, the language spoken most often is IsiXhosa, followed by Afrikaans, English and Sesotho.

Figure 1.2 shows the population in each District Municipality in the Province as well as the number of households.

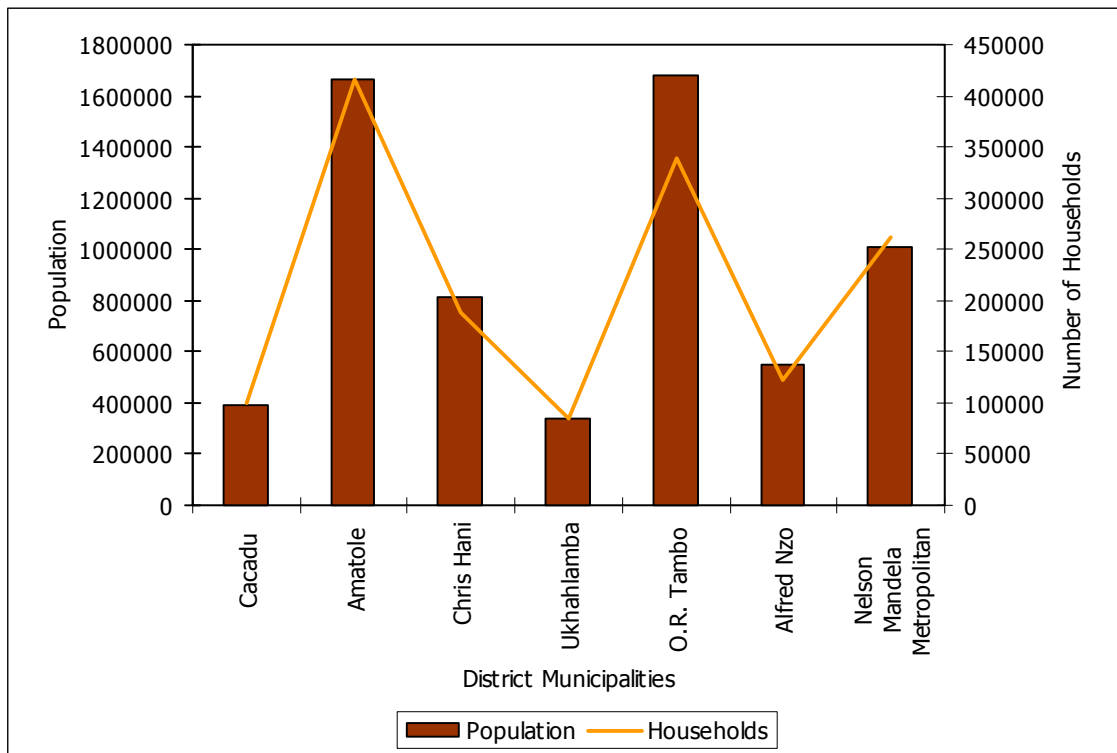


Figure 1.2: Population and number of households per District Municipality in the Eastern Cape Province – 2001 (Municipal Demarcation Board, 2003)

The Province has five universities, two satellite campuses, 20 technical colleges and numerous primary and secondary schools, many of which are high quality educational facilities. Some of South Africa's oldest schools are found in the Province (Eastern Cape Province, 2003). While 6.3% of the population over 20 years of age has received some form of higher/tertiary education, 22.8% have never received schooling (Statistics South Africa, 2003).

1.3: Biophysical environment

The Eastern Cape Province has the highest number of biomes and vegetation types out of the nine provinces in South Africa. Seven biomes and twenty-nine Acocks veld types are present, as well as a number of species; namely Plants (6164), Mammals (156), Birds (384), Amphibians (51) and Reptiles (57). The Province has many sensitive and conservation worthy areas within its region, such as the subtropical thicket, wetlands, river systems, cultural sites, rare and endangered species and its coastal areas. There are also many areas which require immediate attention, for example the eradication of alien vegetation, erosion control, pollution and land use. This special and varied environment presents many opportunities for the economic development of the area (Cape Action for the Environment, 2000).

1.4: Economic activities

The Eastern Cape Province is the poorest province in terms of average monthly expenditure (Statistics South Africa, 2000). Eastern Cape's plentiful human and natural resources are employed below their productive potential, due mainly to an insufficient accumulation of physical and human capital. The Province is afflicted by poverty and unemployment, as is explained below:

- Relatively high rural population;
- Relatively high proportion of young people;
- Relatively low literacy rate;
- Relatively low proportion of employed people; and
- Relatively high proportion of poorly paid employees.

As a consequence the provincial Gross Geographic Product (GDP) per capita is substantially less than the national average (Eastern Cape Business Information Service, 2001).

However, the Province also possesses a strong, dynamic and diversified productive sector. In 1999 the estimated provincial Gross Geographic Product (GDP) exceeded R57 billion. In terms of infrastructure, electricity costs are the second cheapest in the world and all factories are supplied with 3-phase electricity at 220/380 volts (Eastern Cape Business Information Service, 2001). The water quality is of a very high standard and can generally be used without further treatment.

The Province has capacity to accommodate further industrial expansion and industrial land is available in most towns at competitive prices. Good quality factories are generally available in Butterworth, East London, Port Elizabeth, Queenstown, Uitenhage and Umtata and all these areas are served by an efficient transport and containerised traffic network (Eastern Cape Province, 2003). Port Elizabeth and East London are the two largest industrial regions of the province and are both served by well equipped ports. The container ports in East London and Port Elizabeth are of international standard but are under-utilised. Major airports link Port Elizabeth and East London to Cape Town, Durban and Johannesburg (Eastern Cape Business Information Service, 2001).

The metropolitan economies of Port Elizabeth and East London are based primarily on manufacturing, the most important being motor manufacturing. The province is widely regarded as having the potential to substantially increase its contribution to GDP as South Africa moves towards an export-led industrial strategy (Eastern Cape Business Information Service, 2001).

Table 1.1 presents a breakdown of provincial sectoral employment.

Table 1.1: Sectoral employment in the Eastern Cape Province (Statistics South Africa, 2003; Eastern Cape Business Information Service, 2001)

Sector	Number of employees (2001)	% of Total (2001)	Number of employees (1999)	% of Total (1999)
Agriculture, hunting, forestry & fishing	72 123	9.6	70 470	13.2
Mining& quarrying	4 574	0.6	7 154	1.4
Manufacturing	90 864	12.0	97 035	18.1
Electricity, gas & water supply	3 763	0.5	5 598	1.0
Construction	36 761	4.9	43 635	8.1
Wholesale, retail trade & accommodation	104 647	13.9	83 818	15.7
Transport, storage & communication	27 587	3.7	32 851	6.1
Financial, insurance, real estate & business services	51 450	6.8	35 181	6.6
Community, social & personal services	196 345	26.0	159 453	29.8
Private Households	89 337	11.8	-	-
Undetermined	76 836	10.2	-	-
Total	754 338	100.0	535 195	100.0

The Province as a whole has a particularly large manufacturing sector, accounting for a consistent percentage of private production and employment (Eastern Cape Business Information Service, 2001). Many well-known companies have made considerable investments in the Province, including Volkswagen, General Motors (Delta), DaimlerChrysler, Goodyear Tyres, Nestlé, Cadbury's, Firestone Tyres and Dulux Paints.

To facilitate integrated planning sensitive to the environment, the Province is in the process of implementing two Spatial Development Initiatives (SDIs), namely the Fish River SDI and the Wild Coast SDI, and two Industrial Development Zones (IDZs), namely the West Bank (East London) IDZ and the Coega IDZ. The latter, 20 km east of the Nelson Mandela Metropolitan Municipality, was the first IDZ to be earmarked and is one of the biggest initiatives ever undertaken in South Africa. Plans for the development of the area as an export-orientated zone include the building of a deepwater port (Eastern Cape Province, 2003).

Chapter 2: Drivers of environmental change

Driving forces can be described as the human influences and activities that, when combined with environmental conditions, underpin environmental change (DEAT, 1999). It is important to understand the context of the drivers of environmental change in order to address those practices which result in harming the environment and to encourage those that are environmentally sustainable. Driving forces that impact on the environment of the Eastern Cape Province are international, national and local in nature. They relate primarily to economic, political, social or legislative issues. Some of the relevant drivers of environmental change are described in the following sections. These are by no means exhaustive but serve to illustrate some of the complex inter-relationships between the social, economic and political drivers of environmental change within the Eastern Cape Province.

2.1: International driving forces

Global

Since 1994 the South African economy has been in a period of great restructuring. Ten years of consistent economic growth has been recorded. Macroeconomic stabilisation has essentially been achieved, enabling an acceleration of the GDP growth rate. South Africa's integration into the global economy means that it is exposed to both the positive and negative forces that constitute the process of globalisation. Globalisation can further entrench existing inequalities and marginalisation but can also contribute to rising output per capita and in so doing encourage production, microeconomic growth and foreign exchange. These in turn contribute to poverty alleviation, income redistribution and employment creation (RSA, 2002).

Continental

The New Partnership for Africa's Development (NePAD) is an African initiative, based on a common vision to eradicate poverty and to place African countries, individually and collectively, on a path of sustainable growth and development (NePAD, 2001). NePAD thus provides an overarching strategy that will influence all future development, decision-making and management of Africa's natural resource base. NePAD initiatives have a direct bearing on the protection, planning and management of natural resources as well as socio-economic issues in South Africa, and therefore the Eastern Cape Province.

Regional

The Regional Economic Community that is directly applicable to South Africa is the Southern African Development Community (SADC). This community was established in 1992 and comprises 14 member states. The overall objectives of this community are to achieve *inter alia* development and economic growth, alleviation of poverty, enhancement of the standard and quality of life of the people of southern Africa, support for the socially disadvantaged through regional integration, and the sustainable utilisation of natural resources in order to effectively protect the environment (SADC, 1992). Over the years, South Africa has entered into several regional protocols with its neighbouring SADC countries in order to achieve these objectives. These have a direct bearing on how member countries conduct their affairs in relation to, for example, fisheries, mining, trade, transport, water resources and tourism.

2.2: National driving forces

While South Africa is rich in natural resources and has a growing economy, there are still disparities in income, joblessness and poverty. The strategic priorities of the country have been identified as *inter alia*:

- Moving to a faster, job-creating, economic growth path;
- Investing in human resources;
- Rural development and urban renewal;
- Eradicating poverty and expanding access to social services; and
- Fighting crime and corruption (RSA, 2002).

In order to address some of these issues the national government has developed a Programme of Action. The overall goal of this programme is to achieve a better life for all South Africans (RSA, 2002). The Programme of Action comprises a collection of initiatives, policies, strategies and legislation, some of which are described below.

South Africa's main economic policy framework comprises Growth, Employment and Redistribution (GEAR). GEAR aims to combine the goals of deficit reduction, reprioritisation of government expenditure to enhance poverty reduction, and embarks on microeconomic reforms to enhance job creation (RSA, 2002). Although many economic indicators point towards further growth in the economy, the rate of growth that has been achieved is believed to fall short of the economy's potential, and of what is needed for a substantial reduction in unemployment and more rapid progress in reducing poverty (RSA, 2002).

The key industrial policies of South Africa centre on a commitment to fostering sustainable industrial development in areas affected by poverty and unemployment. This is pursued through Spatial Development Initiatives (SDIs), which focus on areas where socio-economic conditions require concentrated government intervention and where inherent economic potential exists (RSA, 2002).

Unemployment remains one of South Africa's serious challenges, and the creation of work opportunities is important to poverty eradication. Job creation is promoted by a number of measures, such as government's macro-economic, industrial, labour market and development policies (RSA, 2002).

In addition, the national Programme of Action focuses on the social upliftment of the most disadvantaged in South African society. It combines direct poverty-alleviation programmes with the broadening of access to social services and infrastructure such as housing, electrification, social development, health, education, water, telecommunications, and sport and recreational facilities (RSA, 2002).

These national imperatives in some way all act as drivers of environmental change within South Africa and the Eastern Cape Province where these policies, strategies and initiatives might be implemented.

2.3: Local driving forces

In order to achieve the broad national priorities described above, specific initiatives have to be implemented within the Eastern Cape Province. The primary strategy for economic growth, employment creation, poverty eradication and income redistribution is the *Eastern Cape Strategy Framework for Growth and Development for 2004-2014* (Province of the Eastern Cape, 2003).

Most of the constraints to development stem from the severe poverty faced by much of the Province and the high inequality between:

- Poor, densely populated labour reserves and relatively affluent, sparsely populated commercial agricultural areas; and
- Well-serviced urban centres and under-serviced townships and informal settlements (Province of the Eastern Cape, 2003).

The Eastern Cape Province has set quantifiable targets for growth and development for the period 2004 to 2014, with 2003 as the base year. These are listed as follows:

- To maintain an economic growth rate of between 5% and 8% per annum;
- To halve the unemployment rate by 2014;
- To reduce the number of households living below the poverty line by 2014 by 60-80%;
- To reduce the proportion of people suffering from hunger by 2014 by 60-80%;
- To establish food self-sufficiency in the Province by 2014;
- To ensure universal primary education by 2014, with all children proceeding to the first exit point in a secondary education;
- To improve the literacy rate in the Province by 2014 by 50%;
- To eliminate gender disparity in education and employment by 2014;
- To reduce by two-thirds the under-five mortality rate by 2014;
- To reduce by three-quarters the maternal mortality rate by 2014;
- To halt and begin to reverse the spread of HIV/AIDS by 2014;
- To halt and begin to reverse the spread of tuberculosis by 2014;
- To provide clean water to all in the Province by 2014; and
- To eliminate sanitation problems by 2014 (Province of the Eastern Cape, 2003).

Some existing initiatives that are contributing to achieving the strategic growth and development goals of the Province and therefore act as drivers of environmental change include those described below.

Development Initiatives

Development initiatives such as the Wild Coast SDI, the East London Industrial Development Zone (IDZ) and the Coega IDZ are all contributing to job creation and poverty alleviation within the Eastern Cape Province and to the economic growth of South Africa as a whole (ECDC, 2003).

The primary objective of the Wild Coast SDI is to increase income levels and job opportunities by assisting local communities to participate in responsible tourism development and to improve their participation in existing initiatives (SACIC, 2003).

The East London IDZ is part of an initiative endorsed by the South African Department of Trade and Industry to encourage economic growth. The ELDZC (East London Development Zone Corporation) have identified a variety of projects to be undertaken within the IDZ. These include motor component manufacturing, optical fibre manufacturing, metal press stamping mill,

aluminium and magnesium high pressure moulding, pharmaceuticals, ceramics, wood products and textiles (ELDZC, 2003).

The Coega IDZ and deepwater harbour is the single largest infrastructure development project in the country since 1994 and has already attracted R5 billion in committed investment. It aims to make South Africa the hub of all north-south and south-south sea traffic. This initiative will also include all associated infrastructure and is expected to generate 10 000 jobs during the construction phase of the harbour and industrial zone alone (Coega IDZ, 2003).

Tourism

The development of provincial tourism has high potential to create employment and raise incomes in rural areas through community tourism programmes. The development and protection of existing and new parks and reserves, improvement of infrastructure (especially along the Wild Coast), and the development of a strong marketing brand showcasing a number of core attractions and themes are priorities (Province of the Eastern Cape, 2003).

Poverty Eradication

An increasingly integrated approach to poverty reduction has developed within the Province, as is evidenced by the Poverty Eradication Programme. This approach has moved away from traditional social grant provision to include mechanisms to reduce the risks faced by the most vulnerable sections of society, and to ensure that household livelihoods are secured (Province of the Eastern Cape, 2003).

Political Boundaries and Land Reform

The challenges of widespread poverty in the Eastern Cape Province are compounded by the inclusion of two of the former homelands, Transkei and Ciskei, within its boundaries. These homelands were established under apartheid as densely populated suppliers of migrant labour. The Province has inherited these regions which have little economic development and social infrastructure. Critical to improving the livelihoods of the poor in these regions as well as in the rest of the Eastern Cape Province is the land reform process, particularly land redistribution and land tenure reform (Province of the Eastern Cape, 2003).

Institutional Structures

Service delivery is increasingly shifting from provincial to local government as powers and functions are transferred. This will require strengthening of the Integrated Development Planning process within District and Local Municipalities to ensure that service delivery targets are achieved (Province of the Eastern Cape, 2003).

Chapter 3: Environmental issues

This report uses an issues-based framework to report on the current state of the environment in the Eastern Cape Province. An environmental issue is described as a topic of strategic concern that will influence the environmental sustainability of the Province (Muller *et al.*, 2003a). It is important to realise that not all issues are considered equally important at any given moment, and that the issues being considered may change in both character and importance over time (DEAT, 2001).

The environmental issues presented in this report have been grouped into different categories called 'themes'. Each theme forms a separate chapter in the report in order to simplify the reporting process and reduce the number of chapters in the report. There are eight themes presented in this SOE report:

- Atmosphere & climate;
- Biodiversity;
- Environmental management;
- Freshwater;
- Human settlements;
- Land;
- Marine and coast; and
- Poverty.

A summary of the environmental issues considered in this report are presented in Figure 3.1. These issues were derived from consultation with a wide range of stakeholders in the Eastern Cape Province (Muller *et al.*, 2003a).

This list of issues was then used to derive indicators for monitoring and reporting on the various thematic chapters within this report (Muller *et al.*, 2003b). Not all issues have indicators associated with them, as some indicators address multiple issues, and some issues do not warrant being address by provincial-level indicators.

AIR QUALITY	BIODIVERSITY	HUMAN SETTLEMENTS	ENVIRONMENTAL MANAGEMENT
<ul style="list-style-type: none"> Climate change Cumulative impacts Growth in air traffic demand Health impacts Inadequate waste disposal Incineration of medical waste Increasing development Need for strategic planning Poor air quality Proximity of residential areas to sources Various sources of pollution Waste minimisation 	<ul style="list-style-type: none"> Afforestation Bio-prospecting Desertification and climate change Habitat change, loss & fragmentation Increasing industrialisation Introduction of exotic flora and fauna Loss of biodiversity Spread of alien & invasive species Strategic conservation of biodiversity Endangered species trade, Resource value Unsustainable resource use Veld fires 	<ul style="list-style-type: none"> Sewage effluent disposal into rivers Inadequate waste collection Inadequate waste site management Inadequate road maintenance Inadequate waste minimisation Increasing industrialisation & pollution Informal housing developments Predominantly rural population Promotion of clean technologies Provision of infrastructure Provision of services 	<ul style="list-style-type: none"> Alignment of planning processes Appropriate allocation of funding Crime and corruption Education, awareness & communication Enforcement of legislation Inadequate waste minimisation Increasing industrialisation and development Institutional capacity Integrated Environmental Management ISO certification of local authorities Joint initiatives
FRESHWATER	LAND	MARINE AND COAST	POVERTY
<ul style="list-style-type: none"> Declining resource quality Eutrophication Habitat change Implementation of CMA's Loss of biodiversity Non-compliance of sewage works Over-abstraction of surface & groundwater Pollution into surface & groundwater Resource use and exploitation 	<ul style="list-style-type: none"> Agricultural encroachment Land tenure, land access & land jurisdiction Land use change Decreasing natural vegetation Land degradation, Desertification Illegal use of land Land reform process Overgrazing and overstocking Soil erosion and soil quality The use of herbicides and pesticides Uncoordinated land use planning Unsustainable development 	<ul style="list-style-type: none"> Change in land use Development pressures Ineffective community involvement Lack of strategic planning Loss of biodiversity Marine pollution Resource use and exploitation Ribbon development along the coast Threats to the marine & coastal environment 	<ul style="list-style-type: none"> Reliance on natural resources State of former homeland areas Inadequate expenditure of annual budgets Increasing urbanisation Widespread poverty, High unemployment Lack of formal housing Low literacy rate, low formal education Predominantly rural, young population Migration of population to other provinces Incidence of disease Skewed economic distribution Strong, diverse economy

Figure 3.1: Environmental themes and issues addressed in the 2004 Eastern Cape State of the Environment Report

Chapter 4: Atmosphere and climate

4.1: Introduction

The atmosphere consists mainly of nitrogen (78%) and oxygen (21%), and traces of water vapour, carbon dioxide, argon and other gases (1%) (Enviropaedia, 2002). Anything that disturbs this normal chemical balance of the air can be considered as a form of pollution.

Pollution can either be of natural or anthropogenic (man-made) origin. Both natural and anthropogenic activities increase the atmospheric concentrations of gases (e.g. carbon dioxide) above the normal range. Anthropogenic activities include vehicle use, industrial processes and burning of fossil fuels. Natural sources of these pollutants would include veld fires. However, veld fires can also occur from human activity as is evidenced in the Eastern Cape Province. Extensive veld fires in the summer rainfall areas of the Province (with savanna and grassland vegetation) mostly result from human activity (Landman, *pers comm.* 2003).

During the Southern African Fire-Atmosphere Research Initiative (SAFARI-92) and the recent Southern African Regional Science Initiative (SAFARI 2000) it was apparent that South Africa shares its air mass with other countries in the region. Smoke and haze can be transported from the tropics across southern Africa and extend into the Eastern Cape Province (Swap *et al*, 2003). Thus regional pollution sources, especially biomass burning, may be responsible for episodes of poor air quality across the entire province.

The Eastern Cape Province has nine different climatic regions. These nine climatic regions range from areas with late summer precipitation, through to those with frost during winter, to areas with rainfall throughout the year. Agricultural activities include both livestock and crops. The availability of water for these practices is closely linked to rainfall, temperature, management and land use practices (DEAT, 1999). It is predicted that the Eastern Cape Province will be one of the areas worst affected by climate change in South Africa (Rogers, 2003).

Carbon dioxide is considered the most important greenhouse gas (based on emission quantities per year). According to the United Nations, South Africa is the third highest producer of carbon dioxide per capita in the world (Enviropaedia, 2002). Unnaturally high concentrations of carbon dioxide in the earth's atmosphere has amplified the naturally occurring greenhouse effect. This has led to an increase of 0.6 °C in the earth's surface temperature, most of this increase occurring after 1975.

One of the biggest environmental threats to human health in South Africa is domestic fossil fuel burning. In 2001, 610 000 households in the Eastern Cape Province were not electrified and therefore relied on fossil fuels for domestic purposes (NER, 2003). In addition to the use of fires for domestic purposes, they also have a cultural significance (Lents and Nikkila, 2000). Indoor air pollution is thus of utmost importance in the Eastern Cape Province. Studies in a highly polluted industrialised area in South Africa showed that particulate matter in the ambient air (about 70%) was mainly from domestic fuel use and dust, and that industry and motor vehicles contributed only 30% (Terblanche, 1998).

Pollution dispersion in an area is largely influenced by climate and topography, but also the height at which emissions are released. Emissions released at ground level, such as would occur during domestic fuel use, are not easily dispersed and tend to cause fairly severe but localised pollution episodes. Pollution released higher from chimney stacks is more easily dispersed but is also affected by the presence of inversion layers. Pollutants emitted under

normal conditions are warmer and less dense than the surrounding air, and as a result they rise and are easily dispersed into the atmosphere. In an inversion situation, the pollutants rise only to the point where they reach a warmer layer of air. When this layer of warm air is near to the ground (as it is in an inversion layer), the pollutants accumulate near the ground (Zunckel *et al.*, 2002). An inversion layer will therefore result in elevated pollution levels close to the ground.

The Coega area in Port Elizabeth is the largest industrial area in the Eastern Cape Province. The highest ground level concentrations of pollutants may be expected at Coega during the months of May to July (Zunckel *et al.*, 2002) when inversions are more frequent.

4.2: Key Indicators

Six indicators have been selected for monitoring and reporting on the atmosphere and climate of the Eastern Cape Province. These indicators include:

- Ambient sulphur dioxide concentration;
- Ambient particulate matter concentration;
- Ambient nitrogen dioxide concentration;
- Quarterly clinic admissions for respiratory infections by type of infection;
- Trend in household energy use per energy type; and
- Annual rainfall deviations relative to the mean annual rainfall period 1961-1990.

Information and data on these six indicators are presented in the sections that follow.

4.2.1: Ambient sulphur dioxide concentration

The ambient sulphur dioxide (SO₂) concentration will provide an indication of the level of air pollution from industrial development, as well as other sources such as domestic fuel use. Knowledge of the atmospheric level of air pollution is important for understanding the impacts of these pollutants on both human and ecological health.

A monitoring programme for SO₂ is in place in the Nelson Mandela Metropolitan Municipality (NMMM). This programme is a continuation of the 'National Network for Monitoring Smoke and SO₂' that was phased out in the early 1990's. Much of this data is only available as raw data that has not yet been processed, analysed or interpreted. There are also gaps in the data. Trends are therefore not readily available from this monitoring programme.

Table 4.1 shows the available annual average SO₂ concentrations for selected sites in Port Elizabeth, Uitenhage and Despatch. The World Health Organisation (WHO) annual SO₂ guideline value of 50 µg/m³ was exceeded in 2000 at DoraNginzi and in 2003 at the Perseverance industrial and Despatch residential sites.

Table 4.1: Annual average SO₂ concentration in Port Elizabeth, Despatch and Uitenhage – 1999 to 2003 (µg/m³) (Slabbert, *pers comm.* 2003)

Location	1999	2000	2001	2002	2003 (up to Oct)
City Hall (CBD)	16.2	13.2	A	A	14.9
Neave Industrial	10.8	C			
DoraNginzi (township)	18.2	52.4	A	C	
Deal Party (Industrial)	30.3	36.5	A	A	33.2
Perseverance (Industrial)	8.1	13.5	A	A	72.1
Markman Industrial	33.3	A	C		
Bluewater Bay (residential)	27.9	A	A	A	C
Despatch (residential)	D	D	D	A	(E)104.1
Uitenhage Park (residential)	D	D	D	D, A	15.6
Uitenhage (industrial)	D	D	D	D, A	13.6

- A Results missing for > 2 months
 B Station non-existent for part of the monitoring period
 C Station closed
 D Data not processed yet
 E High values possibly due to burning at pallet works

The NMMM also uses OPSIS (an open-path mobile station) to continuously monitor SO₂ at the corner of Kempston and Uitenhage roads in Port Elizabeth (Slabbert, *pers comm.* 2003). Results indicate that values were well below the South African and WHO 24-hour guideline values of 50 µg/m³ (WHO, 1999; DEAT, 2001). The annual averages from the same stations (years for which adequate data was available) were as follows:

Table 4.2: Annual average SO₂ concentration in Port Elizabeth – 1999 to 2001 (Slabbert, *pers comm.* 2003)

Year	Concentration (µg/m ³)
1999	16.1
2000	13.0
2001	14.1

SO₂ monitoring is also undertaken at Coega, with stations located at Amsterdamplein, Saltworks and Motherwell. Results indicate that during 2001 the highest sulphur dioxide concentrations were found with land breezes and stable atmospheric conditions. Concentrations at all three stations were well below the current South African and WHO 24-hour (125 µg/m³) and annual (50 µg/m³) guideline values, with the maximum 24-hour concentration of 10.4 µg/m³ measured at Amsterdamplein in June 2001 (Guastella, 2002; WHO, 1999; DEAT, 2001). During 2002 the highest SO₂ concentration of 16.1 µg/m³ was again measured at Amsterdamplein (Guastella, 2003).

4.2.2: Ambient particulate matter concentration

Airborne particulate matter is a complex mixture of pollutants released from many sources. It is normally found in a range of sizes. Ambient particulates resulting from motor vehicle emissions, combustion processes and domestic burning practices are normally classified as fine particulate matter (particulate matter with an aerodynamic diameter of less than 2.5 μm) (Wilson and Mage, 2000). Coarse particulates ($\text{PM}_{2.5-10}$) are mostly generated by mechanical process such as industrial processes. Particles with a diameter below 10 μm , and particularly those of less than 2.5 μm in diameter, can penetrate deep into the lungs and appear to have the greatest potential for damaging health (Hubbard, 1998). Total suspended particulate matter (TSP) refers to all airborne particulates, without particle size differentiation (Van Leeuwen & Hermens, 1995).

The NMMM monitors particulate matter (PM_{10}) continuously using the OPSIS system (Slabbert, *pers comm.* 2003). Limited results are available as a result of technical problems associated with the monitor. The annual average particulate matter concentration of 40.3 $\mu\text{g}/\text{m}^3$ for 2001 is well below the South African annual PM_{10} guideline value of 60 $\mu\text{g}/\text{m}^3$ (DEAT, 1998).

PM_{10} has also been monitored in East London since March 2003 to gather background data as part of the Industrial Development Zone (IDZ) initiative (Turnbull, *pers comm.* 2003). No results were available from this initiative.

Continuous monitoring of particulate matter (TSP and PM_{10}) is conducted at Coega (Port-Elizabeth), specifically at Amsterdamplein (TSP), Saltworks (TSP) and Motherwell (PM_{10}) (Guastella, 2002). Results are provided below in Table 4.3. The number of exceedances of relevant guideline values are indicated in Table 4.4.

Table 4.3: Maximum 24-hour TSP concentration measured at Coega – 2001 to 2002 (Guastella, 2002; Guastella, 2003)

Year	Compound	Maximum concentration ($\mu\text{g}/\text{m}^3$)	South African guideline value	Location
2001	TSP	79	300	Amsterdamplein
2002	TSP	139	300	Amsterdamplein

Results in Table 4.3 indicate that the maximum 24-hour concentrations of TSP during 2001 and 2002 were below the current South African 24-hour guideline value of 300 $\mu\text{g}/\text{m}^3$ (Guastella, 2002; Guastella, 2003).

Table 4.4: Number of exceedances of South African and US-EPA 24-hour PM_{10} guideline values at Motherwell, Coega (Guastella 2002; Guastella, 2003; US-EPA, 1996)

Year	Guidelines exceeded ($\mu\text{g}/\text{m}^3$)	Number of exceedances	Location of exceedances
2001	SA: 180	4	Motherwell
	US-EPA: 150	6	
2002	SA: 180	1	Motherwell
	US-EPA: 150	2	

During 2001 concentrations of PM_{10} exceeded the South African 24-hour guideline value of 180 $\mu\text{g}/\text{m}^3$ four times at Motherwell, while the US-EPA guideline value of 150 $\mu\text{g}/\text{m}^3$ was exceeded

six times (Table 4.4) (Guastella, 2002). During 2002, the South African guideline value was exceeded once, while the US-EPA guideline value was exceeded twice (Guastella, 2003).

4.2.3: Ambient nitrogen dioxide concentration

Nitrogen oxides are emitted mainly from the burning of fossil fuels, and are generally emitted in the form of nitric oxide (NO). In the atmosphere, nitric oxide is rapidly oxidised to nitrogen dioxide (WHO, 1997). Nitrogen dioxide may also be released to the atmosphere from industrial processes, including the manufacture of nitric acid and fertilizers, motor vehicle exhaust fumes and domestic fuel burning. Nitrogen dioxide is the main precursor of ozone (O₃), and thus a major component of oxidant air pollution. The sum of nitric oxide (NO) and nitrogen dioxide (NO₂) are generally referred to as nitrogen oxides or NO_x (WHO, 1997).

The NMMM uses OPSIS (an open-path mobile station) to monitor NO₂ on a continuous basis as a measure of motor vehicle emissions (Slabbert, *pers comm.* 2003). No exceedances of the WHO hourly guideline value of 200 µg/m³ was found (WHO, 1999). The only available annual average of 13 µg/m³ for 2000 is well below the South African annual guideline value of 94 µg/m³ (DEAT, 1998).

Monitoring of NO, NO₂ and NO_x have also been conducted in East London since March 2003 to gather background data as part of the IDZ initiative (Turnbull, *pers comm.* 2003). No results were available.

4.2.4: Quarterly clinic admissions for respiratory infections by type of infection

This indicator, in conjunction with the first three indicators, assists in providing an indication of how air quality is affecting the incidence of acute respiratory infections, particularly amongst children and the elderly. Much of the Eastern Cape population can be considered a sensitive population group (below 15 or above 65 years of age) (Statistics South Africa, 2003). About 10.2% of the total Eastern Cape population is below 5 years of age (Statistics South Africa, 2003). This age group is considered particularly vulnerable to air pollution related diseases.

Lower respiratory infection rates for children under the age of 5 years could only be obtained for the Nelson Mandela Metropolitan Health District. These are indicated in Table 4.5.

Table 4.5: Lower respiratory infection rate for children under 5 years of age in the Nelson Mandela Metropolitan Health District (Greene, *pers comm.* 2003)

Period	Rate	Total number of new cases
March 2003	2.8	805
April 2003	2.3	707
May 2003	2.7	836
June 2003	3.4	1 064
July 2003	2.7	841
August 2003	2.3	190

The prevalence of acute respiratory infections in children under 5 years of age (defined as children who were ill with a cough, accompanied by short, rapid breathing during the 2 weeks

preceding the survey) are indicated in Table 4.6. The Eastern Cape Province is compared to the KwaZulu-Natal Province, which had the highest prevalence rate.

Table 4.6: Prevalence and treatment of acute respiratory infection (ARI) in children under 5 years of age – 1998 (DOH, 1998)

Province	Percentage children with ARI	Among children with ARI, % taken to health facility or health care provider	Total number of children
Northern Cape	15.1	71.6	97
Eastern Cape	15.6	73.2	690
KwaZulu-Natal	25.9	77.5	1 022
Free State	20.9	79.0	244
Gauteng	21.5	84.1	911
Mpumalanga	20.4	73.2	361
Northern Province	14.5	68.6	691
Western Cape	15.0	(54.9)	396
North West Province	14.0	(70.7)	327

Note: Figures in brackets are based on 25 to 40 un-weighted cases.

The percentage children with acute respiratory infections in the Eastern Cape Province (15.6%) is lower than in most other Provinces. It should be noted that these figures will also include non-air pollution related infections such as influenza.

4.2.5: Trend in household energy use per energy type

In addition to knowing the potential for air quality impacts on the ambient environment, it is important to address any potential impacts on the indoor air quality in communities in the Province. One of the major factors affecting indoor air quality is the dominant household energy source. Figures 4.1 to 4.3 show the number of households per District Municipality using various different types of energy for different domestic purposes (Municipal Demarcation Board, 2003).

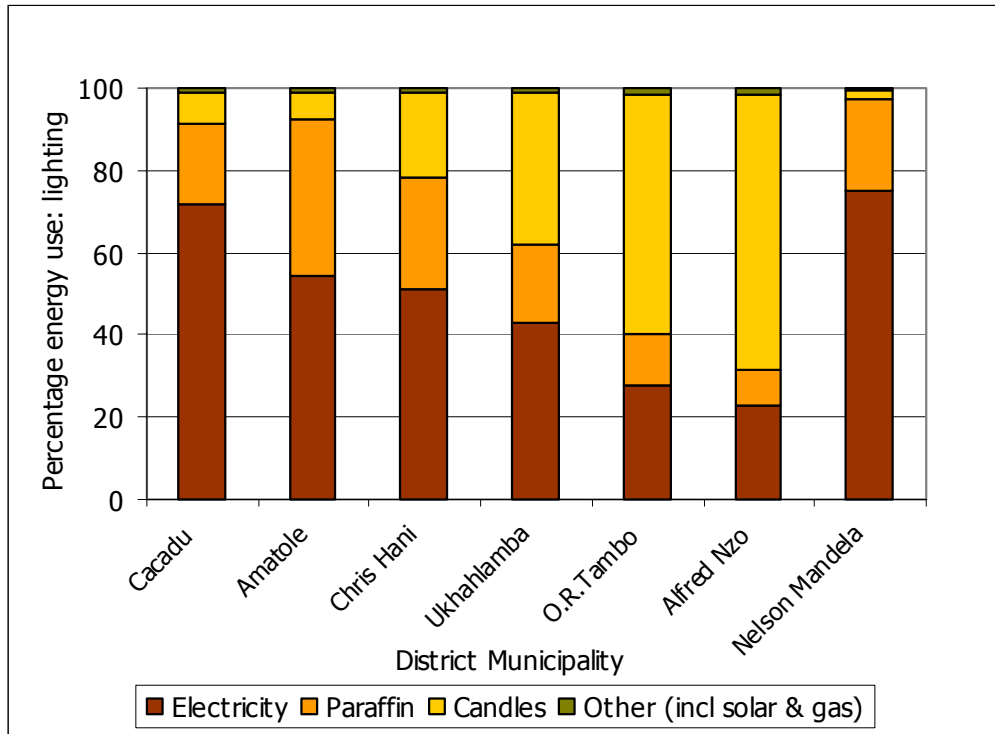


Figure 4.1: Energy use for lighting in the Eastern Cape Province – 2001 (Municipal Demarcation Board, 2003).

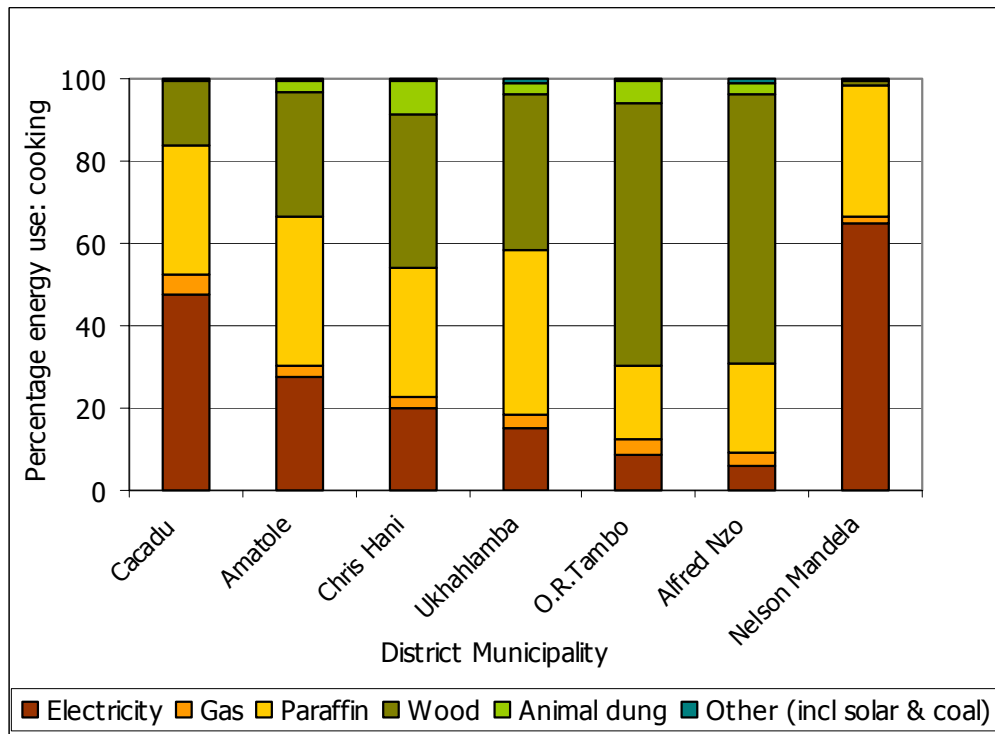


Figure 4.2: Energy use for cooking in the Eastern Cape Province – 2001 (Municipal Demarcation Board, 2003).

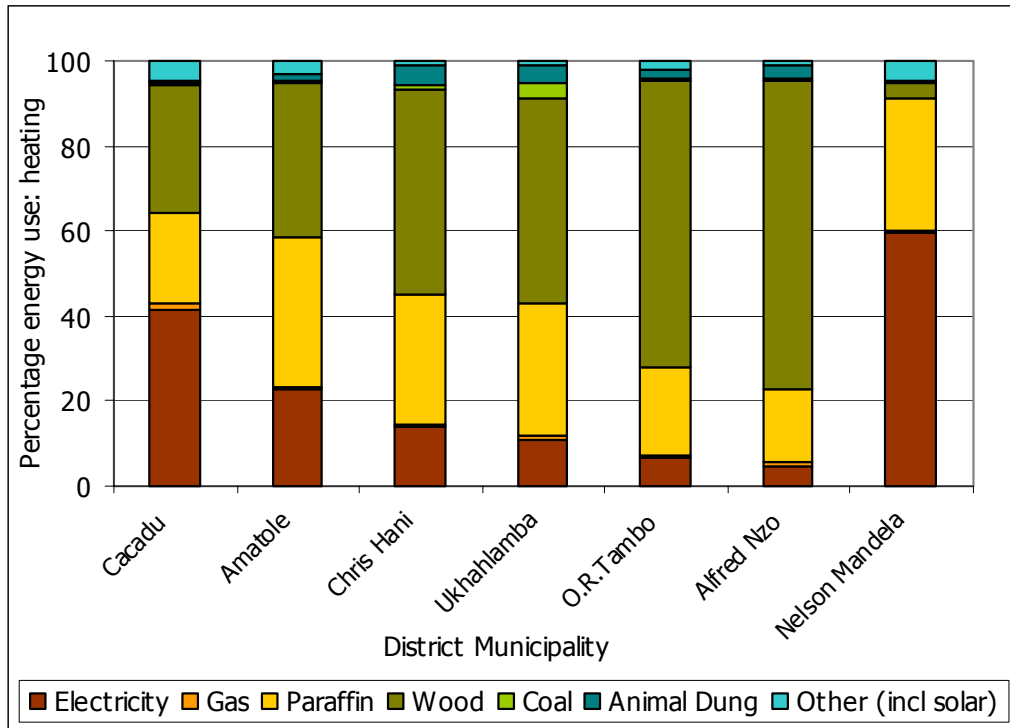


Figure 4.3: Energy use for heating in the Eastern Cape Province – 2001 (Municipal Demarcation Board, 2003).

These graphs indicate that electricity is the predominant energy source in the NMMM, with wood use for cooking and heating being the most prevalent energy source in O.R. Tambo and Alfred Nzo District Municipalities. The NMMM is a predominantly urban area whereas O.R. Tambo and Alfred Nzo District Municipalities are more rural in nature.

The trend in household energy use in the Eastern Cape Province has also varied over time, as shown by Figure 4.4. The figure shows information on energy use as collected during the 1996 and 2001 national Census.

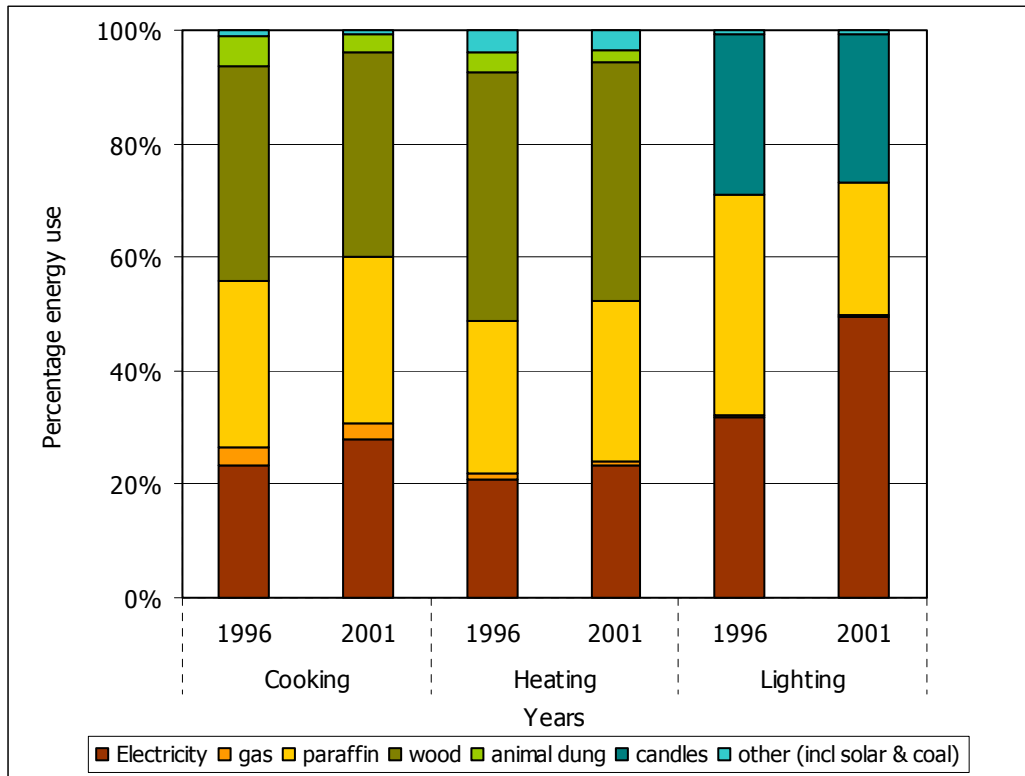


Figure 4.4: Energy use by Eastern Cape households for cooking, heating and lighting – 1996 vs. 2001 (Statistics South Africa, 1999; Statistics South Africa, 2003).

In South Africa, just over half (51%) of all households use electricity as the main source of energy for cooking, while about one fifth use paraffin (21%) and wood (20%) respectively (Statistics South Africa, 2003). In the Eastern Cape Province, commonly regarded as one of the poorer Provinces in South Africa, approximately 51% of households use sources other than electricity for lighting (see Figure 4.4) (Statistics South Africa, 2003). Approximately 77% of households still use sources other than electricity for heating, including biomass (Statistics South Africa, 2003). Biomass smoke contains many thousands of airborne substances, many of which are harmful to human health (Brauer, 1998). Approximately 28% of the population uses electricity for cooking, while 36% uses wood (Statistics South Africa, 2003). The use of electricity for lighting has increased from 32% in 1996 to 50% in 2001, with only a 4% increase in its use for cooking and heating (Statistics South Africa, 1999; Statistics South Africa, 2003). The use of solar energy, reported in the 2001 Census, is still low with less than 1% of households in the Eastern Cape Province using this energy source (Statistics South Africa, 2003).

4.2.6: Annual rainfall deviations relative to the mean annual rainfall period 1961-1990

As no gradual rainfall trend for the past 10 years relative to the climate reference period 1961-1990 was evident, it was not possible to demonstrate any steady increase or decrease in rainfall in recent times. Data over a longer time period may or may not determine statistically whether changes are merely the result of natural cycles or resulting from climate change.

4.3: The state of the atmosphere and climate in the Eastern Cape Province

Atmosphere and climate issues in the Eastern Cape Province are not considered priority issues, as is evidenced by the amount of data and information that was not available for presentation in this chapter. Few large industrial areas exist, with the largest being the Coega industrial zone in Port Elizabeth.

As no co-ordinated air quality monitoring network exists in the Province, air quality monitoring is performed on a fragmented basis, concentrated mainly in the Port Elizabeth area. No comprehensive assessment of air quality is therefore possible for the Eastern Cape Province. Ad hoc studies show very few instances where measured atmospheric pollution concentrations exceed the available guideline values. This situation is primarily a result of the current but outdated air quality legislation, the Atmospheric Pollution Prevention Act 45 of 1965. Once new air quality legislation has been introduced to South Africa, this situation will change.

Energy sources used in the Province are predominantly paraffin and wood, with rural areas relying more heavily on these fuels than urban areas. Electricity, where available, is used mostly for lighting only. One of the reasons for this could be the high capital cost of purchasing electrical appliances for cooking and heating. More households used electricity in 2001 than in 1996. Indoor air quality is therefore likely to present a problem in those households not using electricity. Although not quantified, the effects from indoor air pollution are expected to be fairly high. A South African study involving informal households using paraffin for cooking revealed that sensitive individuals in all of the households were at risk of experiencing adverse health effects from exposure to NO₂ emissions (Muller et al., 2003).

Little information was available on clinic admissions for respiratory infections in the Eastern Cape Province. It is therefore not possible to provide an assessment of the impacts of air quality on human health in the Province.

Chapter 5: Biodiversity

5.1: Introduction

Biological diversity, often shortened to 'biodiversity', is the variety of life on earth. It takes into account the differences in structure, function, and genetic make-up between living organisms and the ecological complexes in which they occur (Wilson, 1988). This variability occurs at the genetic, species and ecosystem levels (Gaston and Spicer, 1998).

Biodiversity is important in assessing the state of the environment, because:

- a) It is closely linked to human well-being. For example, 10 of the world's 25 top-selling drugs are derived from biological resources (UNDP, UNEP, World Bank and WRI, 2000). Eighty percent of South Africa's population depends on wild plants and animals for medicines, and traditional medicinal plants in the Eastern Cape Province are valued at R27 million annually (Dold and Cocks, 2002). This excludes a substantial saving to the provincial government in the provision of health care in remote rural areas.
- b) It provides environmental services such as maintaining river catchments and wetlands for sustainable water production, regulating and controlling floods, maintaining fertile soils, absorbing pollutants from the atmosphere and water bodies, and pollinating crops (Millennium Ecosystem Assessment, 2003). These services are mostly under-valued, although Costanza *et al.* (1997) estimated the global value of 17 ecosystem services, most of them depending on biodiversity, at US\$ 16-54 trillion.
- c) It provides baseline breeding and seed stocks for crop, livestock and wildlife production and is therefore essential in ensuring that the world's population has secure access to food (Millennium Ecosystem Assessment, 2003).
- d) Many species are threatened by extinction, and the status of our biodiversity is therefore an important reflection of our environmental track record in the Province, the country and the planet (Hilton-Taylor, 2000).
- e) Biodiversity is linked to poverty and health, and this is especially true for a poor province such as Eastern Cape. Poor people depend heavily on biodiversity and have a stake in its conservation, but also have a potentially large impact on biodiversity because of their reliance on natural resources (Koziell and Saunders, 2001).

Important issues to consider in the long term planning of biodiversity conservation in the Eastern Cape Province are:

- a) High unemployment ratios and the need for job creation will force decision makers to make trade-offs between industrial development that creates short term wealth and employment, and initiatives that conserve biodiversity.
- b) The large contribution of private land (game ranches and private protected areas) to conservation will require a stronger involvement of the private sector in conservation decision making.
- c) The emergence of community-based natural resource management and community conservation, particularly in the communal areas of Eastern Cape, will place additional time and skills demands on government officials but could potentially make a significant contribution to biodiversity conservation.
- d) The high human population densities in the communal areas and the uneven distribution of land, as a result of historical policies and politics, are resulting in negative impacts on biodiversity, especially in the Thicket biome.
- e) The lack of capacity of government and civil society organisations to implement biodiversity strategies and action plans is hampering progress in biodiversity

conservation. Provincial and local government organizations are under-staffed and in need of capacity development, and staff turn-over is high.

- f) Some of the centres of endemism are under-represented in the Province's protected area network (DEAET, 2003).

