National Accounts

Environmental Economic Accounts

Environmental Economic Accounts Compendium

Report No.: 04-05-20
March 2015

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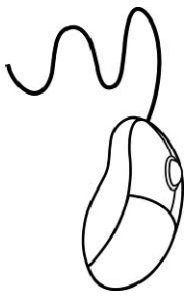

Environmental Economic Accounts Compendium

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Abbreviations and acronyms

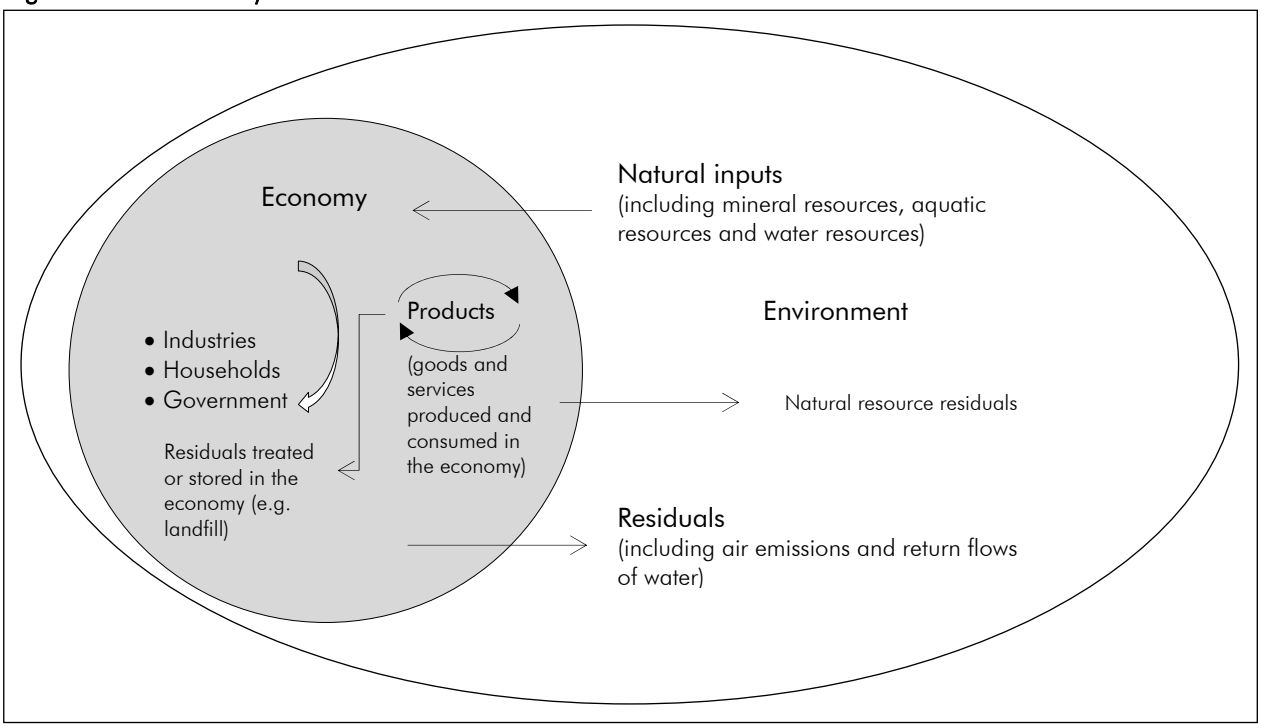
BSU	Basic spatial units
CICES	Common International Classification of Ecosystem Services
cm	Centimetres
CSIR	Council for Scientific and Industrial Research
CO_2	Carbon dioxide
CH_4	Methane
DEA	Department of Environmental Affairs
DoE	Department of Energy
DWS	Department of Water and Sanitation
EAU	Ecosystem accounting units
GDP	Gross domestic product
GHG	Greenhouse gas
GIS	Geographic Information Systems
ISIC	International Standard Industry Classification
IEA	International Energy Agency
km	Kilometres
LCEU	Land cover/ecosystem functional units
m	Metres
NFEPA	National Freshwater Ecosystem Priority Areas
N_2O	Nitrous oxide
PGMs	Platinum group metals
SAEO	South Africa Environment Outlook
SAIAB	South African Institute for Aquatic Biodiversity
SANBI	South African National Biodiversity Institute
SANParks	South African National Parks
SDGs	Sustainable Development Goals
SEEA	System of Environmental-Economic Accounting
SIC	Standard Industrial Classification
SNA	System of National Accounts
Stats SA	Statistics South Africa
TAC	Total allowable catch
TJ	Terajoules
UNEP	United Nations Environment Programme
UNSD	United Nations Statistics Division
WRC	Water Research Commission
WWF	World Wide Fund for Nature

Figures, maps and tables

Background

The System of Environmental-Economic Accounting (SEEA) is an international standard that is continually developed and refined by the United Nations Statistics Division (UNSD). A graphic overview of the SEEA Central Framework that became an international standard in 2012 shows the relationships between the environment and the economy in Figure A. Some of the key focuses are expansion, implementation and experimental ecosystem services accounts. Statistics South Africa (Stats SA) is presenting this report that includes the summarised environmental economic accounts for energy, fisheries and minerals. Indicators derived from the environmental economic accounts tables are featured. The complete tables that include physical stocks and flows, as well as monetary tables for the minerals accounts, are published as a separate Excel work book to allow users to manipulate and analyse the information to suit their requirements. The SEEA is compatible with the System of National Accounts (SNA) in terms of its definitions and classifications.

Figure A: The economy and the environment



Source: United Nations, 2014. *System of Environmental-Economic Accounting, 2012. Central Framework*. New York, 2014.

The development of environmental economic accounts is changing from supply- to demand-driven, and there is a growing demand for environmental economic accounts in South Africa. The Department of Environmental Affairs (DEA) drew on the Energy and Fishery Accounts for South Africa to update specific sections in the South Africa Environment Outlook (SAEO) 2012 that will be published in 2015. Stats SA and the South African National Biodiversity Institute (SANBI) have formed a partnership to develop pilot experimental ecosystem accounts for South Africa. The first experimental phase focuses on national river ecosystem condition accounts as well as integrated land and catchment accounts in one province. A chapter on ecosystem accounting is included for the first time in this report. Ecosystem asset accounts are intended to organise non-monetary information regarding the extent and condition of ecosystems, and expected ecosystem service flows. South Africa is one of seven pilot countries that have embarked on experimental ecosystem accounting, with support from the UNSD. The first phase commenced in 2014 and will continue into 2015, with South Africa preparing a priority work plan for the country. Together with the

Water Research Commission (WRC), Stats SA is exploring avenues to develop a framework, methodology and data sources to start water accounts for South Africa that will commence in 2015.

The environmental economic accounts are based on supply and use tables as contained in the SEEA Central Framework and the methodology contained therein. South Africa is focusing on physical flow accounts that use supply and use tables. The Annexures (Table A1 and Figures A1 and A2) show the format of a supply and use table, and the definition and classification of natural resource inputs and residuals.

The Sustainable Development Agenda requires a robust monitoring process, necessitating the development of indicator sets, which meet a set of minimum requirements pertaining to policy relevance and utility, analytical soundness and measurability and practicality. With the use of indicators based on the environmental economic accounts, the adoption of the SEEA Central Framework, which is an international standard, as a system of organising environmental information would enable the production of indicators to inform strategic decisions. Indicators derived from the SEEA are useful in terms of policy relevance, as they are supported by organised supplementary information which promotes a detailed understanding of the drivers of change. The SEEA also promotes analytical soundness, acting as a vehicle for harmonising methodological inconsistencies across the environmental data production process, as well as enabling integration of environment data with economic and social data in a methodologically sound manner. Finally, implementation of the SEEA will create efficiencies in the data production process, meaning that indicators are more attainable in data poor environments. Stats SA, as a partner in the experimental ecosystem accounting of the UNSD, will contribute to the development of these in partnerships with environmental line ministries phased in over the next two years with funding, while working on a country plan to organise institutional partnerships. The indicators derived from the development of land use accounts will feed into some of the Outcome Indicators monitored by the Department of Planning, Monitoring and Evaluation, while the DEA could start using the information from these accounts and indicators to feed into the Sustainable Development Goals (SDGs).

Chapter 1 – Ecosystem Accounts

1.1 Introduction and background

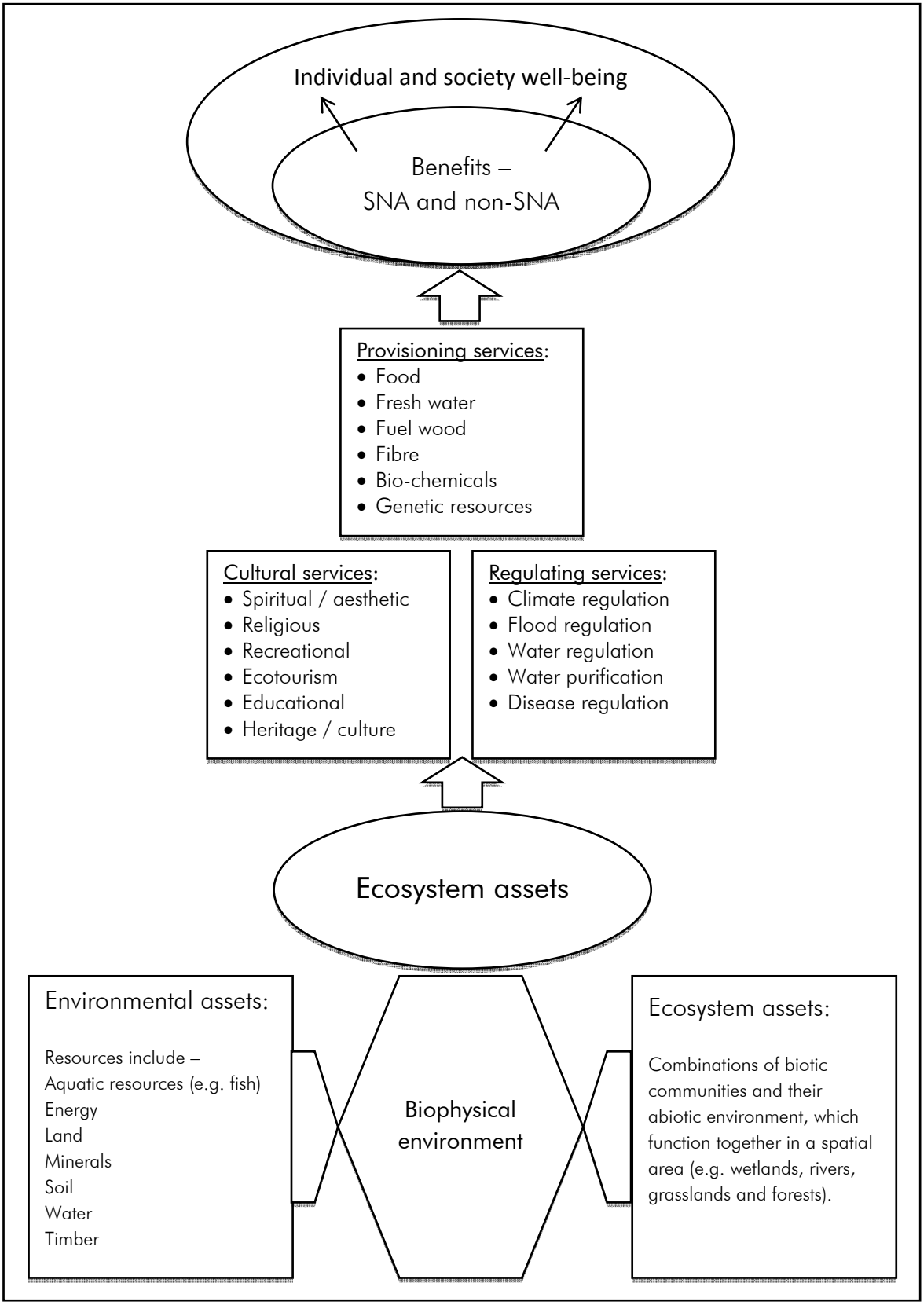
Stats SA, in partnership with SANBI, embarked on a first attempt to develop experimental ecosystem accounting for South Africa during the 2013/2014 financial year. The Council for Scientific and Industrial Research (CSIR) and the Department of Water and Sanitation (DWS) provided support to the pilot project. A decision was made to firstly focus on the river ecosystem assets with most data sourced from DWS and the National Freshwater Ecosystem Priority Areas (NFEPA)[1] project. South Africa is one of seven pilot countries selected by the UNSD to showcase the SEEA-Experimental Ecosystem Accounting. The first phase commenced in August 2014 and is scheduled to be completed in June 2015.

1.2 Overview of ecosystems in South Africa

A distinction is made in ecosystem accounting between ecosystem assets and ecosystem services. Ecosystem services flow from underlying ecosystem assets. Figure 1.1 shows this relationship. South Africa is one of the world's most diverse countries in our cultural diversity, diversity of plant and animal species, diversity of ecosystems and climatic diversity. Many ecosystems and species are under threat from loss and degradation of natural habitats, invasive alien species and over-harvesting. Ecosystem services have a future benefit to human-kind as a sustainable resource base to support economies and societies. The vast majority of these services are usually regarded as free or taken for granted, but they are essential for sustained well-being to all life. It is important to ensure that in using ecosystem services we are not depleting the ecosystem asset base on which their continued provision depends.

Ecosystem services are the benefits provided by ecosystems to humans. As discussed later in this chapter, they can take the form of provisioning services (such as food and water), regulating services (such as flood regulation) or cultural services (such as spiritual or educational services). Ecosystem accounts provide a framework for quantifying ecological aspects of the relationship between the economy and the environment. The main purpose of ecosystem service accounts is to measure flows of ecosystem services as well as the state of the underlying ecosystem assets. This helps to provide the basis for assessing sustainability and for better management of ecosystems. Figure 1.1 shows the relationship between environmental assets, ecosystem assets and ecosystem services.

Figure 1.1: Relationship between environmental assets, ecosystem assets and ecosystem services



Source: United Nations Statistics Division, 2013. *Briefing note: The SEEA Experimental Ecosystem Accounting*. New York, 2013.

1.3 River ecosystems

There is an increasing scarcity of water in South Africa and the impact of this scarcity has led to substantial pressures on freshwater ecosystems, with rivers and wetlands among the most threatened ecosystems in the country.[2] This first experimental ecosystem asset account therefore focuses on rivers. River ecosystems are vital for supplying fresh water, which is one of South Africa's most critically scarce natural resources. Rivers store and transport water to rural and urban areas. Healthy tributaries help maintain natural flow pulses, which flush pollutants from hard-working large rivers. River ecosystem types comprise unique combinations of landscape features, flow variability and channel slope. South African rivers have been degraded by intensive agriculture, mining, and other activities that may boost the economy but can damage ecosystem integrity if inappropriately located and managed.

1.4 Ecosystem condition of rivers

The ecosystem condition of rivers in South Africa is assessed by DWS using a system of Present Ecological State categories, ranging from A (natural) through to F (critically modified). For the national river ecosystem accounts, data on Present Ecological State will be converted to an index of ecological condition, which can then be aggregated and reported at a range of spatial scales (e.g. municipal, provincial and Water Management Areas). At the time of writing, this analysis was under way. The results will be published during 2015.

1.5 Data availability

The data sources that will be used in the compilation of the ecosystem account are the DWS Present Ecological State data for 1999 and 2011, and river Geographic Information System (GIS) data from NFEPA[1]. The main elements of the data are sub-quaternary river reaches and river condition. The DWS Present Ecological State data for 1999 and 2011 provide a time series on which the national river ecosystem accounts will be based.

The NFEPA river data, which built on DWS data, were used in the National Biodiversity Assessment, 2011. The NFEPA project was a multi-partner project between the CSIR, SANBI, WRC, DWA, DEA, Worldwide Fund for Nature (WWF), South African Institute for Aquatic Biodiversity (SAIAB), and South African National Parks (SANParks). This project was aimed at identifying freshwater ecosystem priority areas to meet national biodiversity goals for freshwater ecosystems.

The Atlas of Freshwater Ecosystem Priority Areas packages the map products and provides a DVD of all NFEPA products and GIS data. The Implementation Manual for Freshwater Ecosystem Priority Areas explains how to use NFEPA map products within the existing policy and legislation, and provides freshwater ecosystem management guidelines.[1]

The future of river ecosystem accounts is largely reliant on consistent and comprehensive national spatial datasets for all catchments, with similar classifications and time series. In order to take forward national river ecosystem accounting, it is important to support investment in the collection and collation of Present Ecological State data at regular intervals, preferably at sub-quaternary catchment scale.

1.6 Methodologies for ecosystem accounting

The methodologies for ecosystem accounting apply, more specifically the methodologies presented in the SEEA-Experimental Ecosystem Accounting as well as the suggested structure of the ecosystem accounts.

1.6.1 The SEEA-Experimental Ecosystem Accounting

The SEEA-Experimental Ecosystem Accounting document describes a proposed methodology for accounting for ecosystems. The SEEA-Experimental Ecosystem Accounting has been developed within the context of the SEEA Central Framework and is sometimes referred to as SEEA Volume II.[3,4]

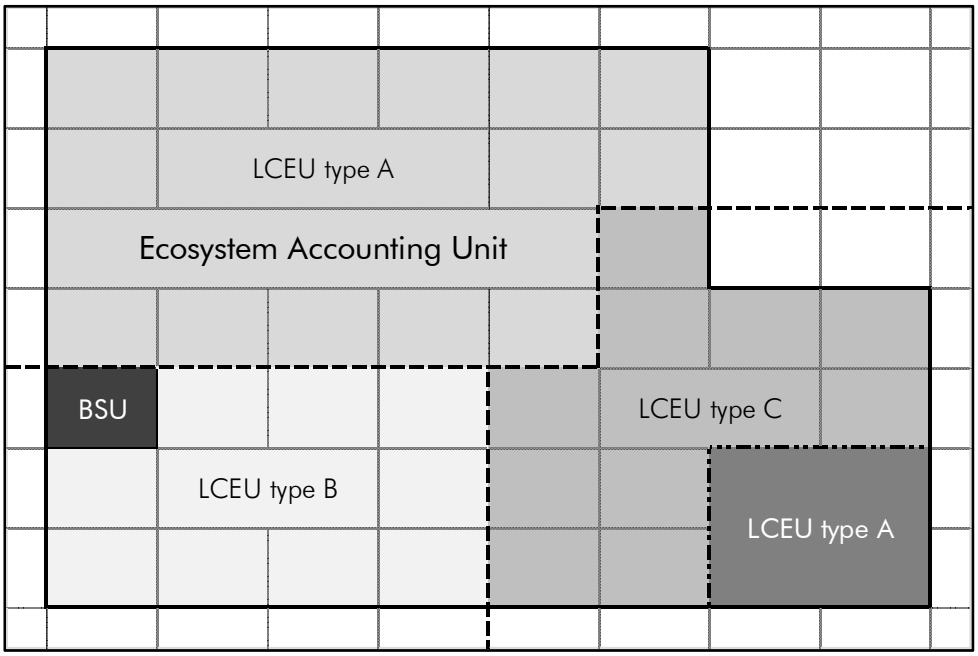
1.6.2 Environmental accounting units

The SEEA-Experimental Ecosystem Accounting discusses accounting units for ecosystems. Economic units can be used for analytical purposes grouped into industries that undertake similar economic activities and institutional sectors (units with similar types of legal bases and behaviour). Statistical units of ecosystem accounting are special areas for which data are collected and statistics are compiled. There are three statistical units, namely:

- Basic spatial units (BSU);
- Land cover/ecosystem functional units (LCEU); and
- Ecosystem accounting units (EAU).

For a single country, it may be relevant to recognise different hierarchies of EAUs. For example, a set of EAUs may be delineated based on administrative regions, a second set may be based on catchment management areas, and a third set may be based on soil types. All EAUs within each set may be aggregated to form national totals but there should not be an aggregation of EAUs across different sets (e.g. aggregation of some administrative regions with some catchment areas), since this would imply the aggregation of 'non-matching units' and the potential to double-count individual areas. Figure 1.2 provides a stylised depiction of the relationships between BSUs, LCEUs and EAUs where, in this case, the BSUs are defined by grid squares. Attribution of BSUs to LCEUs and to EAUs should be based on predominance, as described above. Note that it is possible for a number of LCEU types to be present within a single EAU and for a single LCEU type to appear in various locations within an EAU.[3]

Figure 1.2: Relationship between BSU, LCEU and EAU



Source: United Nations, 2014. *System of Environmental-Economic Accounting, 2012.* Experimental Ecosystem Accounting. New York.

South Africa has taken a slightly different approach in the national river ecosystem accounts, using sub-quaternary river reaches as the basic spatial unit and the ecosystem functional unit. Rivers are linear

features that do not lend themselves to basic spatial units in the form of pixels. The delineation of basic spatial units and ecosystem functional units in the integrated land and catchment accounts is currently being explored. Ecosystem functional units are likely to be based on ecological features such as vegetation types or sub-catchments rather than on land cover.

1.7 Structure of the ecosystem accounts

Only physical accounts are dealt with at present in South Africa.

1.7.1 Physical accounts

The assessment of ecosystem assets involves the measurement of three key aspects: ecosystem condition, ecosystem extent, and expected ecosystem service flows. There are considerations of which ecosystem services may be the focus of measurement, given that it is not possible to identify and define all ecosystem services.

Assessing ecosystem condition and extent

Assessment of ecosystem extent focuses on land cover determining areas and changes in areas such as forests, wetlands, etc. The measurement of ecosystem extent identifies the location of an ecosystem asset on the surface of the earth and the location in relation to other ecosystem assets. This creates the spatial foundations for ecosystem accounting. Measures of the second aspect, ecosystem condition, are compiled in two stages. In the first stage, a set of relevant key characteristics is selected and various indicators concerning these characteristics are chosen. In the second stage, indicators for these characteristics are related to a reference condition. The next step is to further develop spatial information to enhance the information on conditions with time series.

Assessing expected ecosystem service flows

The third aspect is an assessment of the ability of an ecosystem asset to generate an expected combination (or basket) of provisioning, regulating and cultural services. Expected ecosystem service flows are dependent upon assumptions regarding future use patterns. In general there will be differences between current use patterns, e.g. where a fishery may be over-exploited or alternative use patterns, such as fishing at a sustainable yield. The relationship between ecosystem assets and ecosystem services is complex. In the short to medium term, there can be an inverse relationship between the condition of an ecosystem asset and the flow of services it delivers.

Assessing changes in ecosystem assets

An important accounting objective is the measurement of changes in ecosystem assets, particularly ecosystem degradation and ecosystem enhancement. These are complex concepts since ecosystem assets may change for a variety of reasons that could be both natural and human induced.

Links to standard asset accounting

The starting point for the approach in SEEA-Experimental Ecosystem Accounting is the standard asset accounting model used to account for produced assets in the SNA and as applied to the measurement of individual environmental assets in the SEEA Central Framework[4]. The standard asset accounting model focuses on a single asset (most commonly a produced asset) and estimates an expected flow of benefits (in terms of capital services) that accrue to the user/owner of the asset over a given period of time (the asset life). The pattern of expected flows provides the basis for valuing the asset, determining flows of income and depreciation and assessing the way in which the asset contributes to production. However, defining

ecosystem asset aggregates is problematic due to the need to define relationships between the various characteristics.