5.2: Key Indicators

Biodiversity in the Eastern Cape Province is monitored through the following indicators:

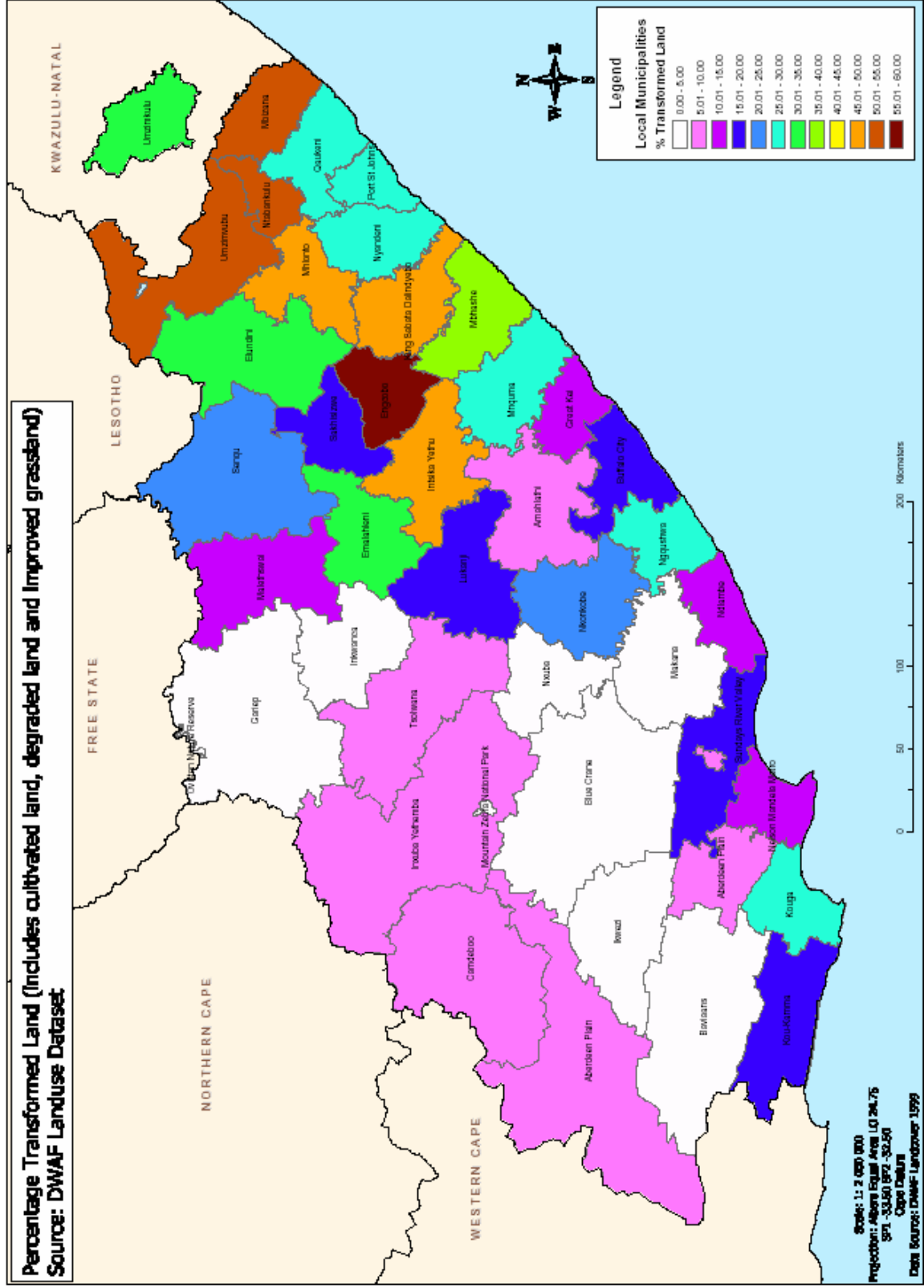
- Habitat transformation;
- Extinct, threatened and endemic species per taxonomic group;
- Distribution and abundance of selected alien species; and
- Extent of conserved areas in the Province.

The results of these indicators are reported in the following sections.

5.2.1: Habitat transformation

Habitat transformation is a key driver of biodiversity change. It is also a useful indicator of biodiversity loss. Habitat transformation through activities such as cultivation, grazing, urban developments, afforestation, mining and alien plant invasions is considered to be the single biggest threat to biodiversity in South Africa (Wynberg, 2002; van den Berg and Lloyd, 2002; Rouget *et al*, 2003). The main causes of land transformation are cultivation, land degradation and grassland improvement i.e. planted pastures that are often associated with deforestation. Land degradation has a particularly negative effect in the Thicket Biome, where 13% of the land area is transformed (DEAET, 2003; Rouget *et al*, 2003). The percentage of habitat that has been transformed per municipal area is illustrated in Figure 5.1 (DEAET, 2003). Transformed land in this case refers to cultivated land, degraded land and improved grasslands. In 17 of the 42 municipal areas, over 20% of the land has been transformed.

Figure 5.1: Land transformation in Local Municipalities in the Eastern Cape Province



The Subtropical Thicket Ecosystem Planning (STEP) project also conducted work on habitat transformation in the Eastern Cape Province. Van den Berg and Lloyd (2002) assessed the amount of thicket that has been transformed (urban areas, rural settlements, cultivated lands, mines and quarries and commercial plantations) as well as the amount of pristine, moderately degraded and severely degraded thicket. Of the total area studied (116 574 ha), 7.08% was transformed, 4.11% was pristine, 10.86% was moderately degraded and 22.75% severely degraded. In the Cape Floristic Region (CFR) 30% of the area was transformed by urban sprawl, cultivated land including forest plantations, and medium to high density stands of alien invasive species (Rouget *et al*, 2003).

5.2.2: Extinct, threatened and endemic species per taxonomic group

The absolute number of extinctions, as well as the rate of extinctions (or the avoidance thereof) is a good measure of the success of provincial and national conservation efforts. The institutional capacity to monitor and record extinction trends, and the ability to detect signs of extinction (e.g. age distributions skewed towards very old individuals, populations that are below minimum viable thresholds, and negative rates of population increase) is a key factor when guarding against extinctions. It also requires close cooperation between provincial, national and international authorities to maintain good communication regarding priorities at the three scales.

Threatened species fall into a World Conservation Union (IUCN) or National Botanical Institute (NBI) threat category, and indicates the number of species that are threatened by extinction. It includes categories such as 'critically endangered', 'endangered', 'rare', 'vulnerable', 'near threatened' or 'data deficient' (Table 5.1). Trends in the number of species in each category, and the re-classification of species into more, or less threatened categories, are good indicators of trends in the success or otherwise of conservation in the province. The different categories used by the NBI and IUCN remains problematic.

Endemic species are those with distribution ranges falling entirely, or 90%, in the Eastern Cape Province. Information on endemic species is not separately presented in this chapter because of the correlation between endemism, rarity and extinction, and because endemic species are generally threatened due to their small populations, localised distribution and specific habitat requirements.

Table 5.1: National Botanical Institute threatened categories (Hilton-Taylor, 1996)

No.	Abbrev.	Category	Explanation
1	EX	Extinct	A taxon where the last individual has died and detailed and comprehensive surveys of its habitat don't produce signs of existence
2	EN	Endangered	A taxon that is at very high risk of extinction in the wild, unless prevailing causal factors are attended to.
3	VU	Vulnerable	A taxon that is at likely to be re-listed as Endangered, unless prevailing causal factors are attended to.
4	R	Rare	Taxa with small populations, often highly localized. Currently not listed as E or V, but face high risk due to population size or range
5	I	Intermediate	Taxa suspected of being E, EN, V or R but lack of data prevents final classification.
6	K	Insufficiently Known	A taxon where incomplete data makes an assessment of risk not feasible. Abundance and distribution data

			are commonly a problem.
7	NT	Not Threatened	Taxa which no longer require E, V or R categories, due to increase in population sizes or better data on distribution and population sizes
8	?	No information	Taxa with little or no data
9	O	Out of Danger	Previously listed in the threatened categories above, but de-listed due to improvements in the status of the species.

Plants

Eastern Cape has at least one record of a plant extinction: the endemic orchid *Holothrix longicornu* (Lewis) (SABONET, 2003). Victor and Dold (2003) list a further five plant species, all in the Albany Centre of Endemism, that have become extinct:

- *Alepidia multisepta*;
- *Aspalathus cliffortifolia*;
- *Brachystelma tabularium*;
- *Brachystelma schoenlandianum*; and
- *Ceropegia bowkeri*.

The Province is home to 316 threatened plant species (see Table 5.2 and Appendix 1).

Table 5.2: Threatened Eastern Cape Plants (PRECIS – National Herbarium Pretoria Computerised Information System)

No.	Category	No. of Species
1	Endangered	16
2	Extinct	1
3	Intermediate	44
4	Insufficiently Known	70
5	Vulnerable	54
	<i>Sub Total</i>	<i>185</i>
5	Rare	132
	TOTAL	316

Endangered and vulnerable plants are unevenly distributed in the Province. The municipalities with the highest percentage of ¼ degree grids containing endangered plants are situated along the seaboard (Figure 5.2). The percentage of ¼ degree grids containing vulnerable species (Figure 5.3) is highest towards the south-west of the Province and in the Thicket and Forest biomes, and lowest towards the North-Western part of the Province, in the Nama Karoo biome.

Figure 5.2: Endangered species and municipalities in the Eastern Cape Province. Municipalities were used as the unit of analysis, and the map depicts the percentage 1/4 degree grids per municipality containing endangered species (PRECIS, classes according to Hilton-Taylor, 1996)

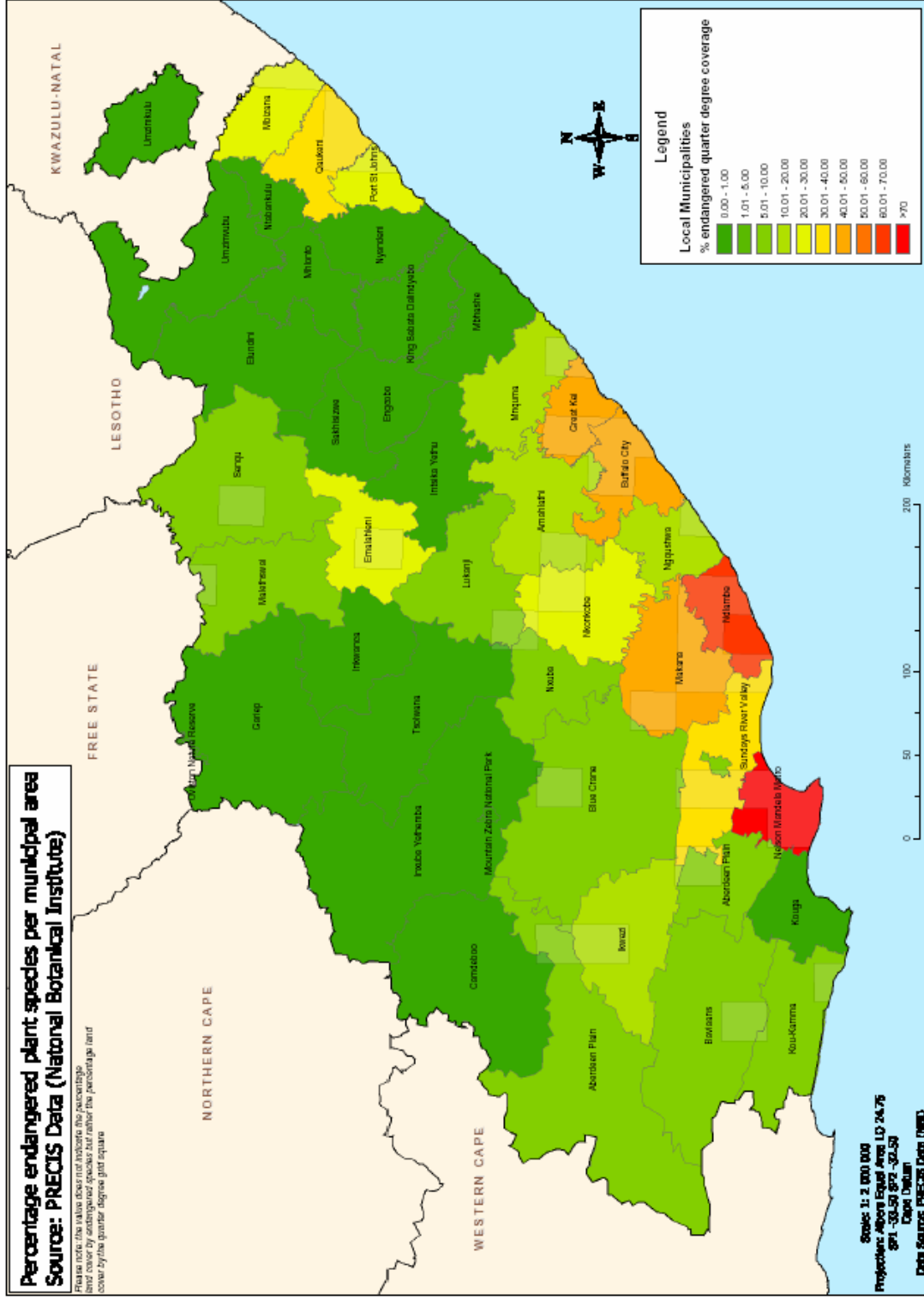
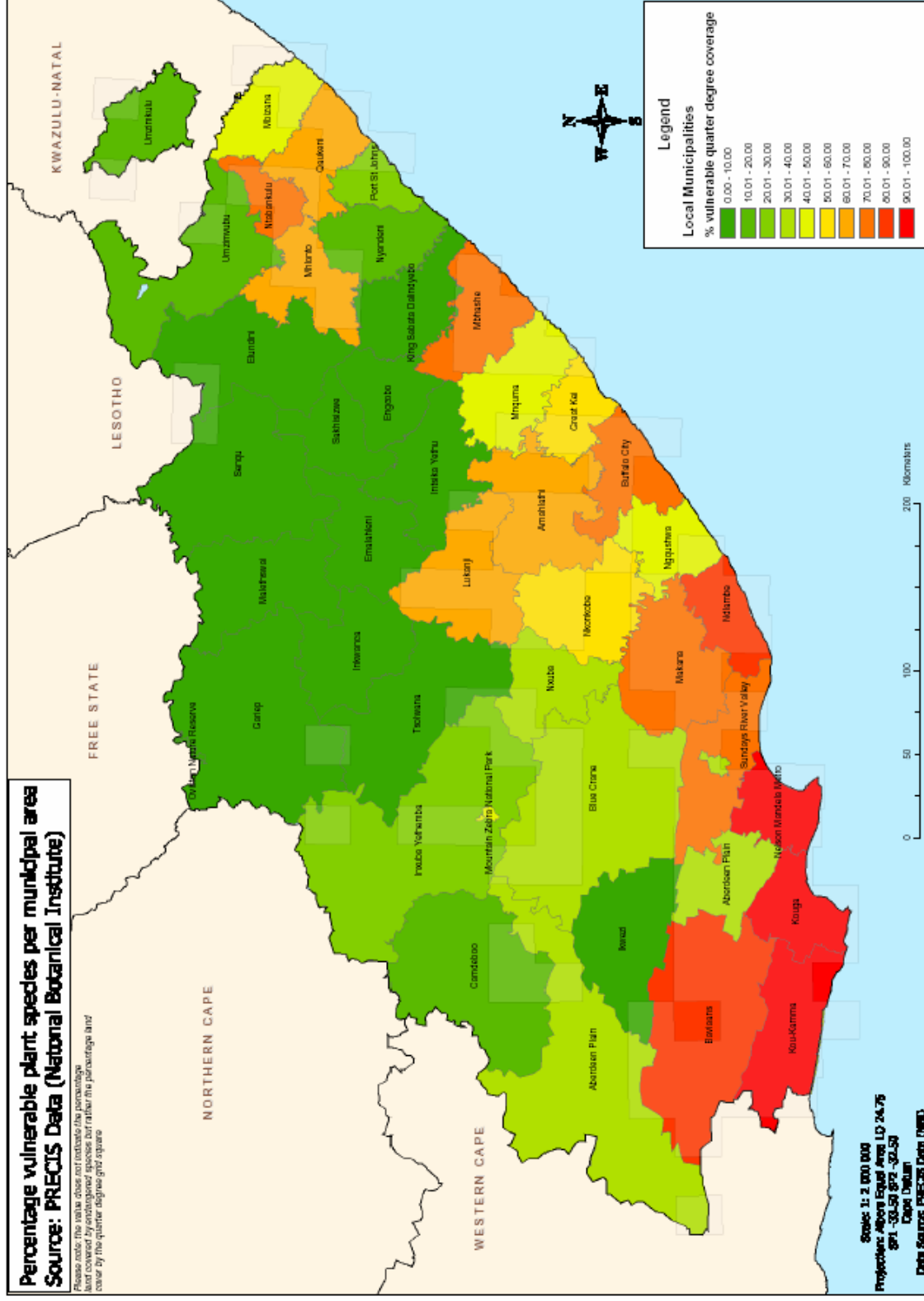


Figure 5.3: Vulnerable plant species and municipalities in the Eastern Cape Province



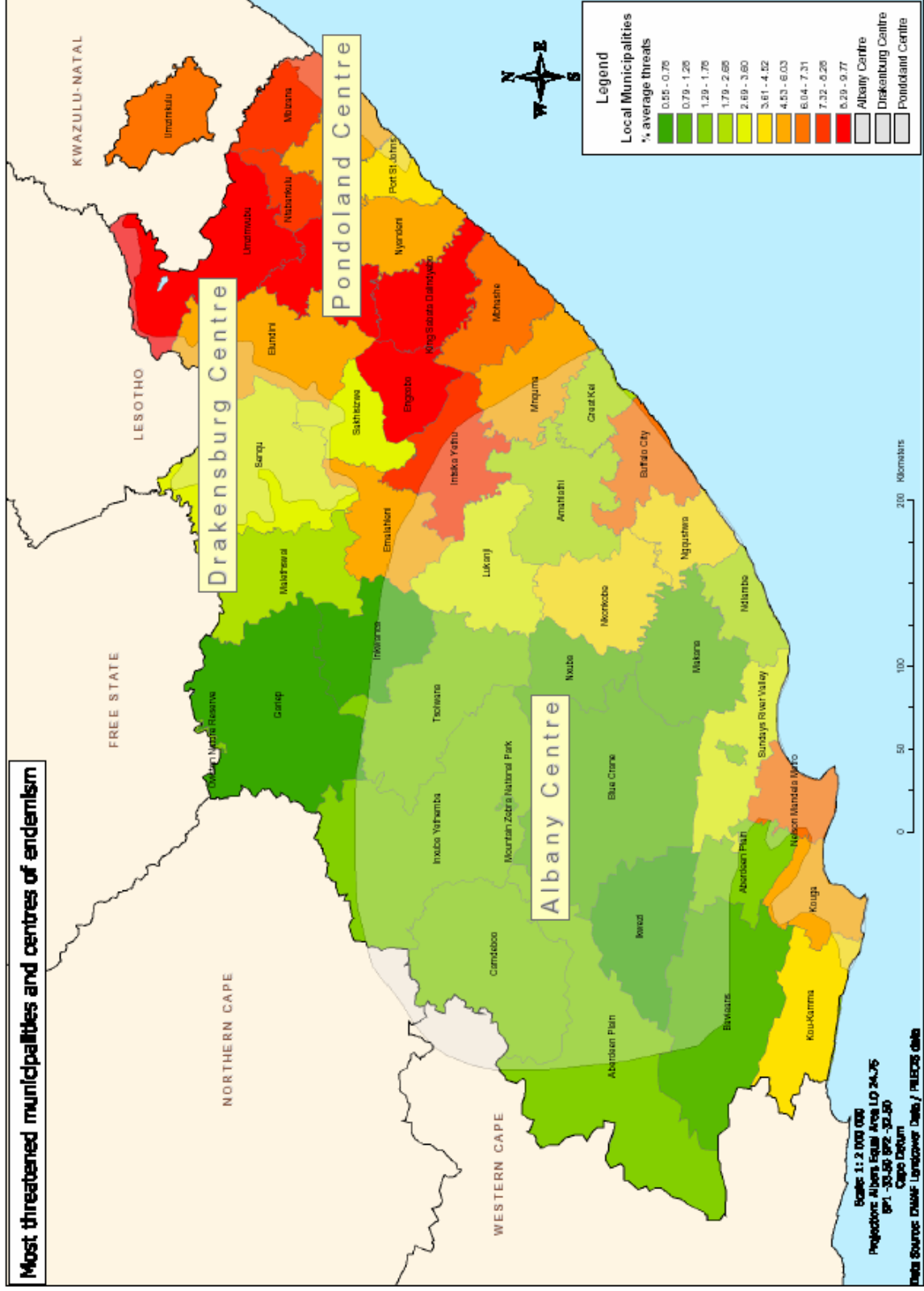
Proportionally, threatened plants are most widely distributed in the Thicket and Forest biomes, with 23 and 20% of their grid squares, respectively, containing threatened plants, and least widely in the Succulent Karoo biome (Table 5.3).

Table 5.3: The proportion of ¼ degree grids in each biome containing threatened plant species

Biome	Proportion of grids containing threatened plant species
Forest	20%
Fynbos	13%
Grassland	17%
Nama Karoo	11%
Savanna	15%
Succulent Karoo	1%
Thicket	23%

There are three centres of plant endemism in the Province: Albany, Drakensberg, and Pondoland (Figure 5.4). The Albany Centre contains 126 plants threatened with extinction, and 22 species listed as 'data deficient'. Six Albany Centre plant species are believed to be extinct (Victor & Dold, 2003).

Figure 5.4: Centres of endemism in the Eastern Cape Province



Where pressures on the environment are high (especially through habitat loss), and these overlap with centres of endemism, one can expect increasing numbers of red data species and ultimately extinctions. Portions of all three Centres coincide with high population densities (DEAET, 2003).

Albany Centre

This region (totalling almost 9 million hectares) is dominated by the thorny, spinescent, often succulent bush known as Subtropical Thicket. The region is a melting pot of many phytochoria, and includes 6 of the 7 biomes. Predictably, there are many succulent endemic plants. Van Wyk and Smith (2001) report high numbers of endemic or near endemic species belonging to the Mesembryanthemaceae, Crassulaceae, Liliaceae, Euphorbiaceae and Asclepidaceae families. Overall endemism for the 4000 species is estimated at 15% (Anderson and Van Wyk, 1999). Major threats include agriculture, overgrazing, alien invader plants and urbanisation (DEAET, 2003).

Pondoland Centre

The distribution of this centre is closely correlated with sandstone bedrock. Lamiaceae and Asclepiadaceae constitute the bulk of species that Van Wyk and Smith (2001) considered endemic or near endemic. Notable exceptions include typically fynbos species (e.g. *Leucospermum innovans* - Proteaceae). Endemism for the 1500 species is recorded at 8% (Anderson and Van Wyk, 1999). The area is under serious threat from poor land use practices. Cowling and Hilton Taylor (1994) cited 33 species with Red Data status.

Drakensberg Centre

This centre is almost exclusively in the Grassland biome, occurring at high altitudes and engulfing the greater portion of Lesotho and the higher lying sections of the KwaZulu-Natal Drakensberg. Succulent endemism is 5% and overall endemism is around 18%. At least four genera are endemic to the region (Van Wyk and Smith, 2001). The endemic or near endemic species are concentrated in the Asclepidaceae and Crassulaceae families.

Although not within the jurisdiction of the Eastern Cape Province, a significant portion of the Little Karoo Centre of endemism is in close proximity to the Province's border. This area should receive attention as a trans-provincial protected area, as many ecosystem functions and landscape process will operate at spatial scales that could have impacts for the populations resident within the Eastern Cape Province.

Fish

Four endemic fresh water fish species occur in the Eastern Cape Province (the River pipefish *Sygnathus watermeyerii*, the Border barb *Barbus trevelyani*, the Eastern Cape redfin *Pseudobarbus afer*, and the Eastern Cape rocky *Sandelia bainsii*). Amongst the marine and estuarine fishes the Giant scale mullet *Liza melinoptera* (endangered), the Doublesash butterflyfish *Chaetodon marleyi* (vulnerable), and the Brindlebass *Epinephalus lanceolatus* (vulnerable) are threatened. Five vulnerable shark species (the Sand tiger shark *Carcharias taurus*, the Great white shark *Carcharodon carcharias*, the Tope shark *Galeorhinus galeus*, the Bluntnose sixgill shark *Hexanchus griseus* and the Flapnose houndshark *Scylliogaleus queketti*) occur in Eastern Cape waters. In 1938 a single Coelacanth (*Latimeria chalumnae*) specimen was caught by a trawler at a depth of 70 m off the Chalumna River near East London (Froese and Pauly, 2003).

Herpetiles (Amphibians and Reptiles)

Amphibians and certain reptiles are sensitive to habitat change and are therefore good indicators of land transformation. There are six threatened and four endemic frog species in the Eastern Cape Province (Table 5.4). One species, *Heleophryne hewitti*, is critically endangered

and known from only four rivers in the Elandsberg range. The Province contains 19 threatened reptiles, of which 18 are endemic to Eastern Cape.

Table 5.4: Threatened and endemic reptiles and frogs (Burger, *pers comm.* 2003)

	Species	Threatened	EC Endemic	Distribution
AMPHIBIANS	<i>Heleophryne hewitti</i>	CR	X	Longmore Forest, only four rivers in the Elandsberg range
	<i>Anhydrophryne rattrayi</i>	EN	X	Amatola forests, e.g. Katberg, Stutterheim, Keiskammahoek
	<i>Bufo amatolicus</i>	EN	X	Winterberg and Amatola mountains, Katberg to Keiskammahoek
	<i>Leptopelis xenodactylus</i>	EN		
	<i>Natalobatrachus bonebergi</i>	EN		
	<i>Afrivalus spinifrons</i>	EN		
	<i>Bufo pardalis</i>		X	Wide distribution from Eastern seaboard from Port Elizabeth to East London and inland to Amatola region
REPTILES	<i>Bitis albanica</i>	RDB candidate	X	Restricted to Algoa Bay
	<i>Acontias meleagris orientalis</i>		X	Sundays River valley and Cradock
	<i>Acontias pusilus</i>		X	Border EC KZN; Kokstad
	<i>Acontias percivali tasmani</i>		X	Algoa basin
	<i>Scelotes anguinus</i>		X	Algoa basin
	<i>Nucras taeniolata</i>			Algoa basin and Albany centre
	<i>Tropidosaura montana subsp rangeri</i>		X	From Amatola mountains as S to Albany region
	<i>Tetradactylus africanus fitzsimonsi</i>	RDB candidate	X	Algoa basin
	<i>Cordylus tasmani</i>		X	Algoa basin
	<i>Bradypodion. cafferum</i>		X	Wild Coast
	<i>B. contanicum</i>		X	Centani
	<i>B. taeniabroncum</i>	Possibly EN	X	Van Stadens Berg and near Kareedouw
	<i>B. ventrali</i>		X	Coast to Karoo and Thicket
	<i>Afroedura amatolica</i>		X	Amatole and Katberg mountains
	<i>Afroedura karroica</i>		X	Inland mountains in Karoo; Tarkastad to Graaff-Reinett regions
	<i>Afroedura tembulica</i>		X	Mountains around Queenstown
	<i>Afroedura sp nova</i>		X	Kouga Mountains and Cockscomb
<i>Cryptactites peringueyi</i>	RDB candidate	X	From Chelsea Point near P.E., east to Kromme estuary	
<i>Goggia essexi</i>		X	Upland areas in Albany region, Suurburg to Great Fish River	

Notes:

CR = critically endangered; EN = endangered; VU = vulnerable

Eastern Cape endemics defined as either complete distribution or at least 90% in the Eastern Cape

Mammals

Large to medium sized mammals are good indicators of biodiversity, as they respond to incompatible farming practices (e.g. predators being exterminated by stock farmers), habitat transformation (e.g. Cape Mountain Zebra, Oribi) or over-utilization (e.g. Cape Pangolin). Fifteen threatened large- to medium-sized mammals occur in the Eastern Cape Province (Table 5.5).

Table 5.5: Threatened large- to medium-sized mammals in the Eastern Cape Province (Smithers, 1986)

Latin Name	Name	Status
<i>Lycaon pictus</i>	Wild dog	Endangered
<i>Hyaena brunnea</i>	Brown hyaena	Rare
<i>Proteles cristatus</i>	Aardwolf	Rare
<i>Felis nigripes</i>	Black-footed cat	Rare
<i>Felis serval</i>	Serval	Rare
<i>Panthera pardus</i>	Leopard	Rare
<i>Philantomba monticola</i>	Blue duiker	Rare
<i>Mellivora capensis</i>	Honey badger	Vulnerable
<i>Felis lybica</i>	African wild cat	Vulnerable
<i>Orycteropus afer</i>	Aardvark	Vulnerable
<i>Equus zebra</i>	Cape Mountain zebra	Vulnerable
<i>Diceros bicornis</i>	Black rhinoceros	Vulnerable
<i>Ourebia ourebi</i>	Oribi	Vulnerable
<i>Manis temminckii</i>	Pangolin	Vulnerable
<i>Felis nigripes nigripes</i>	Small-spotted cat	Rare

Birds

The Eastern Cape Province contains 62 threatened bird species (Table 5.6). Many of them are associated with wetlands or are grassland species, highlighting the declining condition of these ecosystems. As can be expected from this highly mobile group there are no Eastern Cape endemic birds, although nine bird species are South African endemics.

Table 5.6: Threatened bird species in the Eastern Cape Province (Barnes, 2000)

Common Name	Latin Name	Conservation Status
Bearded Vulture	<i>Gypaetus barbatus</i>	Endangered
Bittern	<i>Botaurus stellaris</i>	Critical
Black Harrier	<i>Circus maurus</i>	Near-threatened *
Black Oystercatcher	<i>Haematopus moquini</i>	Near-threatened
Black Stork	<i>Ciconia nigra</i>	Near-threatened
Blackbellied Korhaan	<i>Eupodotis melanogaster</i>	Near-threatened
Blackbrowed Albatross	<i>Diomedea melanophris</i>	Near-threatened
Blackwinged Plover	<i>Vanellus melanopterus</i>	Near-threatened
Blue Crane	<i>Anthropoides paradisea</i>	Vulnerable *
Blue Korhaan	<i>Eupodotis caerulescens</i>	Near-threatened *
Broadtailed Warbler	<i>Schoenicola brevirostris</i>	Near-threatened
Bush Blackcap	<i>Lioptilus nigricapillus</i>	Near-threatened *
Cape Cormorant	<i>Phalacrocorax capensis</i>	Near-threatened
Cape Gannet	<i>Morus capensis</i>	Vulnerable
Cape Parrot	<i>Poicephalus robustus</i>	Endangered
Cape Vulture	<i>Gyps coprotheres</i>	Vulnerable *
Caspian Tern	<i>Hydroprogne caspia</i>	Near-threatened
Chestnutbanded Plover	<i>Charadrius pallidus</i>	Near-threatened
Corncrake	<i>Crex crex</i>	Vulnerable
Crowned Eagle	<i>Stephanoaetus coronatus</i>	Near-threatened
Damara Tern	<i>Sterna balaenarum</i>	Endangered

Delegorgue's Pigeon	<i>Columba delegorguei</i>	Vulnerable
Finfoot	<i>Podica senegalensis</i>	Vulnerable
Grass Owl	<i>Tyto capensis</i>	Vulnerable
Greater Flamingo	<i>Phoenicopterus rubber</i>	Near-threatened
Grey Petrel	<i>Procellaria cinerea</i>	Near-threatened
Ground Hornbill	<i>Bucorvus leadbeateri</i>	Vulnerable
Halfcollared Kingfisher	<i>Alcedo semitorquata</i>	Near-threatened
African Penguin	<i>Spheniscus demersus</i>	Vulnerable
Knysna Warbler	<i>Bradypterus sylvaticus</i>	Vulnerable *
Knysna Woodpecker	<i>Campethera notata</i>	Near-threatened *
Kori Bustard	<i>Ardeotis kori</i>	Vulnerable
Lanner	<i>Falco biarmicus</i>	Near-threatened
Lesser Flamingo	<i>Phoenicopterus minor</i>	Near-threatened
Lesser Kestrel	<i>Falco naumanni</i>	Vulnerable
Ludwig's Bustard	<i>Neotis ludwigii</i>	Vulnerable
Mangrove Kingfisher	<i>Halcyon senegaloides</i>	Vulnerable
Marabou	<i>Leptoptilos crumeniferus</i>	Near-threatened
Marsh Harrier	<i>Circus ranivorus</i>	Vulnerable
Martial Eagle	<i>Polemaetus bellicosus</i>	Vulnerable
Melodious Lark	<i>Mirafrans cheniana</i>	Near-threatened *
Orange Thrush	<i>Turdus gurneyi</i>	Near-threatened
Painted Snipe	<i>Rostratula benghalensis</i>	Near-threatened
Pallid Harrier	<i>Circus macrourus</i>	Near-threatened
Peregrine	<i>Falco peregrinus</i>	Near-threatened
Roseate Tern	<i>Sterna dougallii</i>	Endangered
Rudd's Lark	<i>Mirafrans ruddi</i>	Critical
Secretary bird	<i>Sagittarius serpentarius</i>	Near-threatened
Shy Albatross	<i>Diomedea cauta</i>	Vulnerable
Southern Giant Petrel	<i>Macronectes giganteus</i>	Near-threatened
Stanley's Bustard	<i>Neotis denhami</i>	Vulnerable
Striped Flufftail	<i>Sarothrura affinis</i>	Vulnerable
Tawny Eagle	<i>Aquila rapax</i>	Vulnerable
Wandering Albatross	<i>Diomedea exulans</i>	Vulnerable
Wattled-Crane	<i>Burgeranus carunculatus</i>	Endangered
White Pelican	<i>Pelecanus onocrotalus</i>	Near-threatened
Whitebacked Night Heron	<i>Gorsachias leuconotus</i>	Vulnerable
Whitebellied Korhaan	<i>Eupodotis cafra</i>	Vulnerable
Whitechinned Petrel	<i>Procellaria aequinoctialis</i>	Near-threatened
Whitecrowned plover	<i>Vanellus albiceps</i>	Near-threatened
Yellowbilled Stork	<i>Mycteria ibis</i>	Near-threatened
Yellowbreasted Pipit	<i>Anthus chloris</i>	Vulnerable *

Note: SA endemic indicated by a *

5.2.3: Distribution and abundance of selected alien species

Alien plants have a major impact on biodiversity and are one of the major threats to biodiversity in all the Province's seven biomes (DEAET, 2003). Three elements of this indicator were identified: a) the proportion of Eastern Cape's surface area covered by invasive alien plant, b) the number and distribution of Working for Water project sites; and c) the area infested by two indicator invasive alien plant species, *Acacia cyclops* and *A. mearnsii*.

The lack of reliable invasive alien plant data for the Eastern Cape Province is a cause for concern. Gibson and Low (2003) conducted an audit and gap analysis of existing data sets and sources of information. Other than WfW's National Biological Alien (NBAL) data, few comprehensive data sets exist. The coastal catchments are generally well covered by WfW project areas, although NBAL data is sparse. Three comprehensive but small invasive alien plant data sets are available for the Addo Planning Domain, Mondi Forests Open Area Management Plans in the vicinity of Maclear, and Coega Development Zone.

WfW determined the extent of alien invasion by *Acacia cyclops* and *Acacia mearnsii* for the Eastern Cape from satellite imagery and field assessments (Working for Water Programme, 2002) (Table 5.7).

Table 5.7: Area infested and biomass of two invasive *Acacia* species in the Eastern Cape Province

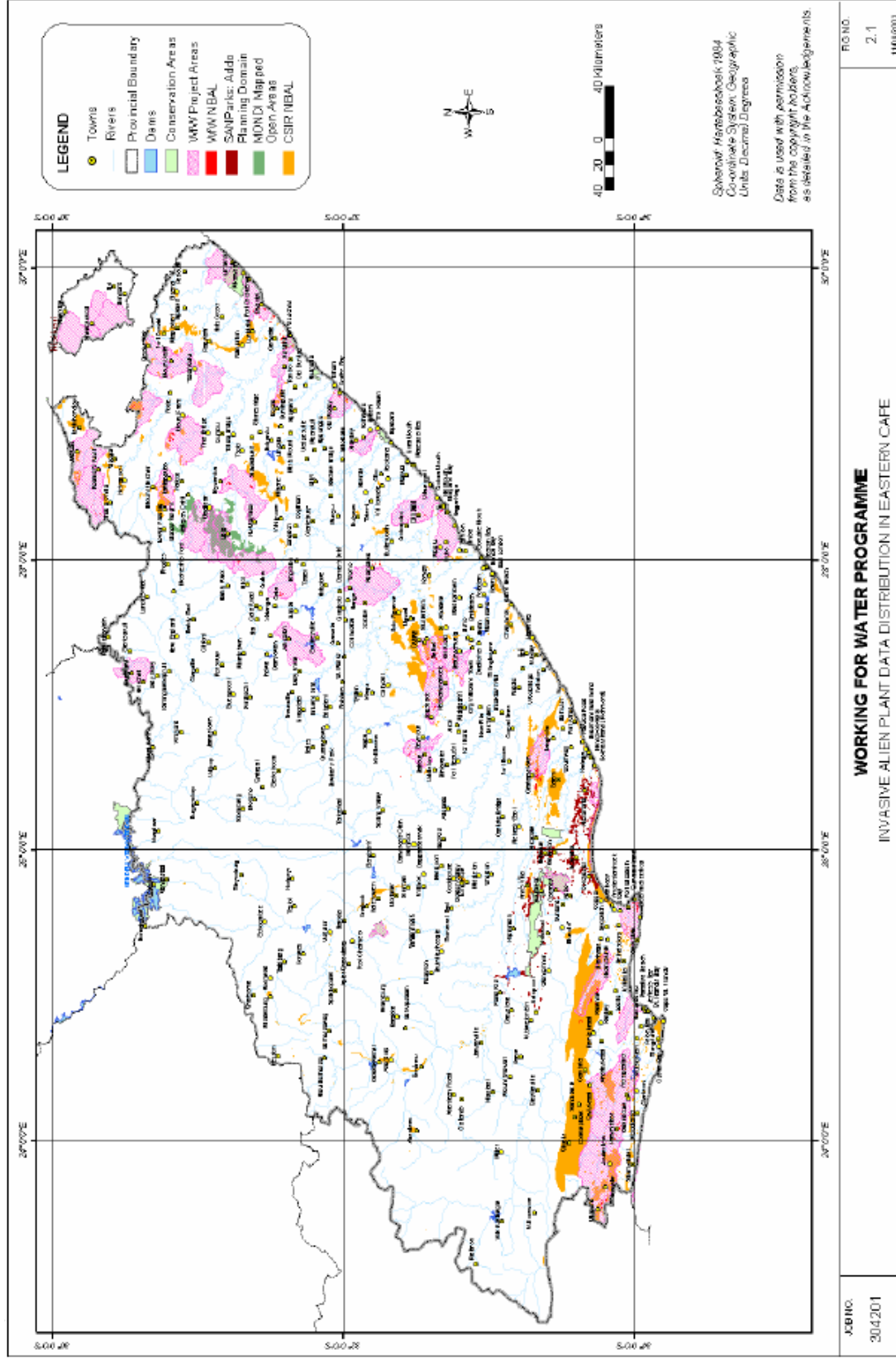
Species	Infested areas (ha) >50 % crown density	Biomass (tonnes)
<i>A. cyclops</i>	28 179	3 312 690
<i>A. mearnsii</i>	48 537	4 833 517

To estimate the area covered by invasive alien plants in the Province, Gibson and Low (2003) combined Working for Water's NBAL database, the South African Plant Invader database, CSIR's estimates and expert opinion. They found that WfW's NBAL data could underestimate the extent of alien plant invaders in Eastern Cape by as much as 75%, i.e. 0.15% (NBAL data) vs. 0.79% (integrated data) (Table 5.8). The more than 100 000 ha invaded by alien plants could, however, have a substantial impact on biodiversity if left unchecked (Le Maitre, 2003). Figure 5.5 outlines the areas estimated to be invaded by alien plants, on the basis of various data sources, as well as the distribution of Working for Water's project areas where they are currently controlling aliens. It appears that the different sources of data are not consistent. A further complication is that WfW's interventions have not been selected on the basis of alien plant infestations but rather on the basis of socio-political considerations. To infer alien plant infestations from the distribution of WfW project intervention areas is therefore erroneous.

Table 5.8: Estimates of the area covered by invasive alien plant data in the Eastern Cape Province

Estimated Area covered by identified/collected IAP data ¹ (km ²)	Estimated area covered by WfW NBAL data ² (km ²)	Percent coverage (%) by WfW NBAL data	Percent coverage (%) by WfW and collected IAP data
1081	254	0.15	0.79

Figure 5.5: The distribution of invasive alien plants and Working for Water project areas in the Eastern Cape Province (Gibson & Low, 2003)



Emerging invaders do not appear to be spreading outside of areas already invaded by well-established invasive species, which suggests that historical invasions by major invaders facilitates invasions by other alien species. This suggests that these areas may be susceptible to invasion by alien plants because of certain climatic features, patterns of human settlement or disturbance related to land uses (Le Maitre, 2003).

No data are available on herbaceous alien species or alien fauna for the Eastern Cape Province.

5.2.4: Extent of conserved areas

Although the unprotected matrix makes a large contribution to biodiversity conservation, protected areas are vital to conserve species that decrease as a result of agricultural practices and over-use by humans, and to ensure the long-term maintenance of viable populations of especially large mammals (Fabricius, Burger and Hockey, 2003). Four descriptors are useful in tracking trends in the extent of protected areas: a) the percentage of the Province's surface area covered by national, provincial, municipal and private protected areas respectively; b) the percentage of each biome's surface area conserved; c) the proportion of each local municipality's area conserved and d) the size distribution of the Province's protected areas. These four descriptors combined give an idea of trends in the success, or otherwise, of government and private sector conservation efforts in the Province. Figure 5.6 shows the Eastern Cape's conservation areas in relation to areas of high biodiversity.

Dye and Lasiak's (1995) research in the Dwesa/Cwebe nature reserves reveal the vital role that these protected areas play in sustaining mussel populations. For example, 90% of the coastline that is not protected from exploitation is impoverished, suffers from algae domination and supports 100 times less shellfish than protected areas such as Dwesa and Mkambati.

A comparison between protected areas and neighbouring communal land (Fabricius, Burger and Hockey, 2003) revealed that nature reserves in the Thicket biome are critical in conserving species that are sensitive to disturbance but that a diversity of land uses, including nature reserves, communal grazing areas, commercial farms, creates a landscape mosaic and thus promotes large scale diversity in the Xeric Succulent Thicket of South Africa. This study is supported by Fabricius, Palmer and Burger (2002) who found that nature reserves in Xeric Succulent Thicket of the Eastern Cape contain a greater diversity of wildlife, disturbance agents and consequently had higher landscape patchiness than adjacent, unconserved freehold and communal rangeland.

A relatively high proportion of the Eastern Cape Province (10.18%) is formally and informally (privately) conserved. When one includes only formal protected areas (national parks, state forests, provincial nature reserves and reserves run by local municipalities) in this analysis, the percentage drops to 4.7% (Table 5.9).

Table 5.9: Approximate breakdown of conserved terrestrial areas in the Eastern Cape Province (DEAET, 2003)

Responsibility	Approximate Hectares	Approximate % of the Eastern Cape Province
National*	370 462	2.19
Provincial	419 351	2.47
Local Municipality	13 818	0.01
<i>Subtotal</i>	<i>803 631</i>	<i>4.74</i>
Private	921 350	5.43
Total	1 724 981	10.18

* Denotes all National Parks, or property purchased for the expansion of national parks. All state forests are technically a national competency and have been included in this category, as the delegation of management authority of these state assets to DEAET is likely in the near future.

Fynbos is the most protected biome while the Grassland, Nama Karoo and Savanna are the least protected biomes (Table 5.10) (DEAET, 2003). This reflects the uneven distribution of protected areas. This uneven distribution of protected areas is also depicted in Table 5.11, showing that 10 municipalities have less than 1% of their areas conserved while 2 municipalities have 100% conservation status.

The size distribution of formal protected areas is also highly variable. Table 5.12 demonstrates the size of all protected areas with national, provincial and municipal status. Of the 38 protected areas in the Eastern Cape Province, only two are larger than 100 000 ha. Four protected areas are between 25 000 and 100 000 ha in size, and two are larger than 10 000 ha but less than 25 000 ha. The remaining 30 protected areas are smaller than 10 000, which is a cause for concern as viable populations of most large mammals cannot be indefinitely sustained in such small areas.

Table 5.10: Biomes formally and informally conserved in the Eastern Cape Province (DEAET, 2003)

Biome	Total Ha in Eastern Cape	Ha formally conserved	% formally conserved	Ha informally conserved	% Informally conserved	Total ha conserved	Total % conserved
Forest	370218.0	140521.0	38.0	19719.0	5.3	160240.0	43.3
Fynbos	1030657.0	229963.0	22.3	37985.0	3.7	267948.0	26.0
Grass-land	6672858.0	146061.0	2.2	163714.0	2.5	309775.0	4.6

Nama Karoo	4332138.0	66965.0	1.5	304550.0	7.0	371515.0	8.6
Savanna	1745286.0	26961.0	1.5	168367.0	9.6	195328.0	11.2
Succulent Karoo	2300.0	407.0	17.7	0.0	0.0	407.0	17.7
Thicket	2799155.0	192753.0	6.9	225941.0	8.1	418694.0	15.0
Totals	16952612.0	803631.0	4.7	920276.0	5.4	1652514.0	9.7

Table 5.11: Percentage area conserved per Municipality in the Eastern Cape Province (DEAET, 2003)

Name	Area conserved (ha)	Total Area (ha)	% of Municipality Conserved
Aberdeen Plain	53401	1328348	4.0
Amahlathi	967	426620	0.2
Baviaans	118710	772415	15.4
Blue Crane	2653	983103	0.3
Buffalo City	2531	251597	1.0
Camdeboo	14998	723267	2.1
Elundini	2923	535875	0.5
Gariep	26426	883658	3.0
Great Kei	1010	173563	0.6
Ikwezi	160	444969	0.0
Inkwanca	3006	358367	0.8
Inxuba Yethemba	3221	1159462	0.3
Kouga	13484	228906	5.9
Kou-Kamma	82673	370343	22.3
Lukanji	2750	419149	0.7
Makana	16798	422196	4.0
Mbhashe	5664	303047	1.9
Mbizana	26	241188	0.0
Mountain Zebra National Park	7056	7056	100.0
Ndlambe	13760	200080	6.9
Nelson Mandela Metro	1957	195215	1.0
Nggushwa	227	224578	0.0
Nkonkobe	45031	379337	11.9
Nxuba	732	273439	0.3
Nyandeni	509	261054	0.2
Oviston Nature Reserve	7011	7011	100.0
Port St Johns	255	128779	0.2
Qaukeni	7441	255395	2.9
Senqu	2477	677073	0.4
Sundays River Valley	59092	350760	16.8
Tsolwana	13720	608695	2.3
Umzimkulu	9285	243613	3.8
Umzimvubu	13740	553262	2.5

Table 5.12: The areas of national parks, provincial nature reserves and municipal nature reserves in the Eastern Cape Province (DEAET, 2003)

Name	Size (hectares)
National parks	
Addo Elephant National Park	127556
Mountain Zebra National Park	7259
Tsitsikamma National Park	6205
Provincial nature reserves	

Baviaanskloof Wilderness Area	175104
Great Fish River Nature Reserve	43760
Oviston Nature Reserve	32876
Groendal Wilderness Area	28876
Formosa Nature Reserve	25399
Karoo nature reserve:	14850
Malekgonyane (Ongeluksnek) Wildlife Reserve	13614
Ntsikeni Wildlife Reserve	9290
Mpufo	8178
Tsolwana nature reserve	7896
Mkambati Wildlife Reserve	7281
Commando Drift Nature Reserve	5815
Dwesa-Cwebe wildlife reserve and marine sanctuary	5410
Water's meeting Nature Reserve	3955
Nthabathemba Tribal Reserve	3097
East London Coast Nature Reserve	2892
Fort Fordyce Nature Reserve	2648
Thomas Baines Nature Reserve	1964
Sunshine Coast Nature Reserve	1293
The Island Nature reserve	495
Hluleka Wildlife Reserve	445
Silaka Wildlife Reserve	263
Kabeljousriver nature reserve	223
Seekoeirivier nature reserve	117
Cape St Francis nature reserve	71
Municipal nature reserves	
Gamtoos Coastal	1499
Loerie Dam	779
Kap River/Great Fish River Mouth Wetland Reserve	624
Ladys slipper	389
Roundhill	279
Huisclip	230
Blaauwkranz	200
Ecca	119
Ghio Marsh Dam	73
Sardinia Bay Coastal	38

5.3: The state of biodiversity in the Eastern Cape Province

The Eastern Cape Province comprises seven biomes: Forest (2%); Fynbos (6%); Grassland (39%); Nama Karoo (26%); Savanna (10%); Succulent Karoo (0.01%); and Thicket (17%) (DEAET, 2003).

Land transformation is a major driver and indicator of biodiversity change. In 17 of the 42 municipal areas, over 20% of the land has been transformed.

The Province contains 316 threatened plant species, of which six have become extinct. Most of the threatened plants (23%) occur in the Thicket biome, but the Forest and Fynbos biomes contain the highest number of threatened plants per unit area. The three centres of endemism are the Albany centre (where most plant extinctions have occurred), covering a large area in the centre of the Province; the Drakensberg centre, covering the Senqu and Elundini municipalities in the north-east; and the Pondoland centre, covering the Port St Johns and Mbizana municipalities in the east.

The Province is home to four endemic freshwater fishes, eight threatened marine fish species, six threatened frog species (of which four are endemic), and 19 threatened reptile species (of which 18 are endemic). Areas of reptile and frog endemism include Algoa Bay and the Amatole mountain range.

Invasive alien plants cover between 0.15% and 0.79% of the Eastern Cape Province surface area, but there are major data deficiencies that have to be addressed. More than 10% of the Province's surface area is conserved in some way, but only 4.7% is formally protected as National Parks or Provincial conservation areas (DEAET, 2003). Once the State forests have been transferred to the Provincial conservation authority and a number of mega-parks have been developed as planned, this figure will increase substantially to more than 16%. The distribution of protected areas is highly skewed; 48% of Local Municipalities have no protected areas within their boundaries, and many of these municipalities contain rare, threatened or vulnerable species. In contrast, certain municipalities contain few rare, threatened or vulnerable species but are well covered by protected areas (DEAET, 2003). Protected areas are crucial to the conservation of all species and ecosystems in the Eastern Cape Province, and are supported by well managed unprotected areas.