1.7.2 Classifications of ecosystem services

The classification of ecosystem services is described in the SEEA-Experimental Ecosystem Accounting. The Common International Classification of Ecosystem Services (CICES) fits into the broader picture of ecosystem accounting by providing a structure to classify those flows that are defined as ecosystem services. The CICES provides for three levels of classifications, with each level being more disaggregated. According to SEEA-Experimental Ecosystem Accounting at the highest level there are three types of ecosystem services, namely:

- Provisioning services reflect contributions to the benefits produced by or in the ecosystem, for example a fish or a plant with pharmaceutical properties. These benefits may be provided by agricultural systems, as well as within semi-natural and natural ecosystems.
- Regulating services result from the capacity of ecosystems to regulate climate, hydrological and bio-chemical cycles, earth surface processes, and a variety of biological processes. These services often have an important spatial aspect. For instance, the flood control service of an upper watershed forest is only relevant in the flood zone downstream of the forest.
- Cultural services relate to the intellectual and symbolic benefits that people obtain from ecosystems through recreation, knowledge development, relaxation, and spiritual reflection. This may involve actual visits to an area, indirectly enjoying the ecosystem (e.g. through nature movies), or gaining satisfaction from the knowledge that an ecosystem containing important biodiversity or cultural monuments will be preserved.[4]

Rivers provide services in all three of the categories that are stated above. However, the focus of this feasibility study for these accounts is on the condition of the underlying river asset, rather than accounting directly for the flow of services, which may be dealt with in separate accounts, e.g. water accounts. The chapter on indicators shows the results of linking Census 2011 data to access to water in its different provisioning structures, i.e. rivers and piped water.

Chapter 2 – Energy

2.1 Overview

The South African economy depends heavily on energy resources provided from coal. Coal dominates primarily because it is abundant and relatively cheap by international standards. South Africa's coal mining comprises 47% underground mining and 53% opencast mining operations. Many of the deposits can be exploited at extremely favourable costs, and as a result a large coal mining industry has developed. South Africa has large coal and uranium reserves. In 2012, South African mines produced 259 million tons of coal. In 2012 there were 116 years left to depletion, given current rates of extraction and proven resources of 30 156 million tons.

Oil and gas explorations are limited in South Africa. Small oil and gas fields are situated off the south coast of Mossel Bay. Due to limited oil fields in the country, the bulk of crude oil is imported from the Middle East and Africa (Saudi Arabia, Iran, Kuwait, Yemen, Qatar, Iraq, Nigeria, Egypt and Angola). The small gas fields in South Africa supply Mossgas, a project started in 1987 to exploit offshore gas deposits.

Other energy resources in South Africa include biomass (such as wood and dung), natural gas, hydropower, nuclear power, solar power, wave power and wind power. Limited reserves of hydropower exist. South Africa has a huge potential for developing solar power, especially in the Northern Cape, with considerable potential for wind power existing in the coastal regions.

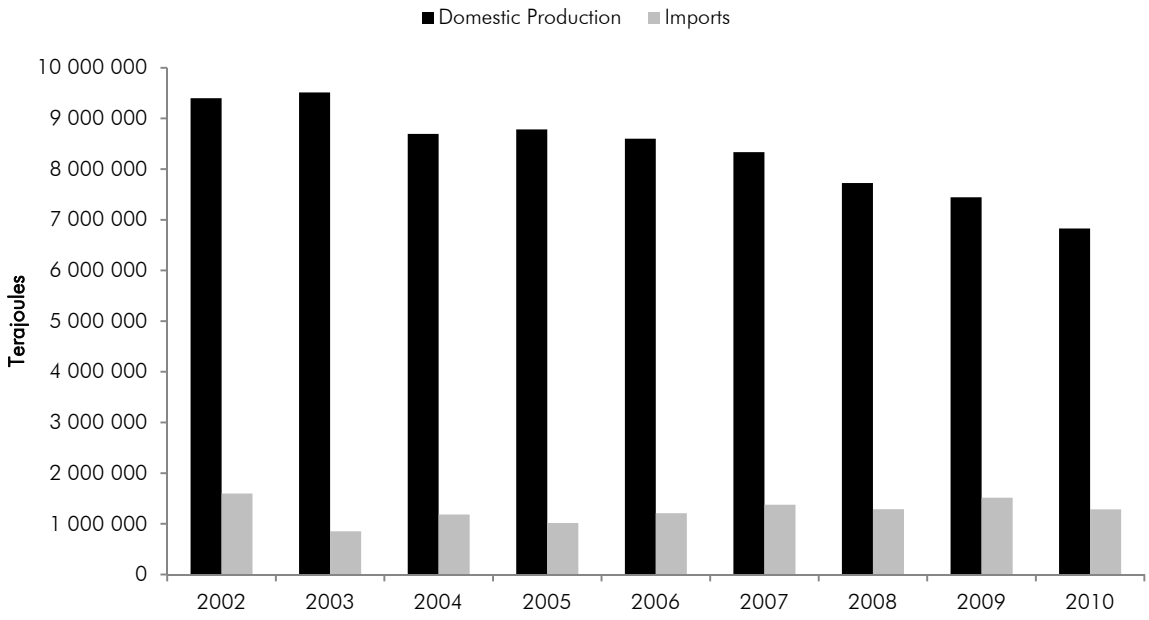
Energy is a key driver of South Africa's economy. The economy's structure is dominated by large-scale, energy intensive primary mineral beneficiation and mining industries. Coal, as the major indigenous energy resource, is relied on for the generation of most of the country's electricity and a significant proportion of its liquid fuels. Diversification of the primary energy mix, the bulk of which comprises coal, is especially challenging.[5,6]

The key findings for energy are focused on energy supply and energy use for the reference years 2002 to 2010.

2.1.1 Energy supply and use, 2002 to 2010

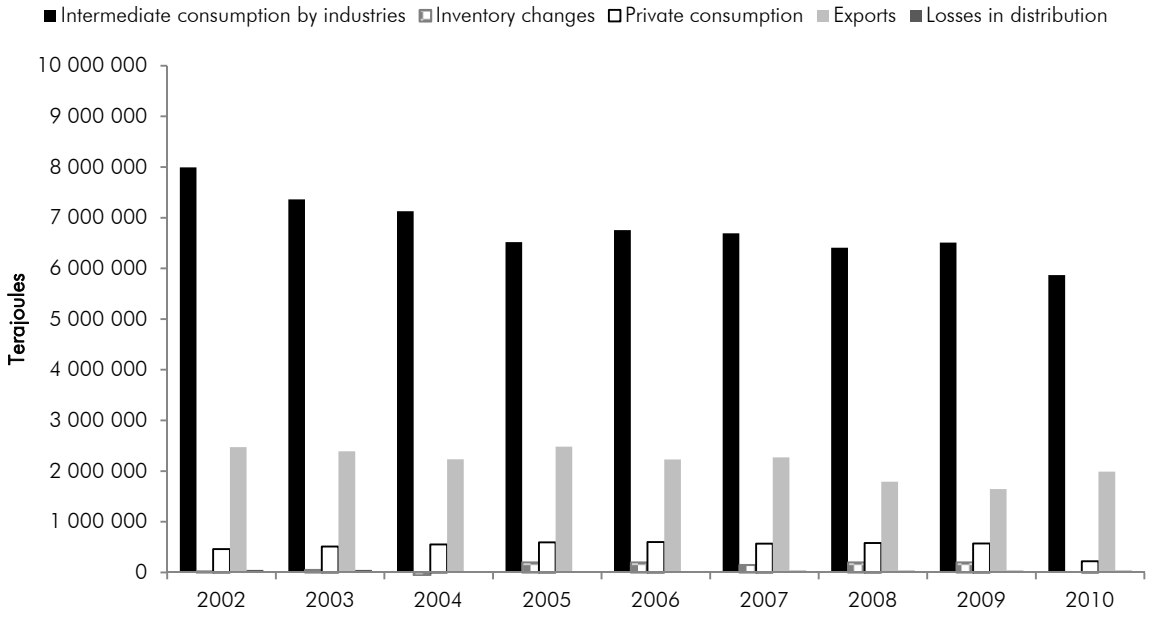
Figure 2.1.1 and Table 2.1.1 show energy supply in Terajoules (TJ) for the period from 2002 to 2010. Figure 2.1.2 and Table 2.1.2 show domestic energy use for the period from 2002 to 2010. Domestic production decreased by 27,4% from 9 400 045 TJ in 2002 to 6 827 633 TJ in 2010. Imports decreased by 19,7% from 1 598 650 TJ in 2002 to 1 284 103 TJ in 2010. Intermediate consumption declined by 26,6% from 7 993 761 TJ in 2002 to 5 866 679 TJ in 2010. Exports declined by 19,6% from 2 474 046 TJ in 2002 to 1 989 542 TJ in 2010.

Figure 2.1.1: Energy supply, 2002–2010



Sources: Department of Energy, 2014. *Energy Balances, 2010*. Statistics South Africa. Environmental Economic Account Tables.

Figure 2.1.2: Energy use, 2002–2010



Sources: Department of Energy, 2014. *Energy Balances, 2010*. Statistics South Africa. Environmental Economic Account Tables.

Table 2.1.1: Energy supply, 2002–2010

	2002	2003	2004	2005	2006
			Terajoules		
Domestic Production	9 400 045	9 513 263	8 695 420	8 781 738	8 598 682
Imports	1 598 650	852 397	1 183 446	1 017 563	1 209 496
	2007	2008	2009	2010	
			Terajoules		
Domestic Production	8 334 892	7 723 828	7 442 213	6 827 633	
Imports	1 376 677	1 288 187	1 515 742	1 284 103	

Sources: Department of Energy, 2014. *Energy Balances, 2010*. Statistics South Africa. Environmental Economic Account Tables.

Table 2.1.2: Energy use, 2002–2010

	2002	2003	2004	2005	2006
			Terajoules		
Intermediate consumption by industries	7 993 761	7 363 246	7 129 263	6 517 286	6 753 939
Inventory changes	21 216	49 346	-53 861	197 741	198 165
Private consumption	459 920	510 980	552 888	592 930	601 305
Exports	2 474 046	2 391 112	2 231 611	2 482 535	2 230 088
Losses in distribution	49 752	50 976	18 965	8 809	24 682
	2007	2008	2009	2010	
			Terajoules		
Intermediate consumption by industries	6 691 034	6 409 214	6 510 368	5 866 679	
Inventory changes	149 348	197 741	197 741	0	
Private consumption	567 418	580 124	570 769	221 869	
Exports	2 270 123	1 791 291	1 645 431	1 989 542	
Losses in distribution	33 646	33 646	33 646	33 646	

Sources: Department of Energy, 2014. *Energy Balances, 2010*. Statistics South Africa. Environmental Economic Account Tables.
Note:The complete disaggregated tables can be viewed in the online Excel workbook.

Chapter 3 – Fisheries

3.1 Overview

South Africa's coastline spans 3 200 kilometres (km), linking the east and west coasts of Africa. Its shores are rich in biodiversity, with some 10 000 species of marine plants and animals recorded. The productive waters of the West Coast support a variety of commercially exploited marine life that includes hake, anchovy, sardine, horse mackerel, tuna, snoek, rock lobster and abalone. On the East Coast one finds squid, linefish and a whole range of intertidal resources that provide an important source of food and livelihoods for coastal communities. Marine life that is not harvested, such as whales, dolphins and seabirds, is increasingly recognised as a valuable resource for nature-based tourism.

The South African fishing industry is well managed and South Africa is one of the world's leading countries in the implementation of an ecosystem approach for fisheries management. The coastline provides substantial opportunities for economic and social development. However, it is a resource threatened by inappropriate development, pollution, poaching and over-use. There are two components to the fishing sector: wild capture and aquaculture. Programmes are developed to reduce the degradation of the marine environment through policies that promote conservation and sustainable use of marine-living resources. It also aims to restore and maintain productive capacity and biodiversity of the marine environment and protect human health.

The projected increase in demand for high-end fisheries products provides an opportunity for substantial increases in aquaculture production. Total annual fish production from marine fisheries exceeds 600 000 tons. With South Africa's environmental potential for aquaculture and the state of development of its industry, production could grow from 3 543 tons to more than 90 000 tons over the next 10 to 20 years.

As of July 2010, the commercial harvesting of abalone was opened to allow fishing communities to derive a livelihood from the sea. This came with multifaceted conditions to ensure that social, economic and security plans and structures were in place to support communities, especially along the entire south-western and west coast of South Africa.

The fishing sector comprises large-scale operators as well as small-scale, artisanal or recreational fishermen and women. The Small-Scale Fisheries Policy aims to support investment in community entities to take joint responsibility for sustainable management of the fishery resources and to address the depletion of critical fish stocks.

This document focuses on hake, West Coast rock lobster, abalone, Cape horse mackerel and South Coast rock lobster as the main marine resources that contribute to the economy.[7]

3.2 Hake

The location of hake (*Merluccius paradoxus and M. capensis*) fishing waters is in the South East Atlantic within the South African 200 nautical mile Economic Exclusion Zone. The fishing gear that is used is bottom trawl and the season is year-round. Products include whole, headed and gutted, fillets, steaks, portions, minced, chilled, coated, frozen block, marinated, loins, pickled, ready meal, and smoked fish meat.[7,9]

Trawl fisheries targeting hake provide over half of the value of all fisheries in South Africa. The main export markets are Europe, Australia and the United States of America. The offshore trawl fishery mostly targets deepwater *M. paradoxus* on the shelf edge from the Namibian border southwards. Shallow water *M. capensis* is the target of the inshore trawl fishery, which operates mostly on the Agulhas Bank off the South Coast. The two species overlap in their depth distribution, and both are found around the entire South African coast. Growth in both species is slow, and fish can reach 115 centimetres (cm) in size. Hake are piscivorous as adults, feeding at night, whereas they aggregate near the sea bottom during the day, when they are targeted by trawlers.

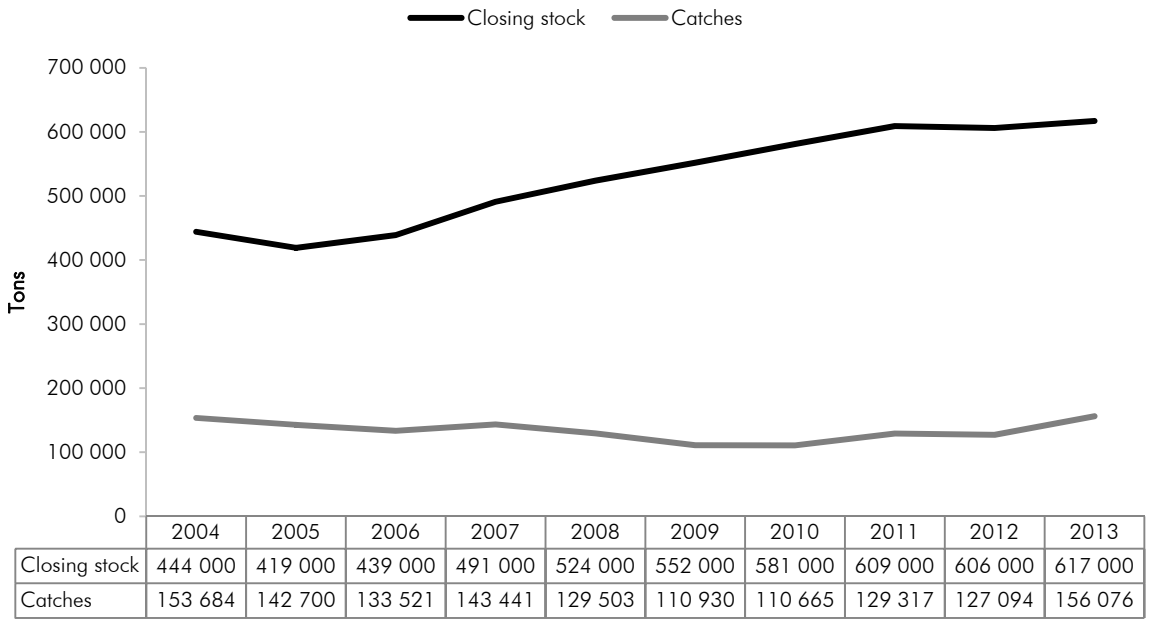
The South African hake fishery has become more inclusive and consultative recently. All fishing rights holders have signed Codes of Conduct, committing them to compliance procedures and accepting the concept of sustainable harvesting. An Operational Management Plan is in place to allow the recovery of *M. paradoxus* stocks to sustainable levels within 20 years.[7]

The key findings for the hake commercial fishing industry are focused on total catches and closing stock over a ten-year period from 2004 to 2013.

3.2.1 Hake closing stock and total catches, 2004 to 2013

The closing stock for hake increased from 444 000 tons in 2004 to 617 000 tons in 2013. This is an increase of 39,0% over the ten-year period. Total catches for hake increased from 153 684 tons in 2004 to 156 076 tons in 2013. This is an increase of 1,6% over the ten-year period.

Figure 3.2.1: Hake closing stock and total catches, 2004–2013



	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Closing stock	444 000	419 000	439 000	491 000	524 000	552 000	581 000	609 000	606 000	617 000
Catches	153 684	142 700	133 521	143 441	129 503	110 930	110 665	129 317	127 094	156 076

Source: Statistics South Africa. Environmental Economic Accounts Tables.

Table 3.2.1: Hake closing stock and total catches, 2004–2013

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
						Tons				
Closing stock	444 000	419 000	439 000	491 000	524 000	552 000	581 000	609 000	606 000	617 000
Catches	153 684	142 700	133 521	143 441	129 503	110 930	110 665	129 317	127 094	156 076
						% Change from previous period				
Closing stock		-5,6%	4,8%	11,8%	6,7%	5,3%	5,3%	4,8%	-0,5%	1,8%
Catches		-7,1%	-6,4%	7,4%	-9,7%	-14,3%	-0,2%	16,9%	-1,7%	22,8%

Note: Closing stock is influenced by other volume changes and not only the catches reflected here. Refer to Excel Online Workbook.
Source: Statistics South Africa. Environmental Economic Accounts Tables.

3.3 West Coast rock lobster

The West Coast rock lobster (*Jasus lalandii)* is a species of spiny lobster found off the coast of southern Africa. It occurs in the shallow waters from Cape Cross in Namibia to Algoa Bay in South Africa, where it can usually be found in rocky outcrops in the sea. West Coast rock lobsters are slow-growing, long-lived animals listed on the National Environmental Management Biodiversity Act of 2004 as a threatened and protected species, which means that it is a species of high conservation value or national importance that requires national protection.

West Coast rock lobster is caught via a number of methods, mainly using traps or ring-nets. Hand collection is used by recreational fishers. These methods are very selective, and thus the by-catch levels are low or non-existent. These methods are minimally destructive to benthic habitats or benthic species (characteristics of the sea bottom and the plants and animals that live there), but depletion of lobsters will have had adverse effects on the benthos as West Coast rock lobster has important effects as a predator.

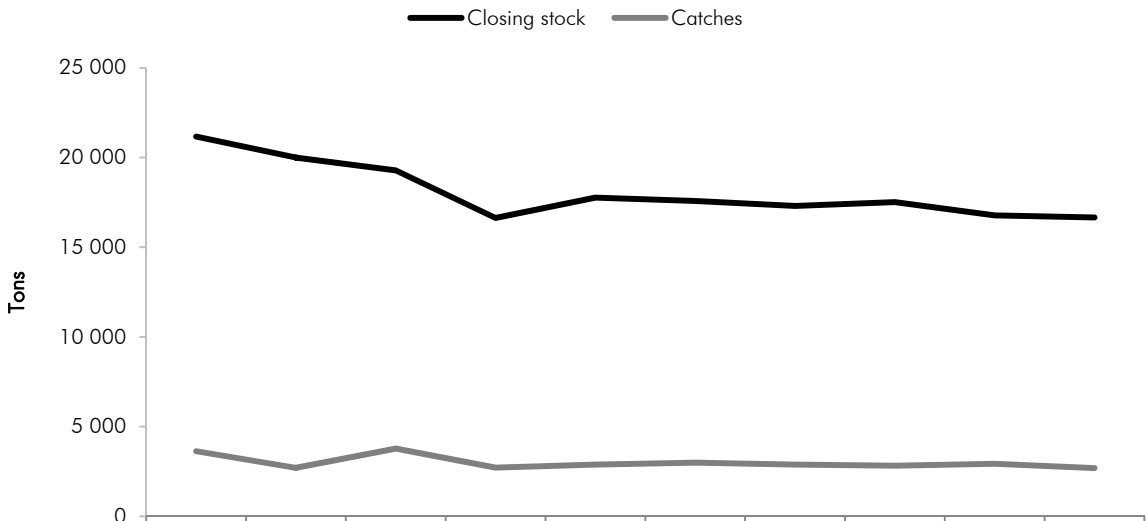
The commercial fishery for West Coast rock lobster is controlled by Total Allocable Catch (TAC), which is subdivided across geographical areas. However, there is a considerable amount of poaching from the stock, which adds to the uncertainty of the stock assessment. Other issues of concern are whale entanglements in the gear as well as gear loss, which results in ghost fishing. This concern has been decreased because the netting for the traps is made of biodegradable materials. Ecosystem based management has been put in place for this fishery.[7]

The key findings for West Coast rock lobster include commercial, recreational, and subsistence catches, as well as poaching estimates. The focus is on total catches and closing stock over a ten-year period from 2004 to 2013.

3.3.1 West Coast rock lobster closing stock and total catches, 2004 to 2013

The closing stock for West Coast rock lobster declined from 21 170 tons in 2004 to 16 661 tons in 2013. This is a decline of 21,3% over the ten-year period. Total catches for West Coast rock lobster decreased from 3 632 tons in 2004 to 2 690 tons in 2013. This is a decrease of 25,9% over the ten-year period.

Figure 3.3.1: West Coast rock lobster closing stock and total catches, 2004–2013



	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Closing stock	21 170	19 997	19 282	16 636	17 766	17 575	17 303	17 517	16 773	16 661
Catches	3 632	2 704	3 779	2 711	2 888	2 987	2 880	2 820	2 929	2 690

Source: Statistics South Africa. Environmental Economic Accounts Tables.

Table 3.3.1: West Coast rock lobster closing stock and total catches, 2004–2013

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
					Tons					
Closing stock	21 170	19 997	19 282	16 636	17 766	17 575	17 303	17 517	16 773	16 661
Catches	3 632	2 704	3 779	2 711	2 888	2 987	2 880	2 820	2 929	2 690
					% Change from previous period					
Closing stock		-5,5%	-3,6%	-13,7%	6,8%	-1,1%	-1,5%	1,2%	-4,2%	-0,7%
Catches		-25,6%	39,8%	-28,3%	6,5%	3,4%	-3,6%	-2,1%	3,9%	-8,2%

Note: Closing stock is influenced by other volume changes and not only the catches reflected here. Refer to Excel Online Workbook.
Source: Statistics South Africa. Environmental Economic Accounts Tables.

3.4 Abalone

Abalone (*Haliotis midae*), locally called 'perlemoen', is a large marine snail that is a highly prized seafood delicacy in the Far East. Abalone are slow-growing, reaching sexual maturity at around seven years of age, and take approximately 8 to 9 years to reach the minimum legal size of 11,4 cm shell breadth. Abalone reach a maximum size of 18 cm shell breadth, and are believed to live to an average age of greater than 30 years. They occur in shallow waters of below 20 metres (m) in depth, with the highest densities in waters of below 5 m in depth.

Abalone are widely distributed around the South African coastline, from St Helena Bay on the West Coast to just north of Port St Johns along the East Coast. Historically, the resource was most abundant in the region between Cape Columbine and Quoin Point, where it supported a commercial fishery for almost 60 years. Along the East Coast, the resource was considered to be discontinuous and sparsely distributed and as a result no commercial fishery for abalone was implemented there. However, harvesting of abalone along the East Coast was allowed for a number of years through the allocation of experimental permits and subsistence exemptions. The recreational sector also targeted abalone for many years, but due to the decline in the resource, this component of the fishery was suspended in 2003/2004.

Once a lucrative commercial fishery, earning up to approximately R100 million annually at the turn of the century, rampant illegal harvesting and continued declines in the abundance of the resource resulted in a total closure of the fishery in February 2008. The resource has also been heavily impacted by an ecosystem shift that was brought about by the migration of West Coast rock lobster into two of the main, most productive abalone fishing areas.