Chapter 6: Environmental management and governance

6.1: Introduction

The term environment is often very difficult to define. Within the context of sustainable development it encompasses the social, economic, biophysical and political spheres. Section 24 of the Constitution of the Republic of South Africa (RSA, 1996) legally mandates the government to ensure the people of South Africa are not harmed by the environment and the environment is protected against abuse. The Constitution also provides for co-operative government.

The White Paper on Environmental Management Policy (DEAT, 1997a) refers to the conditions and influences under which any individual or thing exists, lives or develops. Culture, economic considerations, social systems, politics and value systems determine the interaction between people and the environment, the use of natural resources, and the values and meanings that people attach to life forms, ecological systems, physical and cultural landscapes and places. People are part of the environment and are at the centre of concerns for its sustainability (DEAT, 1997a).

In summary, environmental management and governance comprise a system of tools which include principles, policies, legislation, regulation and practice. Each of these has a spatial element, i.e. occurs at global, regional, national, provincial, local, and/or neighbourhood scales. In turn, each of these elements might have components for which government, non-government organisations or civil society would be responsible.

In a South African context, the Eastern Cape provincial government through the Department of Economic Affairs, Environment and Tourism (DEAET) has certain governance responsibilities in terms of the environment, along with national government. The strategic objective of the Chief Directorate: Environmental Affairs in the Province has been defined as "To ensure sustainable environmental management in the Province" in the Provincial Business Plan for DEAET of 2003/04. The functions can be listed as:

- Programme Outcome 1: Ensuring environmental quality, protection and promotion of integrated environmental management;
- Programme Outcome 2: Ensure biodiversity, conservation and coastal zone management; and
- Programme Outcome 3: Monitor services rendered by the Eastern Cape Wildlife Services (ECWS) and other parastatals (MBB Consulting, 2003).

Prior to 1999, environmental management was the responsibility of two separate departments, namely Nature Conservation and Environmental Protection. In 1999 there was a restructuring and Nature Conservation and Environmental Protection were housed together under the Chief Directorate of Environmental Affairs. In 2001 the Department motivated for two Directors under the Chief Director: Impact Management and Biodiversity and Coastal Management. These Directorates operate through teams based in 5 regional offices (Table 6.1).

Table 6.1: Distribution of environmental management regional offices in the Eastern Cape Province (Sokupa, *pers comm.*, 2004)

Region	Location
Western	Port Elizabeth
Central	East London
Northern	Queenstown
Eastern	Umtata
EG/Kei	Kokstad
Head Quarters	Bisho

In the future Section 20 (permitting of landfills) of the Environment Conservation Act 73 of 1989 (RSA, 1989) may be devolved down to provincial government. The Department is thus looking at establishing another Directorate on waste management in the next financial year. As of 01 April 2004, the Province will also be forming a Parks Board. This Board will sit under the Department as a parastatal. The Directorate's organogram will thus change to accommodate waste management responsibilities as well as the creation of an Eastern Cape Parks Board. The new functions of the Chief Directorate: Environmental Affairs will likely be EIA, community services (environmental education), biodiversity, waste management, and coastal management. The Department is thus trending from environmental protection and nature conservation towards more developmental issues. At the same time, the Department is becoming more focused and the regional officers more competent.

The actions of Eastern Cape government departments in terms of environmental management and the environmental governance linkage with the public sector is the focus of this chapter.

6.2: Key Indicators

The indicators selected for reporting on environmental management and governance in the Eastern Cape Province includes:

- Budgetary allocation to environmental management, research, education and awareness;
- Institutional capacity for environmental management;
- IDP commitment to environmental management;
- Voluntary adoption of environmental management systems; and
- Compliance with environmental legislation.

Information on these indicators is presented in the following pages to provide a reflection of the state of environmental management and governance in the Eastern Cape Province.

6.2.1: Budgetary allocation to environmental management, research, education and awareness

This indicator measures provincial government expenditure on environmental management, research, education and awareness in the Province. The budget allocation reflects the priorities of the provincial government. Trends of budget allocation over time give an indication as to whether the environmental management portfolio is increasing or decreasing over time.

The data reflected in Figure 6.1 below was obtained from the DEAET (Sokupa, *pers comm.*, 2004). The budget is allocated to three broad programmes including:

- Impact Management;
- Biodiversity and Coastal Management; and
- Research and Information.

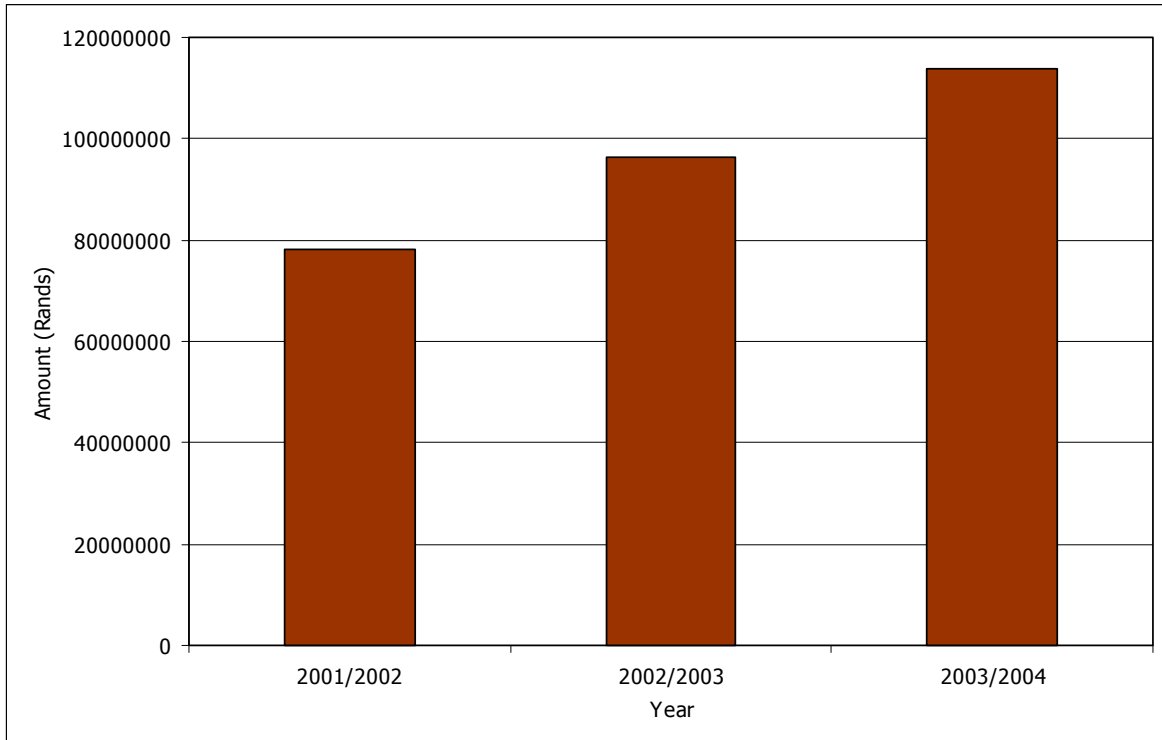


Figure 6.1: Budgetary allocation to environmental management, research, education and awareness in the Eastern Cape Province (Sokupa, *pers comm*, 2004)

The budget for environmental management is allocated by the Legislature on the basis of business plans submitted by the Departments. The departmental budget is in turn based on costed business plans submitted by the regional offices to the Department. Figure 6.1 shows that there has been an increasing trend in expenditure of the environmental management budget in the Eastern Cape Province. This trend is positive as it suggests that environmental management continues to receive support from the provincial government.

6.2.2: Institutional capacity for environmental management

Institutional capacity for environmental management is a serious problem for many of the provincial departments. Institutional capacity is critically important to ensure that there are sufficient personnel to implement policies and to enforce and monitor compliance with the legislation. This indicator measures the current institutional capacity versus the required institutional capacity for the Department to operate effectively. The data for this indicator are shown in Table 6.2 as the current posts filled compared to the ideal posts allocated.

Table 6.2: Actual and required institutional capacity for environmental management within DEAET (Sokupa, *pers comm.*, 2004)

Region	Current posts filled	Posts allocated
EG/Kei	9	13
Northern (Queenstown)	12	14
Central (E.L.)	6	8
Eastern (Umtata)	7	8
Western (P.E.)	9	10
Head Quarters	5	5

The indicator reflects that in the regional offices, there are additional posts still to be filled. The data for this indicator do not however provide a complete picture. The Impact Management Directorate will be going through a process of restructuring in the 2004/2005 financial year and there will be substantial changes to organisation and responsibilities of the various programmes. The data presented thus reflect a temporary situation until a new organogram is conceived for the Directorate. Notable changes for the new year include the creation of an Eastern Cape Parks Board as a parastatal body, and the introduction of waste management responsibilities at the provincial level. It is thus likely that there will be a need for greater capacity for the Directorate in future years.

6.2.3: IDP commitment to environmental management

Whilst the bulk of this chapter has focused on the responsibility of the provincial government to manage the environment, local government also has a responsibility for environmental management and governance. This indicator seeks to measure how Local Municipalities address environmental issues through their Integrated Development Plans (IDPs). IDPs are the master plan for local development, and thus the manner in which the environment is addressed in this plan is a measure of the role and responsibility the municipality accepts for environmental management. In order to measure this indicator, several IDP documents were evaluated against a set of questions. The IDPs selected for review were those that had been completed and the reviewed documents are available publicly through the official website of the Province of the Eastern Cape (2004). The questions were as follows (adapted from Morris, 2002):

1. Does the IDP show an understanding of the policy and legislative framework surrounding the environment?
2. Does the IDP show an understanding of the implications of the above policy and legislative framework for the municipality and their day-to-day operations?
3. Does the IDP provide a structure and mechanisms for the responsibility and accountability of environmental issues?
4. Does the IDP provide Localised Strategic Environmental Guidelines for the development of strategies?
5. Is there an Integrated Environmental Program?
6. Is there an Integrated Waste Management Plan?
7. Have any projects related to the following been identified?
 - a. Sanitation and water
 - b. Energy
 - c. Integrated land and human settlement planning
 - d. Environmental health
 - e. Integrated pollution and waste management
 - f. Biodiversity and sensitive areas

- g. Parks and open spaces
 - h. Community based natural resource management
8. Throughout the IDP, is the *environment* considered in an holistic manner, or does it merely relate to conservation or 'green' issues?

The IDPs selected for evaluation included (Province of the Eastern Cape, 2004):

1. Alfred Nzo;
2. Cacadu;
3. Chris Hani;
4. Emalahleni;
5. Gariiep;
6. Great Kei;
7. King Sabata Dalindyebo;
8. Kouga;
9. Maletswai;
10. Nxuba;
11. Nyandeni;
12. Qaukeni;
13. Senqu;
14. Sunday's River Valley; and
15. Ukhahlamba.

The results of the evaluation are presented in Table 6.3 with positive responses recorded for each question. The results were obtained through an analysis of each Municipality's IDP document. The results show that in general, IDPs are weak in identifying and addressing environmental issues. At a strategic level, there is some recognition of national environmental legislation with 73% of IDPs identifying significant environmental legislation such as the National Environmental Management Act 108 of 1998 (RSA, 1998) and the Environment Conservation Act 73 of 1989 (RSA, 1989). However, the translation of policy implications into the activities of the municipality and the responsibilities of municipal structures is poor (46% and 20% positive responses respectively). Some guidance on environmental planning through the presence of Localised Strategic Environmental Guidelines, Integrated Environmental Programmes and Integrated Waste Management Plans exists, however these guidelines tend to be pitched at the level of generic principles rather than practical actions.

In terms of practical projects prioritised within the IDP and financed through the Medium Term Expenditure Framework, there is a stronger emphasis on the developmental environmental projects rather than the conservation projects. Water and sanitation, energy, human settlements and waste projects were more evident in the IDPs than those projects dealing with biodiversity management, open spaces and community based natural resource management. This is partly a reflection of the level of poverty in the Eastern Cape Province and the need to focus on meeting basic needs.

In general, the IDPs prioritised infrastructure development and economic development far above environmental management.

Table 6.3: IDP commitment to the environment in the Eastern Cape Province – 2003 (Ramasar, 2004)

Question	Total number of positive responses	Percentage of positive responses
Does the IDP show an understanding of the policy and legislative framework surrounding the environment?	11	73
Does the IDP show an understanding of the implications of the above policy and legislative framework for the municipality and their day-to-day operations?	7	46
Does the IDP provide a structure and mechanisms for the responsibility and accountability of environmental issues?	3	20
Does the IDP provide Localised Strategic Environmental Guidelines for the development of strategies?	10	66
Is there an Integrated Environmental Program?	9	60
Is there an Integrated Waste Management Plan?	11	73
Have any sanitation and water projects been identified and budgeted for?	15	100
Have any energy projects been identified and budgeted for?	11	73
Have any integrated land and human settlements projects been identified and budgeted for?	9	60
Have any environmental health projects been identified and budgeted for?	3	20
Have any integrated pollution and waste management projects been identified and budgeted for?	11	73
Have any biodiversity and sensitive areas projects been identified and budgeted for?	4	26
Have any parks and open spaces projects been identified and budgeted for?	4	26
Have any community based natural resource management projects been identified and budgeted for?	3	20
Throughout the IDP, is the <i>environment</i> considered in an holistic manner, or does it merely relate to conservation or 'green' issues?	1	6

6.2.4: Voluntary adoption of environmental management systems

As environmental governance extends beyond the responsibilities of provincial and local government, this indicator measures the commitment of the private sector to managing their environmental impact. Environmental management systems are programmes put in place by businesses to ensure environmental governance. There are numerous environmental management systems used globally. One of the most commonly used and internationally recognised systems is the ISO 14001 certification system.

Through this system, a company is certified by an external auditor on its compliance with the ISO 14001 requirements. There are many companies that provided accredited certification, however not all these companies were forthcoming with data on certification in the Eastern Cape Province. Data from the South Africa Bureau of Standards (SABS) and NOSA shows that 18 Eastern Cape companies have been certified for ISO 14001 (SABS, 2004; van Heerden, *pers comm.*, 2004).

As economic development continues at a rapid rate in the Eastern Cape Province (ECDC, 2003), this indicator will be very important to track the environmental commitment of the private sector to environmental management.

6.2.5: Compliance with environmental legislation

This indicator tracks compliance with environmental legislation in the Province. This indicator should report on the number of provincial responsibilities (mandated nationally) that the Province is adhering to, such as adherence to the environmental management plan agreed to in environmental impact assessments. The Directorate: Environmental Impact Management processed 2216 EIAs from 05 September 1997 to end December 2003 (Sokupa, *pers comm.*, 2004). Monitoring enforcement and compliance with these approved EIAs is thus a substantial job.

At present however there are no data for this indicator. The Standing Committee on Economic Affairs, Environment and Tourism (Legislature of the Province of the Eastern Cape, 2003) recognised the weakness of the Department in environmental impact compliance and monitoring. The Committee recommended that corrective measures be put in place to address underperformance in this area.

6.3: The state of environmental management and governance in the Eastern Cape Province

As described in the introduction to this chapter, environmental management and governance is a multi-faceted theme and involves role-players from all levels of government, the private sector and civil society. Environmental management and governance is also a cross-cutting theme which is closely linked to the success and failure of all themes of natural resource management.

The budgetary allocation and institutional capacity of the provincial government for environmental management suggest that there is political support for this responsibility of government. The budgetary allocation has shown an increasing trend over the last few years and the indications are that this will continue to grow as the provincial government takes on added responsibilities of waste management. The provincial government also has most of its required posts filled thus suggesting that the required institutional capacity is available to deliver environmental management commitments of the Department. However, the Department will be

going through a restructuring process in the new financial year starting April 2004 (Sokupa, *pers comm.*, 2004). This restructuring may involve the creation of a waste management unit and personnel moving from the Department in to the newly established Eastern Cape Parks Board. As the responsibilities of the Department change, the capacity requirements may also change thus creating a different picture from that reflected in Table 6.1. One area that DEAET appears to be weak in is enforcement and compliance monitoring. Insufficient data were available to provide an accurate picture of this indicator. The lack of capacity for monitoring has however been recognised by the Department.

At a local government level, the review of IDPs suggested that there is less commitment and prioritisation of environmental issues by municipalities. In many cases, the municipalities only focused on the environmental issues that directly relate to human needs such as water, sanitation and waste removal. Conservation issues were not considered a priority and thus local governments do not appear to be investing in maintenance of biodiversity and ecosystem protection.

Private sector's role in environmental management and governance was measured through the use of environmental management systems by companies. The data suggest that many of the large companies are compliant with international environmental management standards. However, as environmental enforcement and compliance monitoring is weak in the Province, it is difficult to judge whether environmental legislation and good environmental management practice is being applied in all the companies in the Province. As the Eastern Cape's economic development continues to grow around nodes such as Coega, private sector commitment to environmental management will become more important.

The overall picture of environmental management and governance in the Eastern Cape Province suggests that there are promising signs of progress in some areas (provincial government), lack of data in others (private sector and enforcement and compliance monitoring) and a need for greater integration of environmental issues into development in still others (local government). This suggests that environmental management and governance must be looked at more broadly in the Eastern Cape Province so that all role-players recognise their responsibility in this area.

Chapter 7: Freshwater

7.1: Introduction

The Eastern Cape provincial boundary includes two of South Africa's Water Management Areas (WMA). Almost all of the Mzimvubu to Keiskamma WMA sits within the provincial boundary whereas approximately 95% of the Fish to Tsitsikamma WMA resides within the provincial boundary. In addition, the Kraai sub-WMA of the Upper Orange WMA lies within the Eastern Cape Province and has therefore been included for reporting purposes. The WMAs and sub-WMA which lie within the Eastern Cape Province are depicted in Figure 7.1.

Land use in the Mzimvubu to Keiskamma WMA is predominantly livestock farming and subsistence agriculture, with commercial timber grown in the higher rainfall areas (DWAF, 2002a). Three main rivers flow to the coast, of which the Mzimvubu is the largest undeveloped river in South Africa (DWAF, 2002a). Three small hydro-electric developments exist on the Mbashe and Mtata Rivers.

Land use in the Fish to Tsitsikamma WMA is mainly sheep and mohair farming, with extensive cultivation of irrigated land along the main rivers. Several national parks and conservation areas are also found in this WMA. The water of the Fish River and Sundays River have a naturally high salinity, necessitating a major inter-water management area transfer from the Gariiep Dam in the Upper Orange WMA to the Fish to Tsitsikamma WMA. This transfer takes place via the 80km long Orange-Fish tunnel (DWAF, 2002a). Groundwater is used extensively for towns and rural water supply (DWAF, 2002a).

7.2: Key Indicators

The core indicators for the freshwater resources reporting theme include:

- Surface water nutrients;
- Surface water toxicity;
- Groundwater nutrients;
- Total surface water demand; and
- Effectiveness of water resource management.

7.2.1: Surface water nutrients

Water quality is an important issue in the Eastern Cape Province and was identified in various stakeholder workshops conducted in the Province. Issues related to water quality include the declining quality of water, eutrophication of water resources, non-compliance of sewage works and pollution of water from various sources such as the use of fertilisers and pesticides in the agricultural sector. Two indicators are used to assess the state of surface water nutrients in the Eastern Cape Province, namely surface water nutrients and surface water toxicity. The indicator surface water nutrients is a state indicator which measures the ratio of total inorganic nitrogen to orthophosphate (TIN:PO₄) together with the absolute orthophosphate concentration in a body of water.

Figure 7.1: Water Management Areas within the Eastern Cape provincial boundary

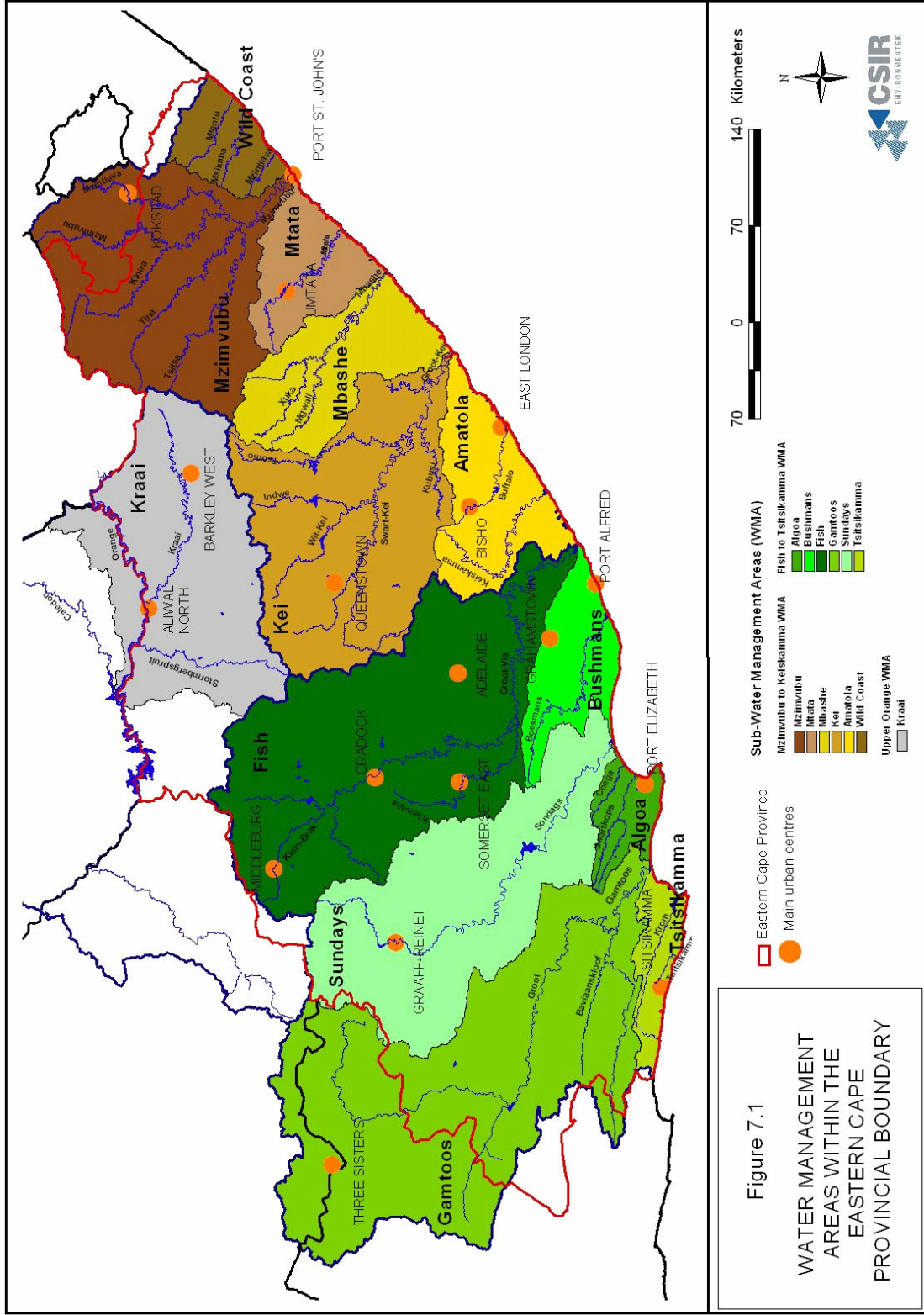


Figure 7.1

WATER MANAGEMENT
AREAS WITHIN THE
EASTERN CAPE
PROVINCIAL BOUNDARY

High levels of nitrates in water can cause health effects in humans when ingested and can also result in algal blooms, eutrophication and a decline in water quality. When measured over time, this indicator provides a measure of the decline or improvement of water in each water management area.

Table 7.1: TIN:PO₄ ratio and orthophosphate concentrations for WMAs in the Eastern Cape Province (DWAF, 2003a)

WMA	TIN:PO ₄ ratio			Orthophosphate concentration (mg/l)		
	1996	2001	2003	1996	2001	2003
Mzimvubu to Keiskamma	9.267	6.925 ↓	8.982 ↑	0.022	0.038 ↑	0.029 ↓
Upper Orange	14.514	1.994 ↓	4.677 ↑	0.007	0.059 ↑	0.041 ↓
Fish to Tsitsikamma	5.509	3.373 ↓	5.315 ↑	0.041	0.065 ↑	0.046 ↓

Note: Values presented are median values

Table 7.1 details the TIN:PO₄ ratio and orthophosphate concentrations for water management areas in the Eastern Cape Province in 1996, 2001 and 2003. These median values give a useful indication of the degree of change in the system. A decrease in the ratio between total inorganic nitrogen and orthophosphate (TIN: PO₄) implies a deterioration of the resource, while an increase in the ratio indicates an improvement in the system. Higher PO₄ concentrations, however, indicate impacted conditions. These results are graphically depicted in Figure 7.2.

Both of the WMAs in the Eastern Cape Province as well as the Kraai sub-WMA have shown decreased TIN:PO₄ ratios between 1996 and 2001, indicating a deterioration in the quality of water systems. However, 2003 results indicate elevated TIN:PO₄ ratios in all areas, indicating an improvement in water quality.

Absolute orthophosphate concentration values indicate a similar trend in water quality. Results in 2001 show impacted conditions compared to 1996, while 2003 results show an improvement in all systems.

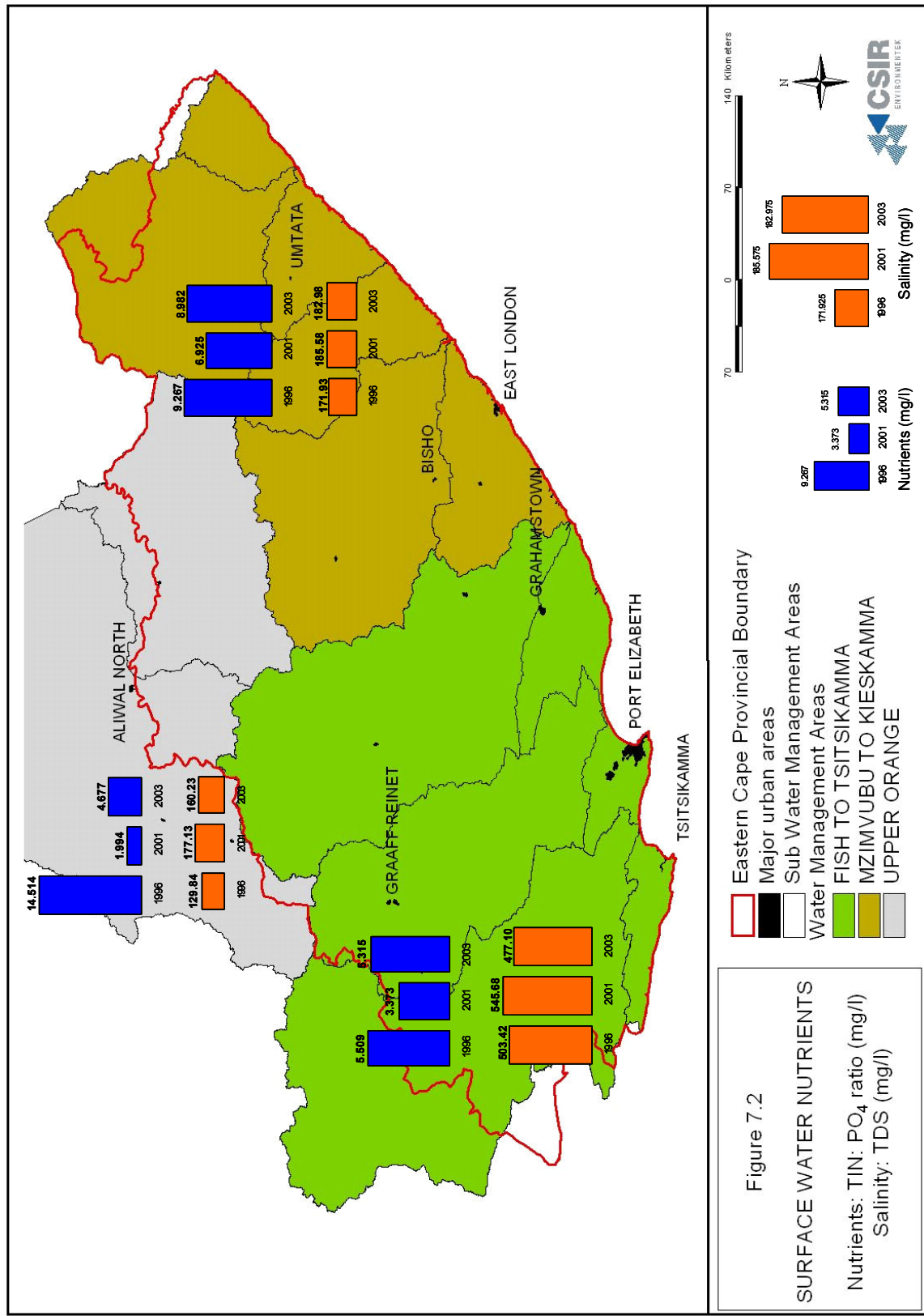
Figure 7.2 also shows salinity results for each WMA. Salinity levels are determined by measuring total dissolved solids (TDS). A high TDS concentration decreases the aesthetic value of the water and makes the water salty and unable to slake thirst (DWAF, 2002b). TDS levels are particularly elevated in the Fish to Tsitsikamma WMA (545 mg/l in 2001). TDS concentrations in this WMA have improved slightly in 2003, but elevated levels appear to be a result of the natural geology of the area, and will continue to be high (DWAF, 2002b).

7.2.2: Surface water toxicity

The measurement of surface water nutrients does not allow evaluation of the potential harm contaminated water may have on both people and ecosystems. This indicator highlights the potential impact of impaired water quality on people and ecosystems. The indicator measures the percentage exceedance of South African Water Quality Guideline values in surface waters (DWAF, 1996a and 1996b) to give an indication of the toxicity of those waters.

One limitation of this measure is the lack of toxicant data for most WMAs in South Africa. Not all monitoring stations measure actual in-stream toxicity, however some toxic compounds (such as heavy metals) are monitored at selected stations where impacts are expected. In the Eastern Cape Province, levels of aluminium, copper, iron, manganese, nickel, lead and zinc are not measured or monitored in any of the water courses. The reason for this is that there is very little industrial activity which may cause elevated levels of these metals (such as mining).

Figure 7.2: Surface water nutrients



Of the constituents which are measured (pH, EC, TDS, Ca, Mg, Na, K, Cl, SO₄, F, NO_x and NH₄), the highest percentage exceedance exists in the Upper Orange WMA with nearly 80% of samples exceeding the DWAF industrial water quality guideline for pH. Another high exceedance rate exists in the Fish to Tsitsikamma WMA, with 74% and 70% of water samples exceeding the DWAF irrigated water quality guideline for electrical conductivity (EC) and TDS, respectively. In the same water management area, TDS and EC levels exceed both the DWAF drinking water and industrial use guidelines in 52% of cases (see Table 7.2), with chloride and sodium levels exceeding irrigation guidelines in 36% and 57% of samples tested.

These elevated levels make irrigated agriculture more challenging as more salt tolerant crops are required to grow in high salt soils (DWAF, 2002b). According to DWAF (2002b) elevated TDS levels are a result of natural geology in most areas, with the possible exception of those sites near cultivated land or plantations such as the Sundays River at Addo Drift East and the Boesmans River at Donkerhoek. Elevated chloride and sodium levels in the Fish to Tsitsikamma WMA may pose health risks to sensitive individuals. Chloride may produce nausea and vomiting at very high concentrations and high levels of sodium may interfere with heart function (DWAF, 1996a).

Other notable exceedances exist in the Mzimvubu to Keiskamma WMA with nearly 40% of samples exceeding the DWAF irrigated agriculture guideline for EC and TDS and 48% of samples exceeding the pH guideline for industrial use.

Table 7.2: Percentage of samples exceeding DWAF water quality standards (DWAF, 2003a)

Parameter	Mzimvubu to Keiskamma WMA			Fish to Tsitsikamma WMA			Upper Orange WMA		
	Drinking Water Class 1 ⁽¹⁾	Industry Category 3 ⁽²⁾	Agric. Irrigation ⁽³⁾	Drinking Water Class 1 ⁽¹⁾	Industry Category 3 ⁽²⁾	Agric. Irrigation ⁽³⁾	Drinking Water Class 1 ⁽¹⁾	Industry Category 3 ⁽²⁾	Agric. Irrigation ⁽³⁾
pH	0.1	48.3	13	0	1.7	37.6	0	78	7.3
EC	16.2	16.2	39.5	52.8	52.8	74	2.4	2.4	14.6
TDS	14.9	14.9	39.5	52.5	52.5	70.4	7.7	7.7	25.6
Ca	0			2.1			0		
Mg	0.5			7.2			0		
Na	2.5		18.4	19.7		56.6	0		0
K	0			1			0		
Cl	5	13.7	13.7	18.6	35.6	35.6	0		0
SO4	0.2	1.3		4.1	8.8		0	0	
F	0		0.1	6.6		0.5	0		0
NOx as N	0.1		2.1	0		0	0		2.4
NH4 as N	0.1		0.1	0.3		0.1	4.9		0
Al									
Cu									
Fe									
Mn									
Ni									
Pb									
Zn									

Not measured in the Eastern Cape Province

(1) WRC, 1998. Quality of Domestic Water Supplies. Volume 1: Assessment Guide (2nd Edition), WRC, Report no. TT101/98, Pretoria
 (2) DWAF, 1996a. South African Drinking Water Quality Guidelines (2nd Edition), Volume 3: Industrial Use
 Category 3 Industry – cooling water, process water, product water, utility water.
 (3) DWAF, 1996b. South African Drinking Water Quality Guidelines (2nd Edition), Volume 4: Agricultural Use: Irrigation
 # Those chemical parameters for which no % exceedance is given had no attribute data available or had no Target Water Quality Range stipulated, and as such could not be assessed.
 NB: data represented per WMA, therefore some areas of poor water quality may be outside of the Eastern Cape Province.

7.2.3: Groundwater nutrients

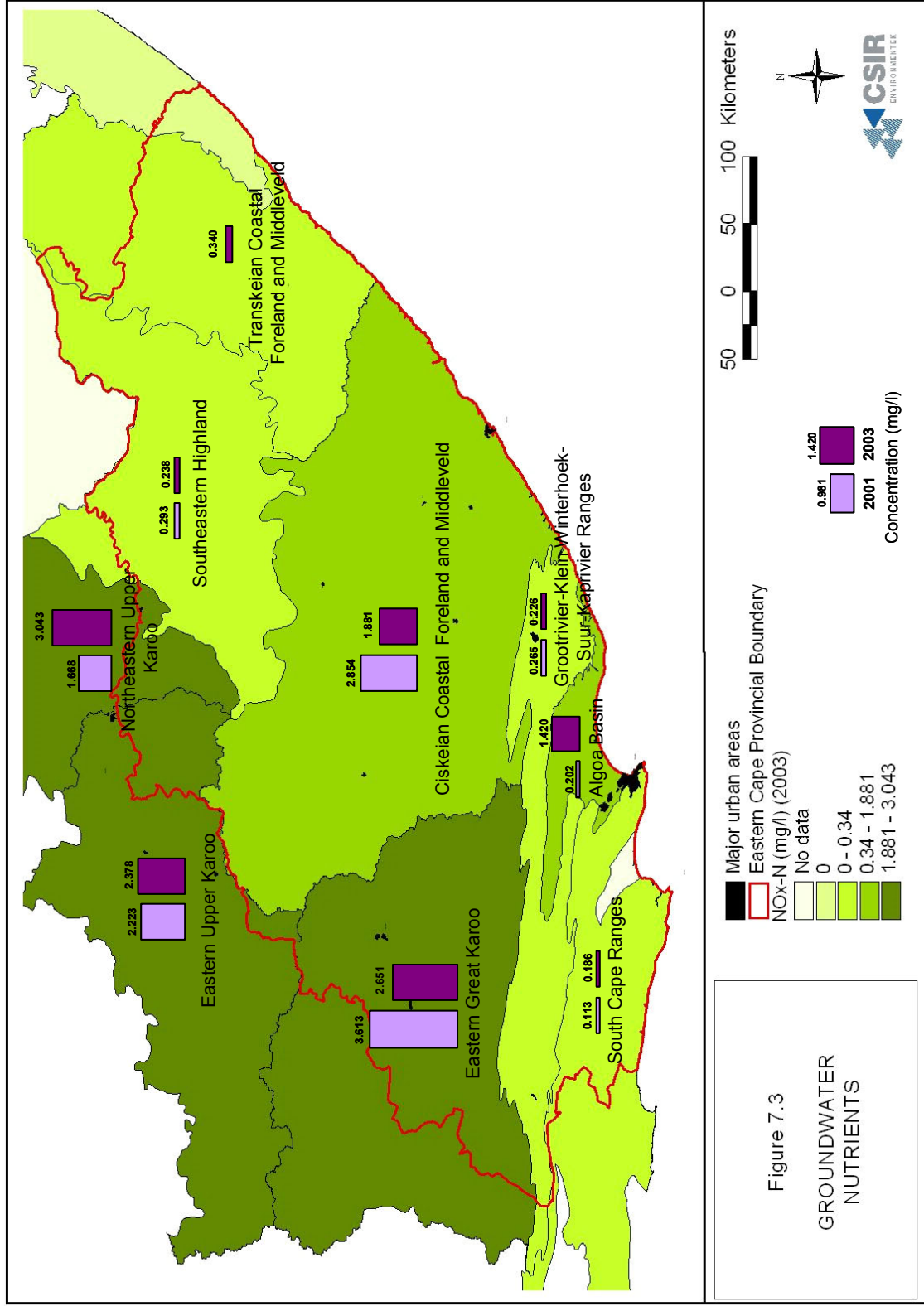
Groundwater resources are vulnerable to land-based activities, difficult to rehabilitate once polluted and are slow to recover from over-exploitation (DWAF, 2002a). The integrity of groundwater resources should be evaluated over time to ensure that these resources are protected and managed. This indicator is a state indicator which measures nutrients in groundwater expressed as the concentration of nitrates and nitrites (mg/l NO_x-N). Increased nitrate concentrations in groundwater can be caused by ineffective sewage disposal and faecal contamination. These increased concentrations can cause diarrhoea and vomiting if ingested by humans. When measuring this indicator, it is important to determine whether elevated concentrations of nitrates and nitrites in the groundwater are as a result of anthropogenic pollution or are typically natural in the area.

There are nine groundwater regions situated within the Eastern Cape Province, as indicated in Figure 7.3. Four of these regions (the Eastern Upper Karoo, Northeastern Upper Karoo, South Cape Ranges and the Algoa Basin) have shown an improvement in groundwater quality, while another four regions (the Eastern Great Karoo, Ciskeian Coastal Foreland and Middleveld, the Southeastern Highland and the Grootrivier-Klein Winterhoek Suur-Kaprivier Ranges) indicate a deterioration of groundwater quality (DWAF, 2003a). The ninth region (Transkeian Coastal Foreland and Middleveld) only has data for 2003, and no trend can therefore be seen.

The target water quality threshold for domestic water is set at 6 mg/l. Ingestion of water with NO_x-N concentrations below this level will not cause any significant health effects (WRC, 1998). The highest NO_x-N concentration exists in the Northeastern Upper Karoo groundwater region (3.043 mg/l), but this concentration is below the target threshold.

Groundwater is extensively utilised for towns and the provision of a rural water supply in the Fish to Tsitsikamma WMA. It is important that this vital water resource is managed well so that nutrient concentrations do not increase to levels presenting significant risk to human health. The median NO_x-N concentration for all sub-WMAs in the Province has increased since 2001 (from 0.981 to 1.420 mg/l in 2003). These elevated concentrations however, should not present any significant health risk to human health if ingested as they are well within acceptable limits for human consumption (WRC, 1998).

Figure 7.3: Groundwater nutrients



7.2.4: Total surface water demand

Over-abstraction of surface and groundwater is also a key concern in the Province. Measuring the total surface water resources used per sector shows the extent to which freshwater resources are already used in the Province, and the need for an adjusted supply and demand management policy (CSD, 2001). If measured against the total availability of water resources in the Province, a reflection of the extent of water resource scarcity with increasing competition and conflict between different water uses and users can be obtained (CSD, 2001). Water scarcity can have far-reaching effects on the sustainability of environmental and ecological systems and can negatively affect regional development.

Water resources used per sector

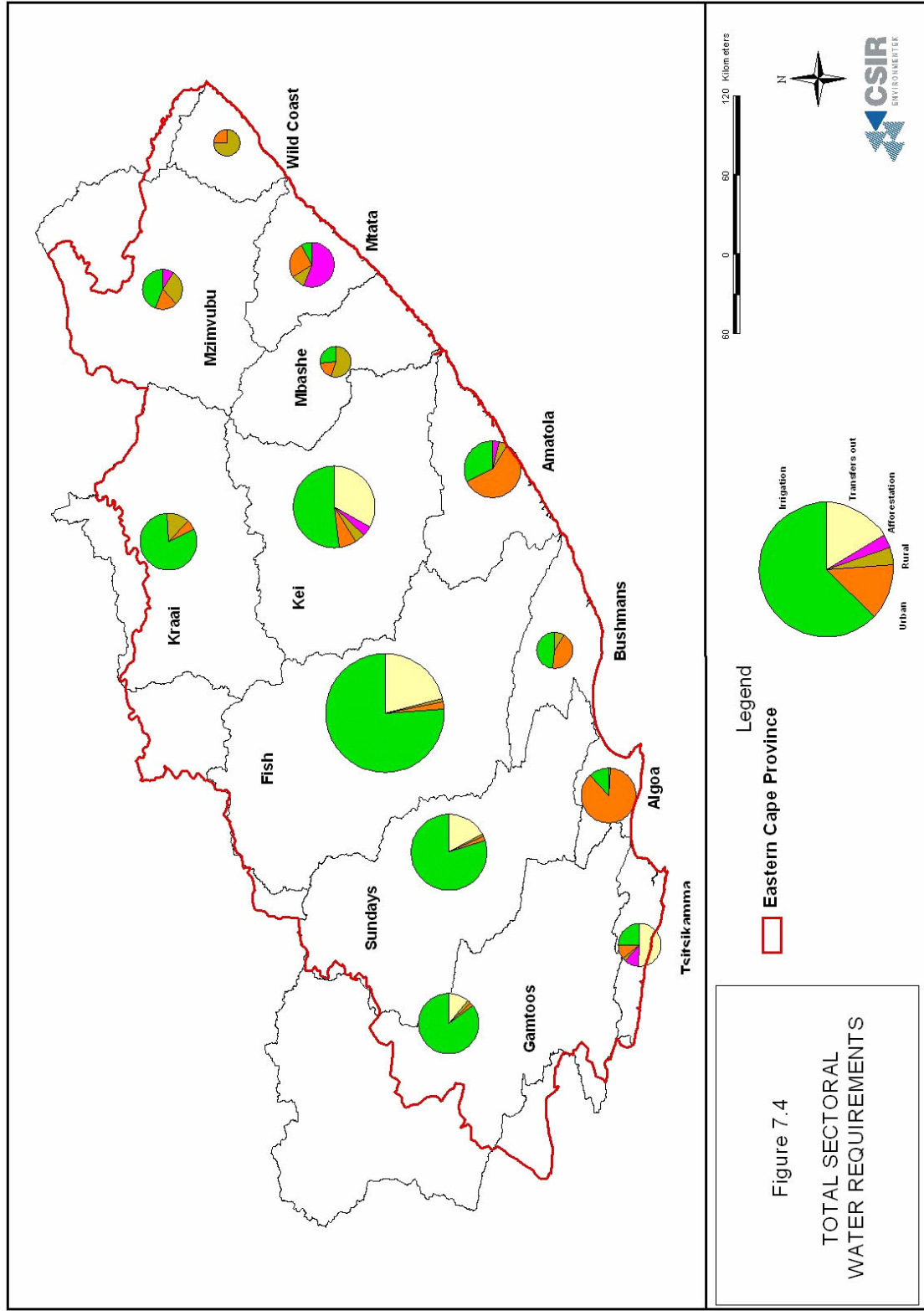
The most common uses of water in the Eastern Cape Province are 'irrigation', 'transfers out', 'urban', 'rural' and 'afforestation'. There are no pressures for water from either the 'mining and bulk industrial' or 'power generation' sectors in the Province. Sectoral water requirements in each sub-WMA are provided in Table 7.3.

Table 7.3: Sectoral water requirements per sub-WMA within the Eastern Cape Province – 2000 (adapted from DWAF, 2002a)

WMAs	Sub-WMAs	Sectoral requirements (volumes in million m ³ /a)						Transfers out	Total local requirements
		Irrigation	Urban	Rural	Mining & bulk industrial	Power generation	Afforestation		
Mzimvubu to Keiskamma	Mzimvubu	15	6	10	0	0	3	0	34
	Mtata	4	13	5	0	0	28	0	50
	Mbashe	3	2	6	0	0	0	0	11
	Kei	135	18	10	0	0	11	85	259
	Amatola	33	60	5	0	0	4	0	102
	Wild Coast	0	1	3	0	0	0	0	4
Fish to Tsitsikamma	Fish	453	12	6	0	0	2	120	593
	Bushmans	11	10	2	0	0	0	0	23
	Sunday	174	5	3	0	0	0	35	217
	Gamtoos	103	3	3	0	0	0	12	121
	Algoa	11	81	1	0	0	0	0	93
	Tsitsikamma	11	5	1	0	0	5	22	44
Upper Orange	Kraai	84	6	13	0	0	0	0	103
Total sector requirement		1037	222	68	0	0	53	274	1654

Total sectoral requirements in the Province amount to 1654 million cubic metres per annum. Total requirements for the Province are graphically depicted for each WMA in Figure 7.4. Figure 7.5 displays the total surface water used per sector. Over half the water resources required in the Province are for irrigation (63%). Several irrigation developments exist in the Mzimvubu to Keiskamma WMA, with intensive cultivation of irrigated land along the main rivers in the Fish to Tsitsikamma WMA.

Figure 7.4: Total sectoral water requirements



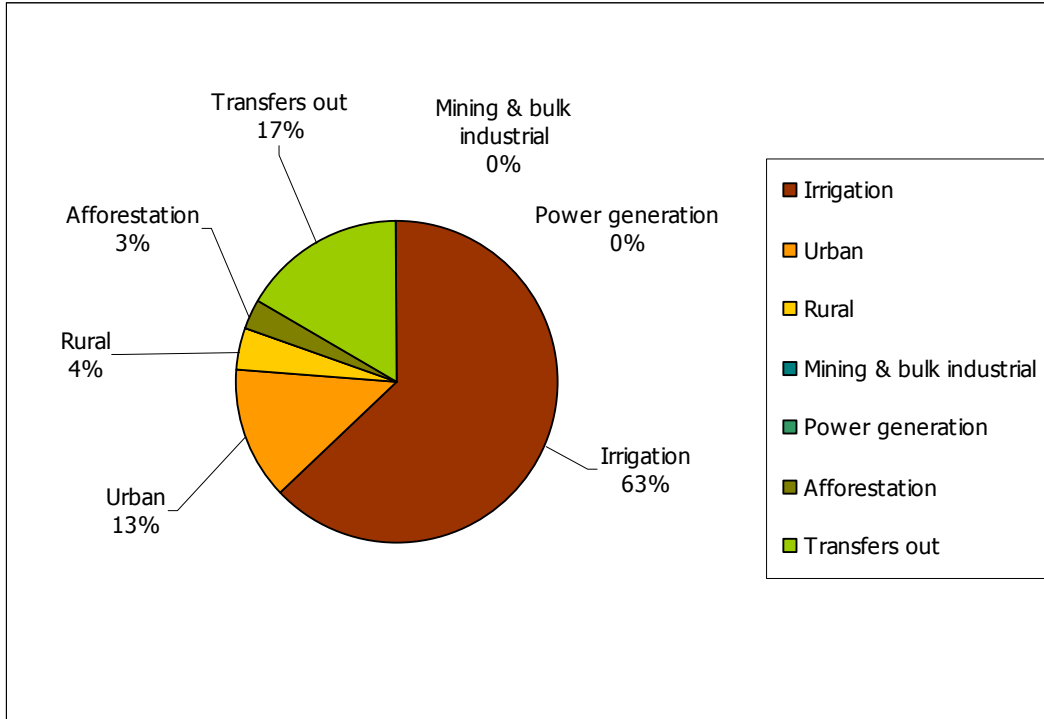


Figure 7.5: Total surface water used per sector (2000) (DWAF, 2002a)

Water availability

The yield from a water resource system is the volume of water which can be abstracted at a certain rate over a specified period of time. Available water, however, refers to all water which can be available for practical application to desired uses. Table 7.4 depicts the volumes of water available from natural sources (surface and groundwater), usable return flows (irrigation, urban and mining/industrial) as well as water availability from transfers into the WMA.

Table 7.4: Water availability per sub-WMA within the Eastern Cape Province – 2000 (million m³/a) (adapted from DWAF, 2002a)

Reporting scale		Natural resource		Usable return flow			Transfers in	Total resource available
WMAs	Sub-WMAs	Surface water	Ground-water	Irrigation	Urban	Mining and bulk industrial		
Mzimvubu to Keiskamma	Mzimvubu	85	3	1	2	0	0	91
	Mtata	129	1	0	6	0	0	136
	Mbashe	112	1	0	1	0	85	199
	Kei	325	14	14	6	0	0	359
	Amatola	122	1	2	25	0	0	150
	Wild Coast	4	1	0	0	0	0	5
Fish to Tsitsikamma	Fish	-21	6	77	6	0	571	639
	Bushmans	16	2	0	4	0	1	23
	Sunday	81	16	29	2	0	120	248
	Gamtoos	119	5	7	1	0	0	132
	Algoa	21	6	1	6	0	68	102
	Tsitsikamma	49	1	1	2	0	0	53
Upper	Kraai	34	10	0	0	0	0	44

Orange								
Total water available in all sub-WMAs in EC boundary	1076	67	132	61	0	845	2181	

Surface water is the most abundant source of water in all water management areas and accounts for almost half of the resource available in the Province (Figure 7.6). Due to the lack of good quality surface water in the Fish sub-WMA, large transfers of good quality water enter the Province into the Fish sub-WMA from the Gariep Dam in the Upper Orange WMA. Total water resources available in each of the WMAs are graphically depicted in Figure 7.7.