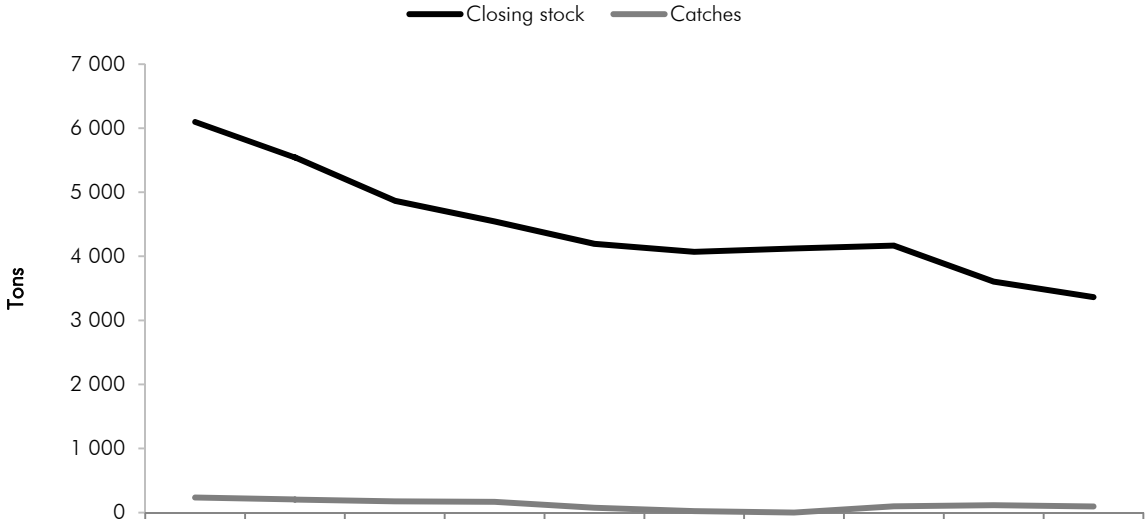
The commercial fishery subsequently re-opened in July 2010. Controlled experimental fisheries for abalone are currently being undertaken in False Bay and the Eastern Cape – areas that are not presently part of the commercial fishery. The purpose of these experiments is to determine the spatial distribution and abundance of the resource and whether these areas may be viable for sustainable fisheries in the future.[7]

The key findings for abalone include commercial and experimental sustainable estimates. The focus is on total catches and closing stock over a ten-year period from 2003 to 2012.

3.4.1 Abalone closing stock and total catches, 2003 to 2012

The closing stock for abalone decreased from 6 096 tons in 2003 to 3 364 tons in 2012. This is a decline of 44,8% over the ten-year period. Total catches for abalone declined from 234 tons in 2003 to 95 tons in 2012. This is a decline of 59,4% over the ten-year period.

Figure 3.4.1: Abalone closing stock and total catches, 2003–2012



	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Closing stock	6 096	5 543	4 866	4 544	4 194	4 071	4 122	4 168	3 606	3 364
Catches	234	204	175	169	75	24	0	99	116	95

Source: Statistics South Africa. Environmental Economic Accounts Tables.

Table 3.4.1: Abalone closing stock and total catches, 2003–2012

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
					Tons					
Closing stock	6 096	5 543	4 866	4 544	4 194	4 071	4 122	4 168	3 606	3 364
Catches	234	204	175	169	75	24	0	99	116	95
					% Change from previous period					
Closing stock		-9,1%	-12,2%	-6,6%	-7,7%	-2,9%	1,3%	1,1%	-13,5%	-6,7%
Catches		-12,8%	-14,2%	-3,4%	-55,6%	-68,0%	-100,0%	0,0%	17,2%	-18,1%

Note: Closing stock is influenced by other volume changes and not only the catches reflected here. Refer to Excel Online Workbook.
Source: Statistics South Africa. Environmental Economic Accounts Tables.

3.5 Cape horse mackerel

Cape horse mackerel (*Trachurus capensis*) is a semi-pelagic shoaling fish that occurs on the continental shelf off southern Africa from southern Angola to the Wild Coast.

Horse mackerel as a group are recognised by a distinct dark spot on the gill cover and a row of spiny scales (scutes) along the lateral line. It is, however, not easy to distinguish between the three species that occur in southern Africa. Cape horse mackerel generally reach 40 to 50 cm in length and become sexually mature at around three years of age when they are roughly 20 cm long. They feed primarily on small crustaceans, which they filter from the water using their modified gillrakers. Historically, large surface schools of adult Cape horse mackerel occurred on the West Coast and supported a purse-seine fishery that made substantial catches. These large schools have since disappeared from the South African West Coast, but still occur off Namibia where horse mackerel are the most abundantly harvested fish. Adult horse mackerel currently occur more abundantly on the South Coast than the West Coast of South Africa.

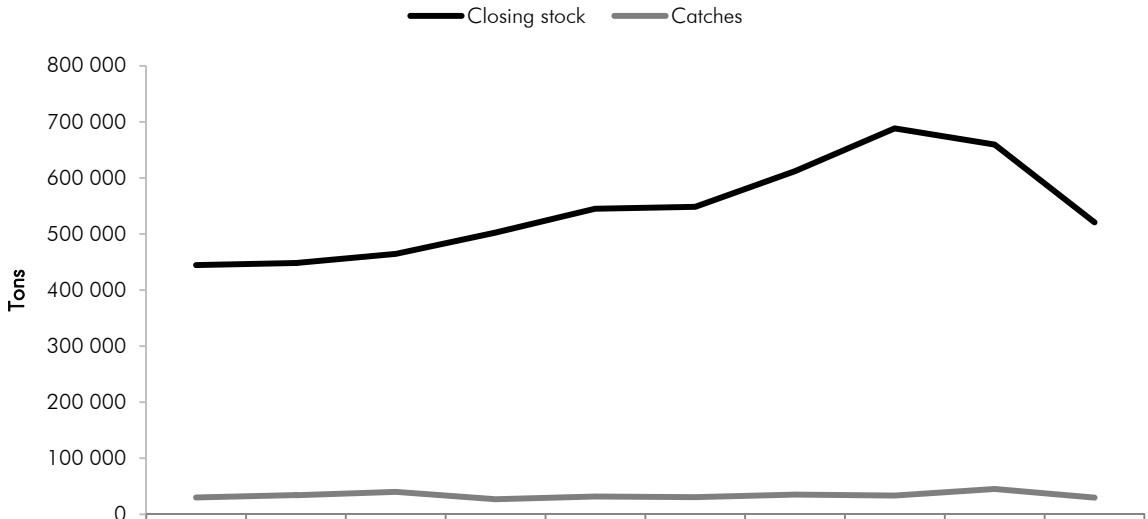
Adult Cape horse mackerel are taken as a bycatch by the demersal trawl fleet and as a targeted catch by the midwater trawl fleet, mainly on the South Coast. In addition, the pelagic purse-seine fleet on the West Coast takes juveniles as a bycatch. Cape horse mackerel yield a low value product and are a cheap source of protein.[7]

The key findings for Cape horse mackerel focus on bycatches by the demersal trawl fleet and as targeted catches by the midwater trawl fleet. The focus is on total catches and closing stock over a ten-year period from 2003 to 2012.

3.5.1 Cape horse mackerel closing stock and total catches, 2003 to 2012

The closing stock for Cape horse mackerel increased from 444 298 tons in 2003 to 520 679 tons in 2012. This is an increase of 17,2% over the ten-year period. Total catches for Cape horse mackerel decreased from 29 880 tons in 2003 to 29 719 tons in 2009. This is a decrease of 0,5% over the ten-year period.

Figure 3.5.1: Cape horse mackerel closing stock and total catches, 2003–2012



	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Closing stock	444 298	448 255	464 488	502 527	545 033	548 471	612 143	688 345	659 626	520 679
Catches	29 880	34 134	39 905	27 014	31 744	30 501	35 235	33 457	45 267	29 719

Source: Statistics South Africa. Environmental Economic Accounts Tables.

Table 3.5.1: Cape horse mackerel closing stock and total catches, 2003–2012

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
					Tons					
Closing stock	444 298	448 255	464 488	502 527	545 033	548 471	612 143	688 345	659 626	520 679
Catches	29 880	34 134	39 905	27 014	31 744	30 501	35 235	33 457	45 267	29 719
					% Change from previous period					
Closing stock		0,9%	3,6%	8,2%	8,5%	0,6%	11,6%	12,4%	-4,2%	-21,1%
Catches		14,2%	16,9%	-32,3%	17,5%	-3,9%	15,5%	-5,0%	35,3%	-34,3%

Note: Closing stock is influenced by other volume changes and not only the catches reflected here. Refer to Excel Online Workbook.
Source: Statistics South Africa. Environmental Economic Accounts Tables.

3.6 South Coast rock lobster

South Coast rock lobster (*Palinurus gilchristi*) is endemic to the southern coast of South Africa, where they occur on rocky substrata at depths of 50 to 200 m.

The fishery operates between East London and Cape Point and up to 250 km off-shore along the outer edge of the Agulhas Bank. Fishing gear is restricted to longlines with traps. It is the second largest rock lobster fishery in South Africa, and is capital intensive, requiring specialised equipment and large ocean-going vessels. For this reason, it is restricted to the commercial sector.

Products (frozen tails, whole or live lobster) are exported to the United States of America, Europe and the Far East. Sales are affected by seasonal overseas market trends and competition from other lobster-producing countries. High prices on international markets and the rand to dollar exchange rate make the sector lucrative.

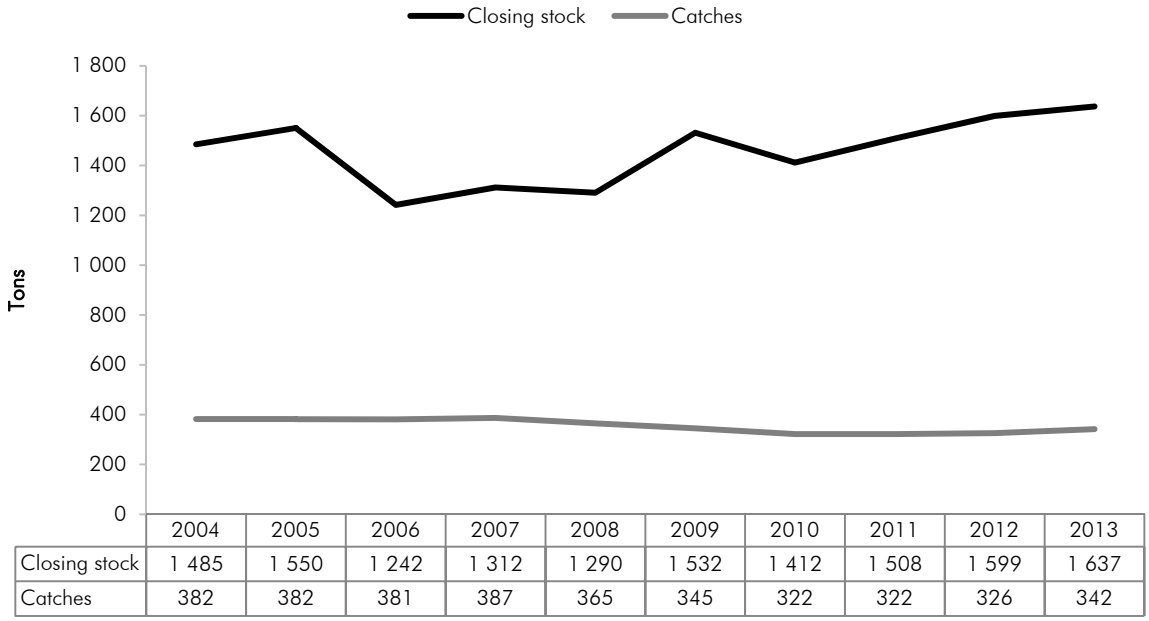
Longline trap-fishing is labour intensive and as such each boat requires approximately 30 officers and crew. The total sea-going complement of the fleet is about 300. The sector employs approximately 100 land-based factory (processing) and administrative staff.[7]

The key findings for South Coast rock lobster focus on specialised commercial harvesting requiring specialised equipment. The focus is on total catches and closing stock over a ten-year period from 2004 to 2013.

3.6.1 South Coast rock lobster closing stock and total catches, 2004 to 2013

The closing stock for South Coast rock lobster increased from 1 485 tons in 2004 to 1 637 tons in 2013. This is an increase of 10,2% over the ten-year period. Total catches for South Coast rock lobster declined from 382 tons in 2004 to 342 tons in 2013. This is a decrease of 10,5% over the ten-year period.

Figure 3.6.1: South Coast rock lobster closing stock and total catches, 2004–2013



	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Closing stock	1 485	1 550	1 242	1 312	1 290	1 532	1 412	1 508	1 599	1 637
Catches	382	382	381	387	365	345	322	322	326	342

Source: Statistics South Africa. Environmental Economic Accounts Tables.

Table 3.6.1: South Coast rock lobster closing stock and total catches, 2004–2013

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
					Tons					
Closing stock	1 485	1 550	1 242	1 312	1 290	1 532	1 412	1 508	1 599	1 637
Catches	382	382	381	387	365	345	322	322	326	342
					% Change from previous period					
Closing stock		4,4%	-19,9%	5,6%	-1,6%	18,7%	-7,8%	6,8%	6,0%	2,4%
Catches		0,0%	-0,3%	1,6%	-5,7%	-5,5%	-6,7%	0,0%	1,2%	4,9%

Note: Closing stock is influenced by other volume changes and not only the catches reflected here. Refer to Excel Online Workbook.
Source: Statistics South Africa. Environmental Economic Accounts Tables.

Chapter 4 – Minerals

4.1 Overview

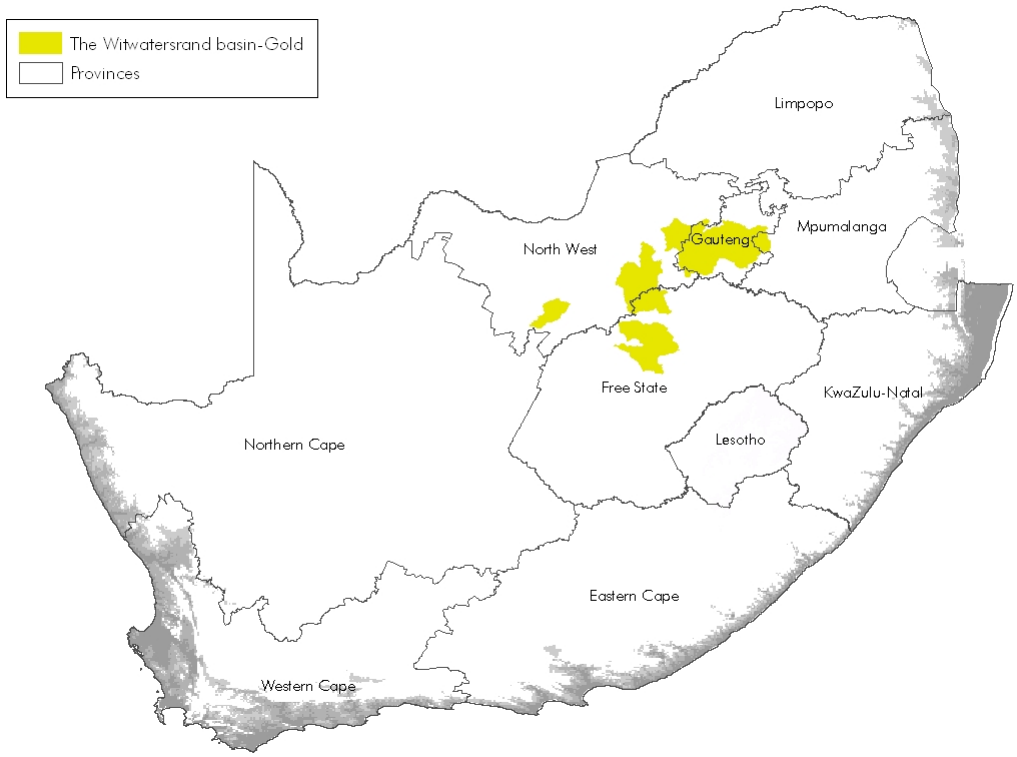
Mining and related industries provide critical inputs to the country's socio-economic development. The contribution of mining to gross domestic product (GDP) was 8,3% in 2014.[10] South Africa ranks among the top 10 countries with regard to production of minerals such as manganese, iron ore, gold, chrome and ferrochrome. The discovery of world-class diamond and gold deposits in the latter half of the 19th century laid the foundation for the emergence of South Africa from an agricultural to a modern industrial economy. The mining industry covers a wide spectrum of minerals in which South Africa has an exceptional mineral endowment. Mining plays a vital role as a foundation industry that stimulates key services, manufacturing and side-stream industries. Mining provides direct employment to about half a million economically active people.

South Africa's mineral wealth is found in well-known geological formations and settings, i.e. the Witwatersrand Basin (gold deposits), the Bushveld Complex (platinum group metal (PGM) deposits) and the Karoo Basin (coal deposits).

The Witwatersrand Basin

The geology and gold mines of the 'Ridge of White Waters' are world famous. Nearly half of all the gold ever mined has come from the extensive Witwatersrand conglomerate reefs that were discovered in 1886, not far from Johannesburg's city centre – seven major goldfields distributed in a crescent-like shape along the 350 km long basin, which produced more than 50 055 tons of gold.[6]

Map 4.1.1: The Witwatersrand Basin

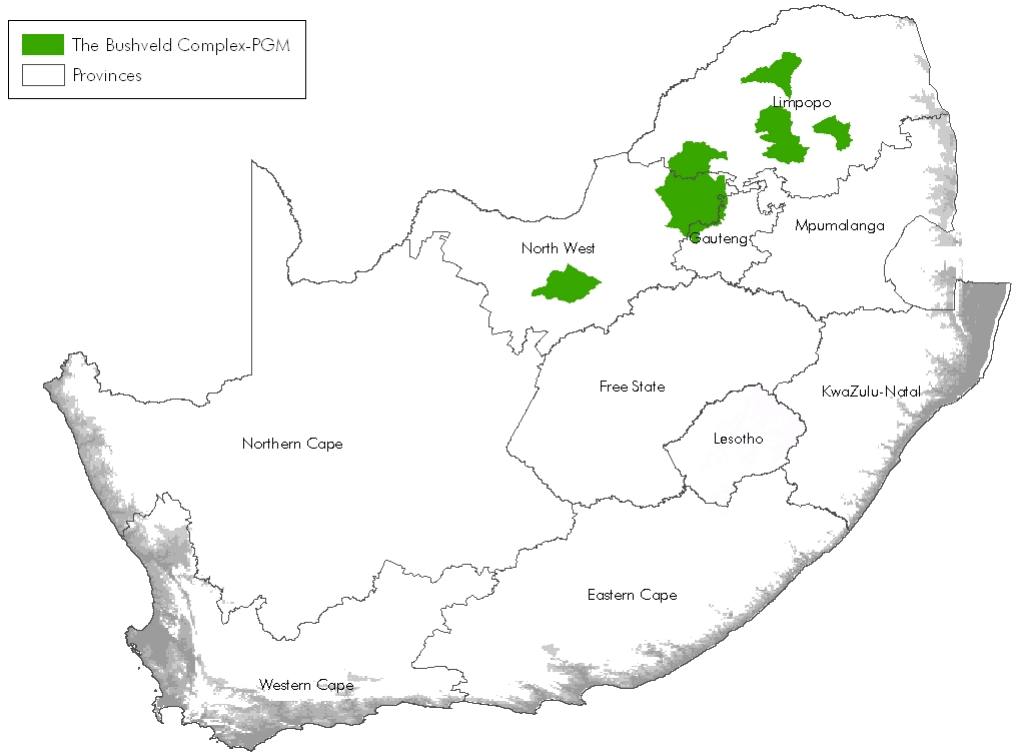


Source: Statistics South Africa.

The Bushveld Complex

The Bushveld Complex extends over an area of 65 000 square kilometres and reaches up to 8 km in thickness. It is by far the largest known layered igneous intrusion in the world and contains most of the world resources of chromium, PGMs and vanadium. The impressive igneous geology of the Bushveld complex can best be viewed in North West, Gauteng and Limpopo in the mountainous terrain around the Steelpoort Valley. The imposing Dwars River chromitite layers, platinum-bearing dunite pipes, the discovery site of the platinum-rich Merensky Reef, and the extensive magnetite-ilmenite layers and pipes near Magnet Heights and Kennedy's Vale are in this area.[6, 11]

Map 4.1.2: The Bushveld Complex

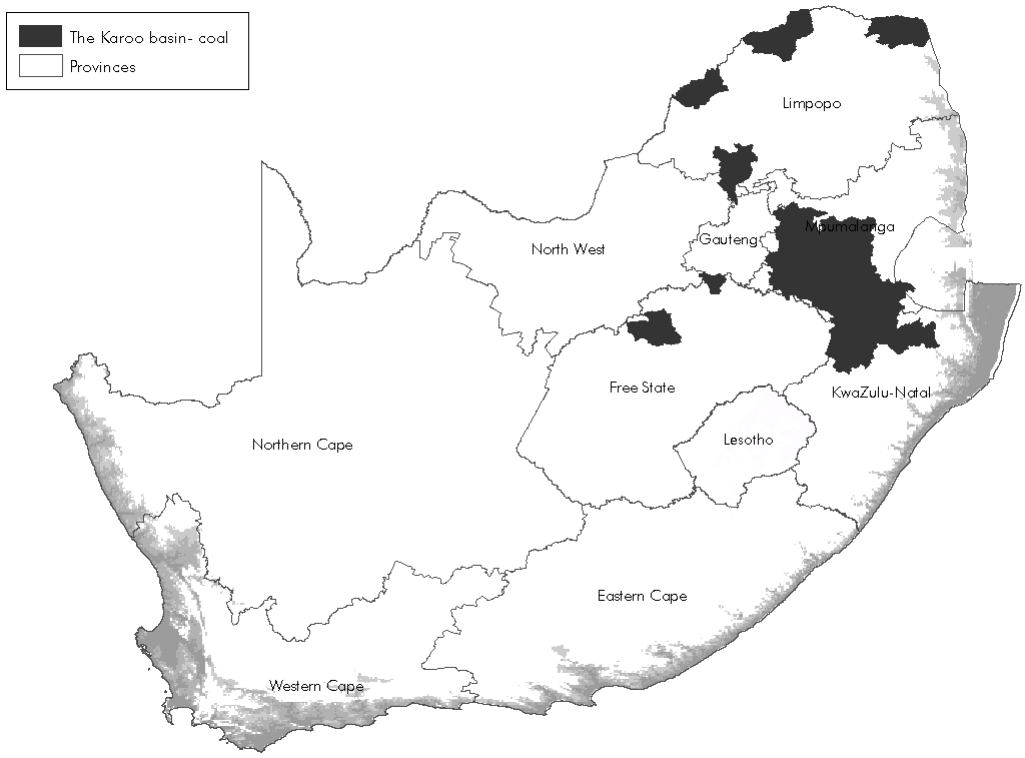


Source: Statistics South Africa.