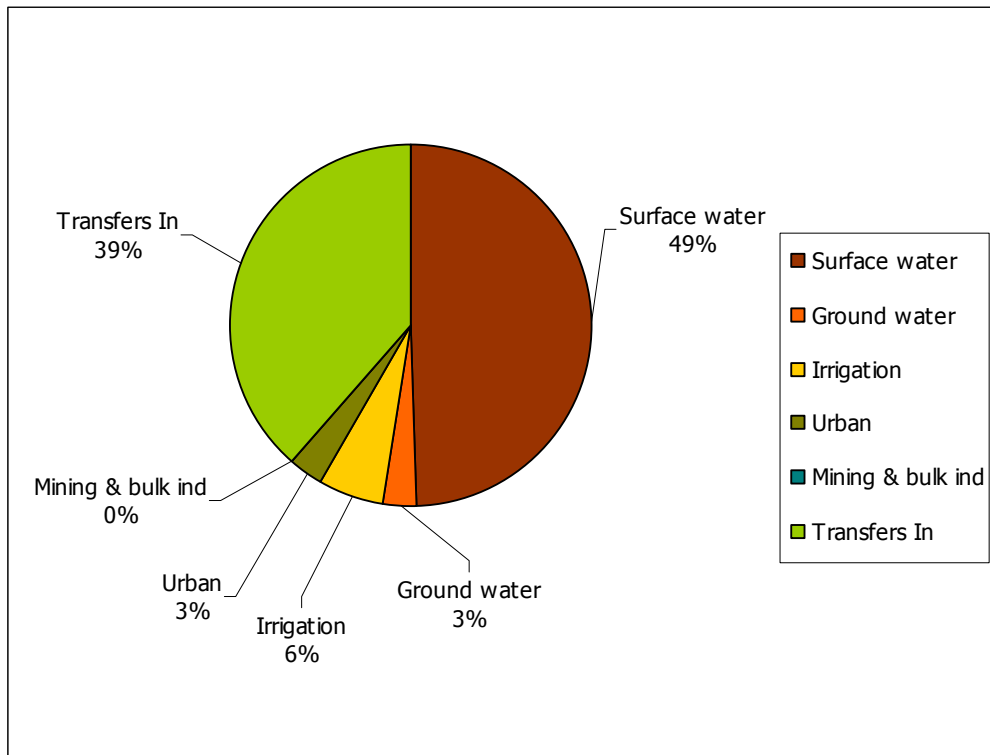
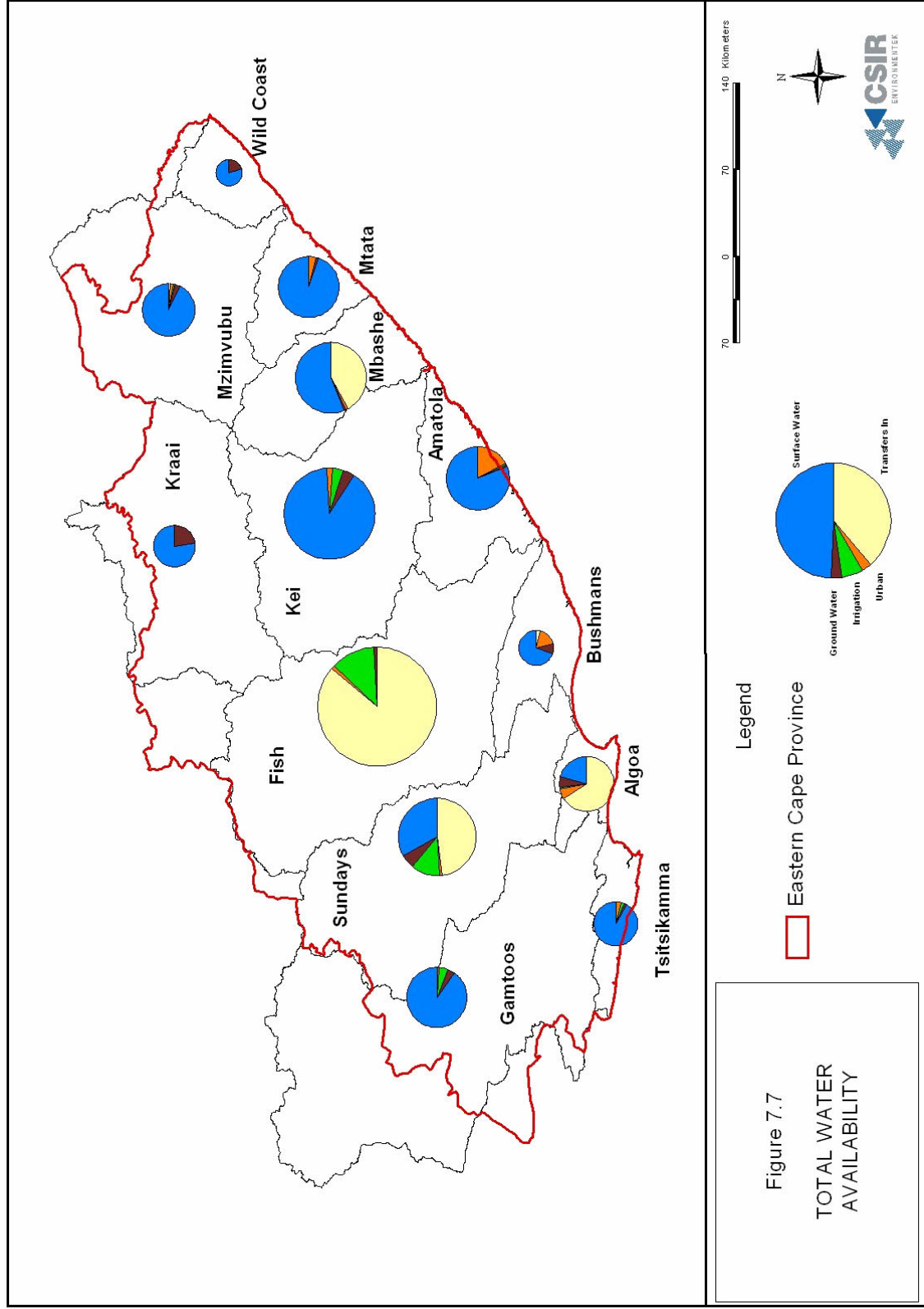


Figure 7.6: Total water available in the Eastern Cape Province – 2000 (DWAf, 2002a)

Figure 7.7: Total water availability



Water requirements and water availability

A comparison of total water required with total water available for use provides a picture of the current or potential stress placed on water resources in the Province. Figure 7.8 displays the total volume of water resources required within the sub-WMAs in the Eastern Cape Province against the total volume of water resources available.

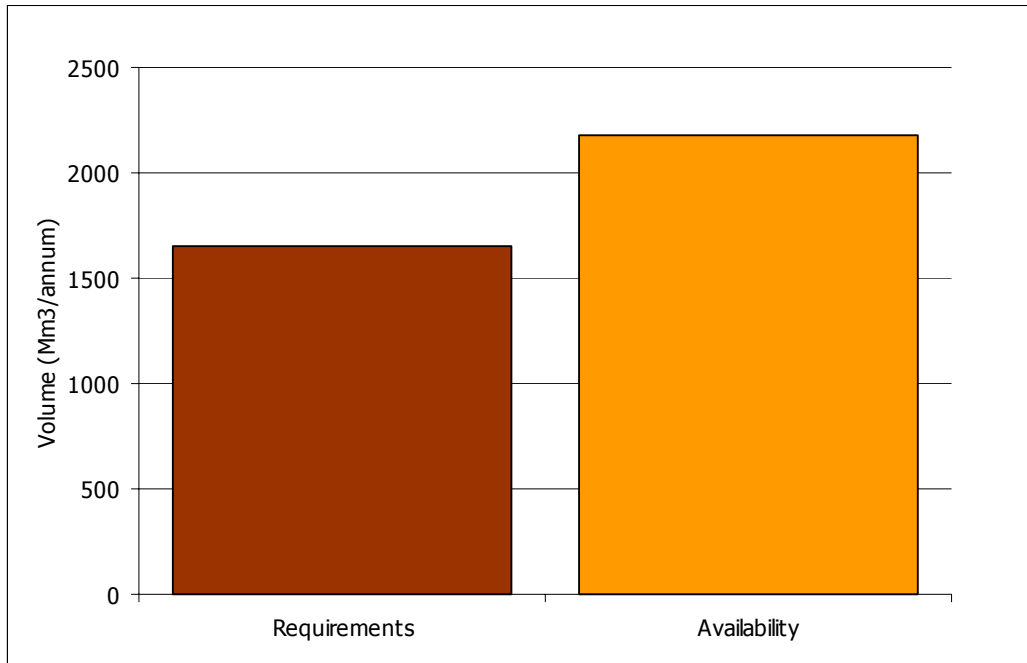


Figure 7.8: Total water resources required vs. available in the Eastern Cape Province – 2000 (DWAF, 2002a)

A comparison of water requirements vs. water availability is given in Figure 7.9 for each sub-WMA in the Province. All areas, except the Kraai sub-WMA have more water available than is currently required, making the Fish to Tsitsikamma and Mzimvubu to Keiskamma WMAs two of the eight WMAs in South Africa without a water deficit (DWAF, 2002a).

Figure 7.9: Water requirements and water availability

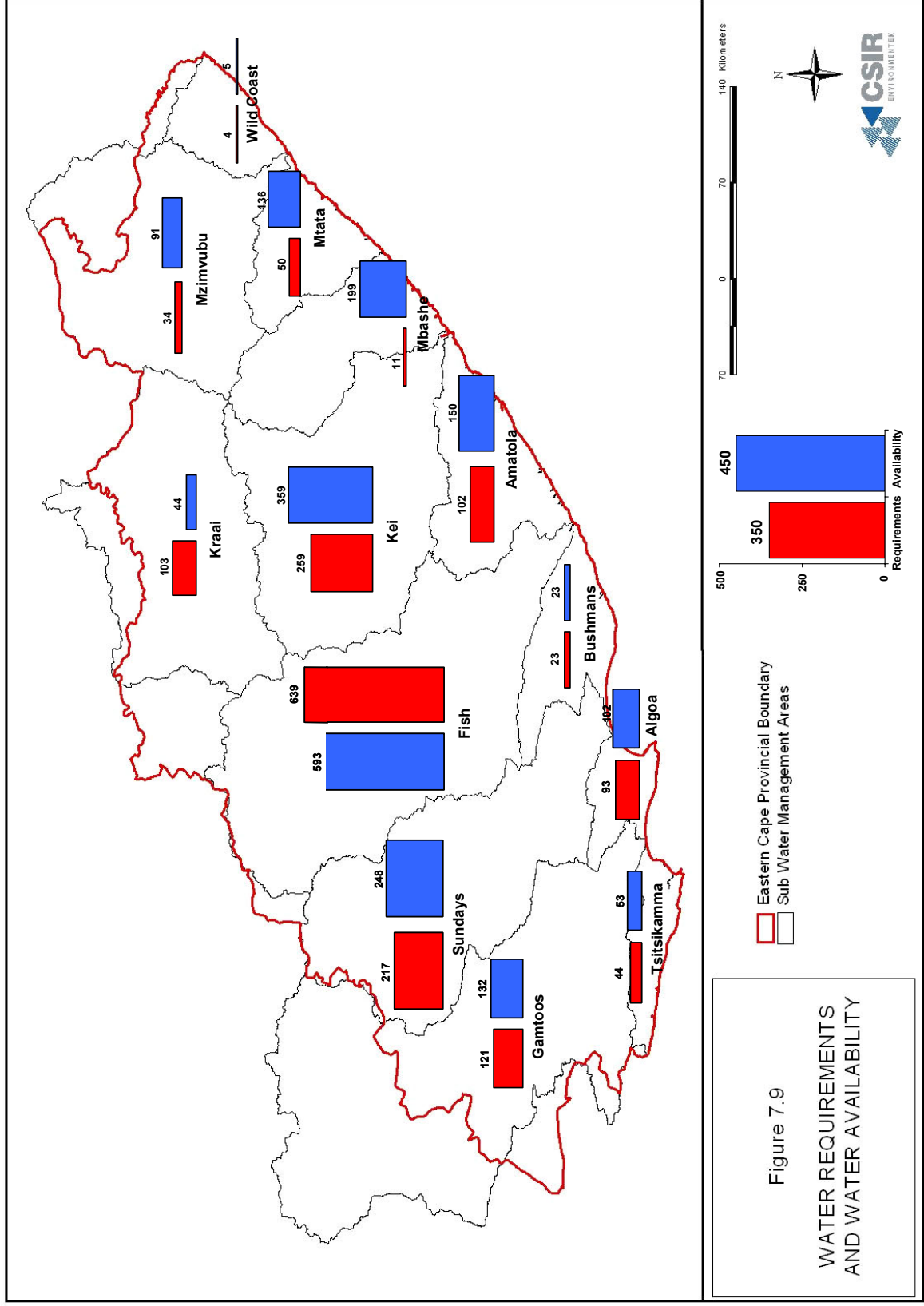


Figure 7.9

WATER REQUIREMENTS AND WATER AVAILABILITY

7.2.5: Effectiveness of water resource management

The fifth indicator in this set attempts to evaluate and report on the effectiveness of water resource management in the Eastern Cape Province. This indicator assesses the effectiveness of water management institutions in protecting, managing and conserving water resources. The institutional framework is one of the most important aspects of water resource management in that it determines the effectiveness of policy implementation (DWAF, 2002a).

An assessment of the effectiveness of water resource management has been ascertained by answering the following questions:

1. Is a catchment management agency (CMA) established in each WMA?
2. Has a governing board been appointed in each CMA?
3. Does a catchment management strategy exist for each CMA?
4. Is the CMA financially sustainable?
5. How many water user associations and forums are active in the Eastern Cape Province?
6. Does capacity exist for ensuring effective water resource management in the Province?

The regional office of DWAF is responsible for managing the Mzimvubu to Keiskamma and the Fish to Tsitsikamma WMAs. Part of the Upper Orange WMA, the Kraai, which resides within the border of the Eastern Cape Province, is managed by the Free State regional office of DWAF.

There is currently no Catchment Management Agency established in either of the 2 WMAs in the Eastern Cape Province. The CMA process has not been established yet and therefore no governing board, strategy or budget exists for either water management area (Daniel, *pers comm.*, 2003).

In response to question 5, there are presently 2 water user associations and one catchment forum active in both WMAs. According to DWAF (Eastern Cape regional office), capacity does exist for ensuring effective water resource management. There are currently 276 staff (including administrative staff, labourers, artisans, scientists, technicians and engineers) in the Water Resource Management Directorate of the DWAF Eastern Cape regional office. Systems and processes are required to ensure that the capacity which does exist is utilised to maximum benefit (Daniel, *pers comm.*, 2003).

7.3: The state of freshwater in the Eastern Cape Province

The water quality indicators have shown that water quality overall has improved since 2001. Levels of orthophosphate have decreased and the TIN:PO₄ ratio has improved, indicating less eutrophication in the Province's water courses. Obviously, point source pollution and site-specific degradation of rivers and dams still occurs and should be managed locally by the relevant water management agency.

The quality of groundwater resources have improved in some areas, but declined in others. These resources are critical in some regions and proper management of these resources is therefore essential.

High TDS, EC, sodium and chloride levels (particularly in the Fish to Tsitsikamma WMA) are indicative of the natural geology of the area and may be influenced by seawater intrusion in the coastal areas. High TDS levels in the Fish sub-WMA have necessitated the transfer of water from

the Upper Orange WMA to the Fish sub-WMA. The water quality guidelines for calcium, magnesium, potassium, sulphate and fluoride have not been exceeded.

Currently there are more water resources available for use in the Province than what is currently being used. This positive position requires ongoing management so that water requirements do not exceed water availability. Management of the demand (requirements) for water has been applied in many WMAs in South Africa and is recognised as a successful way of managing water resources in South Africa (DWAF, 2002a).

The effectiveness of water resource management in the Province has been qualitatively determined in this report through the use of a selection of questions. If monitored over time, these measures may indicate an improvement or decline in the effectiveness of water resource management. The establishment of Catchment Management Agencies in both WMAs is required so that all interests in the WMA can be represented. CMAs will also contribute to ensuring the effective management of water resources and will co-ordinate all water-related activities in the Province. With time this indicator can be amended to track effectiveness of the CMAs.

Chapter 8: Human Settlements

8.1: Introduction

Human settlements cover those places where people live, including both rural and urban communities (Newman *et al.*, 1996). Human settlements typically include the physical structures and services providing material support. Human settlement patterns are influenced largely by economic, social, and political forces (Napier, 2000), to the point where they are often found in locations that defy economic reason. Settlement patterns in South Africa still show the effects of apartheid policies, with vast disparities being evident between former homeland areas and the former Republic of South Africa. These disparities most often (but not always) translate into disparities between rural and urban areas, where rural areas are characterised by a distinct lack of services.

In order to understand human settlements in the Eastern Cape Province, a number of indicators have been selected for monitoring changes. Research has shown that the poorest communities often have the poorest service provision (Thomas *et al.*, 1999). The indicator 'Level of service provision' will provide an indication of the trends in service provision in the Eastern Cape Province. The provision of services could therefore rapidly transform both the urban and rural environments, providing relief particularly to those living in poverty (Department of Housing, 2000). The indicator 'Available landfill lifespan' shows the demand for landfill space in the province. With increasing levels of service provision (refuse removal) landfill space will become critically important in ensuring adequate disposal of waste.

The state of housing in the Eastern Cape Province will be addressed through three indicators, namely; 'Trends in housing type', 'Average number of rooms per house' and 'Average number of people per house'. The provision of housing to communities in the Eastern Cape Province is noted as a priority, however those houses should be of adequate standard and size. Overcrowding in residential estates can lead to various undesirable social and health problems.

The indicator 'Trend in population distribution and structure' is useful in helping us understand future trends in human settlements in the Eastern Cape Province. This indicator can be interpreted together with various indicators in the Poverty chapter in order to more fully understand the dynamics of change.

In interpretation of the indicators, an inference can be made that Cacadu and Amatole District Municipalities represent the areas of better economic standing with O.R. Tambo and Alfred Nzo being on the other end of the scale. Demographic data and datasets on access to housing and services reported in the 2001 Census confirm that, for the most part, low levels of development and productive economic activity prevail over large parts of the Eastern Cape Province.

8.2: Key Indicators

The indicators selected to monitor human settlements in the Eastern Cape Province are listed below:

- Level of service provision (water, sanitation, waste and telephones);
- Available landfill lifespan;
- Trends in housing type;
- Average number of rooms per house;
- Average number of people per house; and

- Trend in population distribution and structure.

8.2.1: Level of service provision

According to the National Population Unit (Department of Social Development, 2000), South Africa's priorities are to meet the basic needs of all South Africans (in terms of water, sanitation, health services, education, housing and infrastructure) to redress disparities in wealth and access to resources, to create employment, to stimulate and sustain economic growth and to improve the quality of life of all South Africans.

This indicator examines the level of service provision in the various Eastern Cape District Municipalities. Services assessed include water, sanitation, waste and telephones. According to Abrahams and Goldblatt (1997) there are three priority services required for the promotion of health, convenience and quality of life: water; sanitation; and electricity (addressed in Chapter 4). Other services such as telecommunications are important for economic development and improvement of quality of life. The Eastern Cape Spatial Development Plan (Eastern Cape Office of the Premier, 2001), regarding access to services in the Province, underscores the well-described disparities between the former Ciskei and Transkei areas and the remainder of the Province.

Water

Access to safe water is essential to good health. Many rural areas obtain their water from natural sources (e.g. boreholes, springs, rivers, streams and rain-water tanks), thus exposing the resident communities to water-related diseases such as cholera. The Water Services Act 108 of 1997 (RSA, 1997a) stipulates that everyone has the right of access to a basic water supply (i.e. the prescribed minimum standard of water supply services necessary for the reliable supply of a sufficient quantity and quality of water to households, including informal households, to support life and personal hygiene). It is evident from Figure 8.1 that between 17% and 38% of households in the Chris Hani, Ukhahlamba, O.R. Tambo and Alfred Nzo District Municipalities obtain water from natural sources. With various initiatives currently in place (Department of Water Affairs and Forestry's Water Supply and Sanitation Policy, and the provision of funding to District Municipalities to implement these projects), the backlog is being addressed. In contrast, the majority of households situated in the more urbanised municipalities of Cacadu, Amatole and Nelson Mandela Metropolitan Municipality have access to piped water (Statistics South Africa, 2003).

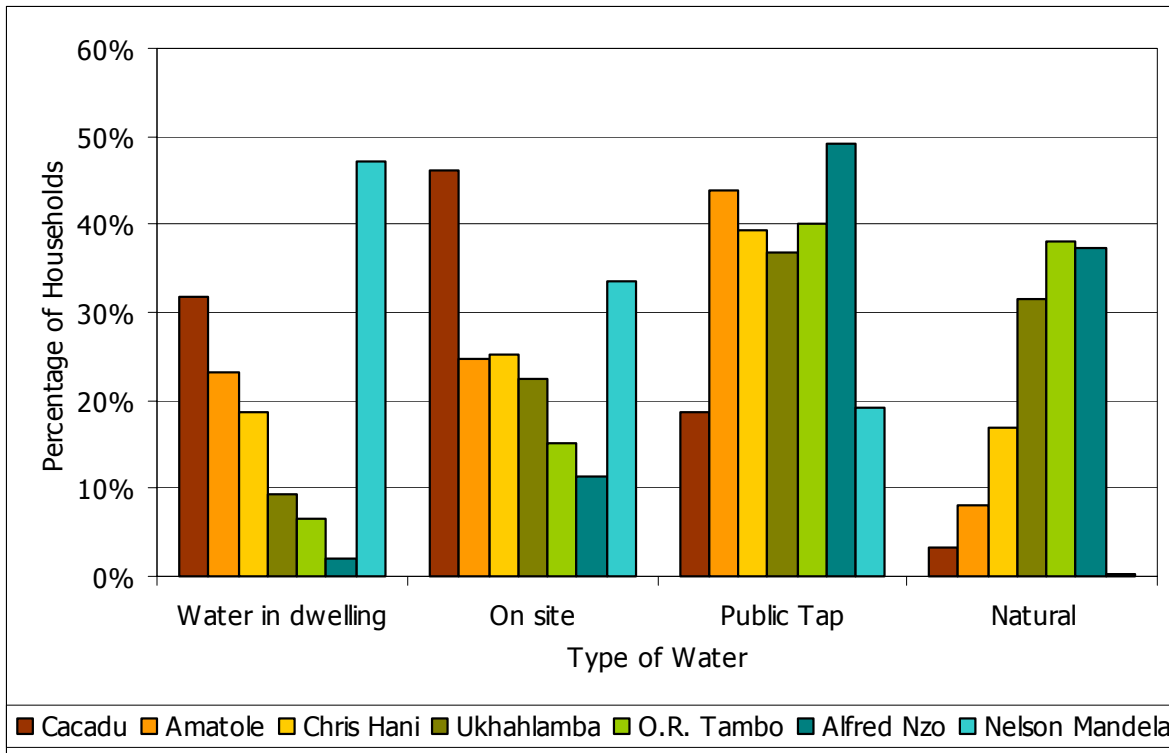


Figure 8.1: Access to water in the Eastern Cape Province – 2001 (Statistics South Africa, 2003)

Sanitation

This indicator measures the type of sanitation available for use by those living in the Eastern Cape. The type of sanitation varies from water-borne sewage, ventilated pit latrine, and bucket to no sanitation at all. The Water Services Act 108 of 1997 (RSA, 1997a) states that everyone has the right to 'basic sanitation' (the prescribed minimum standard of services necessary for the safe, hygienic and adequate collection, removal, disposal or purification of human excreta, domestic waste-water and sewage from households, including informal households).

Alfred Nzo and O.R. Tambo District Municipalities are reported to have the lowest levels of service, with 3% to 8% of households having access to waterborne sanitation, compared to 51% and 37% in the Cacadu and Amatole District Municipalities (refer to Figure 8.2). Informal settlements are assumed to account for most of the households with no facilities. In the former homeland areas a positive correlation is evident between waterborne sewerage systems and water in the dwelling. The dominance of pit latrine systems in rural municipalities is cause for concern, not only because of hygiene, but also the potential pollution of groundwater.

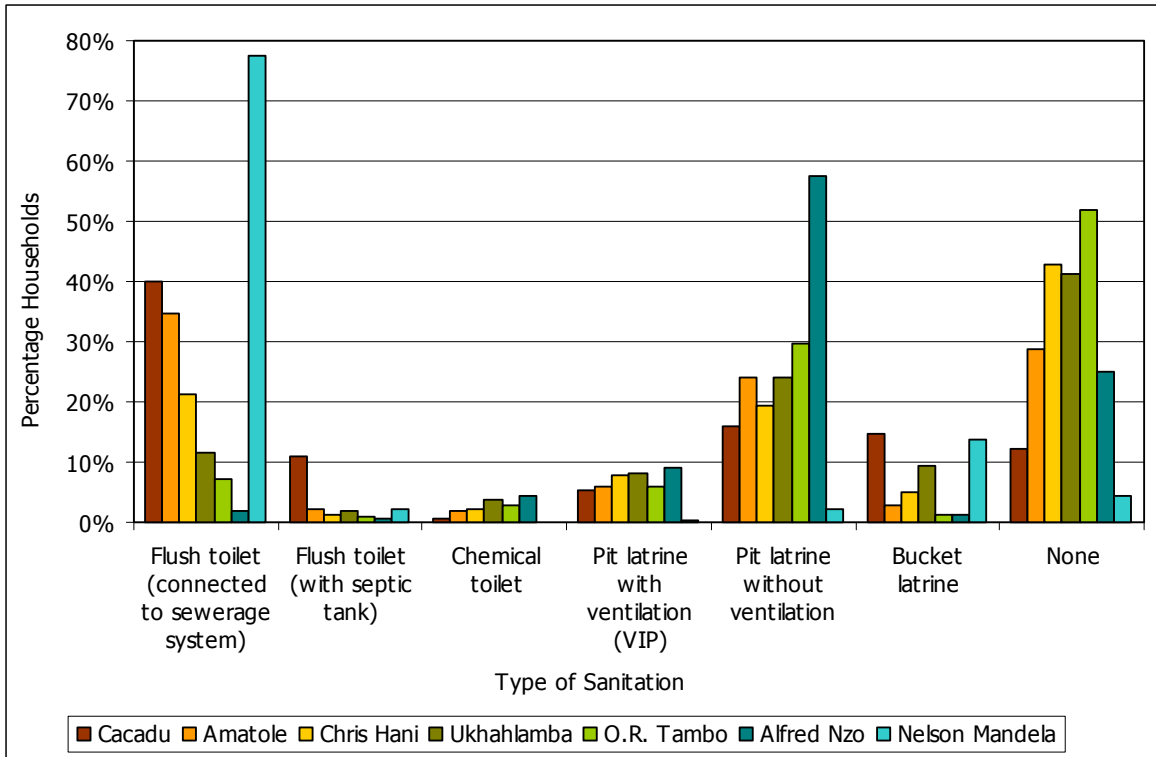


Figure 8.2: Access to sanitation in the Eastern Cape Province – 2001 (Statistics South Africa, 2003)

Waste

Figure 8.3 reflects the state of waste removal in the Eastern Cape. Waste removal is generally poor, particularly in rural areas, namely the Chris Hani, Ukhahlamba, O.R. Tambo and Alfred Nzo District Municipalities. Little formal waste collection and disposal takes place in these Municipalities, and in rural areas these communities generally dispose of waste themselves. A study conducted in the Mbashe Municipality of the Amatole District Municipality (in the former Transkei) highlighted that the local authority in the Willowvale area has no designated dumping site or refuse collection service. This has led to the dumping of waste and pollution on the terrestrial coastal environment (Britz *et al.*, 2001).

In contrast, the local authorities in the Amatole and Cacadu District Municipalities and the Nelson Mandela Metropolitan Municipality are able to collect 40%, 68% and 86% respectively, of the waste from households in their District Municipalities on a weekly basis.

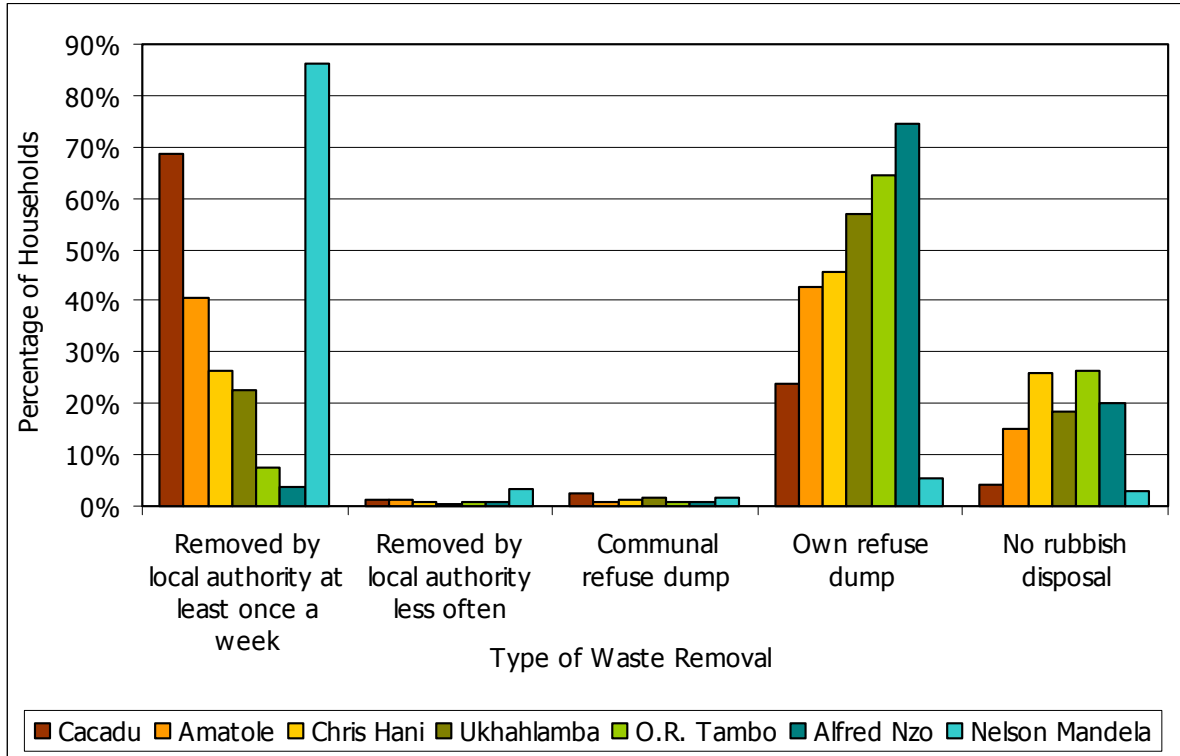


Figure 8.3: Access to waste removal in the Eastern Cape Province – 2001 (Statistics South Africa, 2003)

Telephones

In South Africa 42% of households have access to either a telephone in their dwelling and/or a cellular phone (Statistics South Africa, 2003). A third of all Eastern Cape households have access to the same facility, the second lowest in the country (Limpopo Province at 28%). The Chris Hani, Ukhahlamba, O.R. Tambo and Alfred Nzo District Municipalities have access to telecommunications (telephone in dwelling & cell phone, telephone in dwelling only, and cell phone only) at 24%, 18%, 19% and 14% respectively. This is substantially lower than the national average of 42%. The Nelson Mandela Metropolitan Municipality has a 52% access to this facility, which is higher than the national average (Figure 8.4).

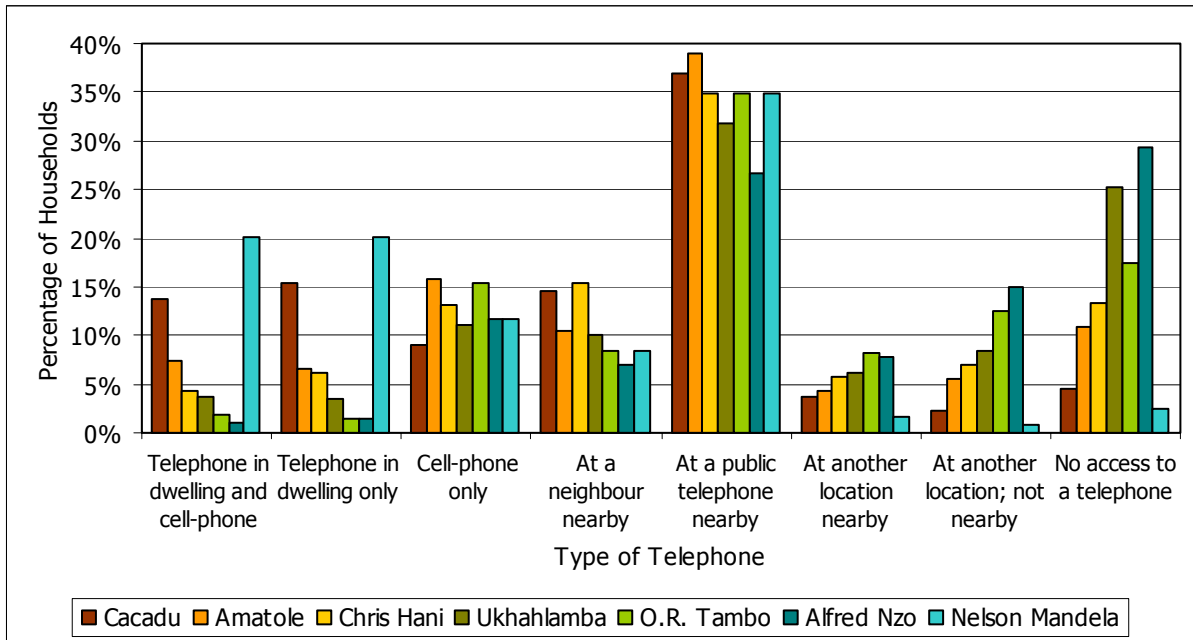


Figure 8.4: Access to telecommunication facilities in the Eastern Cape Province – 2001 (Statistics South Africa, 2003)

8.2.2: Available landfill lifespan

This indicator reports on the availability of space in landfills around the Province. The available space (termed ‘airspace’) is measured in years, and the indicator reflects the number of years remaining in which the current rate of waste disposal can be accommodated.

A study was commissioned by DEAT to undertake a baseline data-collection exercise aimed at all landfills in the Eastern Cape Province that are operated by regional and local authorities (DEAT, 2001). With certain exceptions due to time and budgetary constraints, industrial and mine landfills were excluded from this study. The extent of landfill compliance with the Department of Water Affairs and Forestry (DWAF) ‘Minimum Requirements for Waste Disposal by Landfill’ (DWAF, 1998) and the status of permitting were also assessed. The findings and recommendations of the study were to be used in the formulation of the National Waste Management Strategy (NWMS). Although the study was undertaken before the demarcation of new District Municipality boundaries, extracts from the study, which can be used as results for this State of the Environment Report, are included in this chapter.

Based on the findings of the investigation (DEAT, 2001), it was concluded that there were 101 operational waste disposal sites in the Eastern Cape Province, 74 sites reported from questionnaires, 7 sites from permitting records and 20 sites estimated by projection. It was estimated that there were approximately one million cubic metres of acceptable landfill airspace and some six million cubic metres of potentially acceptable landfill airspace in the Eastern Cape Province. Based on current waste disposal rates, there are shortfalls of acceptable airspace in the Drakensberg, Kei, Western and Wild Coast regions. The questionnaire returns reflected that only 8% of landfills in the Eastern Cape Province complied with DWAF Minimum Requirements (DWAF, 1998), 54% could potentially comply and 38% are currently unacceptable. Of the 37

landfill permits applied for, 43% had been granted. Only 19% of landfills in the Eastern Cape Province are permitted (DEAT, 2001).

8.2.3: Trends in housing type

This indicator reports on the types of dwellings per Eastern Cape District Municipality. Dwelling type varies from formal housing to informal dwellings. The indicator provides some reflection of the conditions in which residents of the Eastern Cape Province live.

The Government has made significant progress in the provision of formal housing, especially to the poorest of the poor. However, a backlog still exists as more than 10% of households in the Eastern Cape still live in an 'Informal dwelling/shack in the backyard' or in an 'Informal dwelling/shack not in a backyard' (Figure 8.5).

The majority of households in the O.R. Tambo (69%) and Alfred Nzo (71%) District Municipalities are reported to reside in 'Traditional dwellings'. The 2001 Census also records a significant number of households residing in such dwellings in the Amatole District Municipality (33%), the Chris Hani District Municipality (43%) and the Ukhahlamba District Municipality (34%) as shown in Figure 8.5. Informal dwellings were more common in the Nelson Mandela Metropolitan Municipality (23%) and Amatole District Municipality (17%), which is consistent with the high number of people seeking employment in these areas.

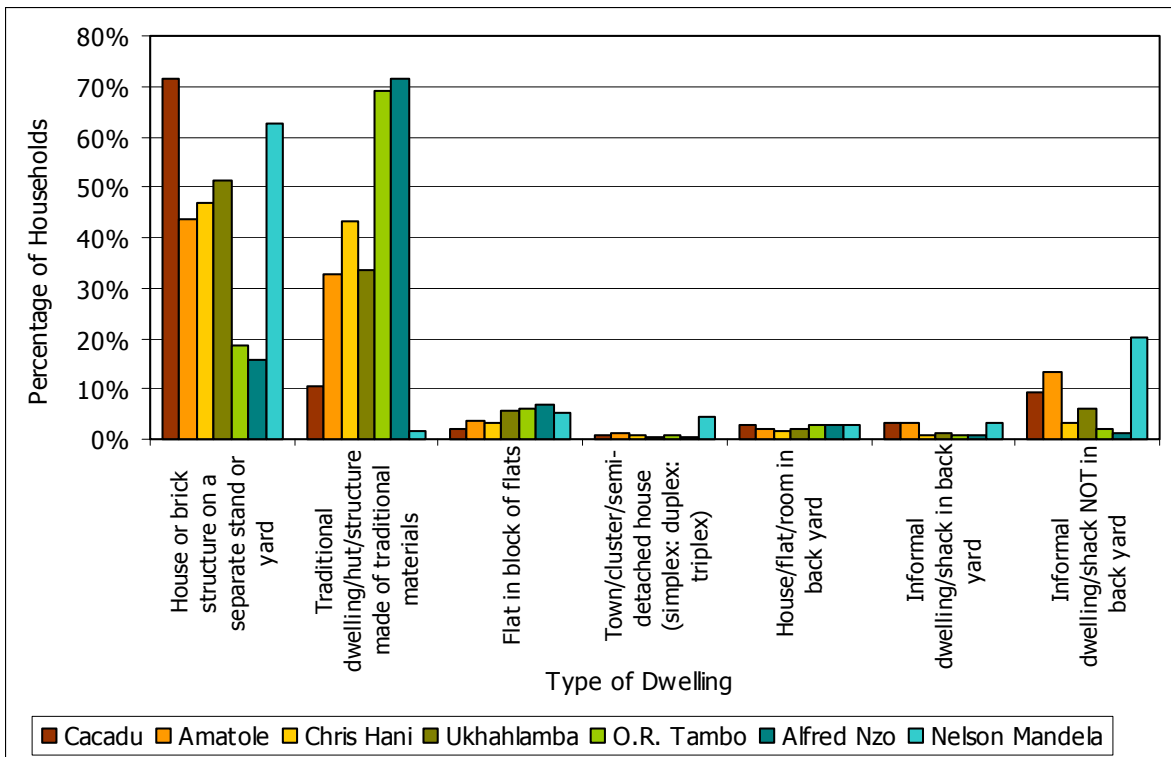


Figure 8.5: Dwelling types in the Eastern Cape Province – 2001 (Statistics South Africa, 2003)

8.2.4: Average number of rooms per house

A different indicator that addresses the state of housing in the Eastern Cape Province is the 'Average number of rooms per house'. Houses that are inadequate in size could lead to various undesirable social and/or health problems. This indicator should be studied in conjunction with the following indicator, 'Average number of people per house' in order to establish the extent of over-crowding in the region. The statistics available to measure this indicator (Statistics South Africa, 2003) have not been provided per District Municipality. The data thus reflects a composite picture of the Province.

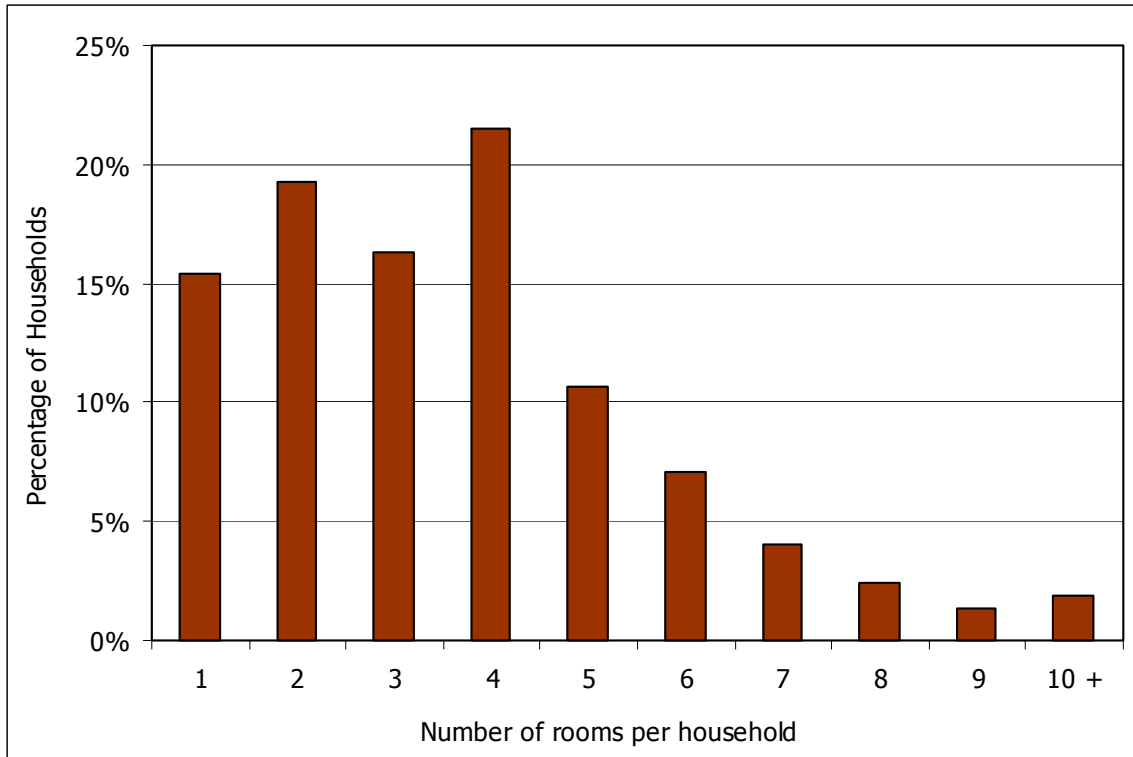


Figure 8.6: Number of rooms per household in the Eastern Cape Province – 2001 (Statistics South Africa, 2003)

The number of rooms per household referred to in Figure 8.6 includes kitchens and outside rooms used by the same household, but exclude bathrooms and toilets. Single room households include those households sharing a single room with another household (or households). Figure 8.6 reflects that just over 15% of Eastern Cape households live in 1-room dwellings while 19% of households reside in 2-room dwellings. This situation is undesirable and could contribute to over-crowding in the Province.

8.2.5: Average number of people per house

This indicator, together with the indicator 'Average number of rooms per house', will provide some indication of the extent of residential over-crowding in the Eastern Cape Province.

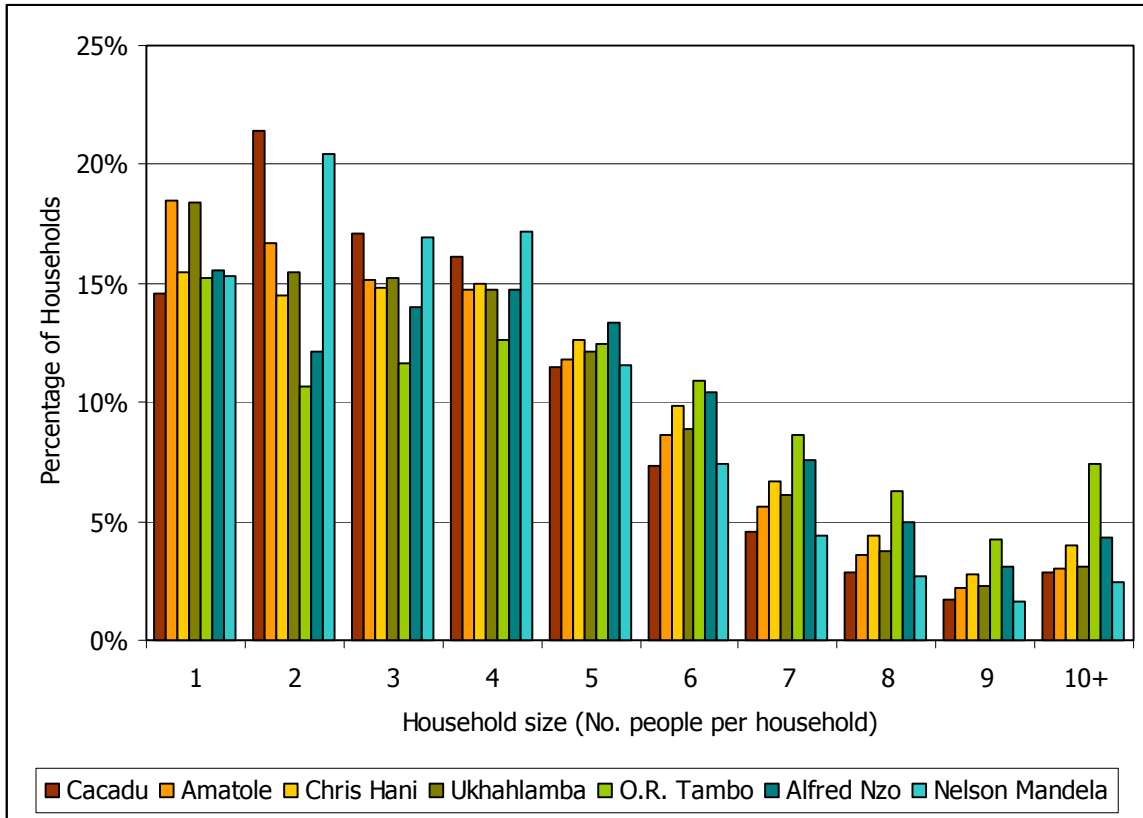


Figure 8.7: Number of people per house in the Eastern Cape Province – 2001 (Statistics South Africa, 2003)

It has been determined from the data used to prepare Figure 8.7 that 39% of Eastern Cape households have 5 or more people per household. Considering that approximately 34% of Eastern Cape households live in dwellings with 2 rooms or less, over-crowding may be a potential problem in some households in the Province. The O.R. Tambo District Municipality has the highest number of large households, with more than 37% of households having 6 people or more. The Cacadu District Municipality has more than 36% of households with 2 or less people.

8.2.6: Trend in population distribution and structure

Population distribution

This indicator highlights the proportion of the population that is currently residing in the various Eastern Cape District Municipalities, and subsequently provides information on the distribution of rural and urban populations. The movement of populations to new areas may place pressure on the environment at a rate that is faster than the natural environment can handle, or at a speed at which environmental responses cannot be put in place soon enough.

The 2001 Census gave the total population of the Eastern Cape Province as 6 436 763 persons, an increase of 2.1% compared to the 1996 Census. The Eastern Cape Province has 14.4% of the country’s population residing in it. Figure 8.8 reflects that 15.4% of the Province’s population live in the Nelson Mandela Metropolitan Municipality, while 27% reside in Amatole District Municipality and 24% live in the O.R. Tambo District Municipality.

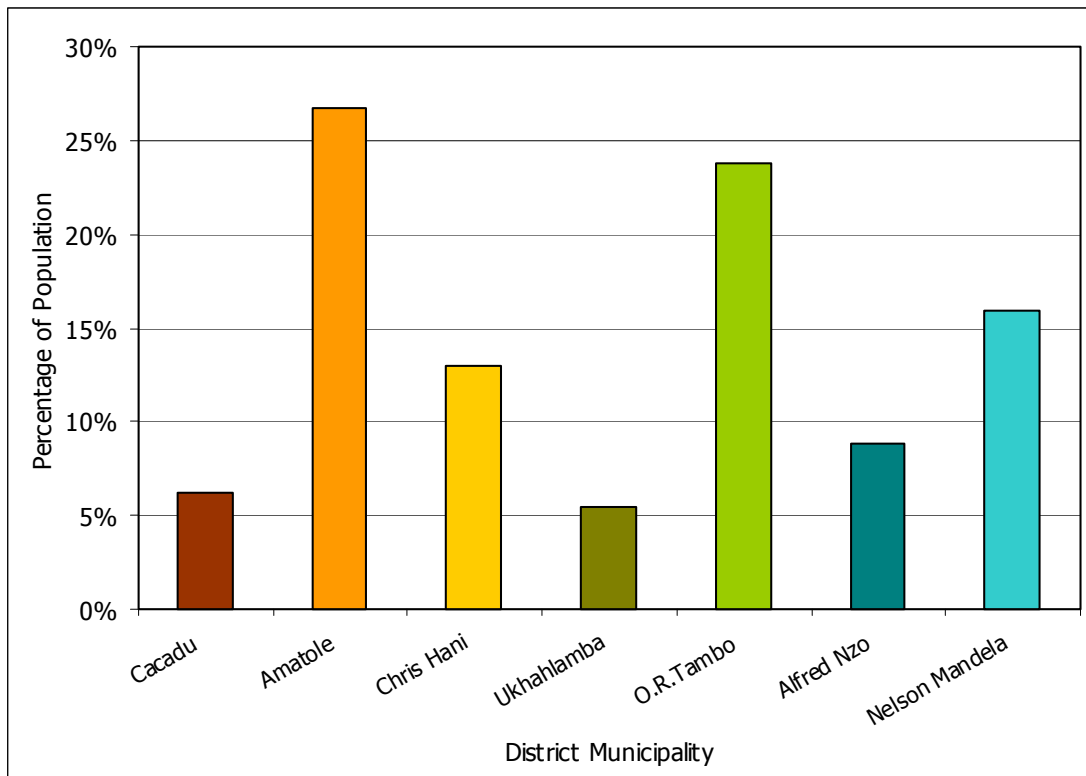


Figure 8.8: Population distribution in the Eastern Cape Province – 2001 (Statistics South Africa, 2003)

Whilst there is some correlation in the core urbanised areas of (especially) the Nelson Mandela Metropolitan Municipality and Buffalo City Municipality between a higher population density and relatively improved development indicators (e.g. education/literacy, household income, and access to services), these areas also tend to include the highest numbers of households residing in informal dwellings (Eastern Cape Office of the Premier, 2001). In contrast, other areas of relatively high population density, including the former Transkei areas falling within the Alfred Nzo and O.R. Tambo District Municipalities, as well as portions of the Ukhahlamba, Chris Hani and Amatole District Municipalities, consist of fragmented and dispersed settlement patterns, with correspondingly low economic activity thresholds (Eastern Cape Office of the Premier, 2001).

Population structure

Results of the 2001 Census (Figure 8.9) reflect that 35% of the Province's population is below 15 years of age as opposed to the national average of 32%. The Chris Hani, Ukhahlamba, O.R. Tambo and Alfred Nzo District Municipalities, which make up the majority of the rural area within the Province, have approximately 40% of the population younger than 15 years. However, the Nelson Mandela Metropolitan Municipality, which reflects a more urban area of the Province, has 25% of the population younger than 15 years, while 37% of the population is aged 15 to 34 years and 32% of the population is aged 35 to 64 years. All District Municipalities show a very low population in the over 65 year age-group.

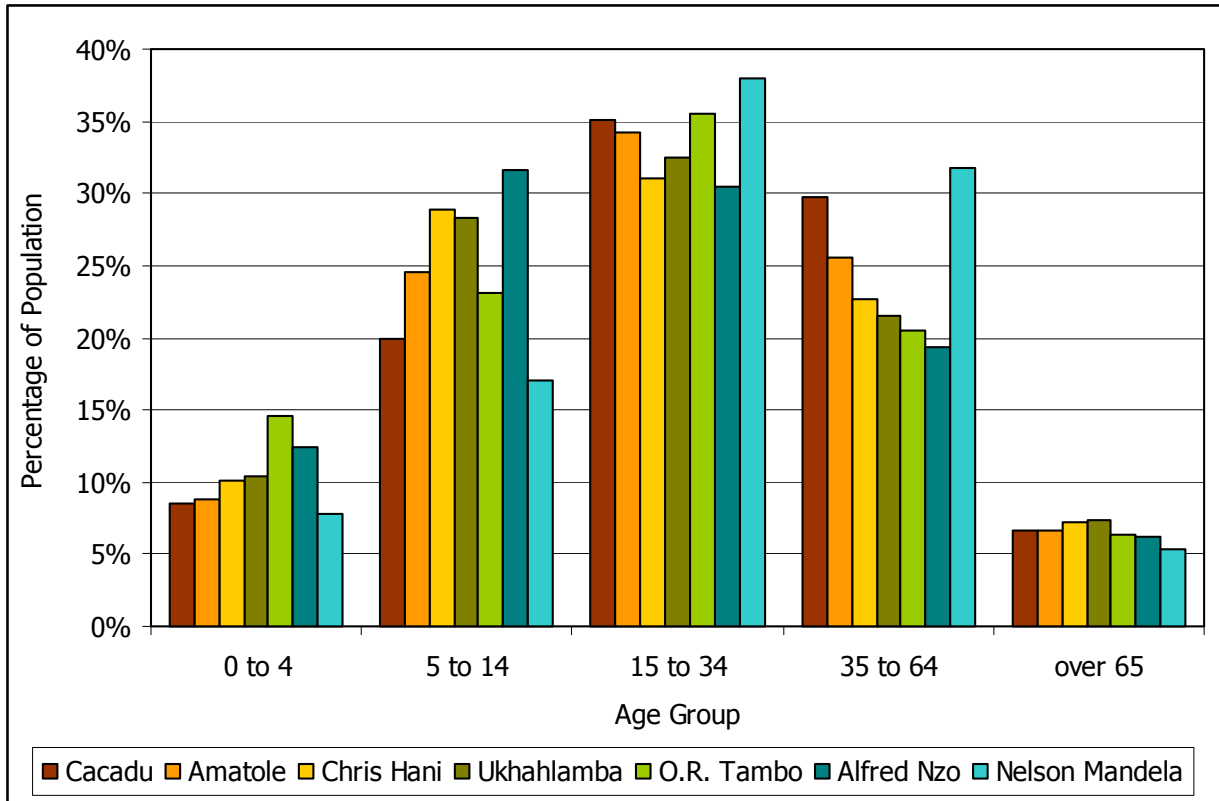


Figure 8.9: Age distribution in the Eastern Cape Province – 2001 (Statistics South Africa, 2003)

The relatively smaller young population group (below 15 years) in the Nelson Mandela Metropolitan Municipality can be attributed to migratory labour, where many people leave Eastern Cape in search of work in other provinces such as Gauteng, Western Cape and KwaZulu-Natal. This phenomenon can have important consequences for the Province, as large numbers of economically active people leave the Province, leaving mainly women, children and the aged behind. The people left behind often live in impoverished circumstances, dependent on subsistence agriculture, remittances and state welfare/pension grants (Eastern Cape Office of the Premier, 2001).

8.3: The state of human settlements in the Eastern Cape Province

The state of human settlements can primarily be defined in terms of the level of service provision, housing and development, population dynamics, although economics, infrastructure and spatial layout are also common descriptors.

Most of the backlog in basic service provision in the Province can be found in the former homeland areas, mostly located in the O.R. Tambo, Alfred Nzo and Chris Hani District Municipalities, with the O.R. Tambo District Municipality having almost 40% of households dependent on natural sources of water. Between 30 and 50% of households in the Amatole, Chris Hani and O.R. Tambo District Municipalities have no sanitation. Similar patterns are observed for many of the other indicators, where most backlogs are experienced in the former homeland areas.

Increased pressure on housing is also experienced in more urban District Municipalities, with more than 23% of dwellings in the Nelson Mandela Metropolitan Municipality being informal dwellings. The rate of housing delivery must surpass the in-migration of people if the housing deficit is to be relieved. In addition, more than a third of Eastern Cape households live in dwellings with two rooms or less.

The population distribution in the Province shows the bulk of the population living in the Amatole and O.R. Tambo District Municipalities (27% and 24% of the population respectively), while 16% lives in the Nelson Mandela Metropolitan Municipality. The population of the Eastern Cape Province is relatively young (the bulk of the population is under 34 years of age), with some areas showing a larger young population than others.

In order to address some of the spatial inequalities in the Province, policy interventions such as the Integrated Spatial Development Strategy seek to address the spatial challenges of rapid settlements in town environs, as well as settlements along main roads in the more rural areas of the Province. In addition, the Provincial Growth and Development Plan (PGDP) will provide the strategic framework for a swift improvement in the quality of life of the poorest people living in the Eastern Cape Province over the next ten years (Eastern Cape Office of the Premier, 2003).

Chapter 9: Land

9.1: Introduction

Human beings are dependent on terrestrial ecosystems for sustenance, raw materials, and space for housing and recreation. The mining, agricultural, forestry and tourism sectors also rely heavily on the land resource base. The condition of the land and how it is used and managed is therefore vital for existence (DEAT, 1999).

The land of the Eastern Cape Province is characterised by extensive areas of thicket vegetation which is affected by agricultural practices, industrial expansion, invasion of alien species and the over-grazing of domestic herbivores (Coastal & Environmental Services, 2003). Historically, much of the prime agricultural land was reserved for relatively few commercial farmers while the majority of the people were forced into marginalised areas. Many people therefore had to depend on subsistence farming for survival, resulting in exploitative and wasteful resource use patterns (Coastal & Environmental Services, 2003). Subsistence agriculture is thus the predominant form of agriculture in the Eastern Cape Province, and incorrect management practices have led to serious veld degradation. The National State of the Environment Report (DEAT, 1999) has identified the Eastern Cape Province as one of the provinces with the highest levels of land degradation. Furthermore, bush encroachment (transformation of a grass-dominated vegetation type into a woody species-dominated type) has become a significant problem due to large areas of grazing land being lost (DEAT, 1999). The transformation of habitats has also increased resulting in a reduction of species diversity.

Environmental degradation in the form of soil erosion and overgrazing are key issues affecting the quality of the land. This has led to a reduction in the productive capacity of the land which is often a catalyst for desertification. Farmers have therefore increased the usage of fertilizers, which in turn impacts on surface and groundwater ecosystem quality (Coastal & Environmental Services, 2003).

The land reform process is currently underway in the Eastern Cape Province and consists of land restitution, land redistribution and land tenure reform. Land restitution involves returning land lost due to racially discriminatory laws, and this could also be achieved through monetary compensation (DLA, 2003). Land redistribution enables disadvantaged people to buy land, while land tenure reform aims to bring all people occupying land under one system of landholding (Regional Land Claims Commission, 2001). There are a number of issues relating to land tenure, access to land and jurisdiction over land, which pose a major obstacle to the development and management of land. There is evidence of large un-used land expanses throughout the region however, there is also limited potential for arable agriculture. The available land for agriculture and other agricultural activities constitutes only 9% of the total land mass within the Eastern Cape Province. This is further threatened by an increasing population and the resettlement of farm dwellers, while a substantial area of land is left unfarmed and under-utilised (Coastal & Environmental Services, 2003).

The following chapter provides a review of the state of land in the Eastern Cape Province and is based on actual data obtained for the Province.

9.2: Key Indicators

The indicators selected for reporting on land in the Eastern Cape Province include:

- Land use;

- Land degradation;
- Desertification;
- Soil loss; and
- Land tenure reform.

9.2.1: Land cover

Land use is an important factor contributing to the condition of the environment. This is due to land management practices associated with different uses having varying effects on ecological functions and the integrity of the land. The land use indicator provides information on the current state of land use in the province (Thompson, 1999). The indicator is differentiated into categories that have been derived by the CSIR for the National Land Cover Database. Table 9.1 depicts the area (Ha) and percentage area (%) for each land cover type while Figure 9.1 illustrates the different land cover types in the Eastern Cape Province (Thompson, 1999).

Table 9.1: Land covers types for the Eastern Cape Province (Thompson, 1999)

Land cover description	Area (ha)	%
Shrubland and low Fynbos	5625719	33
Unimproved grassland	4876532	29
Thicket & bushland (etc)	2684931	16
Degraded: unimproved grassland	1302191	8
Cultivated: temporary - semi-commercial/subsistence dryland	887891	5
Cultivated: temporary - commercial dryland	292285	2
Urban / built-up land: residential	260459	2
Forest plantations	190955	1
Degraded: shrubland and low Fynbos	185781	1
Forest	153000	1
Degraded: thicket & bushland (etc)	86856	0.5
Waterbodies	69249	0.4
Forest and Woodland	55883	0.3
Barren rock	49101	0.3
Dongas & sheet erosion scars	19814	0.1
Cultivated: permanent - commercial dryland	17893	0.1
Wetlands	17504	0.1
Cultivated: permanent - commercial irrigated	11070	0.1
Urban / built-up land: industrial / transport	5049	0.03
Cultivated: permanent - commercial sugarcane	3355	0.02
Degraded: forest and woodland	1121	0.01
Mines & quarries	1323	0.01
Urban / built-up land: commercial	2531	0.01
Urban / built-up land: residential (small holdings: bushland)	2327	0.01
Degraded: Herbland	17	0
Herbland	73	0
Urban / built-up land: residential (small holdings: grassland)	0	0
Urban / built-up land: residential (small holdings: shrubland)	128	0
Urban / built-up land: residential (small holdings: woodland)	26	0
Total	17006986	100.00

Approximately 51% of the Province is largely open areas of unmanaged natural vegetation (as seen in Table 9.1). This percentage includes the categories forest, woodland, grasslands, shrublands and low fynbos. However, it is possible for self-seeded exotic areas to be included in this percentage. Approximately 1.61% of the province is categorised as degraded while an additional 0.12% is eroded. A further 1.58% is grouped as the urban environment which implies

that urbanisation of the Province is relatively low. This figure is similar to Mpumalanga where urbanisation (1.25%) is also relatively low (Mpumalanga DACE, 2003).

A higher percentage of the land (8.2%) is being cultivated and 1.12% is being used for forest plantations. These figures are significant when considering the potential for desertification as the process is closely associated with cultivated land (Hoffman *et al.*, 1999). It should be noted that these percentages are based on the 1994/5 National Land Cover Database (Mudau, *pers comm.* 2003) and may change with the development of the new land cover map currently being undertaken by the CSIR.

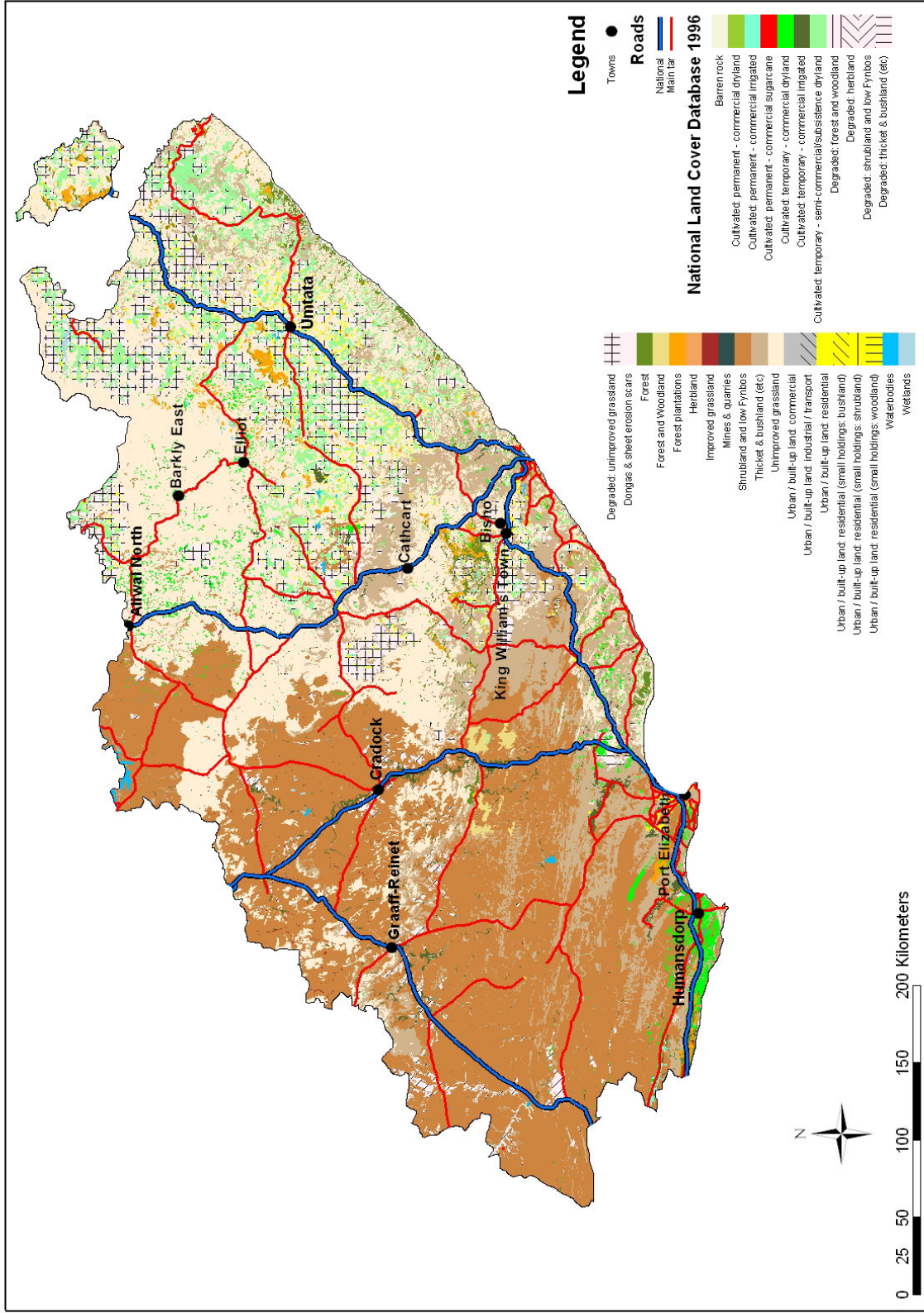


Figure 9.1: Land cover types for the Eastern Cape Province (Thompson, 1999)

9.2.2: Land degradation

Land degradation results in a significant reduction in the productive capacity of land. Human activities such as agricultural mismanagement, overgrazing, fuelwood consumption, industry and urbanisation, as well as natural disasters, could all contribute to land degradation (UNEP, 2002). The land degradation indicator is based on three indices namely: the combined degradation index (CDI); the soil degradation index (SDI); and the vegetation degradation index (VDI). These indices were developed as part of a National Action Plan (NAP) to resolve South Africa's problems of land degradation. The NAP is a requirement of South Africa's ratification of the United Nations Convention to Combat Desertification (UNCCD, 2003).

As a first step in formulating the NAP, the Department of Environmental Affairs and Tourism (DEAT) commissioned a study to assess desertification in South Africa. This study was undertaken by the National Botanical Institute (NBI) in 1999 and resulted in the development of a 'Combined Degradation Index'. A total of 367 magisterial districts were assessed and a SDI and VDI were developed. These indices together form the CDI. The first component of the study comprised an assessment of soil degradation in the 367 magisterial districts. Soil degradation was divided into erosive forms such as water and wind erosion, and non-erosive forms such as acidification or salinisation. The second component was an assessment of veld degradation. Six main types of veld degradation were identified, including: loss of cover and change in species composition; bush encroachment; alien plant invasions; deforestation; and a general category called 'Other' (Hoffman *et al.*, 1999).

Ultimately, the land degradation indicator will represent the percentage of each magisterial district of the Eastern Cape Province that falls into the different land degradation classes as defined by Hoffman *et al.* (1999). Table 9.2 shows the percentage degraded areas per category of degradation while Figure 9.2 illustrates the degraded areas in the Eastern Cape Province using the combined degradation index. Figure 9.3 and 9.4 present the SDI and the VDI respectively, that comprise the CDI (Hoffman *et al.*, 1999) presented in Figure 9.2.

Table 9.2: Percentage of the Eastern Cape Province land area in each degradation category (Combined soil and veld degradation) (Hoffman *et al.*, 1999)

Categories of Degradation	Value Range	Percentage Area
Insignificant	< 72	5.5
Light	72-277	36.5
Moderate	277-482	47
Severe	> 482	11.1

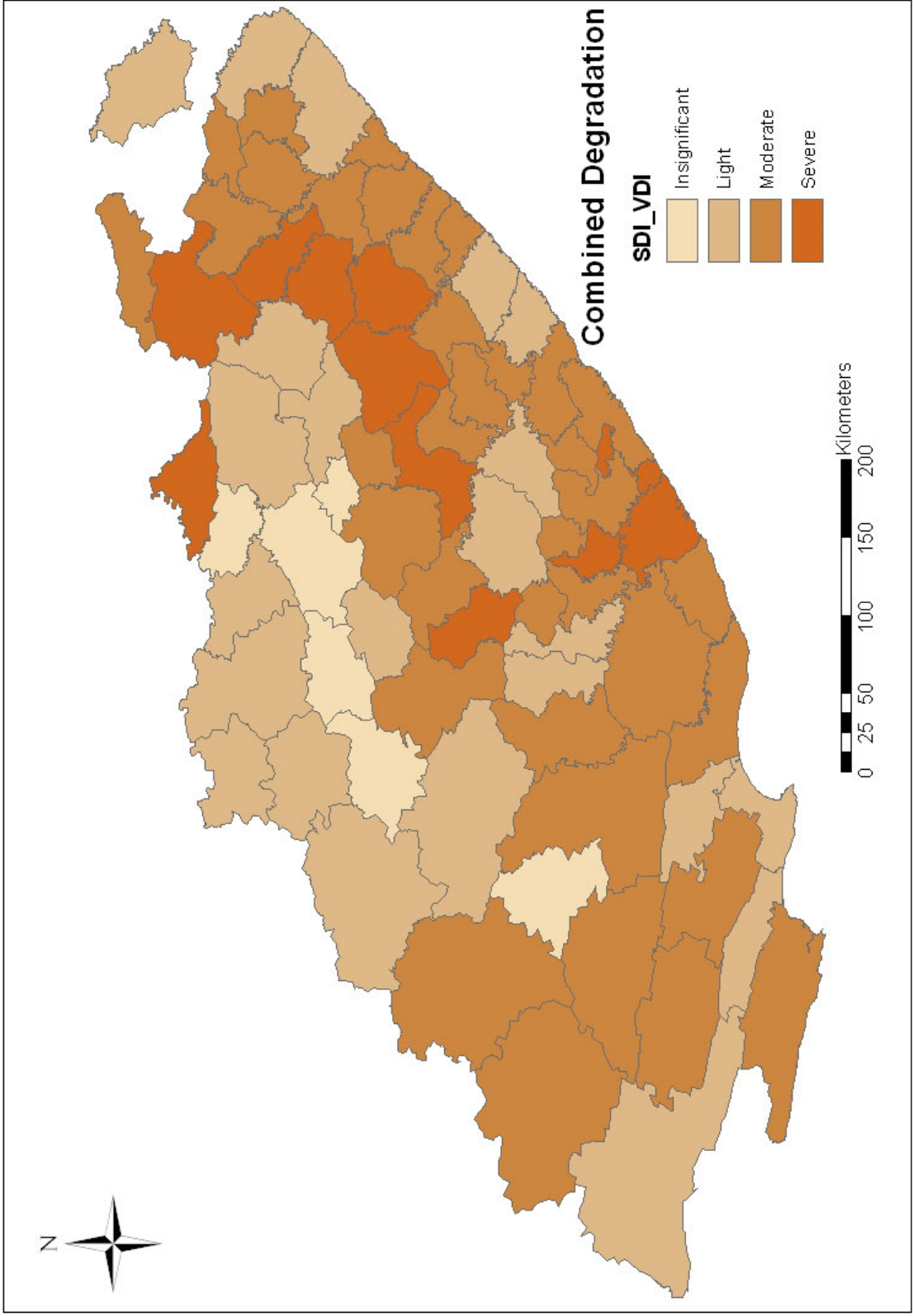


Figure 9.2: Map depicting land degradation in the Eastern Cape Province based on the combined soil degradation and veld degradation indices (Hoffman *et al.*, 1999)

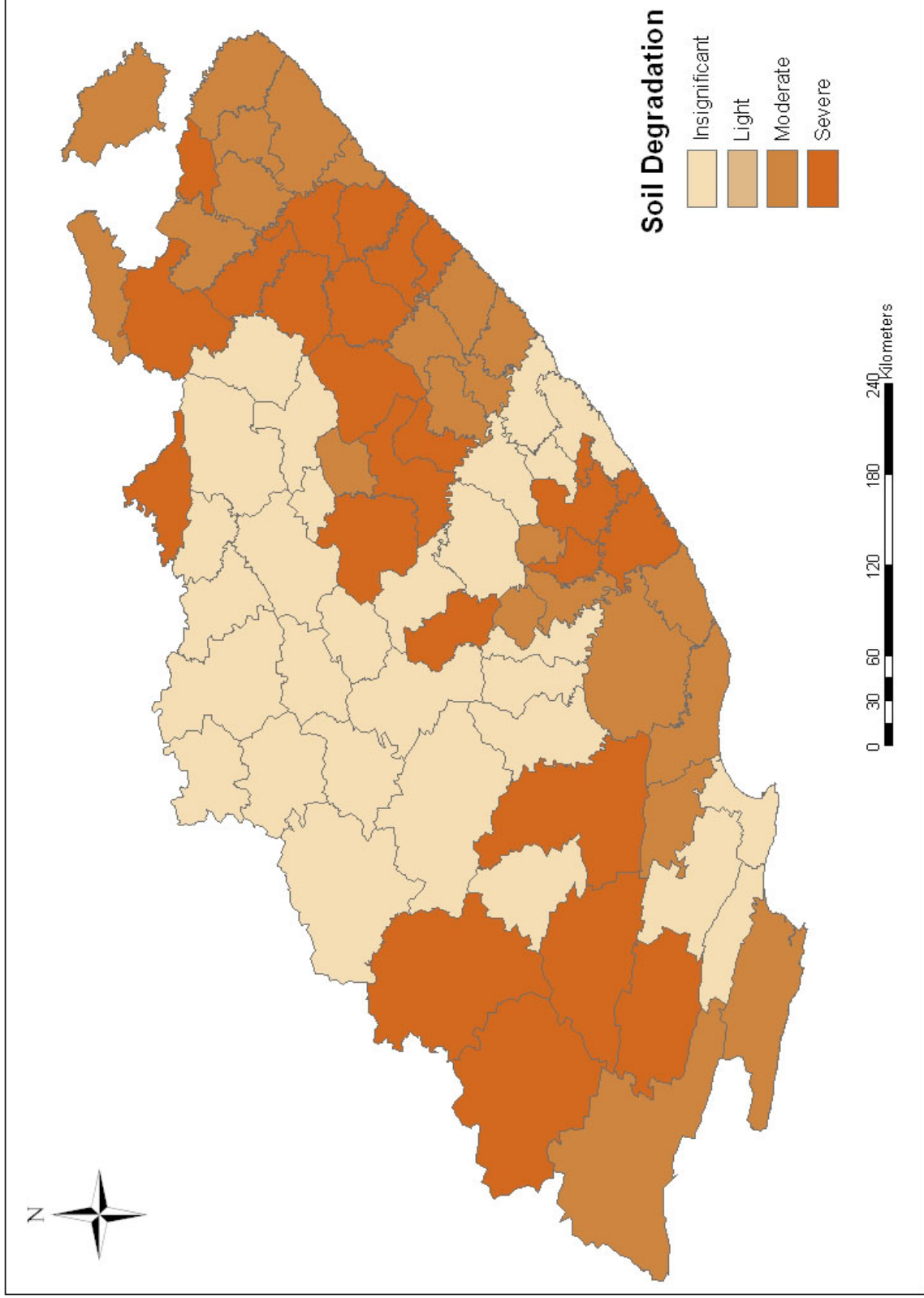


Figure 9.3: Map depicting soil degradation in the Eastern Cape Province (Hoffman *et al.*, 1999)

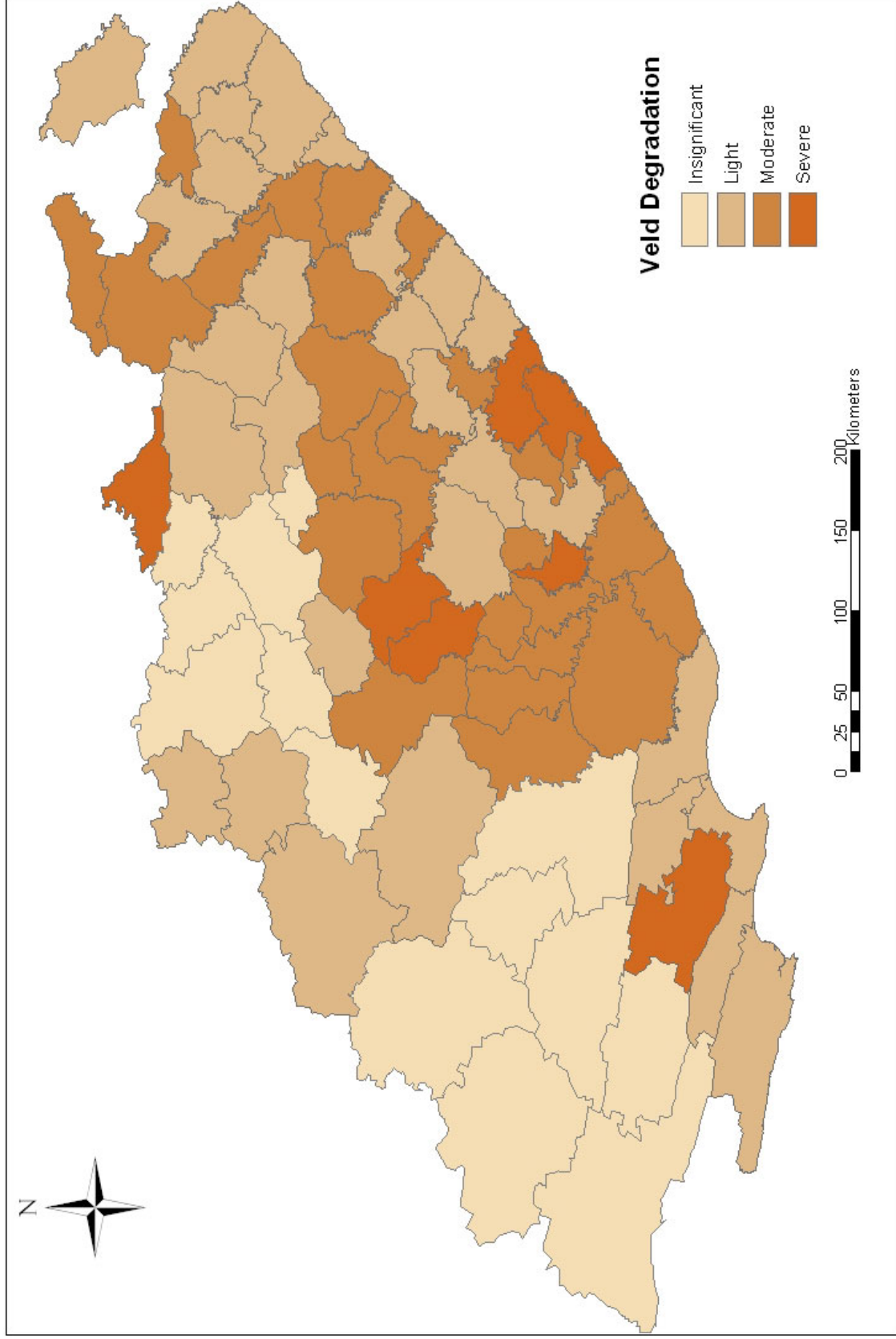


Figure 9.4: Map depicting veld degradation in the Eastern Cape Province (Hoffman *et al.*, 1999)

As is evident from Table 9.2 and Figure 9.2 the overall extent of degradation in the Eastern Cape Province is classified as 'moderate'. Almost half of the Province is moderately degraded, while 11.1% is severely degraded. Results from the NBI study concluded that the Eastern Cape Province is one of the three most degraded provinces in South Africa. The Eastern Cape Province was found to have one of the highest provincial indices of soil degradation, particularly within the commercial farming areas. The grazing and forestry areas as well as the croplands are all characterised by extensive gully and sheet erosion. Soil erosion is affected by the characteristics of the soil, the slope of the land and rainfall erosivity. It is believed that the steeper the slope, the more readily soil will erode. However, recent research has shown that land use and vegetation cover may be more important than slope in predicting soil degradation (Hoffman & Ashwell, 2001).

The veld degradation index was also found to be fairly high, with the commercial farming areas again being amongst the worst affected areas. The commercial areas were found to experience the most serious bush encroachment problems, change in species composition and alien plant invasions (Hoffman *et al.*, 1999). Simultaneously, in the communal areas the problem of over grazing is of greatest concern.

It should also be noted that the degraded areas in Figure 9.2 closely correlate with the degraded areas presented on the land cover map (Figure 9.1).

9.2.3: Desertification

The United Nations Convention to Combat Desertification (UNCCD) defines desertification as land degradation in arid, semi-arid and dry sub-humid areas brought about by factors such as climatic variations and human activities (UNEP, 2002). Desertification therefore, means land degradation, and loss of soil fertility, soil structure and biodiversity in drought prone areas (UNCCD, 2003). Land degradation is only defined as desertification when it occurs in dryland areas. Dryland areas occur where the ratio of annual precipitation to potential evapotranspiration falls within the range of 0.05 to 0.064 (DEAT, 2002). These dryland areas can be farmed but are most at risk of desertification (Hoffman *et al.*, 1999). The desertification indicator therefore shows the total extent of affected dryland areas over the total area of the Eastern Cape Province.

The land areas of the Eastern Cape Province have been categorised in terms of their relative aridity or dryness. The UNCCD has defined five aridity classes namely:

- Hyper-arid;
- Arid;
- Semi-arid;
- Dry sub-humid; and
- Humid.

These classes represent a specific ratio of mean annual precipitation (MAP) to potential evapotranspiration (PET) (UNCCD, 2003). These categories are depicted in Table 9.3 together with the percentages of land cover in the Eastern Cape Province that fall within each aridity class.

Table 9.3: Percentage aridity class according to ratio of MAP: PET for the Eastern Cape Province (Hoffman *et al.*, 1999)

Aridity Zone	MAP:PET Ratio	% Land cover in the Eastern Cape	
Hyper-arid	<0.05	0	Affected Drylands
Arid	0.05-0.2	34	
Semi-arid	0.2-0.5	51	
Dry sub-humid	0.5-0.65	12	
Humid	>0.65	3	

As is reflected by Table 9.3 the majority of the Eastern Cape Province falls within the three 'Affected Drylands' categories with only a small percentage of the province falling within the 'Humid' category. This implies that the Province is a high risk area for desertification. However it must be noted that the indicator reflects the *potential* for desertification and not the *actual* extent of desertification in the Province.

As stated previously, desertification and land degradation are closely linked. Land degradation in the Eastern Cape Province is moderate and it is rated as one of the three most degraded provinces in South Africa. This is significant since desertification is described as land degradation in dryland areas and the Eastern Cape Province can be characterised as an 'Affected Dryland' province. It is therefore likely that the Province is under serious threat of desertification.

9.2.4: Soil loss

Soil erosion is a natural process that is often accelerated by human activities, while soil formation is a relatively slow process. This means that soil is essentially a non-renewable resource. Increased soil loss has negative implications for water systems, the nitrogen cycle and the soil's ability to support biodiversity (UNEP, 2002). The soil loss indicator is a prediction of how much soil is lost per year due to erosion. Table 9.4 and Figure 9.5 illustrate predicted soil loss in the Eastern Cape Province. The data used to compile the predicted soil loss map were extracted from the 'Erosion Prediction Map of South Africa' which was produced by the National Department of Agriculture.

Table 9.4: Predicted soil loss data for the Eastern Cape Province (NDA, 2003)

Description of Soil Loss Type	Loss in tonnes	% Soil Loss
Very Low	0-5	17.8
Low	6-12	25.0
Moderate	13-25	35.6
High	26-60	20.3
Very High	>60	1.2
Total		100

Table 9.4 shows that 20.3% of the Province was predicted as having 'high' soil loss, with 1.2% of the Province within the 'very high' category. One third of the Province (35.6%) was predicted to be suffering from 'moderate' soil loss while 'very low' soil loss was predicted in 25% of the Province. The data predictions illustrate that soil loss may be a problem within the Eastern Cape Province since more than half the Province is predicted to have lost a significant amount of soil for the year 2000 (between 13 to > 60 tonnes of soil, Table 9.4).

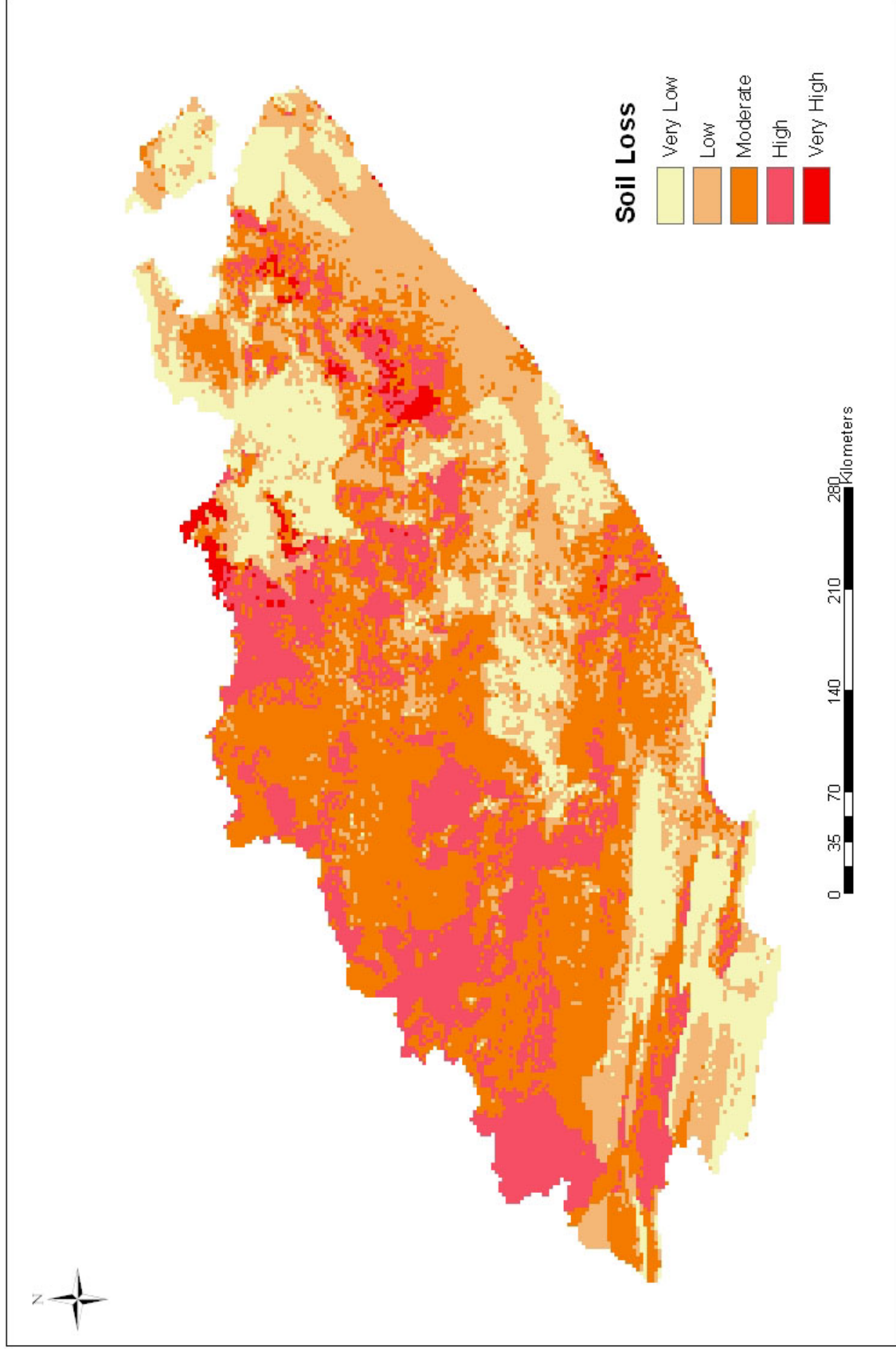


Figure 9.5: Predicted soil loss for the Eastern Cape Province – 2000 (NDA, 2003)

The areas predicted to be greatly affected by soil loss (1.2%), when compared to Figure 9.1, appear to be the degraded unimproved grasslands. This is consistent with the National Land Cover database description of unimproved grasslands which are permanent or near-permanent, man-induced areas of very low vegetation cover. Unimproved grasslands are associated with subsistence agriculture and rural population centres, where overgrazing of livestock has been excessive (Thompson, 1999).

Here again, desertification could be a potential problem since cultivated land (subsistence agriculture) is a catalyst for desertification (Hoffman *et al.*, 1999). The areas predicted to be affected by soil loss experience low vegetation cover and overgrazing which when combined, could contribute to desertification.

9.2.5: Land tenure reform

There are two distinct forms of tenure, namely freehold tenure and communal tenure as defined by Hoffman *et al.* (1999). Freehold tenure provides for individual or corporate ownership of a surveyed area that may be sold freely to any other party (Hoffman & Ashwell, 2001). In most areas of freehold tenure, commercial agriculture is the dominant farming system. Communal tenure refers to individuals having no rights to sell or own land which is ultimately owned by the state.

This indicator measures the percentage land area of the Province under each specific tenure system. At present, there is a lack of available land reform information and therefore the indicator provides a picture of the current state of land tenure in the Eastern Cape Province. Subsequent reports should therefore develop the indicator to monitor changes occurring in terms of land reform.

The land tenure data used for classification of the Eastern Cape Province was categorised into three groups namely (Damane, *pers comm.*, 2003):

- Private - Land previously owned by white, commercial farmers under the apartheid system;
- Communal – Land from the former Transkei/Ciskei homelands; and
- State – Land that is owned by the government.

The data are presented in Table 9.5.

Table 9.5: Percentage land area for each tenure system in the Eastern Cape Province (CSIR, 2000)

Tenure System	% Land Area
Private	66.5
Communal	29.5
State	4.0

The data in Table 9.5 were then mapped (Figure 9.6) and overlaid with the combined soil and veld degradation index map (Figure 9.7) to ascertain land degradation for each tenure type.

As depicted in Table 9.5 and Figure 9.6, 66.5% of land in the Eastern Cape Province is private and 29.5% is communal which clearly represents historical land distribution patterns. Only 4.0% of the Eastern Cape Province is state owned land.

Figure 9.7 shows land tenure overlaid with the combined land degradation map. This illustrates that most of the private land is moderately degraded while the severely degraded land is communal land. These findings are supported by the NBI study which concluded that communal land is severely degraded due to overgrazing of cattle and goats (Hoffman & Ashwell, 2001). This results in deforestation and loss of plant cover whilst bush encroachment is not a major problem. On the other hand, bush encroachment in the communal farming areas is severe. However, it must be noted that there are a number of other factors that could contribute to degradation. It has been found that changes in rainfall and temperature patterns together with human activities could be influencing the severity and rate of degradation (Hoffman *et al.*, 1999).

The provincial LandCare Programme was specifically designed to target communal farming areas (Joubert, *pers comm.* 2003). The vision for the Programme is to have communities and individuals adopt an ecologically sustainable approach to the management of the environment and natural resources, while improving communal livelihoods. This requires implementation of soil and water conservation and sustainable agricultural practices (LandCare South Africa, 1999; LandCare South Africa, 2002).

At present, there are 28 projects in place in the Eastern Cape Province. The projects specifically target the promotion of LandCare by the youth, erosion control and conservation of natural resources, eradication of weeds, land reclamation and the implementation of sustainable management practices (Joubert, *pers comm.* 2003).

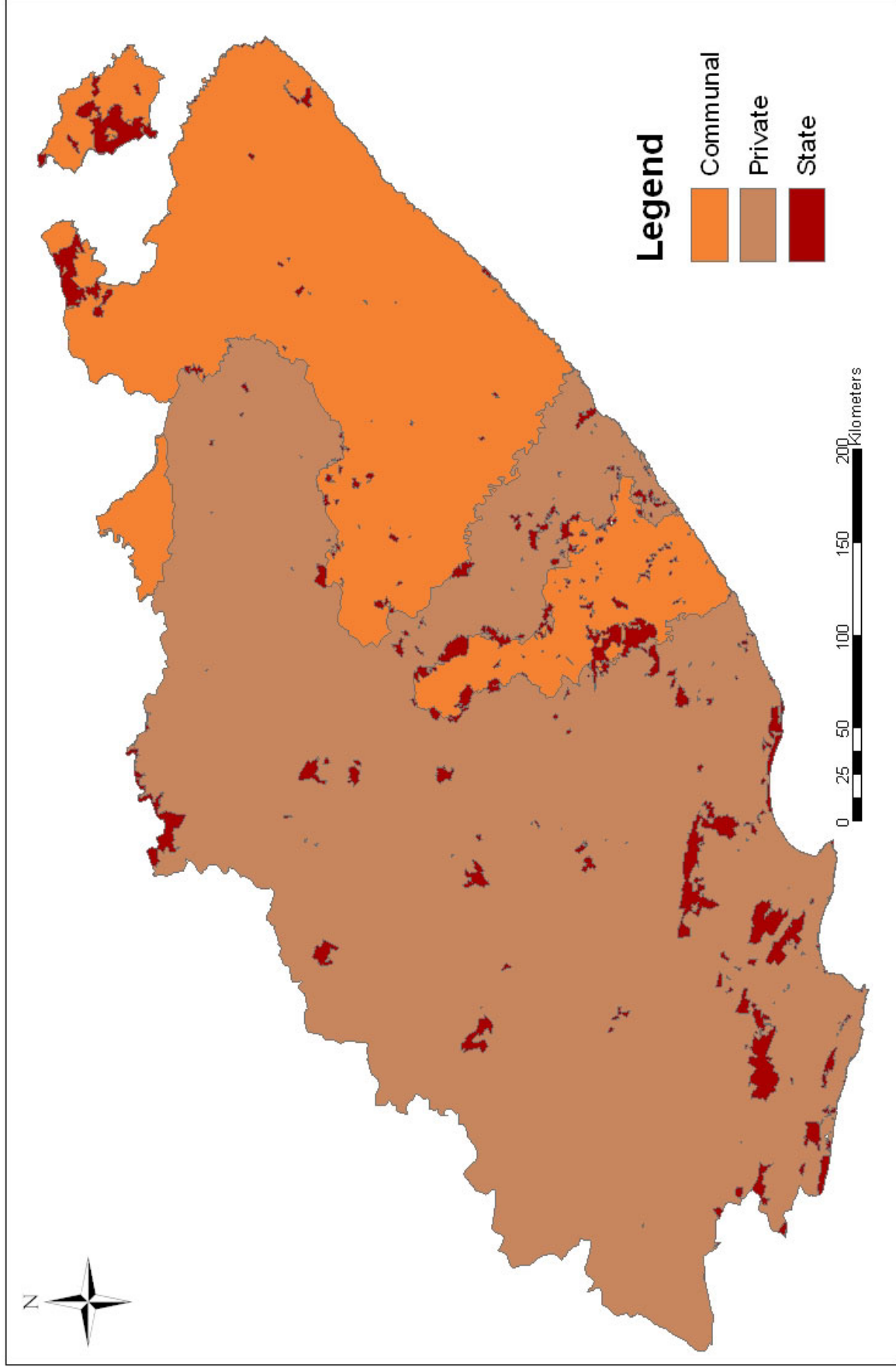


Figure 9.6: Land area under each tenure system in the Eastern Cape Province (CSIR, 2000)

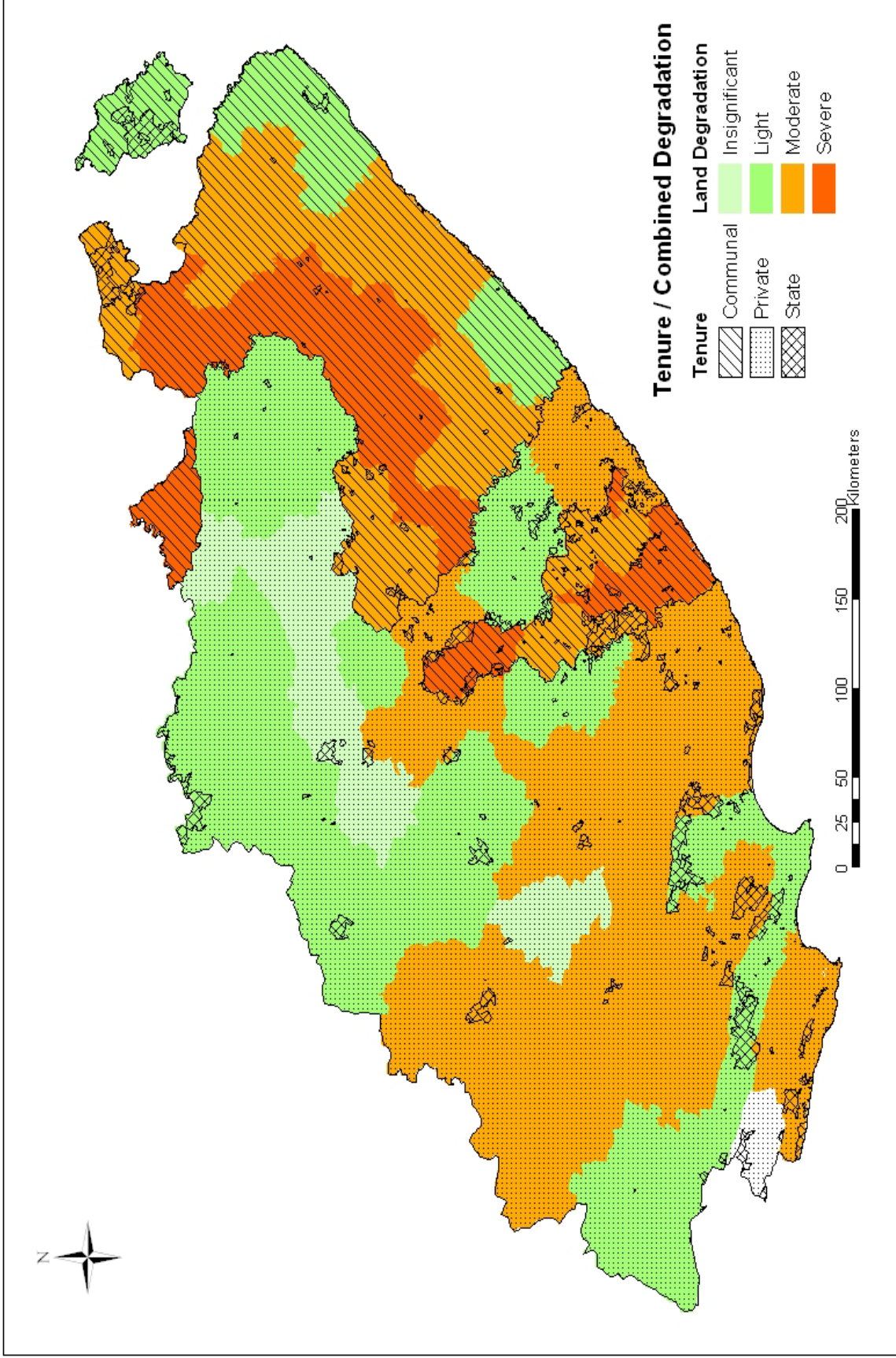


Figure 9.7: Land tenure classified by (Combined Soil and Veld Degradation) land degradation class (Damane, *pers comm.* 2003; CSIR, 2000; Hoffman *et al.*, 1999)

9.3: The current state of land in the Eastern Cape Province

An assessment of the indicators presented in this chapter reflects that the state of land in the Eastern Cape Province requires some attention. There are large areas of natural vegetation in the Province (51.4%) however, there is also considerable man-induced degradation from permanent or near-permanent removal of vegetation cover. This is a direct result of subsistence farming which is widespread in the Eastern Cape Province. Predicted soil loss within the Province is also considerable with almost half the Province predicted to be suffering from 'moderate' or 'high' soil loss.

Almost the entire Province is classified as 'Affected Drylands', implying a high susceptibility to desertification. Furthermore, the potential for desertification is increased by the use of large tracts of land for cultivation which is a catalyst for desertification (Hoffman *et al.*, 1999). Land degradation, also closely related to desertification, is very high in the Eastern Cape Province. Soil and veld degradation within the Province is significant, especially in the privately owned commercial farming areas. The communal areas are also experiencing severe degradation particularly due to overgrazing of domestic herbivores.