The Karoo Basin

The Karoo Basin extends through Mpumalanga, KwaZulu-Natal, the Free State and Limpopo, hosting considerable bituminous coal and anthracite resources. All of the known coal deposits in South Africa are hosted in sedimentary rocks of the Karoo Basin. The coals range in age from Early Permian (Ecca Group) through to Late Triassic (Molteno Formation) and are predominantly bituminous to anthracite in rank, which is a classification in terms of metamorphism under the influence of temperature and pressure. Based on variations in sedimentation, origin, formation, distribution and quality of the coal seams, coalfields are defined within the Karoo Basin. These variations are in turn attributed to specific conditions of deposition and the local tectonic history characteristic of each area.[6]

Map 4.1.3: The Karoo Basin

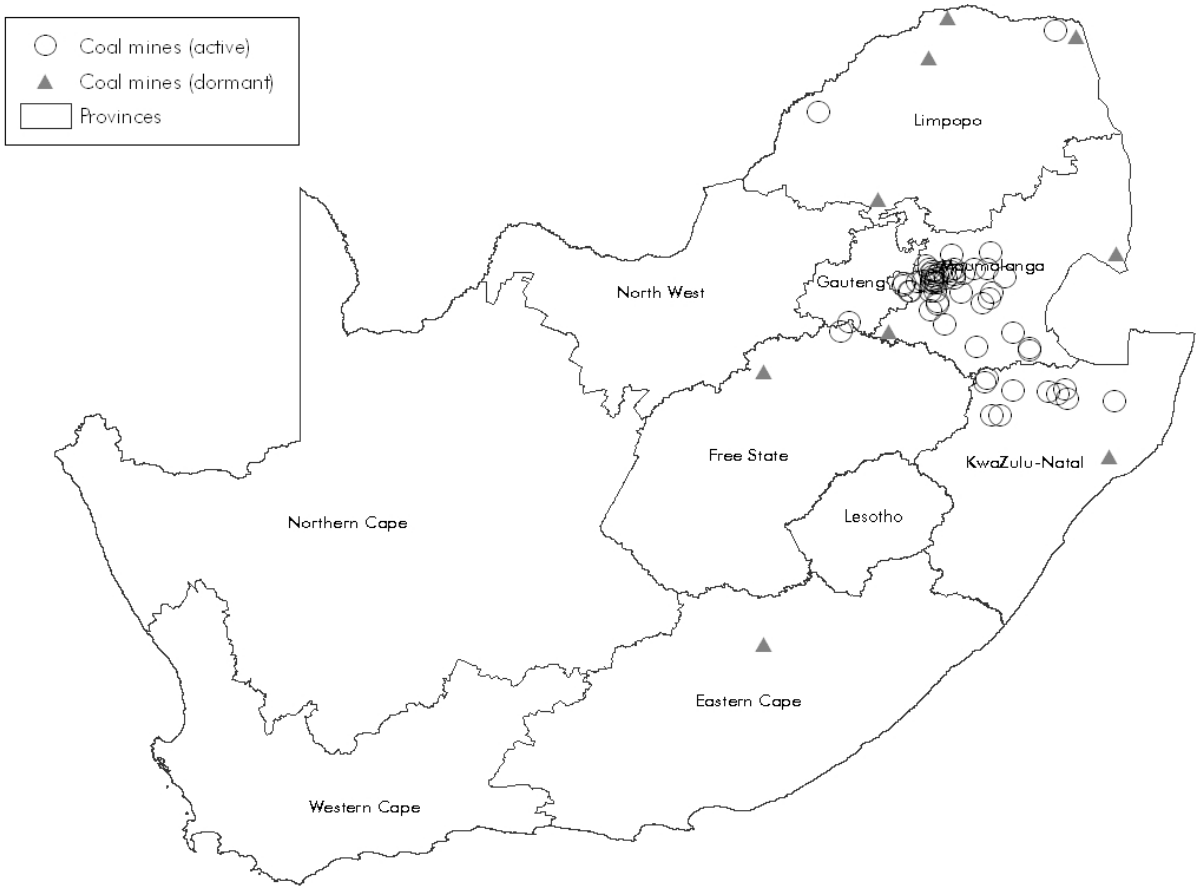


Source: Statistics South Africa.

4.2 Coal

South Africa's indigenous energy-resource base is dominated by coal. Internationally, coal is the most widely used primary fuel. Most of the country's primary energy needs are provided by coal. Many of the coal deposits can be exploited at extremely favourable costs and, as a result, a large coal-mining industry has developed. In addition to the extensive use of coal in the domestic economy, South Africa exports coal through the Richards Bay Coal Terminal, making South Africa the fourth-largest coal exporting country in the world according to the DoE.[5] South Africa's coal mining is 47% underground mining and 53% opencast mining operations. The coal mining industry is highly concentrated in large mines. Coal production feeds electricity generation, petrochemical industries, general industries, the metallurgical industry, and merchants for local and export sales. By international standards, South Africa's coal deposits are relatively shallow with thick seams, which are easier to mine.[6] The key findings for the coal mining industry are focused on production, years to depletion, volumes sold, value of sales, and resource reserves over a ten-year period from 2003 to 2012.

Map 4.2.1: Geographic locations of coal mines

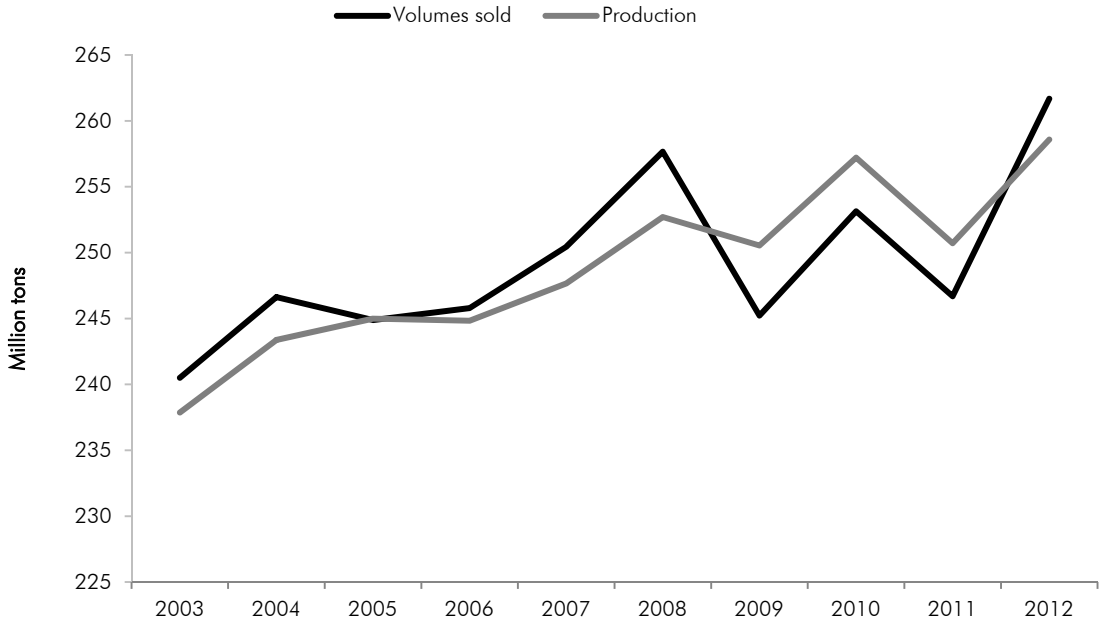


Source: Statistics South Africa.

4.2.1 Coal production and volumes sold, 2003 to 2012

Coal production increased from 238 million tons in 2003 to 259 million tons in 2012. This is an 8,8% increase in coal production (extraction) over a ten-year period. The total volume of coal sold increased by 9,2% over a ten-year period from 240 million tons in 2003 to 262 million tons in 2012.

Figure 4.2.1: Coal production and volumes sold, 2003–2012



Source: Statistics South Africa. Environmental Economic Accounts Tables.

Table 4.2.1: Coal production and volumes sold, 2003–2012

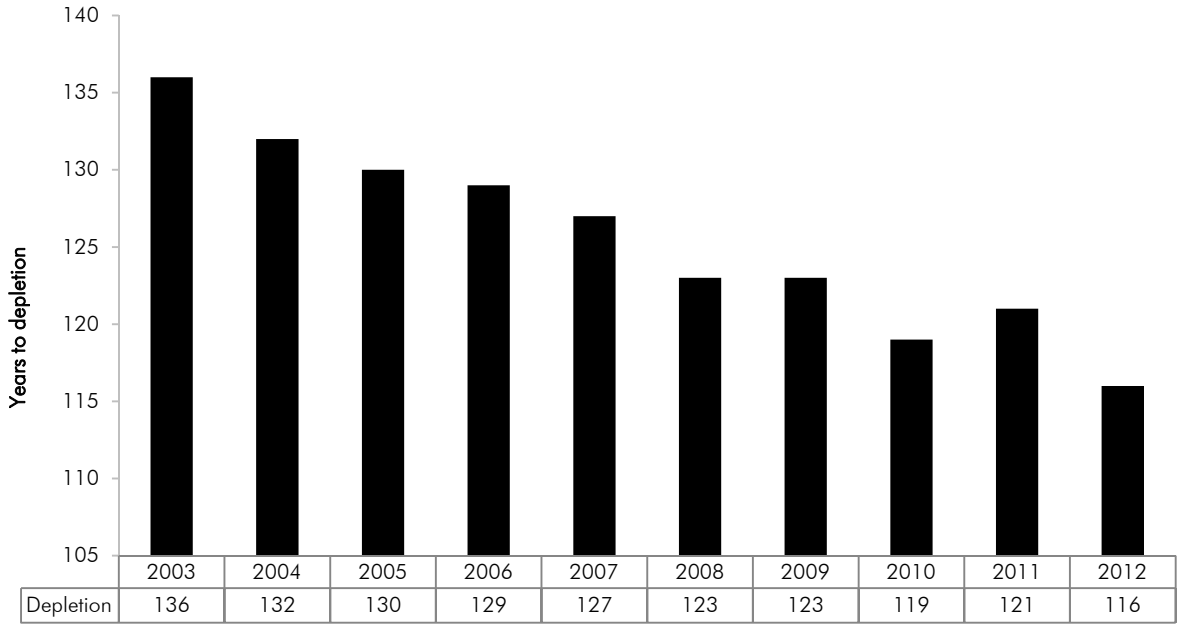
	2003	2004	2005	2006	2007
			Million tons		
Production	238	243	245	245	248
Volumes sold	240	247	245	246	250
			% Change from previous period		
Production		2,1%	0,8%	0,0%	1,2%
Volumes sold		2,9%	-0,8%	0,4%	1,6%
	2008	2009	2010	2011	2012
			Tons		
Production	253	251	257	251	259
Volumes sold	258	245	253	247	262
			% Change from previous period		
Production	2,0%	-0,8%	2,4%	-2,3%	3,2%
Volumes sold	3,2%	-5,0%	3,3%	-2,4%	6,1%

Source: Statistics South Africa. Environmental Economic Accounts Tables.

4.2.2 Coal years to depletion, 2003 to 2012

The estimated number of years to depletion for proven coal reserves in 2012 was 116 years. In 2003 there were 136 years left to depletion, decreasing to 116 years in 2012, which is a 14,7% decrease over the ten-year period.

Figure 4.2.2: Coal years to depletion, 2003–2012



Source: Statistics South Africa. Environmental Economic Accounts Tables.