To achieve sustainable use of land resources, sound policies and legislation are required. Equally important is capacity building for land resource planners, farmers and managers at local, provincial and national levels of government. This is evident in the commercial farming areas where the levels of soil and veld degradation have started to decline due to good agricultural extension services, farmer study groups, government-subsidised soil conservation works, bush clearing and stock reduction schemes, conversion to game farming and the strict application of agricultural legislation (Hoffman *et al.*, 1999). The provincial LandCare Programme on the other hand, specifically addresses land issues in the communal farming areas. As shown, land degradation in these communal areas is severe.

Chapter 10: Marine and coast

10.1: Introduction

The coastline can be broadly divided into four distinguishable environments namely; inshore, offshore, terrestrial and estuarine environments.

The inshore coastal resources are those found below the high water mark and which are accessed primarily through land-based activities. These resources are diverse and can be broadly divided into estuaries, sandy beaches and rocky shores. They are highly vulnerable to human activities as they are easily accessible and are therefore subject to high levels of exploitation, primarily by recreational and subsistence users (Nicolson *et al.*, 1996). Illegal poaching of high value inshore resources and commercial harvesting also occurs within the Province. As a result the inshore resources are under heavy pressure from human activities. Approximately 25 fish species and 5 invertebrate species are targeted along sandy beaches, and the level of exploitation and stock status is variable by region within the Province (Britz *et al.*, 2001). Approximately 30 fish species are targeted along rocky shores and exploitation levels for most species is high with many species being overexploited. Eighteen invertebrate species are harvested along the rocky shores of the Province with several being overexploited (Britz *et al.*, 2001), particularly in the former homeland areas where the dependence on these resources for food is high. Seaweed is also harvested along the rocky shoreline. Estuaries are areas of high recreational activity and approximately 18 fish species and 12 invertebrate species are exploited by both recreational and subsistence fishers, with many species being over exploited.

The habitats of the offshore environment range from the warm water coastal reef areas along the Transkei Wild Coast to the cool temperate deep-waters of the Agulhas bank (Britz *et al.*, 2001). A wide range of species (including 60-70 fish species, spiny lobster and chokka squid) are exploited primarily by commercial fishers and the recreational ski boat sector (Britz *et al.*, 2001). The majority of these vessels operate south of Port Alfred, with a few commercial fishing vessels operating out of East London, Port St Johns and Coffee Bay.

The terrestrial coastal resources are considered to be within 2.5km of the high water mark, and are under the influence of the marine environment (Lubke, 2000). Due to the aesthetic nature of the coastal environment, the terrestrial resources have been subject to varying levels of urbanisation and development. Formal development has occurred primarily in the Cacadu and Amatole regions where there has been considerable urban and industrial development with the two largest cities and ports occurring in these regions. The O.R. Tambo coastal region of the province is comprised of the former homeland areas which are rural in nature. These coastal areas, however, have been subject to illegal cottage developments and uncontrolled sand mining activities due to a lack of enforcement.

Estuarine systems are highly productive systems (Turpie, 1999) which act as nursery areas for several marine species and are therefore rich in biodiversity. They are utilised by the subsistence, recreational and commercial sectors (Van Niekerk & Taljaard, 2002) and support a wide range of activities and resources. The Eastern Cape Province has the largest proportion of South Africa's estuaries (213 of the 371), which have unique assemblages of ichthyofauna as the Province is situated in the transitional zone between the warm temperate and subtropical regions (Whitfield, 1998). The western and central coastal regions of the Province are characterised by ribbon development and high levels of utilisation of these regions, while there is little or no information on many of the systems within the eastern coastal region.

In the past the management of coastal resources and implementation of policy and legislation within the Eastern Cape Province was fragmented. Several government agencies are involved in coastal management within the Province, the two main bodies being the Eastern Cape Department of Economic Affairs, Environment and Tourism (DEAET) and the Marine and Coastal Management Branch of DEAT. An important step to improve coastal management on a national level was the drafting of the White Paper for Sustainable Coastal Development (DEAT, 2000). This has led to the drafting of a Provincial Coastal Management Programme aimed at improving integrated coastal management within the provinces. The Eastern Cape Provincial Coastal Committee (PCC) has been active since early 2002, and plays a key role in bringing managers together to discuss crosscutting coastal issues and integrated coastal management, and was the first step towards improving coastal management within the Province.

10.2: Key Indicators

The indicators used in this section to present the state of the marine and coastal environment were decided upon after interaction with key stakeholders. They are by no means exhaustive and aim to provide a brief indication of the current status of the marine and coastal environment and resources within the Province.

The following indicators will be covered in more detail:

- Estuarine health index;
- Catch and Total allowable catch (TAC) per fishery sector;
- Distribution and abundance of resource species;
- Pollutant loading entering the sea from land-based sources;
- Number of functional co-management initiatives; and
- Blue Flag beaches.

10.2.1: Estuarine health index

The estuarine health index provides a comprehensive assessment of the condition of estuaries as it is comprised of three separate indicators, assessing the status of fish assemblages, the water quality and the aesthetics of each system. This index therefore provides a good overall assessment of the level of urbanisation and development as well as the ecosystem health.

Estuaries are among the most dynamic ecosystems supporting a diverse range of fauna and flora (Turpie, 2002) and act as nursery and feeding areas for many species of marine fish and shellfish. Due to their aesthetic appeal they are also important centres for tourism and recreation and are thus subject to heavy anthropogenic pressures. Being situated between the marine environment and river systems they are influenced by both marine pollution events and industrial and domestic effluent discharges which occur in the river catchments.

The Eastern Cape Province has a total of 213 estuaries, more than half (57%) of South Africa's estuaries. These estuaries range from large permanently open systems to small temporary open/closed systems. Several scientists and researchers have attempted to classify and estimate the health and condition of South African estuaries (e.g. Whitfield, 1992; Harrison *et al.*, 2000) with the use of various biological and physical indicators. Whitfield (2000) undertook a broad assessment of the condition and available information on individual estuarine systems within South Africa and classified the condition of each estuary based on the opinions of scientists from the different regions as well as available literature. In the State of South African Estuaries report (Harrison *et al.*, 2000) all estuaries were rated according to their condition for fish communities, water quality and aesthetics. The condition of estuarine systems within the

Province was represented as a percentage of the total number of estuaries for each of the indicators.

In order to ensure the long term sustainability of estuaries within the Eastern Cape Province the Estuarine Health Index should be used to set management goals for the protection of these resources in the future.

A summary of the condition of estuaries within the Province according to Whitfield's (2000) classification¹ system is provided in Table 10.1. Figure 10.1 highlights the status and condition of Eastern Cape estuaries according to Harrison *et al.* (2000).

Table 10.1: State of estuaries within the Eastern Cape Province (Whitfield, 2000)

State of estuaries	Number of estuaries	Percentage
No information	78	36
Fair	18	9
Good	44	21
Excellent	73	34
Total	213	100

Based on Whitfield's assessment of the condition of estuaries within the Eastern Cape Province (Table 10.1), it is evident that there is no information available on over a third (36%) of the systems. Thirty-four percent were rated as being in 'excellent' condition (in a pristine state with either no or negligible human impacts). A further 21% of the estuaries had no major anthropogenic impacts in either the estuary or catchment and are therefore regarded as being in 'good' condition. The remaining 9% of the estuaries within the Province are ranked as being in 'fair' condition, having been subject to human activities that have resulted in some degree of ecological degradation.

¹ Whitfield's Classification system used the following categories:

Excellent – Estuary in near pristine condition with negligible human impact

Good – No major negative anthropogenic influences on either the estuary or the catchment

Fair – Noticeable degree of ecological degradation in the catchment and/or estuary

Poor – Major ecological degradation arising from a combination of anthropogenic influences.

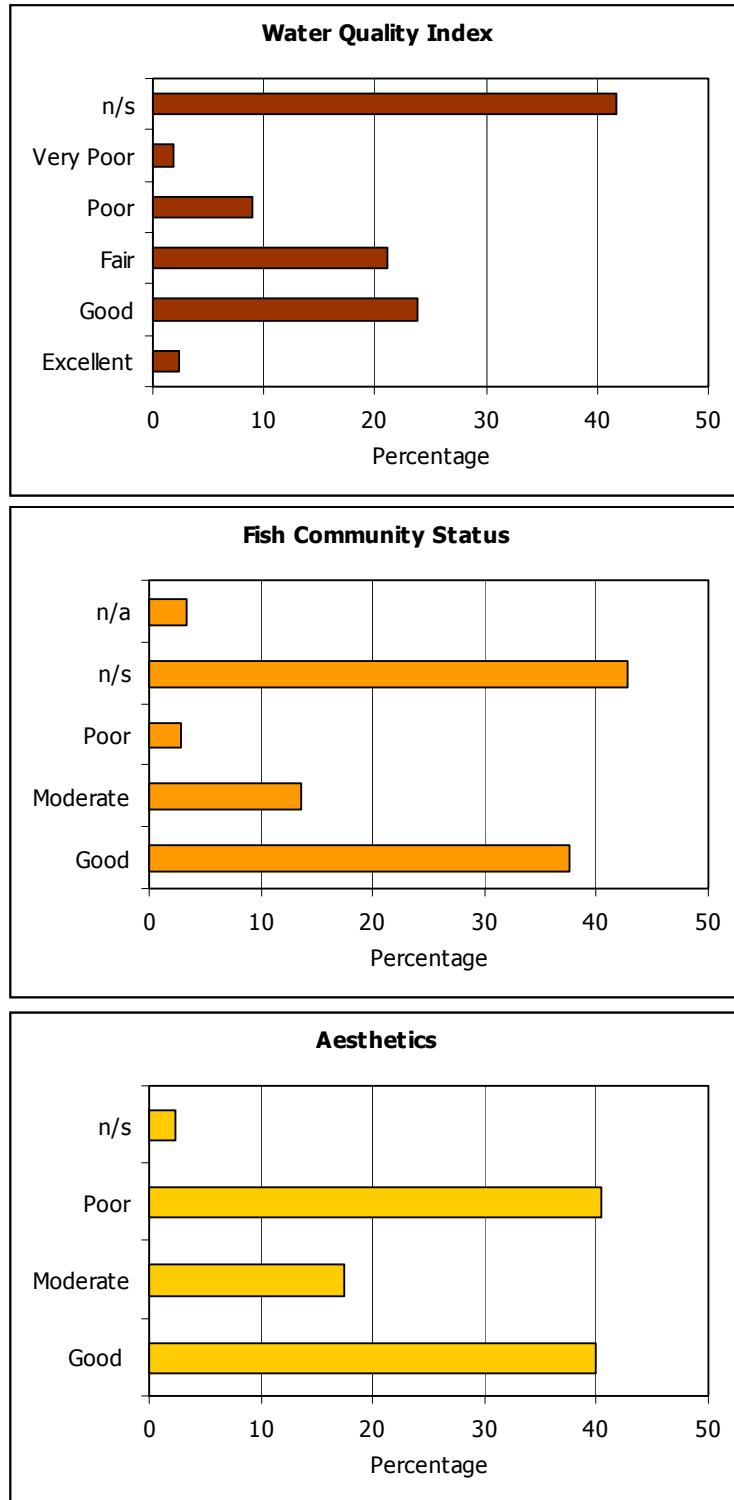


Figure 10.1: Status and condition of Eastern Cape estuaries in terms of fish community structure, water quality and aesthetics (n/s=not sampled; n/a=not analysed) (Harrison *et al.*, 2000)

Based on the assessment by Harrison *et al.* (2000)² presented in Figure 10.1, both the fish community and water quality indices indicate that little research has been undertaken on a large proportion of Eastern Cape estuaries. Ninety percent of the estuaries for which there is no information occur north of the Kei estuary, highlighting the need for estuarine research in this area of the Province. In terms of fish community status, only a small portion of the estuaries have a poor representation of species diversity in comparison to the potential assemblages and are thus considered to be in 'poor' condition. The actual and potential fish assemblages for the majority of estuaries, however, are similar and they are ranked as being in 'moderate' to 'excellent' condition.

Similarly only a small percentage of the estuaries within the province have 'poor' water quality as determined by the parameters measured during sampling trips. The water quality of a large portion of the estuaries sampled was rated as being 'fair' to 'excellent'.

In terms of aesthetics a significant proportion (approximately 40%) of the Province's estuaries have been subject to human-induced pressures and disturbances which has resulted in them being ranked as aesthetically 'poor' in condition. Several of these estuaries are situated in or near urban and industrial areas (e.g. Bakens, Papkuils and Swartkops in Port Elizabeth; Ngcura in the Coega Industrial Development Zone; and Buffalo in East London) and have been subject to intensive development and modification. The majority of the estuaries in the former Ciskei and Transkei homeland areas, however, are largely undeveloped and in aesthetically 'moderate' to 'good' condition.

This assessment of estuaries highlights the lack of adequate information for most systems within the Province, 114 estuaries with poor records and 78 with no records. This indicates a significant need for more research into the structure and functioning of communities and the collection of baseline information for individual systems within the Province (Coastal and Environmental Services, 2003) to ensure that they are protected and remain in good health.

10.2.2: Catch and Total allowable catch (TAC) per fishery sector

The marine resources within the Eastern Cape Province are heavily exploited through subsistence, recreational and commercial activities. An indication of the abundance of these species along with the commercial catches and quota allocations provides good insight into the current status of the marine resources. Monitoring of the fisheries catches and the distribution of species can indicate where certain resources are being overexploited and where opportunities for increased harvesting exist. This indicator presents catch data where possible, and quota allocations, which were awarded to Eastern Cape-based fishing companies. Quota allocations for the chokka squid, hake long-line, inshore and offshore trawl, pelagic and spiny lobster fisheries as well as catch data for the chokka squid and line fishery are presented.

Fisheries resources and fisheries management are highly complex due to the migration paths and life histories of many of the target species, which are not confined by provincial boundaries.

² Harrison *et al.* used the following methods and classification system to rate the condition of estuaries within the province:

The *fish community status* was determined by calculating the similarity between the potential and actual fish assemblages within individual systems. Estuaries were ranked according to their scores which ranged from 0 (poor) to 10 (good). Six indicators were used to calculate the *water quality* index, namely: dissolved oxygen; oxygen absorbed; unionized ammonia; faecal coliforms; nitrate; nitrogen and ortho-phosphates. Using these parameters the water quality of individual systems was ranked as follows: very poor < 3; 3 < poor < 5; 5 < fair < 7; 7 < good < 9; 9 < excellent. The *aesthetic health* of each estuary was rated according to the following series of parameters; floodplain land use; shoreline status; floodplain/estuary surrounds; bridges; dams and weirs; mouth stabilisation; litter and rubble; human use; algal growth; turbidity; odour; air pollution; noise; invasive and exotic vegetation. Final index values for individual estuaries ranged between 0 and 10. Estuaries with an aesthetic rating below 6 were ranked as aesthetically poor, scores of 6-9 were rated as moderate and scores above 9 were rated as in excellent aesthetic condition. The overall aesthetics for the estuaries within the province were calculated as a percentage for each category.

While certain inshore fisheries (e.g. oysters, mussels and linefish) could possibly have some sort of regional definition, the offshore fisheries are managed and zoned nationally by the Marine and Coastal Management Branch of DEAT (Simms, *pers comm.* 2003). Total Allowable Catches (TAC) or Total Allowable Efforts (TAE) are set for the different fishery resources on a national level and not on a provincial basis. For multi-sectoral fisheries (such as the hake fishery which is comprised of inshore and offshore sectors, and hand line and long-line sectors) the TAC is apportioned between the different sectors before being allocated to individual companies or rights holders (Lesly, *pers comm.* 2003). Companies allocated quotas are not restricted by provincial boundaries and fishing companies based in the Eastern Cape can harvest their quotas outside of provincial waters. Likewise, non-Eastern Cape companies can catch their quotas within Eastern Cape waters. As a result, it is unreliable to look at catches landed in Eastern Cape ports as they may have been caught well outside of Eastern Cape waters and thus do not provide a true reflection of the status of fishery stocks within the Eastern Cape Province.

Similarly quota allocations to Eastern Cape companies do not provide a good indication of the status of the provincial fishery resources as many of the companies harvest their quotas on popular fishing grounds outside of the Eastern Cape Province, or move into and out of provincial waters as their target species migrate during different periods of the year. The quota allocations do, however, provide some insight as to the percentage of fisheries allocated to the Eastern Cape Province, and the economic benefit obtained by the Province from marine living resources. However, a change in allocation does not necessarily indicate a change in resource status, but is more likely to be influenced by socio-economic factors.

Seaweed harvesting

Seaweed is harvested from the southern Transkei to the border of the Eastern Cape Province in the west. The target species is *Gelidium sp* which is dried and exported. The harvests for the years 1996 to 1998 are presented in Figure 10.2. The current annual average harvest of seaweed in the Eastern Cape Province is optimal and represents about 70% of the standing crop in Seaweed Concession Area (SCA) number 1 (Britz *et al.*, 2001).

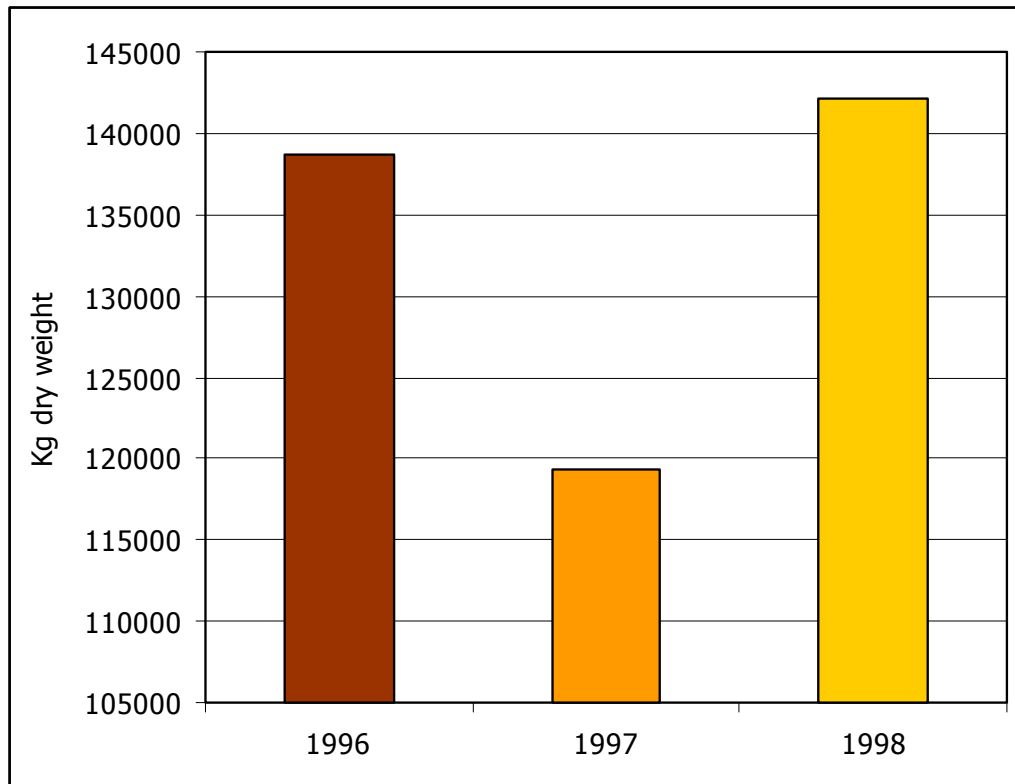


Figure 10.2: Annual harvests in *Gelidium sp* in the Eastern Cape Province (Attwood, 1997; Attwood, 1998)

Chokka squid fishery

This fishery targets *Loligo vulgaris reynaudii* using hand lines. It is regulated by effort with the number of fishers per vessel being stipulated on a permit and is the largest single species commercial fishery in the Eastern Cape Province (Britz *et al.*, 2001).

Table 10.2: Chokka squid fishery allocations in the Eastern Cape Province (1999/2000 season) (Britz *et al.*, 2001)

	No. of fishing vessels 1999/2000	No. of companies 1999/2000	Vessel TAE (No. of fishers) 1999/2000
Total SA	144	107	1 585
Total EC	124	70	1 369
% EC	86%	65%	86%

Within the South African chokka squid industry the majority of the fishing vessels (86%) and companies (65%) are registered within the Eastern Cape, resulting in the majority of the total allowable effort (86%) being allocated to the Eastern Cape Province (see Table 10.2). This further highlights the importance of this fishery to the coastal areas of the Province.

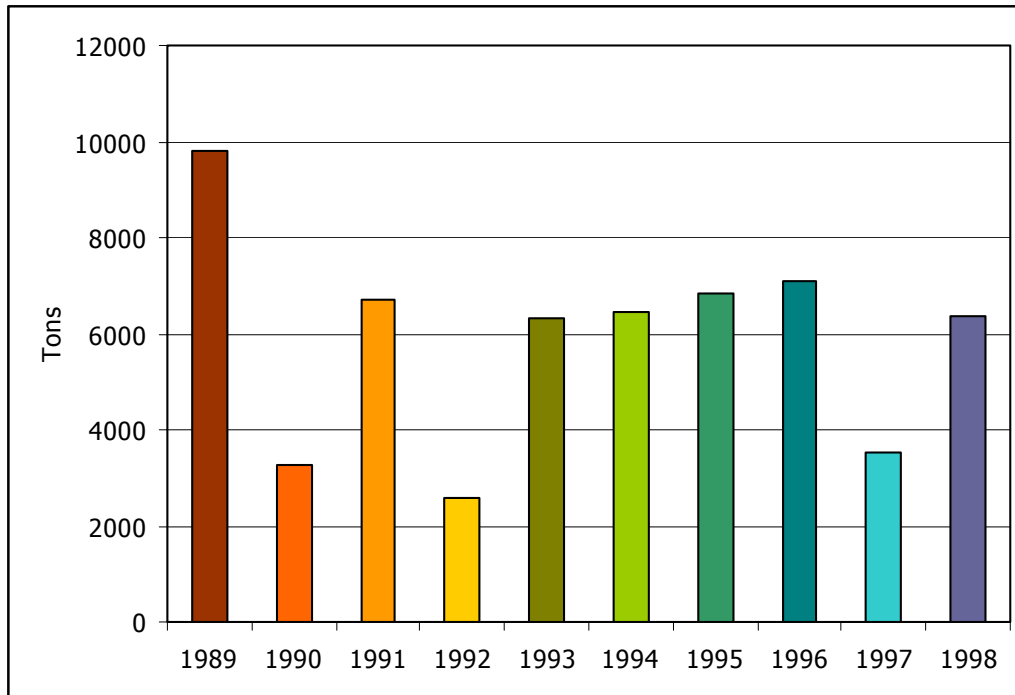


Figure 10.3: Annual catches in the Eastern Cape chokka squid fishery (Britz *et al.*, 2001)

As illustrated in Figure 10.3, catches in the chokka squid fishery peaked at approximately 10 000 tons in 1989 after which there was a considerable decline. Catches have since stabilised at around 6 000 tons between 1993 and 1998, with only a slight decline in 1997. Currently the chokka squid stocks are perceived to be in a good condition (Sauer, *pers comm.* 2003)

Hake long-line fishery

This is a relatively new fishery in South Africa with the first experimental quotas being allocated in 1996. In 1998 the first rights (totaling 5 000 tons) were allocated between the west and east coast fisheries which target different species of hake, namely *Merluccius paradoxus* and *Merluccius capensis* respectively. Only about 6 long-line vessels operating out of Port Elizabeth and Mossel Bay are fishing in the Eastern Cape Province (Britz *et al.*, 2001). Kingklip is caught as a bycatch of this fishery, and is limited to 15% of the hake TAC. Table 10.3 summarises the hake long-line quota allocations for the 2000 to 2002 seasons.

Table 10.3: Hake long-line quota allocations to Eastern Cape-based fishing companies (Jones, 2002)

	2002	2001	2000
Total SA	9825	5691	10000
Total EC	1785	1297	1200
% EC	18%	23%	12%

Inshore trawl fishery

This fishing sector is relatively small in the Eastern Cape Province and catches include both deep water and shallow water hake, *Merluccius paradoxus* and *Merluccius capensis* respectively. In the Eastern Cape Province three companies were awarded quotas for hake and sole for both the

1998 (Britz *et al.*, 2001) and 2002 (Jones, 2002) seasons, while two companies were awarded mackerel quotas for both seasons (Jones, 2002). All companies operated out of Port Elizabeth (see Table 10.4). This sector targets hake, east coast sole and horse mackerel. Valuable bycatch species such as kingklip, monkfish, chokka, horse mackerel, mackerel, gurnard, Cape dory and panga are also caught (Britz *et al.*, 2001).

Table 10.4: Inshore trawl fishery quota allocations in the Eastern Cape Province (1998 and 2002 season) (Britz *et al.*, 2001; Jones, 2002)

	Hake (tons)		Sole (tons)		Horse mackerels (tons)	
	1998	2002	1998	2002	1998	2002
Total SA	9 438.7	9 665	872	784.8	22 000	28 350
Total EC	668.26	728	35.9	40.4	1720.4	2 568
% EC	7%	7.5%	4.1%	5.1%	7.8%	9%

Pelagic fishery

The pelagic fishery targets anchovy and pilchards, and the quotas for these resources are divided into pilchard, anchovy, Bait A and Bait B quotas. During the 1998 fishing season 17 Eastern Cape companies received quotas for the pelagic resources. A summary of the quota allocations for the 1998 season is shown in Table 10.5.

Table 10.5: Pelagic fishery quota allocations in South Africa and the Eastern Cape Province (1998 season) (Britz *et al.*, 2001)

	Anchovy (tons)	Pilchard (tons)	Bait A (tons)	Bait B (tons)
Total SA	98 003	95 329	3 984	8 373
Total EC	11 179	11 274	1 280	839
% EC	11.4%	11.8%	32.1%	10%

South coast rock lobster

In the Eastern Cape Province rock lobster is caught south of the Great Fish estuary using lobster pots. Boats operate out of Port Alfred, Port Elizabeth and Cape St Francis, with the most important fishing grounds being St Francis Bay (55%), Algoa Bay (21%), Agulhas Bank (15%) and Port Alfred (8%) (Britz *et al.*, 2001). A summary of the quota allocations is presented in Table 10.6 below. Landed catch in 2001/2002 totaled 290 tons tail mass, of which 40% was off-loaded in Port Elizabeth (Groeneveld, *pers comm.* 2003).

Table 10.6: South coast rock lobster quota allocations to Eastern Cape-based companies (Jones, 2002)

	1999/2000	2001/2002
Total SA	377 000	340 000
Total EC	123 906	115 240
% EC	33%	34%

Commercial line fishery

Both the recreational and commercial line fisheries exploit the same resources. Bag limits, size limits, closed seasons and marine protected areas are used to manage the line fishery. These fishery resources are heavily exploited and the catches have continued to decrease, with many

species populations having collapsed (e.g. kob, geelbeck, seventy-four, red steenbras) (Britz *et al.*, 2001). The number of South African commercial licenses issued for targeting these resources is to be reduced significantly to approximately a third of the existing licenses. In 2000 the majority of commercial line fishery boats operated south of Port Alfred (515) with few operating out of East London (30) and along the former Transkei area. The reported commercial catch landings for the line fishery are presented in Table 10.7. Plettenberg Bay is included with Eastern Cape landings as many vessels target species within Eastern Cape waters.

Table 10.7: Reported commercial linefish catches (1998 and 1999 season) (Jones, 2002)

Landing place	Snook		Yellowtail		Kabeljou		Geelbek		Carpenter		Mackerel		Sharks		Panga		Hake		Slinger		Other	
	1998	1999	1998	1999	1998	1999	1998	1999	1998	1999	1998	1999	1998	1999	1998	1999	1998	1999	1998	1999	1998	1999
Plettenberg Bay	3.5	2.5	1.7	1.4	25	20.6	89.2	55.1	36.1	32.8	27.6	4.2	4.4	3.6	9.5	4.47	897	1 016			50	126
Jeffrey's Bay	0.11	0	0.06	0.05	25.1	10.3	18	19	17.7	42.5	1	7.1	1	0.78	4.3	3.33	128.5	125.7			15.8	51.57
Port Elizabeth	0.2	0	27.5	18.1	53	34.7	38.5	47	90.1	54.2	17.3	11.1	1.4	4.3	21	14	99.3	234.36			60.7	68.43
Port Alfred		0	1	0.24	84	87	47	38.5	40.8	31.3		0.1		0.7	37.5	49	9	9.9			43.6	24
East London		0	0.04	0.03	5.6	2.1	14	1.6	22	20.8		0.4		0	7.8	9.9	3.2	0.07			8.7	13.43
Transkei Coast				-		0	0.3	0.32		-		0		-		-		-		0.4	0.45	6
Total EC	3.8	2.5	30.3	19.8	192.7	154.7	207.0	161.5	206.7	181.6	45.9	22.9	6.8	9.4	80.1	80.7	1137.0	370.0	0.4	0.5	184.9	289.4
Total SA	7771.1	8361.2	559.7	320.4	650.9	501.2	699.8	455.6	516.3	561.8	132.6	117.1	300.9	322.7	97.1	91.5	2130.5	2974.6	148.8	148.9	717.0	760.1
% EC	0.0	0.0	5.4	6.2	29.6	30.9	29.6	35.5	40.0	32.3	34.6	19.6	2.3	2.9	82.5	88.2	53.4	12.4	0.3	0.3	25.8	38.1

The catch data required to calculate the provincial catch and TAC indicator is not readily available from the Marine and Coastal Management Branch of DEAT as many vessels fish on fishing grounds outside of provincial waters but land their catches in Eastern Cape ports. Although the vessel log books do record the fishing locations this data is not always recorded with landed catch, and it is difficult to determine the proportion of the catch caught between the different fishing grounds when a vessel has been at sea for a long period of time. Britz *et al.* (2001) provides a good overview of Eastern Cape fisheries but it is a once off study and is therefore not a good source of information for calculating this indicator. In order to calculate the quota allocated to Eastern Cape based fishing companies the Fishing Industry Handbook was used (Jones, 2002). This book provides the quota allocation information per company for each resource. The quotas allocated to all companies registered in the Province were used as the provincial total regardless of the areas the company vessels fish in. This suggests that provincial quota allocations are not necessarily a good indication of the status of the marine resources within the Eastern Cape Province as they are influenced by socio-economic factors as well as the stock status of resources which are assessed on a national basis due to the complex life histories of the species.

10.2.3: Distribution and abundance of resource species

This indicator aims to illustrate the distribution and abundance of key resource species within the Eastern Cape Province. The distribution and abundance of resource species is a key indicator for monitoring the change of stocks over time as a result of exploitation, and represents an important tool for fisheries management. However, many fisheries stocks are dispersed across provincial boundaries and migrate between different areas of the South African coastline during their life cycles and as a result are assessed on a national level rather than on a provincial basis. Stock abundance is usually directly related to the fishing industry and history of the fishery. Based on the distribution and abundance of resources, fishing restrictions can be implemented to protect species which are showing a decline in stock abundance, while effort may be increased on other resources.

The distribution and abundance of only two fishery resources, pelagic and demersal stocks, was available for the National State of the Environment Report (DEAT, 1999) from Marine and Coastal Management. This information is not readily available on a provincial scale and as a result the national stock status is presented in Figures 10.4 and 10.5 with the non-Eastern Cape areas obscured (Naidoo & Verheye, 2001). This only serves to illustrate the proportions of the national stocks which occur within Eastern Cape waters.

Seaweeds

Seaweed harvesting occurs along the Eastern Cape coast from Southern Transkei to the western border on the Groot Wes estuary in the Seaweed Concession Area number 1. *Gelidium* species are the main species targeted and of the 450km concession area only 135km of the area provides suitable substrate. The harvest over the last few years suggests that this resource is currently exploited maximally (Britz *et al.*, 2001).

Mussels

Mussels and oysters are harvested along the entire length of the Eastern Cape coastline predominantly by subsistence fishers in the former homeland areas as well as by recreational fishers. Within the former Transkei area mussel stocks have been heavily exploited, particularly in those areas where hotels and backpackers have created a demand and established markets for the local communities harvesting the resources (Calvo-Ugarteburu, *pers comm.* 2003)

Abalone

A survey of the Transkei abalone stocks was undertaken in 1994. Dives were made between Kononqaba and Mzamba and no abalone were found north of the Mbashe river (Fielding *et al.*, 1994). Mean density of abalone was 0.17 abalone per square metre, but ranged from 0.08 to 0.44 abalone per square metre (Fielding *et al.*, 1994). The variability in density reflects the presence of preferred microhabitats within a reef area (Wood, 1993). There is no commercial abalone fishery within the Eastern Cape Province, although subsistence abalone permits were issued to communities in the Hamburg area. Currently the abalone resources within the Province are heavily exploited by illegal poaching activities due to the high value on the export market. This resource is in urgent need of a stock assessment and increased enforcement of the existing legislation in order to curb illegal harvesting activities.

Squid

Loligo vulgaris reynaudii is the most abundant squid in South African waters and supports an important fishery between Plettenberg Bay and Port Elizabeth. The majority of the total effort for the fishery is concentrated in the Eastern Cape Province and the stock status is currently perceived to be in good condition (Sauer, *pers comm.* 2003).

Crustaceans

The south coast rock lobster (*Palinurus gilchristi*) is the only crustacean resource which is harvested commercially within the Province. In the Eastern Cape the south coast rock lobster occurs approximately 2-50km from the coast between Mossel Bay and East London (Groeneveld, *pers comm.* 2003). Stocks of this resource are also found on the Agulhas Bank. Within the Province fishing effort is concentrated south of the Great Fish estuary using lobster pots. The abundance of this resource, including both the inshore and offshore stocks, has shown a steady decline from 1988 to the 1999/2000 fishing season although slight increases in abundance were measured in 2000/2001 (Groeneveld, *pers comm.* 2003). The cumulative decline in the resource over the 1988-2001/2002 period is approximately 59% (Groeneveld, *pers comm.* 2003). The allocated TAC for this resource dropped by about 15% between 1994 and 1998, but it has not made an impact on the rate of stock decline (Britz *et al.*, 2001). A further reduction in the south coast spiny lobster is imminent and the scope for further development is not feasible (Britz *et al.*, 2001).

Pelagic

Pilchard and anchovy are the two main species targeted by the pelagic fishery. These are national stocks which undergo considerable migrations during their breeding cycle. An indication of the abundance of these resources is shown in Figure 10.4 from a national survey undertaken in 2000.

Demersal

Hake, sole and horse mackerel are the main demersal species targeted by the inshore trawl sector. The bulk of the biomass of these species occurs on the west and south coasts with only a small portion occurring in Eastern Cape waters. Figure 10.5 indicates the portion of stocks which occur in Eastern Cape waters.

Linefish

The general perception of the Eastern Cape linefish resource is that it has been exhausted (Britz *et al.*, 2001). There is no province-specific information for the status of the linefish resource but it is well known that many of South Africa's line fish stocks, which also occur in the Eastern Cape, have collapsed (Britz *et al.*, 2001).

Of approximately 100 species presented in the South African Marine Linefish Reports (Mann, 2000), 2% were closed³ to commercial and recreational exploitation, 10% were protected and 14% were classed as critical (DEAT, 1999). However, 42% were categorised as exploitable.

Linefish species associated with reefs in the Eastern Cape Province are heavily exploited and due to their residential and territorial nature and slow growth rates, they are susceptible to over exploitation. The stock status of most of these species is considered to be highly vulnerable (Britz *et al.*, 2001). Several species found over sandy/muddy substrates are also highly vulnerable and heavily exploited. These include species such as geelbek and the silver kob, and it appears that both stocks have collapsed in the Eastern Cape Province and are currently less than 10% of the pristine biomass (Britz *et al.*, 2001). A summary of marine linefish stocks is provided in Table 10.8.

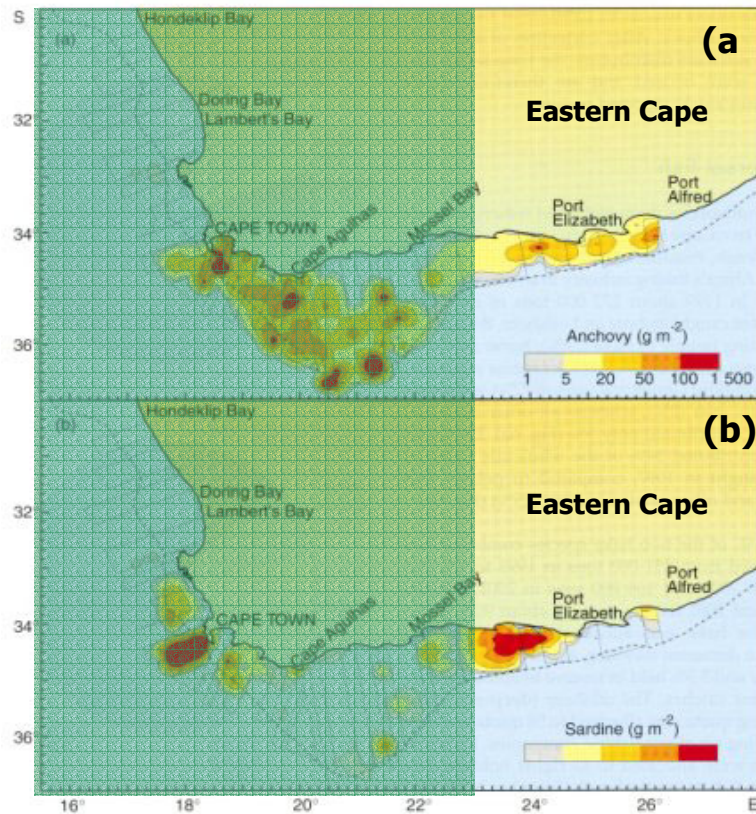


Figure 10.4: Distribution and relative abundance of (a) anchovy and (b) sardine (or pilchard) in November 2000 (Naidoo & Verheye, 2001)

³ The linefish categories have the following bag limits per day:

Closed – No fish may be taken; Restricted – No fish may be taken; Critical – Two fish per person per day

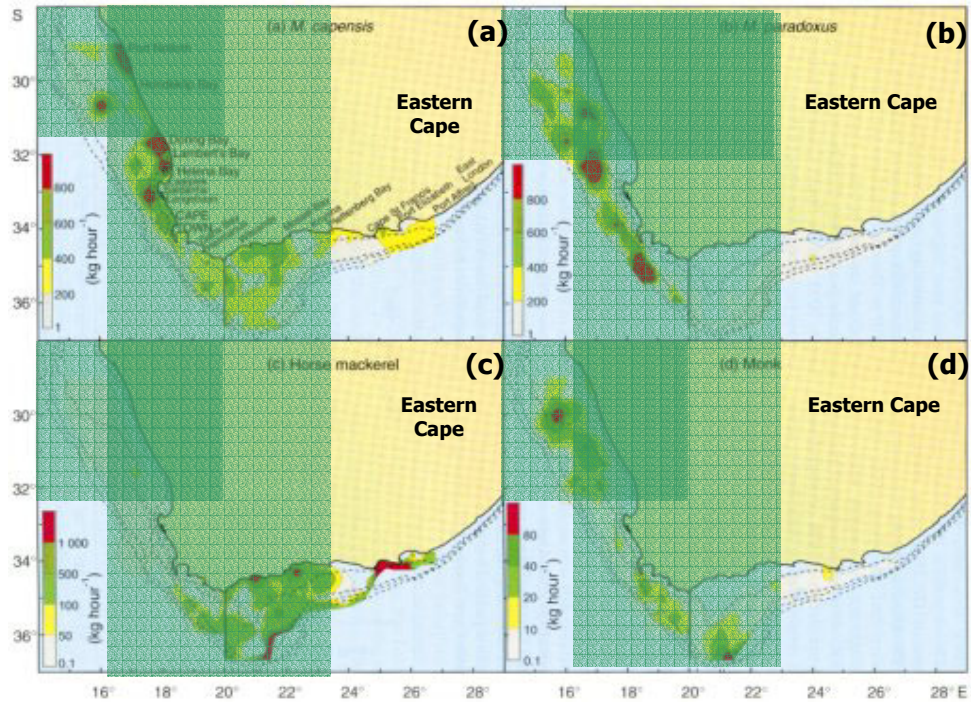


Figure 10.5: Biomass distribution of (a) shallow-water hake, (b) deep-water hake, (c) horse mackerel and (d) monk from January 2000 and May 2000 research surveys (Naidoo & Verheye, 2001)

Table 10.8: Summary of the popular marine linefish stock status (Britz *et al.*, 2001)

Species	Life history	Stock status
Silver Kob	Resident	Collapsed
Dusky Kob	Coastal migrant and resident	Collapsed
Squaretail kob	Resident	Collapsed
Geelbek	Coastal migrant	Collapsed
Dageraad	Resident	Collapsed
Seventy-four	Coastal migrant	Collapsed
Slinger	Resident	Collapsed
Red Steenbras	Resident	Collapsed
White steenbras	Coastal migrant	Collapsed
Yellow belly rockcod	Resident	Collapsed
Catface rockcod	Resident	Collapsed
Red stumpnose	Resident	Collapsed
Red roman	Resident	Collapsed
Scotsman	Resident	Collapsed
Engilsman	Resident	Collapsed
Poenskop	Resident	Collapsed
White mussel cracker	Resident	Collapsed
Bronze bream	Resident	Unknown
Galjoen	Resident	Collapsed
Santer	Resident	Unknown
White stumpnose	Resident	Under review
Carpenter	Resident	Under review
Hottentot	Resident	Under review
Zebra	Resident	Unknown

Blacktail	Resident	Under review
Spotted grunter	Resident	Under review
Strepie	Coastal migrant	Under exploited
Elf	Coastal migrant	Over exploited
Leervis	Coastal migrant	Unknown
Snoek	Nomadic	Under review
Yellowtail	Nomadic	Optimally exploited
King mackerel	Coastal migrant	Over exploited
Queen mackerel	Coastal migrant	Optimally exploited
Panga		Under exploited
Hake		Optimally exploited
Longfin tuna		Optimally exploited

10.2.4: Pollutant loading entering the sea from land-based sources

Industrial and domestic effluents are generated in the developed areas within the Province and are ultimately discharged into the coastal environment where they can have significant impacts on the health of the inshore environment. Monitoring of the number of discharges within the Province and the nature and volume of the effluent is important for future reference and can be used as an indication of the expansion of industrial activities and growth of domestic services. This information must be used to control future licensing of point source discharges. This indicator illustrates the location, nature and volume of the domestic and industrial effluent discharges in the marine and estuarine environments within the Eastern Cape Province.

Currently there are seven registered domestic marine discharge points (Table 10.9) within the Eastern Cape and 5 industrial effluent discharge points (Table 10.10). The domestic discharge effluent for all sites is monitored, either by DWAF or the local municipality, while private companies are responsible for monitoring their industrial effluent and reporting to DWAF. A further permit has been granted for the construction of an offshore pipeline at Hood Point on the West Bank at East London, although this has not been constructed yet. Where available, monitoring data for the effluent discharged are presented in Appendix 1 and 2.

There are many storm water outlets into the marine and estuarine environments within the Province that are maintained by the local municipalities. A list of the major outlets is provided in Table 10.11. Due to the irregular discharges from these outlets there is no water quality monitoring data for these discharge points.

The medians and 95th percentiles of the water quality variables collected during monitoring indicates that conductivity, ammonia, chemical oxygen demand, suspended solids, cadmium, chromium, lead and zinc were often above the DWAF general limits (DWAF, 1999). Although the monitoring data collected is for the effluent discharge and does not include data for the marine environment surrounding the discharge point, it was compared to the target values for the coastal zone (DWAF, 1995) which fall well below the general limits. In addition to those water quality parameters which are above the general standards, pH, copper and nickel were outside the DWAF water quality guidelines for coastal and marine waters.

Problems, which may result from discharges of poor water quality into the marine environment, include increased mortalities, eutrophication and excessive algal growth, as well as changes in growth rates and reproduction of resident marine species. Table 10.12 indicates the potential problems associated with each water quality variable. The water quality criteria for the various water use sectors can be obtained from Kempster, Hattingh and van Vliet (1980).

Table 10.9: Domestic discharges into the coastal environment in the Eastern Cape Province (Lucas, *pers comm.* 2004; Retief, *pers comm.* 2003; Kaleni, *pers comm.* 2003). Available monitoring data for the discharges are presented in Appendix 2.

Name	Location	Description of discharge	Monitoring responsibility	Estimated daily discharge	Permitted annual discharge
Humansdorp Sewage Treatment Works	Seekoei estuary		DWAF		Not to exceed 2 000m ³ /day
Fish Water Flats Water Treatment Works	Sea discharge 2m behind breakers at Deal Party PE	Treated to general standards	DWAF	39.65Ml/day	Domestic - 32 120 000 m ³ /annum
Cape Receive Nelson Mandela Metro Sewage	Sea discharge at Cape Receive	Treated to general standards	DWAF	10.31Ml/day	3 412 800 m ³ /annum
Drift Sands Sewage Treatment Works	Sea discharge at Cape Receive	Treated to general standards	DWAF	11.30Ml/day	No permitted discharge volume. Plant capable of treating 2 410 000m ³ /annum
Hood Point	East London, surf zone	Temporary discharge of raw sewage with screening only	Buffalo City Municipality	7Ml/day	
East Bank Water Treatment Works	East London, surf zone behind breakers	Treated to general standards	Buffalo City Municipality	40 Ml/day (?)	
Gonubie Sewage treatment works	Clako Stream	Treated to general standards	Buffalo City Municipality	5 Ml/day	

Table 10.10: Industrial effluent discharges into the marine and estuarine environments in the Eastern Cape Province (Lucas, *pers comm.* 2004; Fourie, *pers comm.* 2004; Retief, *pers comm.* 2003). Available monitoring data for the discharges are presented in Appendix 3.

Name	Location	Description of discharge	Monitoring responsibility	Current daily discharge	Permitted annual discharge
Osterlig Visery	Port Elizabeth harbour	Cooling sea water	?	?	?
Pretoria Portland Cement (PPC)	Papenkuils Canal tidal areas, Port Elizabeth	Saline water/gypsum (?)	?	?	?
Fish Water Flats Water Treatment Works	Papenkuils Canal	Industrial effluent	DWAF	31.47Ml/day	12 840 Ml/annum
Albany Coastal Water Board Ndlambe municipality	Bushmans estuary	Brine discharge	DWAF (once only)	500m3/day	No permit available
DowAgro Sciences	ex Cyril Lord pipeline at Hood Point, surfzone	Saline effluent	DowAgro Sciences Currently negotiating with municipality to discharge into Hood Point	150m3/day	200 m3/day

Table 10.11: Significant storm water discharges into the marine and estuarine environments in the Eastern Cape Province. Volumes and monitoring data unavailable (Lucas, *pers comm.* 2004)

Name	Location
Summerstrand	Port Elizabeth
Humewood	Port Elizabeth
Central	Port Elizabeth
Bakens River to PE Harbour	Port Elizabeth
Papenskuil Canal	Port Elizabeth
Deal Party	Port Elizabeth
Motherwell Canal	Zwartkops Estuary
Markman Canal	Zwartkops Estuary
Chatty River	Zwartkops Estuary
First Creek	Buffalo Estuary, East London
Second Creek	Buffalo Estuary, East London
Esplenade	East London
Moore Street Drain	East London
Eastern beach	East London
Blind River	Eastern beach, East London
Ihlanze stream	Nahoon beach, East London
Gonubie Point	East London

Table 10.12: Potential problems associated with various elevated water quality parameters (DWAF, 1995)

Natural Environment	Marine Organisms	Recreational Use
pH		
Important in the natural environment as it affects solubility of metals, in which case can lead to toxic releases particularly when low	General growth deficiencies Changes in respiration patterns Changes in water pumping rates Shell deformation Increased mortalities	Skin and eye irritations
Ammonia		
Free ammonia highly toxic to aquatic life, affected by pH, mainly from sewerage and agricultural runoff ⁴	General growth deficiencies Increased mortalities	
Suspended solids		
Unpleasant aesthetics	General growth deficiencies Increased mortalities	Physical injuries Unpleasant aesthetics (odour) Clogging/blockage of equipment
Nitrate		
Eutrophication Decrease in oxygen levels	General growth deficiencies Increased mortalities	
Nitrite		
Eutrophication Decrease in oxygen levels	General growth deficiencies Increased mortalities	
Phosphorous		
Eutrophication Decrease in oxygen levels	Possible increased mortalities	
Cadmium		
Cumulative and highly toxic to higher forms, industrial pollution associated	General growth deficiencies Lowered reproduction	Cumulative and highly toxic to higher forms, industrial

with zinc and lead ⁴	Changes in respiration patterns Changes in water pumping rates Mortalities Burrowing abnormalities	pollution associated with zinc and lead ⁴
Chromium		
	Increased mortalities	Essential in human nutrition without which insulin doesn't function, however toxic in high concentration. Metal plating and tanning industries are potential pollutants. ⁴
Copper		
Toxicity to fish exacerbated by low calcium content and a low conductivity. ⁴	General growth deficiencies Lowered reproduction Changes in respiration patterns Changes in water pumping rates Mortalities Burrowing abnormalities	
Nickel		
Essential element but toxic to certain plants as high concentrations ⁴	Increased mortalities	
Lead		
	General growth deficiencies Lowered reproduction Increased mortality	Main source is burning of fossil fuels, affects nerve tissues, more toxic at low calcium concentrations. ⁴
Zinc		
Toxicity to fish exacerbated by low calcium content and a low conductivity. ⁴	General growth deficiencies Lowered reproduction Changes in respiration patterns Changes in water pumping rates Mortalities Burrowing abnormalities	
Faecal coliforms		
		Gastrointestinal problems Skin, Eye, respiratory irritations

10.2.5: Number of functional co-management initiatives

New policy and legislation advocates a change in resource management to co-operative and co-management agreements in order to encourage local stakeholders to take responsibility for the natural resources as well as assist poorly resourced government departments in management functions. An assessment of the number and effectiveness of co-management initiatives within the Province will indicate the successfulness of co-management projects which have been initiated over the long term.

This indicator aims to represent the level of public, private and community involvement in planning and management in the coastal zone through co-management initiatives. The National Environmental Management Act (RSA, 1998) provides the overarching legislative framework for environmental governance in South Africa. It has provisions for the establishment of partnerships and cooperation agreements for the management of natural resources and provides the legal framework for formalizing co-management agreements (Hauck & Sowman, 2003).

⁴ Adapted from Kempster, Hatting and van Vliet (1980)

In the Eastern Cape several co-management projects have been initiated and are in various stages of implementation. Very few of these projects have been formalised in terms of the legislation and currently exist as local forums which are involved in resource management. The Eastern Cape Estuaries Management Programme established co-management initiatives on 5 estuaries which now range from informal to formalised co-management initiatives. A list of the existing and coastal co-management agreements within the Province is provided in Table 10.13.

Table 10.13: Location, type and status of co-management initiatives within the Eastern Cape Province

Name	Location	Type	Status	Source
Amadiba Adventures initiative	Between Mzamba and Mtentu estuaries	Tourism (Horse and hiking trail, fishing guides)	In process of formalising agreement	Quatekana, pers comm. 2003 Ngubane, pers comm. 2003
Mtentu Estuary Management Forum	Mtentu Estuary	Natural Resource Management	Formal agreement in terms of NEMA Constitution and Management Plan in Place	Ndovela, pers comm. 2003
Mbizana Conservation Development Initiative		Tourism and resource management	No formal agreement signed yet	Huggins, pers comm. 2003
Quakeni Conservation Development Initiative		Tourism and resource management	No formal agreement signed yet	Huggins, pers comm. 2003
Nqabarha Community Projects	Willowvale	Arts & crafts, Medicinal plant garden, woodlots	Draft constitution has been prepared but are still negotiating a formal agreement	Ncisane, pers comm. 2003
Estuary Care	Bushmans & Kariega Estuary	Estuarine management	No formal agreement	Fox, pers comm. 2003
Manteku Estuary	Manteku estuary	Estuarine and resource management along with eco-tourism	In the process of establishing a formal agreement, to be finalised during 2004	Sihlophen, pers comm. 2003
Mngazana Conservation Programme	Mngazana Estuary	Primarily mangrove conservation, initiating canoe trails and tourism projects	Awaiting two signatures on constitution for formal agreement in terms of NEMA	Msimang, pers comm. 2003
Operation Jody	Western Region	Law enforcement and compliance	Contract in terms of MLRA between SAPS and MCM	Dlulani, pers comm. 2003
Dwesa/Cwebe initiative	Dwesa/Cwebe	Participatory Forestry Management agreement	Formal agreement in terms of the National Forest Act	Pienaar, pers comm. 2003
Mkambati initiative	Mkambati	Contractual park arrangement	Will be implemented under the Eastern Cape Environmental Conservation Act	Pienaar, pers comm. 2003

The majority of these co-management initiatives are in the early stages of development and operation and continued monitoring in the future will determine their success.

10.2.6: Blue Flag beaches

Blue Flag status indicates that beaches are in near pristine condition and have excellent amenities available for public use. Monitoring the number of beaches within the Province which attain this status will indicate the success of coastal managers in maintaining their beaches in good condition and ensuring adequate services for the public as well as acting as a surrogate for water quality and pollution (Blue Flag Campaign, 2003).

This indicator reports on the number of beaches in the Eastern Cape Province obtaining Blue Flag status per year. This represents the condition of the major beaches in terms of environmental education and information, water quality, environmental management, and safety and services, which includes excellent life saving standards, top rate ablution and parking facilities as well as access for the disabled.

South Africa is currently one of 24 countries participating in the Blue Flag campaign and our beaches are assessed according to 14 criteria and are subject to a strict monitoring process. The criteria are summarised in Table 10.14. Before they can attain Blue Flag status, each beach must undergo a pilot phase during which they have two years to meet the various criteria. If they fail to meet these standards within this timeframe then they may only reapply for pilot phase after a one-year period. The Wildlife and Environment Society of South Africa (WESSA) are the national Blue Flag coordinators for DEAT and are responsible for monitoring the pilot phase beaches and recommend their approval to the international jury.

Table 10.14: Criteria for assessing beaches for Blue Flag status (Blue Flag Campaign, 2003)

Category	Criteria
Management	Blue Flag Administration
	Management of beach activities
	Provision of ablution facilities
	Cleaning of beach
Water quality	Compliance with recreational bathing water quality
	Management of storm water pollution
	Compliance with National Oil Pollution Contingency Plans
	Compliance with planning legislation
Safety	Provision of lifeguards on beach
	Infrastructure required
	Patrolling of beach area
Information and education	Display and maintenance of notice board
	Undertaking environmental education projects
	Monitoring of beach area

Eight South African beaches were awarded Blue Flag status for the 2003/4 season spanning from 1 November 2002 to 30 April 2003, and a further six have registered and are beginning pilot projects to achieve full Blue Flag status in the near future.

In the Eastern Cape Province, Humewood Beach in the Nelson Mandela Metropolitan Municipality is the only beach to have received Blue Flag status so far (Kelly, *pers comm.* 2003). Humewood was initially awarded pilot phase Blue Flag status during the 2000/2001 season and has since been awarded full status for the 2001/2002, 2002/2003 and

2003/2004 seasons (each season begins on 1 November and runs until 30 April the following year) (Cain, *pers comm.* 2003). Humewood Beach is situated on the outskirts of the main city area of Port Elizabeth and has good facilities and its own Environmental Education division. A further three beaches in the Eastern Cape Province namely, Dolphin Beach in Jeffrey's Bay, Wells Estate near Port Elizabeth and Kelly's beach in Port Alfred are currently running pilot phase projects and aim to achieve full Blue Flag status in the near future (see Table 10.15).

Table 10.15: Number and status of Blue Flag beaches in the Eastern Cape Province (Kelly, *pers comm.* 2003; Cain, *pers comm.* 2003)

Beach Name	Location	Status	Season
Humewood Beach	Port Elizabeth	Full Blue Flag Status	2001/2002; 2002/2003; 2003/2004
Dolphin Beach	Jeffrey's Bay	Pilot Phase	2003/2004
Wells Estate	Port Elizabeth	Pilot Phase	2003/2004
Kelly's Beach	Port Alfred	Pilot Phase	2003/2004

10.3: The state of the marine and coastal environment in the Eastern Cape Province

The Eastern Cape Province marine and coastal environment is an extremely valuable asset and resource due to its aesthetic value, ecological and biological diversity and economic potential (Coastal and Environmental Services, 2003). The Province's coastline is over 820km in length, extending from the Groot Wes estuary in the south to the Umtamvuna estuary in the north (Coastal and Environmental Services, 2004a). The marine and coastal environment includes the terrestrial ecosystems (dune systems, coastal forests and grasslands), which are influenced by the marine environment, as well as the intertidal and inshore habitats and the deepwater offshore environments. These habitats host a wide range of biological diversity and resources, which have been subject to varying levels of exploitation and development in the past. High levels of infrastructural development have occurred between the Kei and Kromme estuaries, which has resulted in increased pollution, and loss of visual appeal of the natural coastal environment in this region of the Province. Inshore marine resources are also heavily exploited within the Province, particularly north of the Kei estuary, where the rural subsistence life style is prominent in the former homeland areas. The offshore resources are less accessible to the subsistence fishermen but are heavily exploited by commercial operators and fishermen who have the necessary equipment.

In the past the marine and coastal environment was managed sectorally on a resource basis. This led to an overlap in the areas of jurisdiction and uncertainty as to the roles and responsibilities between the different organs of state. A new approach to coastal management has recently been outlined in new national policies, which advocate an integrated and co-ordinated approach to management of coastal resources (DEAT, 2000). This requires that the marine and coastal resources are managed holistically and that a coastal management programme is established for the Province. The Marine and Coastal Management Branch of the national Department of Environmental Affairs and Tourism (DEAT) and the provincial Department of Economic Affairs, Environment and Tourism are the lead agents for coastal management within the Province. Currently there is a lack of institutional capacity and coordination between these departments to administer and enforce the existing coastal legislation, which has allowed uncontrolled utilisation and development in several areas of the Eastern Cape coastline (Coastal and Environmental Services, 2004b).

Chapter 11: Poverty

11.1: Introduction

Poverty is simplistically defined as a condition of unacceptable human deprivation. Complexity enters the definition when the concept of 'deprivation' has to be more fully described. The complexity is driven by the fact that different people and institutions view poverty in different ways. Poverty can also be defined at various different levels, from national poverty through to household or individual poverty, each level requiring its own unique intervention strategy (DBSA, 1998). A useful definition that describes the border of poverty is that of a 'competent' household (Eastern Cape Office of the Premier, 2003). This definition states that a 'competent' household is "a household which can command sufficient resources to supply its own needs for nutrition, shelter, health and education and have enough of a surplus to contribute to the welfare of the community at large". A household that cannot achieve this state is considered to be in poverty. This definition combines both the intangible and tangible aspects of poverty (Max-Neef *et al.*, 1989).

The historical causes of poverty in the Eastern Cape Province have been well documented (Eastern Cape Office of the Premier, 2003). A succession of legal enactments, particularly those from the apartheid era, served to create a dual economy in South Africa. This dual economy consisted of a poor and dispossessed rural population, a pool of migrant labour living in rural areas that was dependent on the core economy for its existence. The local economy all but disappeared, markets shrank and the cash multiplier reduced to derisory levels, close to 1.0 (Reynolds, 2003). This in turn gave rise to a transplanted poverty in the urban areas, caused by rural people migrating to urban areas in search of an improved livelihood. The apartheid government attempted to give substance to the economy through rural irrigation schemes and peri-urban industrial townships, where participants enjoyed substantial state-funded inducements to re-locate. These schemes had little impact, and the assets created for this purpose in the Eastern Cape Province are mostly moribund and vandalised today.

The dual economy did not disappear in 1994, although it was not officially recognised in government policy formation until early in 2003, when the President, in his opening of Parliament speech, mentioned it for the first time as an economic factor (Mbeki, 2003). In the intervening years the effects of the dual economy have been greatly exacerbated by the impact of globalisation and South Africa's position as a small, unregulated economy in the global environment.

In a qualitative participatory survey conducted in Intsika Yethu municipal area in the Eastern Cape Province, respondents reported that 50% of the households were 'poor'. This was defined as having only one all-purpose living space, whose structure was considered a health hazard. In terms of nutrition, the household does not know where the next meal is coming from and is dependent on hand-outs. They have no access to health services, the children are frequently sick and perform poorly at school. The category 'better off', constituting 20% of the population, enjoyed marginally better living conditions. In contrast, the 10% of 'very rich' households had secure and insured buildings and were targets of crime. They bought food in bulk and could afford domestic workers. In terms of health, they had access to specialist care in the big towns and could afford to keep stocks of liquor for themselves and their friends. In neighbouring Amahlati, the list was similar, but expanded to include suffering from diabetes, gout and high blood pressure (Eastern Cape Office of the Premier, 2003).

Within this broader framework, the Eastern Cape issues are probably common to all provinces. According to the Eastern Cape Office of the Premier (2003) there is a "sterile triangle"

suppressing economic development in the rural areas. At the one apex of the triangle are abundant human and natural resources which are being under-utilised as evidenced by skilled community members with no employment and major investment in irrigated agriculture which are not benefiting communities. At the second apex, there is institutional failure by government and private enterprises with symptoms such as gate-keeping and non-functional policies. At the third apex is the prevalent attitude of despondency and despair of the population due to failed projects and failed applications. These three factors have led to a situation where the wealth of resources in the Eastern Cape Province is not being used appropriately due to poor governance. This has thus led to despondency and dependency behaviour of the people.

11.2: Key Indicators

The indicators that follow have been selected to provide an indication of the current conditions within the Eastern Cape Province with regards to poverty. The indicators include:

- Household income;
- Unemployment;
- Notifiable diseases;
- HIV/AIDS prevalence;
- Population growth; and
- Budgetary allocation vs. expenditure for poverty alleviation.

The results of the indicators are provided in the following pages.

11.2.1: Household income

Household income is one of the prime determinants of poverty, no matter what definition of poverty is used. Figure 11.1 shows the distribution of annual household income by District Municipality in the Eastern Cape Province. The variation in annual household income between District Municipalities is apparent. The more urbanised District Municipalities such as Nelson Mandela Metropolitan Municipality have a higher proportion of households with above average annual household incomes. The reverse applies in the largely rural Alfred Nzo, Ukhahlamba and O.R. Tambo District Municipalities, where most households have an annual income below R6 000 (70% for Alfred Nzo, 65% for Ukhahlamba and 67% for O.R. Tambo).

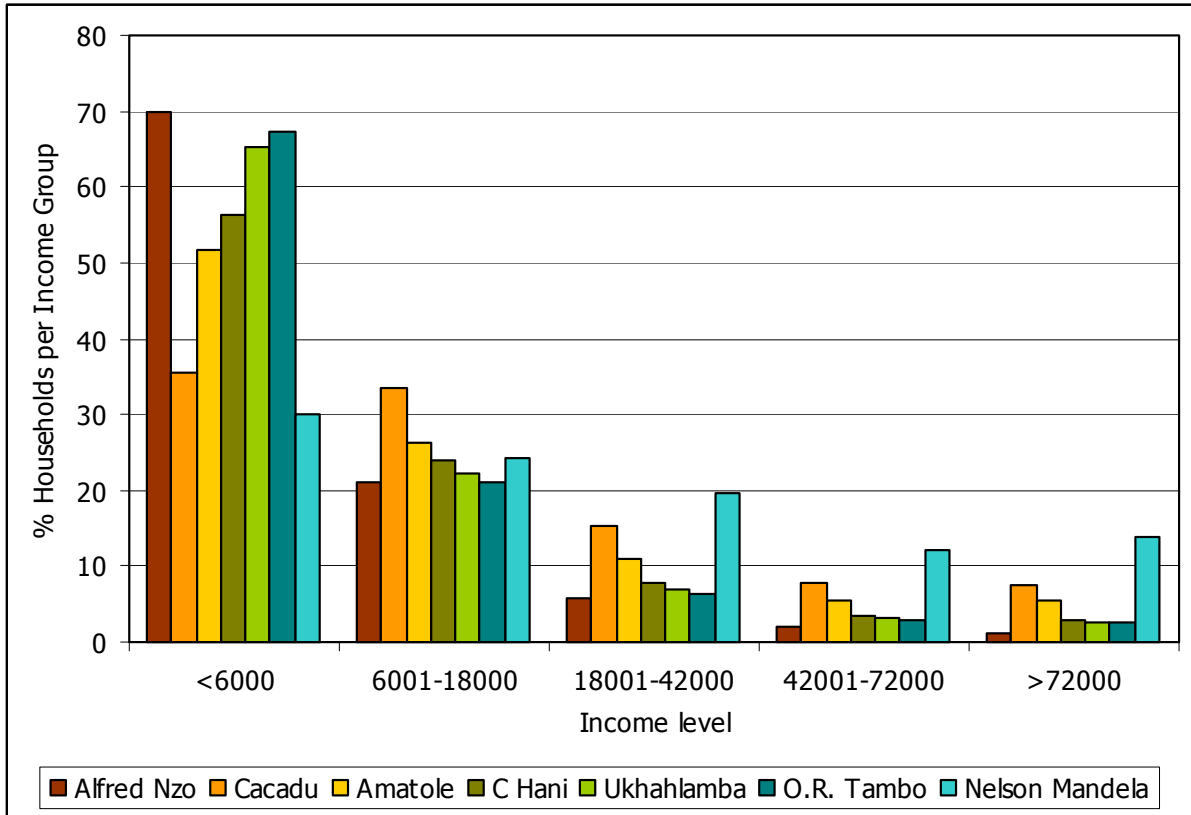


Figure 11.1: Annual household income in the Eastern Cape Province (ECSECC, 2003)

11.2.2: Unemployment

In addition to the low annual household income levels evident in the previous indicator, unemployment is as critical in understanding poverty in the Eastern Cape Province. Employment is a response for poverty alleviation and unemployment is thus a driver of poverty in the Province. The unemployment rate of the Eastern Cape Province is currently 32% (this figure excludes those individuals that are not economically active such as students, homemakers, the disabled, those too ill to work and anyone not seeking work) (Labour Force Survey, 2001 in Statistics South Africa, 2003). This statistic of unemployed people includes a category of household that “does not know where the next meal is coming from and is dependent on hand-outs” (Eastern Cape Office of the Premier, 2003). These people are most vulnerable to changes in their social, economic and biophysical environments as they have few resources at their disposal to cope with change. The 2001 provincial unemployment rate can be compared to the 2001 national unemployment rate of 29.5% and the 1996 provincial unemployment rate of 48.5% (based on an expanded definition of unemployment) (Statistics South Africa, 2000). It would thus appear that whilst unemployment has decreased since 1996 in the Eastern Cape Province, it is still above the national average.

11.2.3: Notifiable diseases

Disease is one outcome of inadequate and unsanitary living conditions, which in turn are an outcome of conditions of poverty. Both exposure to diseases, and an individual’s vulnerability to them, can be expected to increase as that individual’s socio-economic status declines. Of the 31 diseases that are listed as ‘notifiable’ diseases, pulmonary tuberculosis (TB) is by far the

greatest threat to health in the Eastern Cape Province. In addition, TB is often associated with the presence of the HI virus (Department of Health, 2000a). Table 11.1 provides data on notifications and deaths caused by various diseases for the Western region of the Province. Unfortunately, data for other regions of the Province were not available.

Table 11.1: Notifiable diseases in the Eastern Cape Province (Western Region, 2001 and 2002) (Department of Health, Grahamstown District, 2003)

Disease	Total notifications		Deaths	
	2001	2002	2001	2002
Acute flaccid paralysis	2	0	0	0
Acute rheumatic fever	1	0	0	0
Congenital syphilis	134	22	0	0
Haemophilus influenza	0	1	0	0
Leprosy	0	1	0	1
Malaria	7	2	0	1
Measles	10	3	0	1
Menigococcal infection	23	14	3	3
Poisoning, food	11	0	0	0
Poisoning, other agricultural	2	0	1	0
Poisoning, pesticide	6	0	0	0
Shigellosis	8	1	0	0
TB bones and joints	27	19	4	0
TB genito-urinary system	8	3	0	0
TB intestines	14	17	0	2
TB meningitis, CNS	59	62	20	24
TB military	33	34	6	5
TB other organs	144	135	8	11
TB other respiratory	550	505	0	10
TB primary	1151	830	41	31
TB pulmonary	9662	8364	1488	1498
TB pulmonary relapse	1348	1508	0	0
TB peripheral lymph nodes	5	3	0	0
TB pleural effusion	18	8	0	2
TB total	13019	11488	1567	1583
Tetanus	0	2	0	2
Typhoid fever	0	2	0	0
Viral hepatitis A	1	4	0	0
Viral hepatitis B	16	8	5	2
Viral hepatitis non-A,B	3	1	1	0
Viral hepatitis unspecified	1	2	1	2
Whooping cough	1	1	0	1

Of the 31 notifiable diseases, only pulmonary TB resulted in a significant number of cases and deaths in the Province. Relative to the total population of 6.4 million people (Statistics South Africa, 2003), the notified cases amounted to 1.78 per thousand people and the deaths to 0.25 cases per thousand people. While TB remains the major cause of illness and death in the Province, the available data indicate a decline over the two year period. The association between HIV/AIDS and TB and the growing incidence of the former suggests that TB will become a growing problem in the future.

11.2.4: HIV/AIDS Prevalence

This indicator records the prevalence of HIV/AIDS among the different population and age groups within the Eastern Cape Province. As there is no cure or vaccine for HIV/AIDS at present, HIV/AIDS prevalence is closely linked with morbidity and mortality in the Province. Models developed by the Development Bank of South Africa (DBSA, 2002) suggest that the population of the Eastern Cape Province will plateau around 2012 – 2016, after which it will start to decline predominantly due to HIV/AIDS-related deaths.

The annual Department of Health (DOH) 'Survey on the Prevalence of HIV and Syphilis amongst Women Attending Public Health Sector Antenatal Clinics' is regarded as the official data source for HIV/AIDS statistics in South Africa. Dhlamini and Ntonto (2003), using data derived from the DOH Survey, show that the prevalence of HIV among pregnant women attending clinics in the Eastern Cape Province is 23.6%, below the national average of 26.5. It is also growing at a slower rate, as is indicated in Figure 11.2.

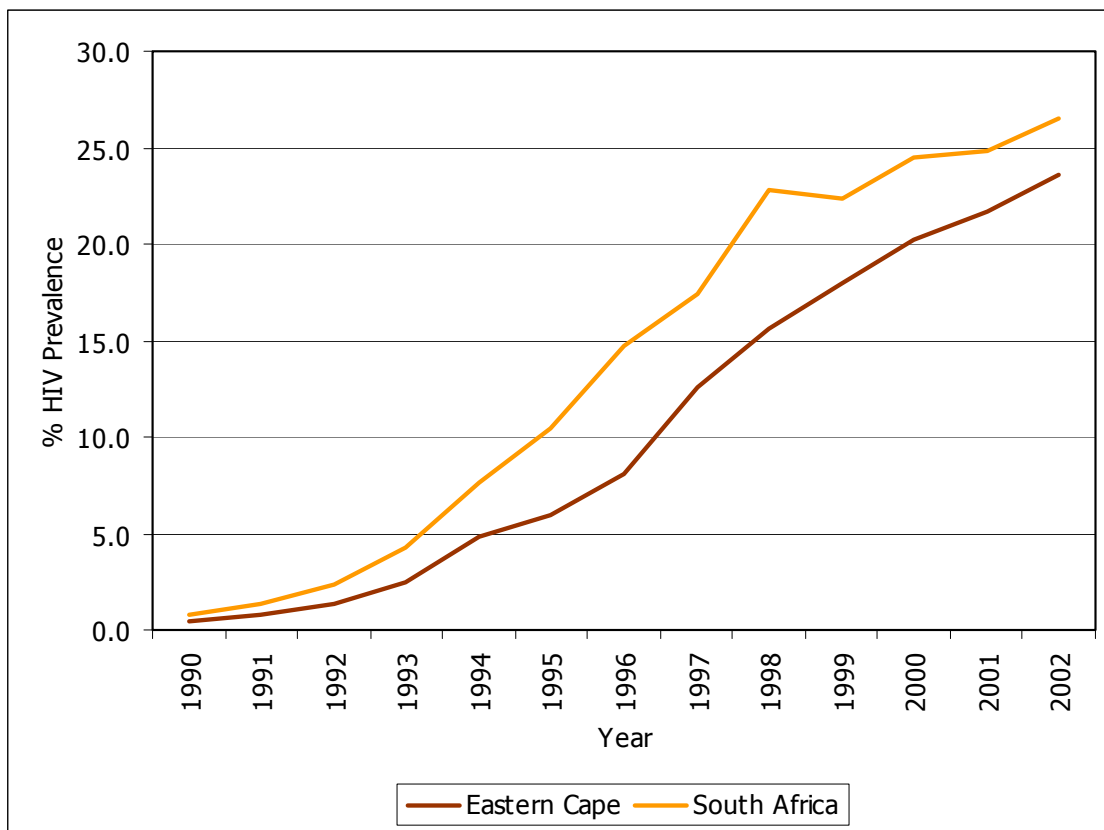


Figure 11.2: Trend in HIV prevalence in South Africa and the Eastern Cape Province among antenatal clinic attendees (Dhlamini and Ntonto, 2003; National Department of Health, 2003)

The Eastern Cape Province has one of the highest HIV growth rates in South Africa, increasing from 0.4% in 1990 to 23.6% in 2002 for antenatal clinic attendees, which indicates a doubling time of approximately 14 months (Dhlamini and Ntonto, 2003). As might be anticipated, the prevalence of the disease is slightly higher in the urban than in the rural areas, as is shown in Figure 11.3.

The Department of Health (2000) also notes that there is an inverse relationship between HIV prevalence and the number of pregnancies. The combination of increased mortality due to HIV/AIDS and decreased birth rates will lead to an overall population decline in the Eastern Cape Province.

In the National HIV/AIDS and Syphilis Antenatal sero-prevalence survey in South Africa 2002 (National Department of Health, 2003) the antenatal clinic data are extrapolated to provide a picture of HIV/AIDS prevalence in the general population. Unfortunately the data have not been extrapolated on a provincial basis, but the national extrapolation suggests a prevalence of approximately 12% in the South African population (Department of Health, 2003). This is comparable to the HSRC study which found a prevalence of 11.4% for HIV/AIDS in the South African population. It is thus likely that the HSRC statistics of 6.6% HIV prevalence in the population of the Eastern Cape Province is comparable to Department of Health statistics (HSRC, 2003).

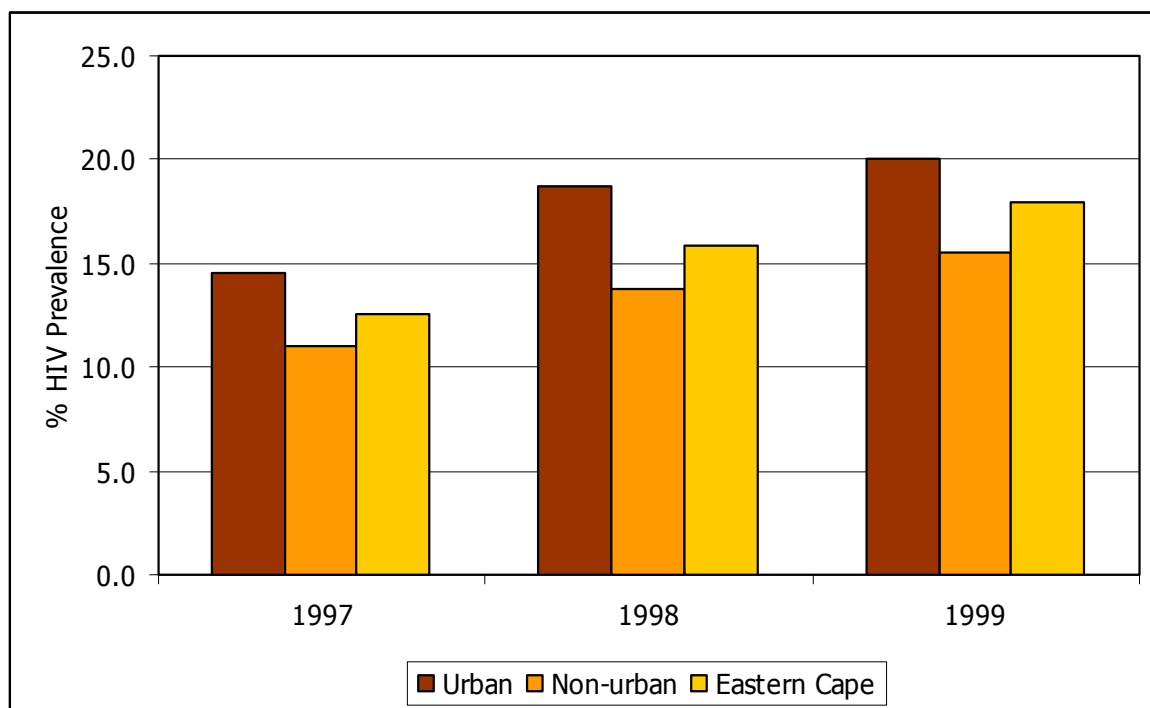


Figure 11.3: Urban and non-urban growth in HIV prevalence among antenatal clinic attendees in the Eastern Cape Province (Department of Health, 2000b)

Even accepting the best interpretation of the data, the picture that emerges is one of a population under an intense and growing threat from HIV/AIDS, with little in sight to change the picture for the better, until anti-retrovirals are widely and functionally available. The implications are that the Province will need to create support mechanisms for orphans and child-headed households at a much more effective level than exists at present. In time the equilibrium of employment will be affected and there is already anecdotal evidence that skilled artisans are being lost in the construction industry. Most pressing, however, is the issue of family welfare, as this is a problem that is already present and rapidly worsening.

11.2.5: Population growth

The rate of population growth is a key indicator for macro level economic planning. It affects the supply of both hard infrastructure such as communication, transport and services, as well as the social overhead such as education and health. Recent growth rates were found to be as low as 2.1% and predictions of declines to below 1.0% in the near future (Statistics South Africa, 2003; DBSA, 2002). Figure 11.4 shows the actual and predicted growth in the population for five year intervals from 1996 to 2021.

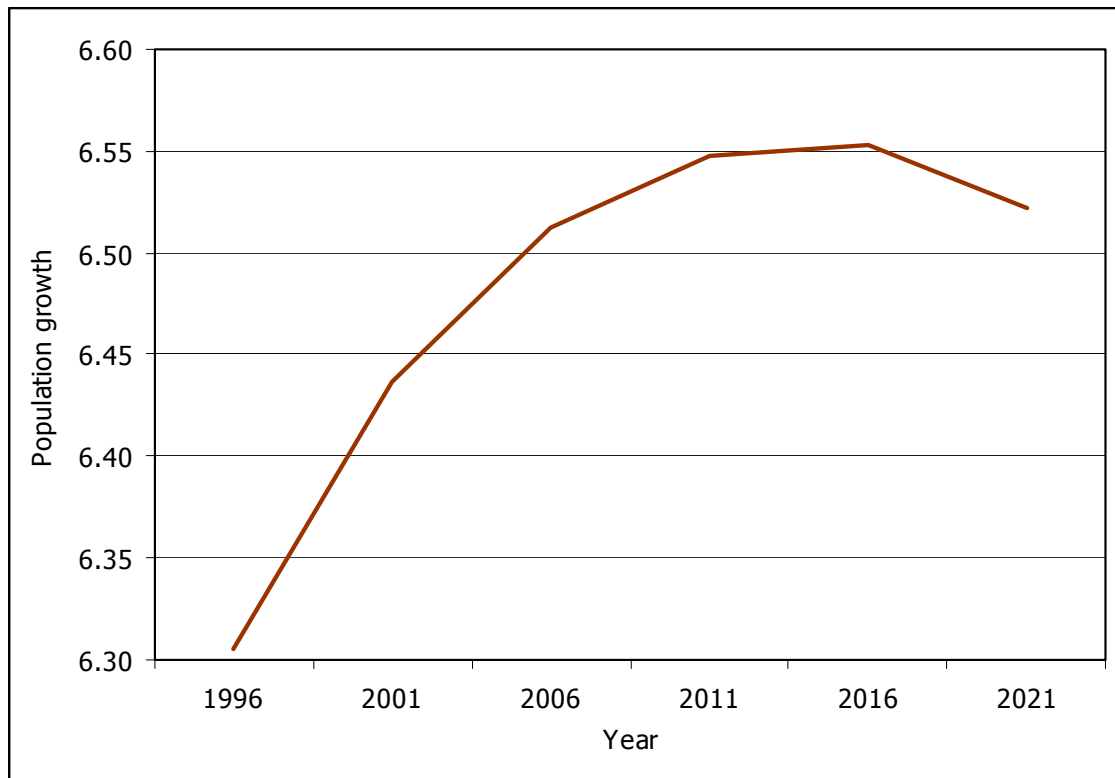


Figure 11.4: Actual and predicted population in the Eastern Cape to 2021 (Statistics South Africa, 2003; DBSA, 2002)

Figure 11.4 shows clearly the predicted decline in population growth from the year 2016. Much of this trend can be attributed to HIV/AIDS prevalence in the Province as people currently living with HIV die of AIDS in the next 5-10 years. A notable impact associated with HIV/AIDS mortality is that large numbers of the economically-active population will be affected resulting in a skewed population pyramid. The loss of that slice of the population traditionally bearing the responsibility of supporting the young and aged will have major implications for macro economic planning in the future. Present indications are that the predictions in Figure 11.4 could be taken as the worst case scenario and prudence suggests that this should be assumed for planning purposes until better information is on hand.

11.2.6: Budget allocations vs. expenditure for poverty alleviation

The sustainable solution to poverty in the Province is the effective implementation of policies put in place by the government to address the structural issues causing it. Some of these policies can be considered drivers or agents of change in the poverty arena. The existing level of

deprivation, however, necessitates short term palliative measures to improve the welfare state of the poorest sections of the community. Data provided in the previous sections indicate that a large proportion of the population require some sort of safety-net support.

While non-governmental organisations have been successful, the reality is that relative to the very large volume of funds available to the State for poverty relief, the funds available to NGOs are not significant. Only the State can make a meaningful impact on the depth and extent of poverty in the Eastern Cape Province. It follows therefore that there is a plethora of special programmes funded by the State, some visible and separately accounted for and some an integral part of departmental budgets which cannot practically be separated out.

The largest identifiable special poverty alleviation programmes are those run by the Department of Economic Affairs, Environment and Tourism (DEAET) and the Working for Water programme (WfW). The DEAET has 80 projects, mostly relating to labour based initiatives in its Isongololo Tourism Programme (DEAET, 2003a). They include:

- Promotion of crafts;
- Labour based road construction;
- Stabilisation of eroded areas;
- Community tourism accommodation and trails;
- Coastal cleanup initiatives;
- Recycling initiatives;
- Removal of invasive plants in biodiversity conservation areas; and
- Development of a nursery for indigenous plants.

The WfW programme is broad-based and includes the removal of invasive plants, community welfare initiatives such as crèches and capacity building within communities.

The Public Sector Accountability Monitor (Tetyana, *pers comm.* 2003) has provided data showing that the Department of Social Development (DOSD) is the lead department for poverty alleviation, with Agriculture, Health and Education sharing some of the responsibilities for individual programmes. The Department of Social Welfare portfolio included:

- Food security (18 projects);
- HIV/AIDS Home Based Care initiatives (10 projects);
- Women cooperatives (20 projects);
- Morale regeneration (20 projects); and
- Youth development (1 project).

The Department of Agriculture has food security initiatives, including the Massive Food Production Programme, focussing on food production in rural communities. The Departments of Health and Education share the responsibility for the Primary School Nutrition Programme (Tetyana, *pers comm.* 2003). Available data on budgets and expenditure for the years 2001 to 2004 are provided in Table 11.2.

Table 11.2: Budget and expenditure on poverty alleviation in the Eastern Cape Province (DEAET, 2003b⁽¹⁾; Marsh, *pers comm.*, 2003⁽²⁾; Tetyana, *pers comm.* 2003⁽³⁾)

Programme	Year	Budget	Expenditure	Remarks
(1) DEAET	2001 to 2004	R133845 977	R83 808 220	Expenditure on track
(2) WFW	2003/2004	R61 072 200	R54 000 000	Expenditure on track
(3) DOSD Budget	2001/2002	R9 517 000	R8 481 000	Variance unexplained

Grant	2001/2002	R150 000	R150 000	2 women's projects
Allocation	2001/2002	R6 500 000	N/A	Poverty relief via IDT ¹
(3) DOSD Budget	2002/2003	R15 280 000	R15 227 000	99% expenditure on salaries
Grant	2002/2003	R14 600 000	N/A	Expenditure not identified
Food grants	2002/2003	N/A	R32 000 000	Food parcels for 36 513 households

The Department of Social Development 2003/2004 first quarter conditional grant for poverty amounted to R107 million. None of this money had been spent by the end of the quarter. The funds were intended for HIV/AIDS home care (R1.9 million); food parcels (R37 million) and child support grants (R68 million). The Department has a further R61 million available for food parcels for the 2003/2004 year (Tetyana, *pers comm.* 2003).

The performance of the departments appears to be patchy, particularly the lead department, Social Development. With the entire budget being spent on salaries in 2001/2002, it is not clear what programmes were put in place to access and use grant funding. This funding has apparently been carried over into the 2002/2003 year, as there had been no draw-down on the R107 million poverty alleviation grant. The reasons for this are not known, but it is likely to be due to structural inadequacies within the department.

11.3: The state of poverty in the Eastern Cape Province

The Eastern Cape Province is arguably the poorest province in South Africa, although the Limpopo and KwaZulu-Natal Provinces are held to compete strongly. Data available from Statistics South Africa show that more than two thirds of the Eastern Cape households are classed as suffering from poverty (Statistics South Africa, 2003) and 32% are unemployed (Labour Force Survey, 2001 in Statistics South Africa, 2003). Thus, although the Gross Geographic Product is R8 197 per annum per capita and average household income is R43 097 per annum (Statistics South Africa, 2003), only 5.4% of employed people earn more than R6 000 per month, with 53.7% of employed people earning less than R500 per month (ECSECC, 2001). A total of 68% of the people in the Province have a per capita expenditure of less than R250 per month (Hendricks, 2003, citing Statistics South Africa, 2000).

The Eastern Cape Province is thus faced with widespread poverty with rural areas being the worst affected. The lack of employment and income in many households means that these households are extremely vulnerable to many of the problems associated with poverty such as poor health care (leading to increased mortality due to notifiable diseases) and lack of access to basic resources for good quality of life. The situation in the Eastern Cape Province is further exacerbated by the increasing incidence of HIV/AIDS.

However there is potential to reduce poverty in the Eastern Cape Province. The Province has a wealth of human and natural resources that can be utilised in poverty alleviation programmes. These resources will however only be effectively deployed once the institutional environment is supportive of poverty alleviation in the Province.

¹ IDT: Independent Development Trust

Chapter 12: Current state of the environment in the Eastern Cape Province

12.1: Introduction

This 2004 Eastern Cape State of the Environment Report has described the environment of the Province through a variety of reporting themes, including:

- Atmosphere and climate;
- Biodiversity;
- Environmental management and governance;
- Freshwater;
- Human settlements;
- Land;
- Marine and coast; and
- Poverty.

There are many different ways in which this report could have represented the environment, and the method presented here is just one of these. The following sections provide a summary of the state of the environment in each individual reporting theme.

12.2: Atmosphere and climate

The Eastern Cape Province does not appear to be a priority area as far as air quality is concerned, as is evidenced by the number and type of industries in the Province. Monitoring of air quality in the Eastern Cape Province is performed on a fragmented basis as no co-ordinated monitoring network exists. Monitoring is currently concentrated in and around the Port Elizabeth area, as was recently started in the East London area as well. No comprehensive assessment of air quality in the Province is therefore possible. Where data exist, only very limited assessments of localised air quality can be done. Available data indicate that both sulphur dioxide and nitrogen dioxide levels in the Port Elizabeth area are below World Health Organisation guidelines (WHO, 1999). Monitoring of particulate matter in specific areas (Motherwell, Coega) has shown some exceedances of both South African and United States Environmental Protection Agency (US-EPA) guidelines. However, construction activities taking place in the vicinity of the monitoring could have contributed to this (Guastella, 2003).

Little information is available on clinic admissions for respiratory infections. The limited information that was available (mainly from the Nelson Mandela Metropolitan Municipality (NMMM)) shows that acute respiratory rates as well as lower respiratory infection rates in children under 5 years of age were lower in the Eastern Cape Province as compared to the KwaZulu-Natal Province (DOH, 1998).

The majority of households in the Eastern Cape Province, particularly in rural areas, rely on energy sources such as paraffin and wood for domestic purposes. Indoor air pollution is therefore a concern in the area, although it has not been quantified. A study in South Africa involving informal households that used mainly paraffin for cooking revealed that sensitive individuals in all of the households were at risk to adverse health effects from exposure to NO₂ (Muller et al., 2003). There has been an increase in the number of households using electricity from 1996 to 2001. Electricity, where available, is mostly used for lighting purposes only.

12.3: Biodiversity

The Eastern Cape Province comprises seven different biomes, of which the Grassland, Nama Karoo, Thicket and Savanna biomes are the most extensive (DEAET, 2003). A total of 316 threatened plant species are found in the Province, most (23%) occurring in the Thicket biome. However, the Forest and Fynbos biomes contain the highest number of threatened plants per unit area. There are three centres of endemism in the Province, the Albany centre (covering a large area in the centre of the Province), the Drakensberg centre (covering the Senqu and Elundini municipalities in the north-east), and the Pondoland centre (covering the Port St Johns and Mbizana municipalities in the east). The Province is also home to four endemic freshwater fishes, eight threatened marine fish species, six threatened frog species (four of which are endemic) and 19 threatened reptile species (of which 18 are endemic). Areas of reptile and frog endemism include Algoa Bay and the Amatole mountain range.

More than 10% of Eastern Cape's surface area is conserved in some way, but only 4.3% is formally protected as National Parks or Provincial conservation areas (DEAET, 2003). Once the State forests have been transferred to the Provincial conservation authority and a number of mega-parks have been developed as planned, this figure will increase substantially to more than 16%. The distribution of protected areas is highly skewed; 48% of Local Municipalities have no protected areas within their boundaries, and many of these municipalities contain rare, threatened or vulnerable species. In contrast certain municipalities contain few rare, threatened or vulnerable species but are well covered by protected areas (DEAET, 2003). Protected areas are crucial to the conservation of all species and ecosystems in the Eastern Cape Province, and are supported by well managed unprotected areas.

The main threats to biodiversity are invasive alien plants that threaten the coastal zone and mountainous areas; land transformation due to cultivation and monoculture; over-grazing due to land shortages and uneven distribution of people; over-use of natural resources, particularly medicinal plants; a low awareness amongst the public of the national and world-wide importance of Eastern Cape's biodiversity; and the weak capacity of provincial and local government to enforce conservation legislation and raise public awareness about biodiversity (DEAET, 2003).

12.4: Environmental management and governance

Environmental management and governance in the Eastern Cape Province is the responsibility of all stakeholders who have an impact on the environment. The three key stakeholder groups that have a significant role to play in environmental governance in the Province are the provincial government through the Department of Economic Affairs, Environment and Tourism (DEAET), local government through municipalities and the private sector.

A review of the commitment and performance of these three stakeholder groups suggests that there are some positive actions being taken to manage the environment. These include the budget and personnel within DEAET focused on environmental management as well as the restructuring that is occurring within the Department to respond to changes in national environmental policy (Sokupa, *pers comm.*, 2004). From a private sector perspective, there are some industries that are showing their commitment to environmental management through the introduction of environmental management systems in their operations (SABS, 2004; van Heerden, *pers comm.*, 2004).

However, there are still many opportunities for improvement in environmental management and governance in the Eastern Cape Province. Notable areas include the integration of

environmental management as a priority issue at the local government level. At present, it would appear that environmental management is not perceived as a priority and there is little integration of issues into the Integrated Development Plans of municipalities (Ramasar, 2004). At a provincial level, the enforcement and compliance monitoring of Environmental Management Plans and other regulatory processes is not being carried out effectively (Sokupa, *pers comm.*, 2004). This is an area which requires greater attention to ensure that Provincial policies are being implemented. As the enforcement and compliance monitoring is weak, it is also difficult to judge whether all industries within the Eastern Cape are following good environmental management practices. At present it would seem that some of the bigger industries in the Province have adopted voluntary environmental management processes but there is more work to be done with new industries and small, medium and micro enterprises.

As environmental management and governance is an evolving field which must be adapted to national policy changes and improvements in our knowledge of biophysical systems, this is an area for continual improvement in the Eastern Cape Province.

12.5: Freshwater

Two of South Africa's 19 water management areas (WMAs) lie entirely within the Eastern Cape Province. They are the Mzimvubu to Keiskamma WMA and the Fish to Tsitsikamma WMA. The Kraai sub-WMA (which is part of the Upper Orange WMA) also lies within the provincial boundary.

In terms of eutrophication, both of these WMAs as well as the Kraai sub-WMA have shown a deterioration in water systems between 1996 and 2001. However, 2003 results indicate an improvement in water quality. This improvement should be monitored over time in order to establish whether the improvement is sustained. There are numerous incidences of water quality guidelines being exceeded within all of the WMAs in the Province. In particular, high total dissolved solids (TDS) exist within the Fish to Tsitsikamma WMA and have necessitated large water transfers into the area from the Upper Orange WMA (DWAf, 2003a).

Half of the groundwater regions situated within the Eastern Cape Province have shown an improvement in groundwater quality over the past two years while another four regions indicate a deterioration in quality. The highest concentration of nitrates and nitrites (mg/l NO_x-N) in groundwater exists in the North-eastern Upper Karoo groundwater region (3.043 mg/l), however this level is below the target threshold and will not cause any significant health effects (DWAf, 2003b; WRC, 1998).

In terms of water quantity, the most common uses of water in the Eastern Cape are for irrigation, transfers out, urban, rural and then afforestation. There are no pressures for water from either the mining or energy sectors in the Eastern Cape Province. Almost two thirds of the water resources required in the Province are for irrigation (63%). Several irrigation developments exist in the Mzimvubu to Keiskamma WMA, with intensive cultivation of irrigated land along the main rivers in the Fish to Tsitsikamma WMA. In 2000 the demand for water in the Province did not exceed the amount of water available for use. Surface water is the most abundant source of water in all water management areas and accounts for almost half of the resource available in the Province.

Water resource management in the Eastern Cape Province is the responsibility of the regional office of the Department of Water Affairs and Forestry. However, part of the Upper Orange WMA, the Kraai, which resides within the Eastern Cape provincial border is managed by the Orange Free State regional office of DWAf. There are presently 2 water user associations and one catchment forum active in both WMAs in the Province. According to DWAf (Eastern Cape

Regional Office), capacity does exist for ensuring effective water resource management, with approximately 276 staff in the Water Resource Management Directorate of the Eastern Cape (Daniel, *pers comm.*, 2003).

12.6: Human settlements

Human settlements cover those places where people live, including both rural and urban communities. Human settlements typically include the physical structures and services providing material support (Newman *et al.*, 1996). Human settlement patterns in South Africa are largely influenced by past and present economic, social and political influences; to the point where human settlements are often found in locations that defy economic reason (Napier, 2000). In the Eastern Cape Province, the state of human settlements has been defined in terms of delivery of basic services, housing trends, population dynamics and waste disposal.

Much of the backlog in basic service provision in the Province can be found in the former homeland areas, now known as the O.R. Tambo, Alfred Nzo and Chris Hani District Municipalities. Increased pressure on housing is experienced in the more urban District Municipalities, with almost a quarter of dwellings in the Nelson Mandela Metropolitan Municipality being informal dwellings. Overcrowding in households is evident in the Province, with more than a third of households living in dwellings with two rooms or less.

The bulk of the Eastern Cape population resides in the Amatole and O.R. Tambo District Municipalities, as well as the Nelson Mandela Metropolitan Municipality. The majority of the population in the Province is young (under 34 years of age).

In describing the current state of human settlements in the Province, various discrepancies become apparent between the former 'homeland' and 'republic' areas. Understanding the historical dynamics of the Province is important as settlement patterns to a large degree can be influenced by land tenure systems. According to the Eastern Cape Office of the Premier (2001), the Eastern Cape has lagged behind in economic and human development terms because of its relatively poor resource endowment and its distance from the main centres of production. In addition, it represented one of the main focal areas for the apartheid social engineering effort (i.e. separate development with all its attendant social, spatial and political consequences).

12.7: Land

Human beings are dependent on terrestrial ecosystems for sustenance, raw materials and space for housing and recreation. The mining, agriculture, forestry and tourism industries also rely on the land resource base. The condition of the land and how it is used and managed is therefore vital for existence (DEAT, 1999).

The Eastern Cape Province is characterised by extensive areas of thicket vegetation which are degraded by agricultural practices, industrial expansion, invasion by alien species and the over-grazing of domestic herbivores. Just over half the Province is largely open areas of natural vegetation including forests, woodlands, grasslands and shrublands. Approximately 8% of the land is cultivated and just over 1% is used for forest plantations.

Eastern Cape is also one of the three most degraded provinces in South Africa. It has one of the highest provincial indices of soil degradation, particularly within commercial farmland areas. Most of the land area of the Eastern Cape Province is classed as 'Affected Drylands', with only a small percentage of the Province categorised as humid and hyper-arid. Predicted soil loss is also significant with more than half of the Province showing moderate or high soil loss. The areas

most affected by soil loss (when compared to the land cover map) are the degraded unimproved grasslands.

Two thirds of the land in the Province is privately owned, slightly less than one third is communally owned, while only 4% is state-owned land. This distribution clearly reflects the historical land allocation patterns of the apartheid system.

12.8: Marine and coast

The marine and coastal environment of the Eastern Cape Province is an extremely valuable asset due to its aesthetic value, ecological and biological diversity, natural resources and economic potential (Coastal and Environmental Services, 2003). The Province's coastline is over 820km in length, extending from the Groot Wes estuary in the south to the Umtamvuna estuary in the north (Coastal and Environmental Services, 2004a). The marine and coastal environment includes the terrestrial ecosystems (dune systems, coastal forests and grasslands), which are influenced by the marine environment, as well as the intertidal and inshore habitats and the deepwater offshore environments. These various habitats host a wide range of biological diversity and resources, which have been subject to varying levels of exploitation and development in the past. High levels of infrastructural development have occurred between the Kei and Kromme estuaries, resulting in increased pollution and decreased aesthetic appeal of the natural coastal environment in this region. Inshore marine resources are also heavily exploited within the Province, particularly north of the Kei estuary where the rural subsistence lifestyle is prominent in the former homeland areas. The offshore resources are less accessible to subsistence fishermen but are heavily exploited by commercial fishers who have the necessary equipment.

In the past the marine and coastal environment was managed sectorally on a resource basis. This led to an overlap in areas of jurisdiction and uncertainty on the roles and responsibilities of the different organs of state. A new approach to coastal management has recently been adopted, advocating an integrated, holistic and co-ordinated approach to the management of coastal resources (DEAT, 2000). This approach requires the establishment of a coastal management programme for the Province. The Marine and Coastal Management Branch of the national Department of Environmental Affairs and Tourism (DEAT) and the provincial Department of Economic Affairs, Environment and Tourism are the lead agents for coastal management in the Eastern Cape Province. Currently there is a lack of institutional capacity and co-ordination between these departments to administer and enforce the existing coastal legislation, which has allowed uncontrolled utilisation and development in several areas of the Eastern Cape coastline (Coastal and Environmental Services, 2004b).

12.9: Poverty

The Eastern Cape Province is arguably the poorest province in South Africa, although the Northern Province and KwaZulu-Natal are held to compete strongly. Data available from Statistics South Africa show that more than two thirds of the Eastern Cape households are classed as suffering from poverty (Statistics South Africa, 2003) and 32% are unemployed (Labour Force Survey, 2001 in Statistics South Africa, 2003). Thus, although Gross Geographic Product is R8 197 per annum per capita and average household income is R43 097 per annum (Statistics South Africa, 2003), only 5.4% of employed people earn more than R6 000 per month, with more than half of employed people earning less than R500 per month (ECSECC, 2001). A total of 68% of the people in the Province have a per capita expenditure of less than R250 per month (Hendricks, 2003, citing Statistics South Africa, 2000).

The Eastern Cape Province is thus faced with widespread poverty, with rural areas being the worst affected. The lack of employment and income in many households means that these households are extremely vulnerable to many of the problems associated with poverty such as poor health care (leading to increased mortality due to notifiable diseases) and lack of access to basic resources for good quality of life. The situation in the Eastern Cape Province is further exacerbated by the increasing incidence of HIV/AIDS. A provincial HIV prevalence amongst antenatal clinic attendees of more than 20% in 2002 is illustrated (extrapolated to around 7% HIV prevalence among the general Eastern Cape population).

However there is potential to reduce poverty in the Eastern Cape Province. The Province has a wealth of human and natural resources that can be utilised in poverty alleviation programmes. These resources will however only be effectively deployed once the institutional environment is supportive of poverty alleviation in the Province.

Chapter 13: Responses to environmental change

There are a wide number of responses to environmental change, including:

- Policy and legislation;
- Regulations;
- Environmental research;
- Management;
- Environmental education; and
- Public preferences.

Responses are directed from various levels, starting from the international or regional level all the way down to the individual members of the public. Responses are societal actions taken collectively or individually to enhance positive environmental change and mitigate negative environmental change.

This chapter provides an overview of the responses to environmental change in the Eastern Cape Province. Overarching international / regional and national responses as well as provincial responses are addressed. The responses are provided in Table 13.1 overleaf.

Table 13.1: Responses to environmental change in the Eastern Cape Province

INTERNATIONAL / REGIONAL RESPONSES	
United Nations Framework Convention on Climate Change (UNFCCC, 2004)	http://unfccc.int/index.html
Montreal Protocol on Substances that Deplete the Ozone Layer (UNEP, 2004)	http://www.unep.org/ozone/Treaties_and_Ratification/2B_montreal%20protocol.asp
United Nations Convention to Combat Desertification (UNCCD, 1994)	http://www.unccd.int
United Nations Convention on Biological Diversity (UNCBD, 1992)	http://www.biodiv.org
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES, 1973)	http://www.cites.org
Convention on Wetlands of International Importance Especially as Waterfowl Habitat (Ramsar Convention, 1971)	http://www.ramsar.org
Convention of the Conservation of Migratory Species of Wild Animals (Bonn Convention) (UNEP, 1979)	http://www.unep-wcmc.org
United Nations Convention Concerning the Protection of World Cultural and Natural Heritage (UNESCO, 1972)	http://whc.unesco.org
Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and their Disposal (UNEP, 1989)	http://www.basel.int
The Rotterdam Convention (Prior Informed Consent) (UNEP & FAO, 2004)	http://www.pic.int
Rio Declaration on the Environment and Development (UNEP, 1992a)	http://www.unep.org/Documents/Default.asp?DocumentID=78&ArticleID=1163
Agenda 21 (UNEP, 1992b)	http://www.un.org/esa/sustdev/documents/agenda21/index.htm
United Nations Office of the High Commissioner for Human Rights (UNHCHR, 2004)	http://www.unhchr.ch
Southern African Development Community (SADC, 2004)	http://www.sadc.int

New Partnership for Africa's Development (NePAD, 2004)	http://www.nepad.org
United Nations Millennium Declaration and Millennium Development Goals (UNDP, 2004)	http://www.undp.org/mdg/
NATIONAL RESPONSES	
Constitution of the Republic of South Africa, Act 108 of 1996 (RSA, 1996)	http://www.polity.org.za/html/govdocs/legislation/1996/index.html
National Environmental Management Act 107 of 1998 (RSA, 1998a)	http://www.polity.org.za/html/govdocs/legislation/1998/index.html
National Water Act 36 of 1998 (RSA, 1998b)	http://www.polity.org.za/html/govdocs/legislation/1998/index.html
Environment Conservation Act 73 of 1989 (RSA, 1989)	http://www.acts.co.za/enviro/enviro.htm#enviro_environment_conservation_act_no_73_of_1989.htm
National Forests Act 84 of 1998 (RSA, 1998c)	http://www.polity.org.za/html/govdocs/legislation/1998/index.html
Conservation of Agricultural Resources Act 43 of 1983 (RSA, 1983)	http://www.dwaf.pwv.gov.za/wfw/Legal/Docs/doc/Prom%20080301%20Eng.doc
Soil Conservation Act 76 of 1969 (RSA, 1969)	No website
Marine Living Resources Act 18 of 1998 (RSA, 1998d)	http://www.polity.org.za/html/govdocs/legislation/1998/index.html
Water Services Act 108 of 1997 (RSA, 1997a)	http://www.polity.org.za/html/govdocs/legislation/1997/index.html
Restitution of Land Rights Act 22 of 1994 (RSA, 1994)	http://www.polity.org.za/html/govdocs/legislation/1994/index.html
World Heritage Convention Act 49 of 1999 (RSA, 1999a)	http://www.polity.org.za/html/govdocs/legislation/1999/index.html
National Heritage Resources Act 25 of 1999 (RSA, 1999b)	http://www.polity.org.za/html/govdocs/legislation/1999/index.html
Disaster Management Act 57 of 2002 (RSA, 2002)	http://www.polity.org.za/pol/acts/2002/
Local Government Municipal Systems Act 32 of 2000 (RSA, 2000)	http://www.polity.org.za/html/govdocs/legislation/2000/index.html
Local Government Municipal Structures Act 117 of 1998 (RSA, 1998e)	http://www.polity.org.za/html/govdocs/legislation/1998/index.html
Housing Act 107 of 1997 (RSA, 1997b)	http://www.gov.za/acts/1997/a107-97.pdf

Various Bills and White Papers (e.g. Air Quality Management Bill, Biodiversity Bill, Protected Areas Bill, Coastal Management Bill, White Paper for Sustainable Coastal Development and the White Paper on Population Policy)	
PROVINCIAL RESPONSES	
Cleaner production mechanisms	Cleaner technologies are production processes and/or methods that strive to prevent pollution while at the same time having economic and environmental benefits such as reduction and/or finding of alternatives for raw materials, energy consumption and waste disposal (Hietkamp, <i>pers comm.</i> 2003).
Eastern Cape Biodiversity Strategy	The Chief Directorate: Environmental Affairs of the Eastern Cape Department of Economic Affairs, Environment and Tourism recently developed a biodiversity strategy for the Province (DEAET, 2003a).
Working for Water Programme, Working for Wetlands, and the River Health Programme	The Working for Water Programme, an initiative by the Department of Water Affairs and Forestry (DWAFF), promotes the eradication of alien vegetation in South Africa, and supports the development of biological weed control (Olickers and Hill, 1999). WFW is active in the Eastern Cape Province, with activities in the Albany / Cadadu, Balfour, Katberg, Kokstad, Madiba Bay, Qolora, Port St. Johns, Mbashe, and Baviaanskloof areas. The Working for Wetlands project is an initiative that identifies and rehabilitates badly degraded wetlands. The National Aquatic Biomonitoring Programme (River Health Programme) is active in the Eastern Cape Province and provides valuable monitoring data for the effective management of riverine ecosystems in the Province. DWAFF leads the River Health Programme, which aims to collect data on the state of South Africa's rivers and to thereafter establish long term monitoring system (IWR, 2003).
Working for the Coast	The Working for the Coast project focuses on environmental rehabilitation and improvement as well as social issues, such as capacity building, job creation and awareness raising of South Africa's coastal communities (Coastal Management Office, 2003).
Eastern Cape Private Nature Reserve Association	Private land owners have responded to biodiversity loss by forming conservancies and initiatives such as the Eastern Cape Private Nature Reserve Association, otherwise known as INDALO. The Eastern Cape Game Managers Association (ECGMA) currently has 750 members, which include professional hunters, hunting contractors, game ranchers, eco-tourism safari operators, taxidermists and conservationists (WildNet Africa, 2001).
Subtropical Thicket Ecosystem Planning (STEP), the Succulent Karoo Ecosystem Planning (SKEP) and the Cape Action Plan for the Environment (CAPE) projects	The STEP, SKEP and CAPE projects are examples of bioregional conservation planning initiatives at a regional scale (NBI, 2003). Their emphasis is on the expansion of protected areas and on promoting conservation-friendly practices on unconserved land. Mega parks, being greater than 500 000 hectares, provide an important management solution, as they are large enough to conserve not only species, but also the pattern and evolutionary processes that create the biodiversity of the Eastern Cape Province. The proposed consolidation and expansion of the Baviaanskloof Conservation Area into the Baviaanskloof Mega-Reserve Project will be the first mega park in Eastern Cape (The WILD Foundation, 2003). Although the proposed Greater Addo National Park Initiative will not attain mega park status, being 398 000 hectares once completed, it will also make a significant contribution to environmental and social sustainability (Kerley and Boshoff, 2003). Other plans for park expansions include the Amatole Biosphere Reserve linked to a proposed Great Fish River conservancy, the Greater Pondoland National Park linked to a Wild Coast Conservation area, and the Maluti-Drakensberg Transfrontier National Park (DEAET, 2003a).

<p>Eastern Cape Protected Areas Bill, and the Eastern Cape Environmental Conservation Bill</p>	<p>At a provincial level, the Province of the Eastern Cape has developed its own policies for environmental management. New policies that have recently been approved by the Legislature of the Eastern Cape are Protected Areas Bill (Province of the Eastern Cape, 2002a) and the Eastern Cape Environmental Conservation Bill (subsequently passed as the Eastern Cape Environmental Conservation Act No. 13 of 2003) (Province of the Eastern Cape, 2002b). Associated with the new policy mandates, the DEAET is also restructuring and recruiting so as to be most effective in meeting its policy (Sokupa, <i>pers comm</i>, 2004).</p>
<p>Environmental Implementation Plan (EIP)</p>	<p>In 2003, the DEAET produced the Eastern Cape Province's first Environmental Implementation Plan (EIP) (DEAET, 2003b). As per the National Environmental Management Act No. 107 of 1998 (RSA, 1998a), the EIP has been developed to co-ordinate and harmonise the environmental policies, plans, programmes and decisions by various provincial and national governments that operate in the Eastern Cape Province. The EIP is meant to facilitate intra-governmental co-ordination on environmental matters in the Eastern Cape Province. DEAET has not been very successful in achieving this and will be looking at establishing an intra-governmental forum for the implementation of the EIP in the future (Sokupa, <i>pers comm</i>, 2004).</p>
<p>Integrated Waste Management Plan</p>	<p>The Province is in the process of developing an Integrated Waste Management Plan. At present district municipalities are developing their Integrated Waste Management Plans. Once all the municipalities have completed this exercise, the provincial department will collate the plans and develop an Eastern Cape Integrated Waste Management Plan. It is expected that this will happen through the course of 2004 (Sokupa, <i>pers comm</i>, 2004).</p>
<p>Catchment Management</p>	<p>Catchment management in South Africa takes place through statutory bodies called Catchment Management Agencies (CMA) within a defined water management area. These agencies are established once the Minister has published a notice in the government gazette and aim to manage and coordinate water related activities of water users within the water management area (DWAF, 2002). While there are no CMAs established yet in the Eastern Cape, the regional office of DWAF is responsible for managing the Mzimvubu to Keiskamma and the Fish to Tsitsikamma Water Management Areas (WMAs).</p>
<p>Routine monitoring and data collection</p>	<p>A network of monitoring stations and data collection points exist within the Eastern Cape Province. These stations record data relevant for the evaluation of surface and groundwater quality and provide valuable hydrological information. The Health Act (Act 63 of 1977) also makes provision for local authorities to monitor water quality (RSA, 1977).</p>
<p>Integrated Spatial Development Strategy</p>	<p>The Integrated Spatial Development Strategy (Eastern Cape Office of the Premier, 2001) consists of the following components: (1) Focus investment and upgrade existing rural settlements, villages and towns in a phased manner according to available resources and development priorities; (2) Reinforce development nodes and development areas through building on strengths and bulk infrastructure; and (3) Focus on economic upliftment and employment creation through Local Economic Development (LED), agriculture, Small Medium and Micro Enterprises (SMME's) and industrial programmes.</p>
<p>Strategy Framework for Growth and Development 2004-2014</p>	<p>The Eastern Cape Provincial Government is in the process of preparing a Provincial Growth and Development Plan (PGDP) for the period 2004-2014 (Eastern Cape Office of the Premier, 2003a). This PGDP is being developed as a consensus between the Provincial Government and its social partners, including</p>

	<p>municipalities in the Eastern Cape Province. The Executive Committee, Province of the Eastern Cape has already adopted a <i>Strategy Framework for Growth and Development 2004-2014</i> (Eastern Cape Office of the Premier, 2003a), which is the pre-eminent framework for all provincial government planning over the its implementation period.</p>
<p>LandCare Programme</p>	<p>Agriculture plays a key role in the development of the Eastern Cape Province. Therefore the aim of the LandCare Programme is to increase the long-term productivity and ecological sustainability of the land resource, thereby ensuring a future within the agricultural sector (LandCare South Africa, 2002).</p>
<p>Land Reform</p>	<p>The Land Reform process was introduced by the Government in 1994 and includes (DLA, 2003): (1) Returning land lost due to racially discriminatory laws (which could also be achieved through monetary compensation); (2) Land redistribution, by enabling disadvantaged people to buy land; and (3) Land tenure reform, which aims to bring all people occupying land under one system of landholding. The Land Reform process has the potential to cause major conflicts over land-use. This process could present an obstacle to development and co-ordinated management of land use if not properly managed and executed.</p>
<p>Fish River and Wild Coast Spatial Development Initiatives (SDIs), West Bank and Coega Industrial Development Zones (IDZs)</p>	<p>To facilitate integrated planning sensitive to the environment, the Province is in the process of implementing two Spatial Development Initiatives (SDIs), namely the Fish River SDI and the Wild Coast SDI, and two Industrial Development Zones (IDZs), namely the West Bank (East London) IDZ and the Coega IDZ. The latter, 20 km east of the Nelson Mandela Metropole, was the first IDZ to be earmarked and is one of the biggest initiatives ever undertaken in South Africa. Plans for the development of the area as an ex port-orientated zone include the building of a deepwater port (Eastern Cape Province, 2003).</p>
<p>Eastern Cape Coastal Management Programme</p>	<p>Each province is required to produce a Provincial Coastal Management Programme in order for provincial lead agents to conduct integrated coastal zone management. This has led to the formulation of the Eastern Cape Coastal Management Programme (ECCMP) which is currently nearing completion and outlines a plan of action to achieve the goals and objectives set out in the White Paper within the Province. Central to the ECCMP is the establishment of a Coastal Management Unit (CMU) consisting of a dedicated team of staff who will facilitate coordination between government departments involved in coastal management, and be responsible for the timeous implementation, monitoring and review of the coastal management plan. This is a positive step towards ensuring sustainable management of the marine and coastal resources within the Eastern Cape Province (Coastal and Environmental Services, 2004).</p>
<p>Local Economic Development</p>	<p>The flagship poverty alleviation programme in the Province is 'Local Economic Development' of LED (DPLG, 2001a; DPLG, 2001b). Since June 2001, the Department of Provincial and Local Government has refined the LED policy to concentrate on the poor, specifically: Low-income people; People living in rural areas of newly demarcated municipalities; Women and children; The elderly; People with disabilities; People who are HIV-positive or who are living with AIDS; and The environment (DPLG, 2001b). LED has not yet delivered a successful programme to attack the root cause of poverty in the Eastern Cape. Until the root causes are addressed, the Province will be obliged to continue with special palliative programmes on humanitarian grounds. (Eastern Cape Office of the Premier, 2003b).</p>

Chapter 14: References

14.1: Introduction to the Eastern Cape Province

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Appendix 1: List of threatened plants for the Eastern Cape Province (PRECIS, classes according to Hilton-Taylor, 1996)

Taxon	¼ degree grid records	Class*
<i>Acmadenia kiwanensis</i> I.Williams	1	K
<i>Acrolophia barbata</i> (Thunb.) H.P.Linder	1	R
<i>Acrolophia micrantha</i> (Lindl.) Schltr. & Bolus	7	R
<i>Adromischus bicolor</i> Hutchison	3	K
<i>Adromischus cooperi</i> (Baker) A.Berger	4	K
<i>Adromischus cristatus</i> (Haw.) Lem. var. <i>zeyheri</i> (Harv.) Toelken	2	K
<i>Adromischus fallax</i> Toelken	1	I
<i>Agathosma acutissima</i> Dummer	1	K
<i>Agathosma unicarpellata</i> (Fourc.) Pillans	3	R
<i>Alberta magna</i> E.Mey.	4	R
<i>Aloe bowiea</i> Schult. & Schult.f.	3	E
<i>Aloe longistyla</i> Baker	12	V
<i>Aloe micracantha</i> Haw.	7	R
<i>Aloe pictifolia</i> D.S.Hardy	3	R
<i>Aloe pratensis</i> Baker	9	K
<i>Aloe reynoldsii</i> Letty	1	V
<i>Amphiglossa callunoides</i> DC.	4	K
<i>Anacampseros lanceolata</i> (Haw.) Sweet subsp. <i>nebrownii</i> (Poelln.) Gerba	1	R
<i>Anacampseros rufescens</i> (Haw.) Sweet	7	K
<i>Anisodonteia alexandri</i> (Baker f.) Bates	1	V
<i>Anisodonteia malvastroides</i> (Baker f.) Bates	3	R
<i>Anthospermum streyi</i> Puff	1	V
<i>Argyrolobium barbatum</i> Walp.	2	I
<i>Argyrolobium crassifolium</i> Eckl. & Zeyh.	3	K
<i>Aristea platycaulis</i> Baker	2	V
<i>Asclepias compressidens</i> (N.E.Br.) Nicholas	1	I
<i>Asclepias cultriformis</i> (Harv. ex Schltr.) Schltr.	1	R
<i>Asclepias disparilis</i> N.E.Br.	1	V
<i>Asclepias expansa</i> (E.Mey.) Schltr.	6	I
<i>Asclepias monticola</i> N.E.Br.	4	R
<i>Asclepias oreophila</i> Nicholas	1	R
<i>Asclepias patens</i> N.E.Br.	2	V
<i>Asclepias peltigera</i> (E.Mey.) Schltr.	4	V
<i>Asclepias praemorsa</i> Schltr.	4	I
<i>Aspalathus bowieana</i> (Benth.) R.Dahlgren	2	K
<i>Aspalathus cliffortiifolia</i> R.Dahlgren	1	E
<i>Aspidoglossum flanaganii</i> (Schltr.) Kupicha	1	V
<i>Aspidoglossum uncinatum</i> (N.E.Br.) Kupicha	2	I
<i>Atalaya capensis</i> R.A.Dyer	8	R
<i>Athanasia quinqueidentata</i> Thunb. subsp. <i>quinqueidentata</i>	2	K
<i>Bauhinia bowkeri</i> Harv.	6	R
<i>Begonia dregei</i> Otto & A.Dietr.	6	R
<i>Begonia homonyma</i> Steud.	4	R
<i>Bobartia macrocarpa</i> Strid	2	K
<i>Bowiea volubilis</i> Harv. ex Hook.f. subsp. <i>volubilis</i>	13	K
<i>Brachycorythis macowaniana</i> Rchb.f.	3	R
<i>Brachystelma australe</i> R.A.Dyer	2	I
<i>Brachystelma campanulatum</i> N.E.Br.	1	I
<i>Brachystelma cathcartense</i> R.A.Dyer	1	I
<i>Brachystelma comptum</i> N.E.Br.	1	I
<i>Brachystelma meyerianum</i> Schltr.	1	R
<i>Brachystelma schoenlandianum</i> Schltr.	1	I
<i>Brunsvigia litoralis</i> R.A.Dyer	5	V
<i>Cassipourea flanaganii</i> (Schinz) Alston	12	R

<i>Ceropegia cancellata</i> Rchb.	6	R
<i>Ceropegia fimbriata</i> E.Mey. <i>subsp. fimbriata</i>	1	R
<i>Ceropegia radicans</i> Schltr. <i>subsp. radicans</i>	1	R
<i>Chasmatophyllum willowmoreense</i> L.Bolus	1	K
<i>Cliffortia arborea</i> Marloth	1	R
<i>Colubrina nicholsonii</i> A.E.van Wyk & Schrire	3	R
<i>Cotyledon orbiculata</i> L. <i>var. flanaganii</i> (Schönland & Baker f.) Toe	2	R
<i>Crassula latibracteata</i> Toelken	3	K
<i>Crassula planifolia</i> Schönland	1	V
<i>Crassula socialis</i> Schönland	3	R
<i>Crinum campanulatum</i> Herb.	10	R
<i>Crinum lineare</i> L.f.	5	R
<i>Crocoshia masonorum</i> (L.Bolus) N.E.Br.	3	I
<i>Cussonia gamtoosensis</i> Strey	4	R
<i>Cyrtanthus clavatus</i> (L'Hér.) R.A.Dyer	9	R
<i>Cyrtanthus flammosus</i> Snijman & Van Jaarsv.	1	R
<i>Cyrtanthus flavus</i> P.E.Barnes	1	K
<i>Cyrtanthus helictus</i> Lehm.	17	R
<i>Cyrtanthus huttonii</i> Baker	6	R
<i>Cyrtanthus smithiae</i> Watt ex Harv.	7	R
<i>Cyrtanthus spiralis</i> Burch. ex Ker Gawl.	3	V
<i>Cyrtanthus staadensis</i> Schönland	6	V
<i>Cyrtanthus suaveolens</i> Schönland	3	K
<i>Cyrtanthus wellandii</i> Snijman	1	V
<i>Dahlgrenodendron natalense</i> (J.H.Ross) J.J.M.van der Merwe & A.E.van W	3	E
<i>Dermatobotrys saundersii</i> Bolus	5	R
<i>Diascia patens</i> (Thunb.) Grant ex Fourc.	3	R
<i>Dierama pulcherrimum</i> (Hook.f.) Baker	13	V
<i>Dietes bicolour</i> (Steud.) Sweet ex Klatt	9	R
<i>Dioscorea brownii</i> Schinz	2	R
<i>Dioscorea elephantipes</i> (L'Hér.) Engl.	9	V
<i>Diosma passerinoides</i> Steud.	2	R
<i>Disa galpinii</i> Rolfe	1	R
<i>Disa montana</i> Sond.	2	I
<i>Disa oreophila</i> Bolus <i>subsp. erecta</i> H.P.Linder	2	R
<i>Disa scullyi</i> Bolus	5	E
<i>Disa tysonii</i> Bolus	2	R
<i>Duvalia pillansii</i> N.E.Br.	1	K
<i>Ectotropis alpina</i> N.E.Br.	1	I
<i>Encephalartos altensteinii</i> Lehm.	15	V
<i>Encephalartos arenarius</i> R.A.Dyer	1	E
<i>Encephalartos caffer</i> (Thunb.) Lehm.	9	V
<i>Encephalartos cycadifolius</i> (Jacq.) Lehm.	4	V
<i>Encephalartos friderici-quillielmi</i> Lehm.	9	V
<i>Encephalartos ghellinckii</i> Lem.	5	V
<i>Encephalartos horridus</i> (Jacq.) Lehm.	5	V
<i>Encephalartos latifrons</i> Lehm.	3	E
<i>Encephalartos lehmannii</i> Lehm.	16	R
<i>Encephalartos longifolius</i> (Jacq.) Lehm.	17	V
<i>Encephalartos natalensis</i> R.A.Dyer & I.Verd.	3	R
<i>Encephalartos princeps</i> R.A.Dyer	3	V
<i>Encephalartos trispinosus</i> (Hook.) R.A.Dyer	5	V
<i>Erica abbottii</i> E.G.H.Oliv.	3	V
<i>Erica abelii</i> E.G.H.Oliv.	1	V
<i>Erica passerinoides</i> (Bolus) E.G.H.Oliv.	1	I
<i>Eriosema dregei</i> E.Mey.	3	R
<i>Eriosema umtamvunense</i> C.H.Stirt.	2	R
<i>Eriosemopsis subanisophylla</i> Robyns	5	R
<i>Eriospermum appendiculatum</i> A.V.Duthie	2	K

<i>Eriospermum bracteatum</i> Archibald	2	R
<i>Eriospermum ciliatum</i> P.L.Perry	4	R
<i>Eugenia erythrophylla</i> Strey	6	R
<i>Eugenia simii</i> Dummer	1	V
<i>Eugenia umtamvunensis</i> A.E.van Wyk	1	R
<i>Eugenia verdoorniae</i> A.E.van Wyk	4	R
<i>Eugenia zeyheri</i> (Harv.) Harv.	21	R
<i>Eulophia platypetala</i> Lindl.	1	V
<i>Euphorbia albipollinifera</i> L.C.Leach	2	V
<i>Euphorbia bruynsii</i> L.C.Leach	1	R
<i>Euphorbia globosa</i> (Haw.) Sims	3	R
<i>Euphorbia jansenvillensis</i> Nel	2	E
<i>Euphorbia ledienii</i> A.Berger var. <i>dregei</i> N.E.Br.	1	R
<i>Euphorbia obesa</i> Hook.f. <i>subsp. obesa</i>	1	E
<i>Euphorbia ornithopus</i> Jacq.	5	K
<i>Euphorbia woodii</i> N.E.Br.	4	R
<i>Euryops ciliatus</i> B.Nord.	1	I
<i>Euryops dentatus</i> B.Nord.	1	R
<i>Euryops gracilipes</i> B.Nord.	1	K
<i>Euryops hypnoides</i> B.Nord.	1	I
<i>Euryops latifolius</i> B.Nord.	1	R
<i>Euryops polytrichoides</i> (Harv.) B.Nord.	1	I
<i>Euryops ursinoides</i> B.Nord.	3	I
<i>Excoecaria simii</i> (Kuntze) Pax	21	R
<i>Fanninia caloglossa</i> Harv.	5	R
<i>Faucaria tigrina</i> (Haw.) Schwantes	1	V
<i>Faurea macnaughtonii</i> E.Phillips	4	R
<i>Ficus bizanae</i> Hutch. & Burt Davy	8	R
<i>Freesia verrucosa</i> (Vogel in Trew) Goldblatt & J.C.Manning	2	V
<i>Freylinia crispa</i> Van Jaarsv.	2	R
<i>Gasteria baylissiana</i> Rauh	5	E
<i>Gasteria bicolor</i> Haw. var. <i>liliputana</i> (Poelln.) Van Jaarsv.	6	R
<i>Gasteria croucheri</i> (Hook.f.) Baker	6	V
<i>Gasteria rawlinsonii</i> Oberm.	4	R
<i>Gladiolus huttonii</i> (N.E.Br.) Goldblatt & M.P.de Vos	7	I
<i>Gladiolus leptosiphon</i> F.Bolus	1	R
<i>Gladiolus oppositiflorus</i> Herb.	26	R
<i>Gladiolus sempervirens</i> G.J.Lewis	2	R
<i>Grewia pondoensis</i> Burret	6	R
<i>Greyia flanaganii</i> Bolus	4	R
<i>Gymnopentzia bifurcata</i> Benth.	8	R
<i>Gymnosporia devenishii</i> M.Jordaan	1	R
<i>Haworthia sordida</i> Haw. var. <i>sordida</i>	5	V
<i>Haworthia springbokvlakensis</i> C.L.Scott	1	V
<i>Helichrysum isolepis</i> Bolus	3	K
<i>Helichrysum palustre</i> Hilliard	1	R
<i>Hermannia repetenda</i> I.Verd.	2	K
<i>Hesperantha hutchingsiae</i> Hilliard & B.L.Burt	1	K
<i>Hesperantha ingeliensis</i> Hilliard & B.L.Burt	1	K
<i>Holothrix longicornu</i> G.J.Lewis	1	EX
<i>Holothrix macowaniana</i> Rchb.f.	2	K
<i>Holothrix pilosa</i> (Burch. ex Lindl.) Rchb.f.	5	I
<i>Homalium rufescens</i> Benth.	12	K
<i>Hoodia pilifera</i> (L.f.) Plowes <i>subsp. annulata</i> (N.E.Br.) Bruyns	8	R
<i>Hoodia pilifera</i> (L.f.) Plowes <i>subsp. pilifera</i>	3	R
<i>Huernia echidnopsioides</i> (L.C.Leach) L.C.Leach	1	I
<i>Huernia humilis</i> (Masson) Haw.	1	R
<i>Huernia hystrix</i> (Hook.f.) N.E.Br. var. <i>parvula</i> L.C.Leach	1	V
<i>Huernia kennedyana</i> Lavranos	1	V
<i>Huernia longii</i> Pillans	4	R
<i>Huernia pendula</i> E.A.Bruce	3	I

<i>Impatiens flanaganiae</i> Hemsl.	1	R
<i>Indigofera hispida</i> Eckl. & Zeyh.	3	K
<i>Isoetes wormaldii</i> Sim	3	E
<i>Jubaeopsis caffra</i> Becc.	3	V
<i>Justicia bolusii</i> C.B.Clarke	9	R
<i>Kniphofia acraea</i> Codd	1	R
<i>Kniphofia bruceae</i> (Codd) Codd	4	R
<i>Kniphofia citrina</i> Baker	10	I
<i>Kniphofia coddiana</i> Cufod.	3	R
<i>Kniphofia drepanophylla</i> Baker	2	K
<i>Kniphofia hirsuta</i> Codd	2	V
<i>Lachenalia campanulata</i> Baker	10	I
<i>Lachnaea glomerata</i> Fourc.	2	I
<i>Lessertia carnosae</i> Eckl. & Zeyh.	3	K
<i>Leucadendron loeriense</i> I.Williams	3	R
<i>Leucadendron nobile</i> I.Williams	7	R
<i>Leucadendron orientale</i> I.Williams	4	V
<i>Leucadendron pondoense</i> A.E.van Wyk	4	R
<i>Leucadendron sorocephalodes</i> E.Phillips & Hutch.	4	V
<i>Leucospermum innovans</i> Rourke	2	V
<i>Lotononis acuminata</i> Eckl. & Zeyh.	3	R
<i>Lotononis carnosae</i> (Eckl. & Zeyh.) Benth. <i>subsp. condensata</i> (Harv.) B.	1	K
<i>Lotononis carnosae</i> (Eckl. & Zeyh.) Benth. <i>subsp. latifolia</i> B.-E.van Wyk	1	K
<i>Lotononis holosericea</i> (E.Mey.) B.-E.van Wyk	1	I
<i>Lotononis minor</i> Dummer & Jenn.	1	R
<i>Lotononis trichodes</i> (E.Mey.) B.-E.van Wyk	1	K
<i>Manulea florifera</i> Hilliard & B.L.Burt	1	R
<i>Marsilea schelpeana</i> Launert	2	V
<i>Maytenus oleosa</i> A.E.van Wyk & R.H.Archer	2	R
<i>Mestoklema albanicum</i> N.E.Br. ex Glen	3	K
<i>Metarungia galpinii</i> (Baden) Baden	3	E
<i>Mimetes pauciflorus</i> R.Br.	2	R
<i>Monsonia galpinii</i> Schltr. ex R.Knuth	1	K
<i>Mossia intervallaris</i> (L.Bolus) N.E.Br.	1	R
<i>Muraltia carnosae</i> E.Mey. ex Harv.	1	K
<i>Nananthus pole-evansii</i> N.E.Br.	1	K
<i>Neopatersonia uitenhagensis</i> Schönland	3	K
<i>Nerine bowdenii</i> Watson	5	K
<i>Nerine gibsonii</i> Douglas	5	R
<i>Nerine huttoniae</i> Schönland	3	K
<i>Nerine masoniorum</i> L.Bolus	3	R
<i>Oldenburgia grandis</i> (Thunb.) Baill.	6	R
<i>Ophioglossum nudicaule</i> L.f.	4	R
<i>Orbea maccloughlinii</i> (I.Verd.) L.C.Leach	1	I
<i>Orbea pulchella</i> (Masson) L.C.Leach	3	I
<i>Ornithogalum capillare</i> J.M.Wood & M.S.Evans	1	I
<i>Osteospermum pterigoideum</i> Klatt	2	K
<i>Otholobium carneum</i> (E.Mey.) C.H.Stirt.	3	E
<i>Otholobium heterosepalum</i> (Fourc.) C.H.Stirt.	3	R
<i>Otholobium pictum</i> C.H.Stirt.	2	R
<i>Otholobium polyphyllum</i> (Eckl. & Zeyh.) C.H.Stirt.	17	R
<i>Othonna membranifolia</i> DC.	2	K
<i>Othonna patula</i> Schltr.	3	K
<i>Pachycarpus linearis</i> (E.Mey.) N.E.Br.	1	K
<i>Paranomus esterhuyseniae</i> Levyns	4	R
<i>Paranomus reflexus</i> (E.Phillips & Hutch.) Fourc.	4	V
<i>Parapodium crispum</i> N.E.Br.	2	K
<i>Pelargonium exhibens</i> Vorster	3	I
<i>Pelargonium suburbanum</i> Clifford ex C.Boucher <i>subsp. suburbanum</i>	4	K

<i>Phylica simii</i> Pillans	1	I
<i>Phylica tysonii</i> Pillans var. <i>brevifolia</i> Pillans	2	K
<i>Phylica tysonii</i> Pillans var. <i>tysonii</i>	1	K
<i>Phymaspermum erubescens</i> (Hutch.) Källersjö	2	K
<i>Phymaspermum villosum</i> (Hilliard) Källersjö	2	I
<i>Plectranthus ernstii</i> Codd	2	R
<i>Plectranthus hilliardiae</i> Codd	4	R
<i>Plectranthus praetermissus</i> Codd	1	E
<i>Podalyria cordata</i> R.Br.	2	R
<i>Podalyria sericea</i> (Andrews) R.Br. ex Aiton f.	2	V
<i>Podalyria velutina</i> Burch. ex Benth.	7	I
<i>Polygala bowkeriae</i> Harv.	2	K
<i>Polygala levynsiana</i> Paiva	14	K
<i>Polygala pottebergensis</i> Levyns	3	I
<i>Polygala serpentaria</i> Eckl. & Zeyh.	16	K
<i>Pseudosalacia streyi</i> Codd	4	V
<i>Pseudoscolopia polyantha</i> Gilg	8	R
<i>Psoralea abbottii</i> C.H.Stirt.	2	R
<i>Psoralea ensifolia</i> (Houtt.) Merr.	6	V
<i>Psoralea repens</i> L.	7	V
<i>Psoralea trullata</i> C.H.Stirt.	2	R
<i>Pterygodium newdigateae</i> Bolus var. <i>cleistogamum</i> Bolus	2	R
<i>Rapanea gilliana</i> (Sond.) Mez	3	E
<i>Rhus albomarginata</i> Sond.	4	R
<i>Rhus grandidens</i> Harv. ex Engl.	2	K
<i>Rhynchochalyx lawsonioides</i> Oliv.	6	V
<i>Rinorea domatiosa</i> A.E.van Wyk	4	K
<i>Riocreuxia flanagani</i> Schltr.	1	I
<i>Sandersonia aurantiaca</i> Hook.	5	R
<i>Satyrium hallackii</i> Bolus subsp. <i>hallackii</i>	4	E
<i>Satyrium princeps</i> Bolus	4	V
<i>Schizoglossum bidens</i> E.Mey. subsp. <i>gracile</i> Kupicha	1	K
<i>Scilla natalensis</i> Planch.	6	K
<i>Selaginella pygmaea</i> (Kaulf.) Alston	2	K
<i>Selago peduncularis</i> E.Mey.	7	K
<i>Senecio microspermus</i> DC.	1	K
<i>Senecio puberulus</i> DC.	10	K
<i>Senecio serrurioides</i> Turcz.	1	K
<i>Senecio thunbergii</i> Harv.	1	K
<i>Siphonoglossa nkandlaensis</i> Immelman	2	R
<i>Stangeria eriopus</i> (Kunze) Baill.	14	R
<i>Stapelia baylissii</i> L.C.Leach	2	R
<i>Stapelia glabricaulis</i> N.E.Br.	4	I
<i>Stapelia obducta</i> L.C.Leach	1	I
<i>Stapelia peglerae</i> N.E.Br.	1	R
<i>Stapelia praetermissa</i> L.C.Leach var. <i>luteola</i> L.C.Leach	1	R
<i>Stapelia praetermissa</i> L.C.Leach var. <i>praetermissa</i>	3	R
<i>Stapelia tsomoensis</i> N.E.Br.	3	R
<i>Stapeliopsis pillansii</i> (N.E.Br.) Bruyns	6	R
<i>Sterculia alexandri</i> Harv.	5	R
<i>Stipagrostis proxima</i> (Steud.) De Winter	2	R
<i>Strelitzia juncea</i> Link	2	R
<i>Streptocarpus formosus</i> Weigend & T.J.Edwards	2	R
<i>Streptocarpus kentaniensis</i> L.L.Britten & Story	1	R
<i>Streptocarpus modestus</i> L.L.Britten	1	K
<i>Streptocarpus porphyrostachys</i> Hilliard	1	I
<i>Struthiola pondoensis</i> Gilg ex C.H.Wright	5	R
<i>Sutera racemosa</i> (Benth.) Kuntze	3	I
<i>Syncarpha recurvata</i> (L.f.) B.Nord.	5	V
<i>Syringodea flanagani</i> Baker	2	K
<i>Syringodea pulchella</i> Hook.f.	3	K

<i>Syzygium pondoense</i> Engl.	3	V
<i>Tephrosia bachmannii</i> Harms	3	I
<i>Tephrosia pondoensis</i> (Codd) Schrire	1	R
<i>Tetradenia barberae</i> (N.E.Br.) Codd	2	R
<i>Tetralia brachyphylla</i> Levyns	1	K
<i>Tetralia robusta</i> (Kunth) C.B.Clarke	5	K
<i>Thamnocalamus tessellatus</i> (Nees) Soderstr. & R.P.Ellis	13	R
<i>Tricalysia africana</i> (Sim) Robbr.	4	E
<i>Trichodiadema rogersiae</i> L.Bolus	1	I
<i>Tritonia atrorubens</i> (N.E.Br.) L.Bolus	3	K
<i>Tromotriche longii</i> (C.A.Lückh.) Bruyns	1	R
<i>Tulbaghia montana</i> Vosa	3	I
<i>Turraea pulchella</i> (Harms) T.D.Penn.	1	V
<i>Umtiza listeriana</i> Sim	4	R
<i>Wahlenbergia kowiensis</i> R.A.Dyer	3	K
<i>Watsonia bachmannii</i> L.Bolus	2	R
<i>Watsonia mtamvunae</i> Goldblatt	2	R
<i>Watsonia pondoensis</i> Goldblatt	1	R
<i>Widdringtonia schwarzii</i> (Marloth) Mast.	8	V
<i>Woodia mucronata</i> (Thunb.) N.E.Br. var. <i>mucronata</i>	6	R
<i>Xysmalobium gerrardii</i> Scott-Elliot	1	R
<i>Xysmalobium tysonianum</i> (Schltr.) N.E.Br.	4	I
<i>Zaluzianskya mirabilis</i> Hilliard	1	K

Appendix 2: Water quality monitoring for domestic discharges. Red values indicate where effluent exceeds the general standards and blue values where effluent exceeds the target value for coastal waters

Parameter	General Standards	Median and 95% and 5% percentiles	Domestic discharge points										Target range for coastal zone
			Humansdorp STW *	Fish Water WTW *	Flats STW *	Cape STW *	Receifels * Drift	Sands	STW	Hood Point	East Bank WTW	Gonubie STW	
pH	5.5-9.5	Median	7.30	7.40	7.40	7.40	7.40	7.40	6.3	7.4	7.3	7.3	7.3-8.2
		95%	7.60	7.80	7.70	7.70	7.57	7.57	12.5(max)	8.0 (max)	7.7(max)	7.7(max)	
		5%	7.14	7.00	7.15	7.15	7.14	7.14	3.9(min)	6.5 (min)	7.0(min)	7.0(min)	
Conductivity (mS/m)	150mS/m	Median	164.00	193.00	111.50	111.50	89.55	158	158	71.4	490	490	0.02mg/l
		95%	261.70	304.30	146.75	146.75	114.69	982(max)	982(max)	97.9 (max)	577(max)	577(max)	
		5%	131.75	167.20	95.26	95.26	82.03	22.1(min)	22.1(min)	43.2 (min)	378(min)	378(min)	
Ammonia (N)	3mg/l	Median	45.00	3.05	2.95	2.95	3.15	9.8	9.8	0.00	0.40	0.40	0.02mg/l
		95%	46.80	30.80	15.75	15.75	7.83	37.0(max)	37.0(max)	5.3 (max)	6.17(max)	6.17(max)	
		5%	28.80	0.36	0.07	0.07	0.24	0.00(min)	0.00(min)	0.00 (min)	0.15(min)	0.15(min)	
COD	75 mg/l	Median	219.00	59.00	44.50	44.50	44.00	22.04	22.04	85	92	92	0.02mg/l
		95%	266.70	376.85	133.25	133.25	88.25	150000(max)	150000(max)	194 (max)	160(max)	160(max)	
		5%	170.40	32.00	31.80	31.80	39.00	0.45(min)	0.45(min)	8 (min)	53(min)	53(min)	
Permanganate		Median	15.00	6.00	7.00	7.00	6.00	9.81	9.81	5.4	6.5	6.5	0.02mg/l
		95%	22.80	11.35	14.75	14.75	7.95	19.6(max)	19.6(max)	18.6 (max)	22.0(max)	22.0(max)	
		5%	10.20	4.00	5.00	5.00	5.00	0.58(min)	0.58(min)	1.2 (min)	4.8(min)	4.8(min)	
Suspended Solids	25 mg/l	Median	73.50	9.50	5.00	5.00	2.50	626	626	8	26	26	Not to exceed ambient concentration by more than 10%
		95%	130.00	93.40	17.70	17.70	7.60	8720(max)	8720(max)	65 (max)	55(max)	55(max)	
		5%	32.30	2.50	2.50	2.50	2.50	40(min)	40(min)	1 (min)	4(min)	4(min)	
Nitrate (mg/l)	15 mg/l	Median	0.05	3.20	0.80	0.80	1.30	4.1	4.1	4.1	2.04	2.04	No target value selected, concentrations not to induce excessive algal growth or reduce DO levels
		95%	0.05	7.67	9.15	9.15	1.79	-	-	11.2 (max)	5.58(max)	5.58(max)	
		5%	0.05	1.05	0.23	0.23	0.75	-	-	0.00 (min)	0.00(min)	0.00(min)	
Faecal Coliforms/100ml	1 000 per 100ml	Median	200000	50.00	145.00	145.00	50.00	92	92	360	92	92	No target value selected, concentrations not to induce excessive algal growth or reduce DO levels
		95%	2712000	100000	2510	2510	83	46000(max)	46000(max)	110 000(max)	46000(max)	46000(max)	
		5%	7240	5.00	50.00	50.00	6.75	23(min)	23(min)	23 (min)	23(min)	23(min)	
E. coli/100ml		Median	-	5	1360	1360	-	36	36	230	36	36	No target value selected, concentrations not to induce excessive algal growth or reduce DO levels
		95%	-	5	1360	1360	-	46 000 (max)	46 000 (max)	46 000 (max)	4300(max)	4300(max)	
		5%	-	5	1360	1360	-	9 (min)	9 (min)	9 (min)	23(min)	23(min)	
Phosphorous	10 mg/l	Median	6.300	-	5.200	5.200	6.200	-	-	0.8	-	-	No target value selected, concentrations not to induce excessive algal growth or reduce DO levels
		95%	8.190	-	6.270	6.270	7.270	-	-	10.6 (max)	-	-	

	5%	3.060		3.210		0.2 (min)		not to induce excessive algal growth or reduce DO levels
Total sulphides (mg/l)	Median	-				-		
	95%	-				-		
	5%	-				-		
Sulphate (mg/l)	Median	-				-		
	95%	-				-		
	5%	-				-		
Iron (Total) Fe 0.3mg/l	Median	0.070				0.1	0.07	
	95%	0.133				8.46 (max)	0.22(max)	
	5%	0.061				0.00 (min)	0.09(min)	
Manganese (Total) Mn 0.1mg/l	Median	0.010				0.02	0.02	
	95%	0.019				2.33(max)	0.12(max)	
	5%	0.010				0.10(min)	0.00(min)	
Cadmium (Cd) 0.005mg/l	Median	0.010				0.00	0.00	
	95%	0.010				0.03(max)	0.02(max)	0.004mg/l
	5%	0.006				0.00(min)	0.00(min)	
Chromium (Total) Cr 0.05mg/l	Median	0.008				0.01	0.00	
	95%	0.055				1.24(max)	0.25(max)	0.008mg/l
	5%	0.008				0.00(min)	0.00(min)	
Copper (Cu) 0.01mg/l	Median	0.005				0.01	0.01	
	95%	0.010				0.90 (max)	0.06(max)	
	5%	0.003				0.00 (min)	0.00(min)	
Nickel	Median	0.020				0.01	0.00	
	95%	0.038				0.13(max)	0.03(max)	0.025mg/l
	5%	0.011				0.00(min)	0.00(min)	
Lead (Pb) 0.01mg/l	Median	0.070				0.00	0.00	
	95%	0.088				2.5(max)	0.00(max)	0.012mg/l
	5%	0.014				0.00 (min)	0.05(min)	
Zinc (Zn) 0.1mg/l	Median	0.070				0.03	0.01	
	95%	85.9				2.84(max)	0.09(max)	0.025mg/l
	5%	0.036				0.00(min)	0.00(min)	
Total alkalinity	Median	-				88	-	
	Maximum	-				124	-	
	Minimum	-				67	-	
Total solids	Median	-				442	-	

	Maximum	-	-	-	-	-	-	-	-	606	-	-
	Minimum	-	-	-	-	-	-	-	-	370	-	-
Chlorine (as free chlorine)	Median	-	-	-	-	-	-	-	-	99	128	-
	Maximum	-	-	-	-	-	-	-	-	184	141	-
	Minimum	-	-	-	-	-	-	-	-	58	119	-
Sodium	Median	-	-	-	-	-	-	-	-	118	114	-
	Maximum	-	-	-	-	-	-	-	-	147	143	-
	Minimum	-	-	-	-	-	-	-	-	88	94	-
Potassium	Median	-	-	-	-	-	-	-	-	12.9	14.1	-
	Maximum	-	-	-	-	-	-	-	-	15.1	15.1	-
	Minimum	-	-	-	-	-	-	-	-	10.9	12.5	-
Calcium	Median	-	-	-	-	-	-	-	-	24.4	25	-
	Maximum	-	-	-	-	-	-	-	-	28.4	75	-
	Minimum	-	-	-	-	-	-	-	-	21.3	6.1	-
Magnesium	Median	-	-	-	-	-	-	-	-	13.7	14.3	-
	Maximum	-	-	-	-	-	-	-	-	16.0	15.6	-
	Minimum	-	-	-	-	-	-	-	-	10.7	12.8	-
Nitrite	Median	-	-	-	-	-	-	-	-	0.02	2.04	-
	Maximum	-	-	-	-	-	-	-	-	0.72	5.58	-
	Minimum	-	-	-	-	-	-	-	-	0.00	0.00	-
Dissolved oxygen	Median	-	-	-	-	-	-	-	-	65%	92%	-
	Maximum	-	-	-	-	-	-	-	-	78%	160%	-
	Minimum	-	-	-	-	-	-	-	-	44%	53%	-
Aluminium	Median	-	-	-	-	-	-	-	2.34	0.02	0.00	-
	Maximum	-	-	-	-	-	-	-	18.98	0.64	0.25	-
	Minimum	-	-	-	-	-	-	-	0.17	0.00	0.00	-
Cobalt	Median	-	-	-	-	-	-	-	0.01	0.01	0.00	-
	Maximum	-	-	-	-	-	-	-	0.08	0.03	0.01	-
	Minimum	-	-	-	-	-	-	-	0.00	0.00	0.00	-
Vanadium	Median	-	-	-	-	-	-	-	0.00	0.00	0.00	-
	Maximum	-	-	-	-	-	-	-	0.42	0.06	0.03	-
	Minimum	-	-	-	-	-	-	-	0.00	0.00	0.00	-
Residual Chlorine	Median	-	-	-	-	-	-	-	0.2	0.2	0.25	-
	Maximum	-	-	-	-	-	-	-	1.47	1.47	1.19	-
	Minimum	-	-	-	-	-	-	-	0.00	0.00	0.00	-
Heterotrophic	Median	-	-	-	-	-	-	-	10000	10000	13000	-

plate count	-	-	-	-	-	-	-	-	-	71000	24000
	Maximum	-	-	-	-	-	-	-	-	1000	100
	Minimum	-	-	-	-	-	-	-	-	430	230
	Median	-	-	-	-	-	-	-	-	110000	46000
Total coliforms	Maximum	-	-	-	-	-	-	-	-	23	23
	Minimum	-	-	-	-	-	-	-	-		

Notes:

*data received from DWAF. Presented as Medians with 5% and 95% percentiles
 #data received from Buffalo City Municipality. Presented as medians with minimum and maximum values
 Data points which were recorded as < a specific value were halved as per standard procedures.
 Standard guideline values taken from Government Gazette No. 20526. General authorizations in terms of section 39 of the National Water Act, 1998.
 Target coastal values taken from Water quality guidelines for coastal and marine waters. Volume 1: Natural Environment.

Appendix 3: Water quality monitoring for industrial discharges. Red values indicate where effluent exceeds the general standards and blue values where effluent exceeds the target value for coastal waters.

Parameter	General Standards	Median and 95% and 5% percentiles	Industrial discharge points				Target range for coastal zone
			Osterlig Visery	PPC	Fish Water Flats WTW	Albany Coast Water board	
pH	5.5-9.5	Median			7.3		7.3-8.2
		95%			7.6		
		5%			6.9		
Conductivity (mS/m)	150mS/m	Median			270.5		
		95%			389.6		
		5%			175.9		
Ammonia (N)	3mg/l	Median			0.8		0.02mg/l
		95%			31.4		
		5%			0.2		
COD	75 mg/l	Median			191.5		
		95%			1239.9		
		5%			46.1		
Permanganate		Median			18.0		
		95%			97.1		
		5%			8.0		
Suspended Solids	25 mg/l	Median			70.0		Not to exceed ambient concentration by more than 10%
		95%			1090.5		
		5%			8.2		
Nitrate (mg/l)	15 mg/l	Median			1.3		No target value selected, concentrations not to induce excessive algal growth or reduce DO levels
		95%			4.5		
		5%			0.1		
Faecal Coliforms/100ml	1 000 per 100ml	Median			86000		
		95%			756000		
		5%			500.0		
E. coli/100ml		Median			500.0		
		95%			345700		
		5%			100.6		
Phosphorous	10 mg/l	Median					No target value selected, concentrations not to induce excessive
		95%					

Data points which were recorded as < a specific value were halved as per standard procedures.
Standard guideline values taken from Government Gazette No. 20526. General authorizations in terms of section 39 of the National Water Act, 1998.
Target coastal values taken from Water quality guidelines for coastal and marine waters. Volume 1: Natural Environment.