Table 4.2.2: Coal years to depletion, 2003–2012

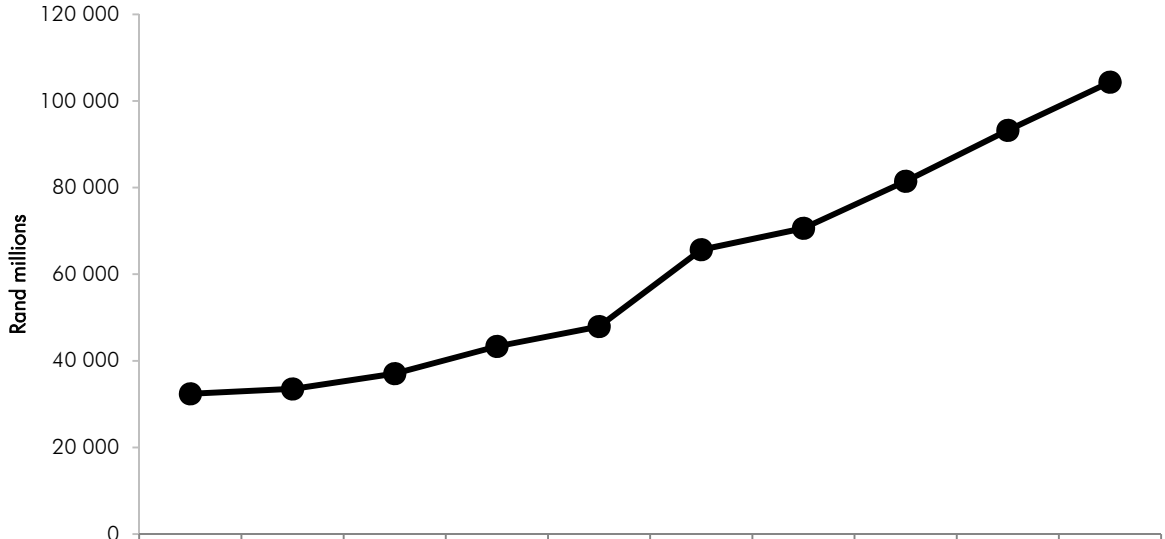
2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Years to depletion									
136	132	130	129	127	123	123	119	121	116
% Change from previous period									
	-3,0%	-1,5%	-0,8%	-1,6%	-3,1%	0%	-3,3%	1,7%	-4,1%

Source: Statistics South Africa. Environmental Economic Accounts Tables.

4.2.3 Coal sales, 2003 to 2012

The total value of coal sales for 2012 amounted to R104 345 million. This is an 11,9% increase from 2011 sales of R93 214 million.

Figure 4.2.3: Coal sales, 2003–2012



	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Sales value	32 380	33 505	37 042	43 329	47 919	65 668	70 607	81 462	93 214	104 345

Source: Statistics South Africa. Environmental Economic Accounts Tables.

Table 4.2.3: Coal sales, 2003–2012

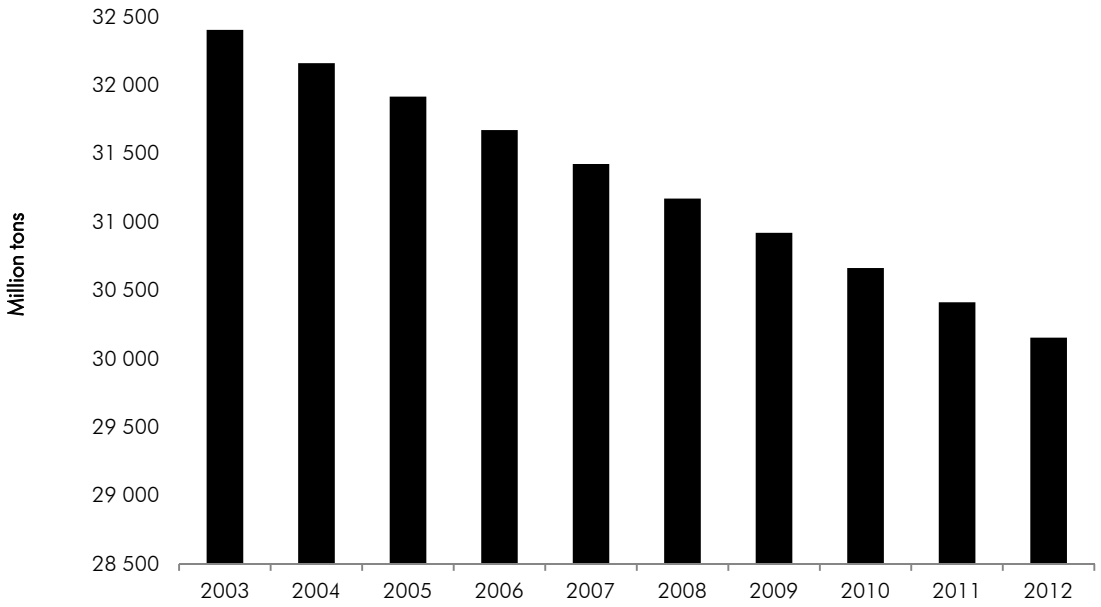
2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Rand millions									
32 380	33 505	37 042	43 329	47 919	65 668	70 607	81 462	93 214	104 345
% Change from previous period									
	3,5%	10,6%	17,0%	10,6%	37,0%	7,5%	15,4%	14,4%	11,9%

Source: Statistics South Africa. Environmental Economic Accounts Tables.

4.2.4 Coal resource reserves, 2003 to 2012

Proven coal resource reserves were 30 156 million tons in 2012. The decrease in proven coal reserves over the ten-year period from 32 408 million tons in 2003 to 30 156 million tons in 2012 is 6,9%.

Figure 4.2.4: Coal resource reserves, 2003–2012



Source: Statistics South Africa. Environmental Economic Accounts Tables.

Table 4.2.4: Coal resource reserves, 2003–2012

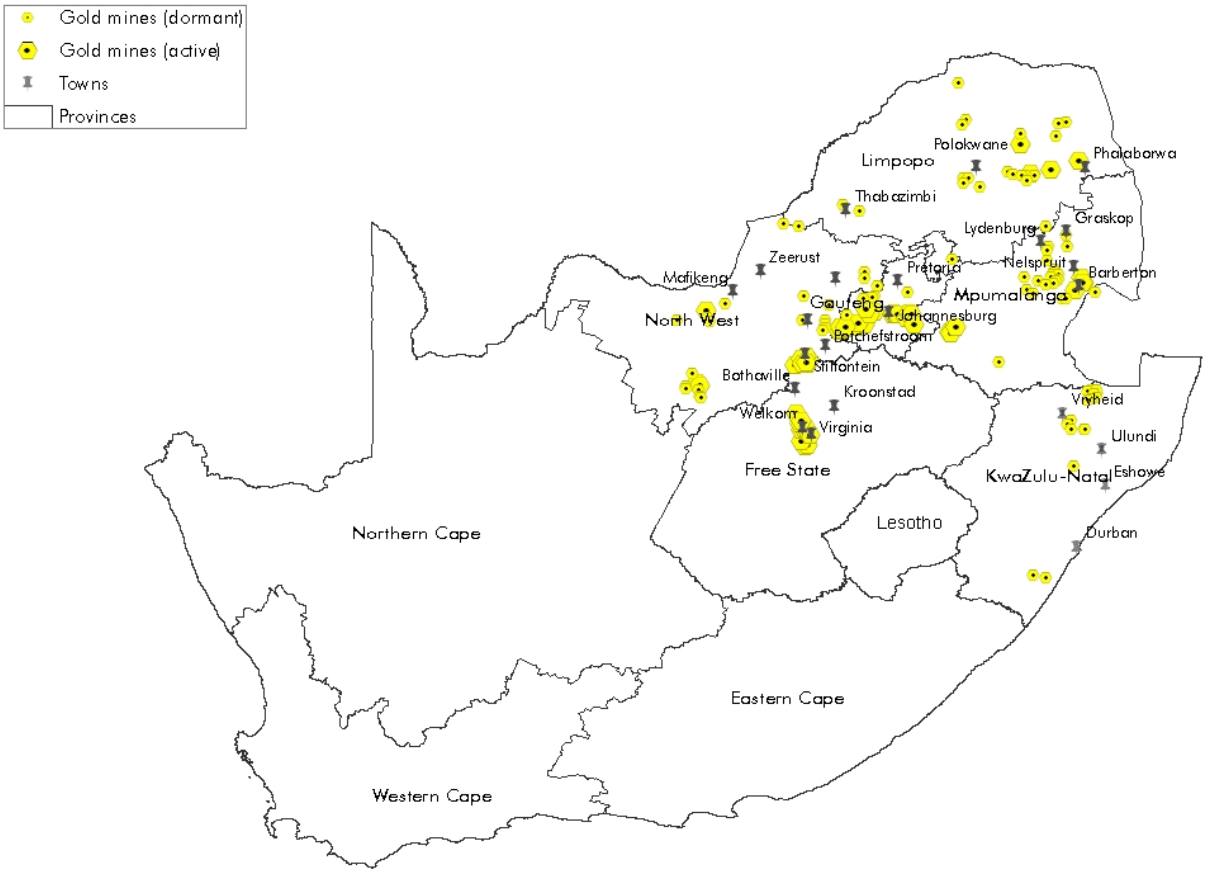
2003	2004	2005	2006	2007
Million tons				
32 408	32 165	31 920	31 675	31 427
% Change from previous period				
	-0,7%	-0,8%	-0,8%	-0,8%
2008	**2009**	**2010**	**2011**	**2012**
Million tons				
31 174	30 923	30 666	30 415	30 156
% Change from previous period				
-0,8%	-0,8%	-0,8%	-0,8%	-0,9%

Source: Statistics South Africa. Environmental Economic Accounts Tables.

4.3 Gold

South Africa accounts for approximately 6% of the world's gold production. More than 50 055 tons of gold have been mined from the Witwatersrand Basin that stretches 400 km through Gauteng and Free State. Significant mining takes place in the greenstone belts in Mpumalanga and North West. South Africa's gold production decreased, resulting in the country dropping in production ranking to the sixth-largest producer in the world. The decrease in production is mainly as a result of the mining of lower-grade ore, influenced by higher rand gold prices, and temporary closure of shafts to maintain infrastructure. A contributing factor is new safety procedures to facilitate auditing. South Africa's gold-mining industry works at deeper levels and under more difficult conditions than any other mining industry in the world.[6] The key findings for the gold mining industry are focused on production, years to depletion, volumes sold, value of sales, and resource reserves over a ten year period from 2003 to 2012.

Map 4.3.1: Geographic locations of gold mines

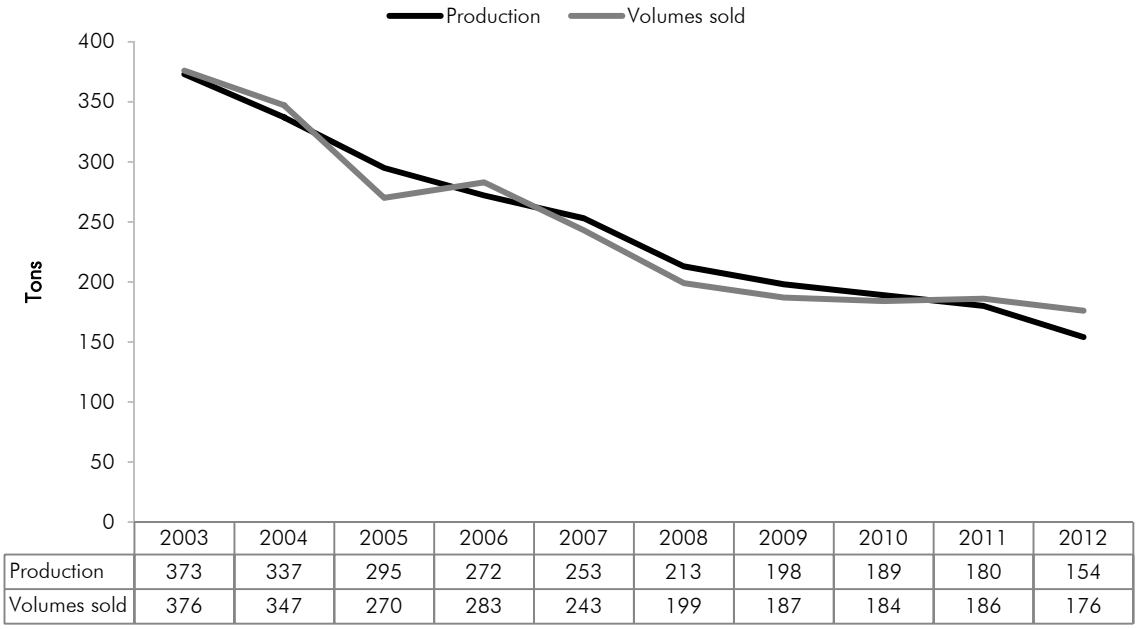


Source: Statistics South Africa.

4.3.1 Gold production and volumes sold, 2003 to 2013

Gold production decreased from 373 tons in 2003 to 154 tons in 2012. This is a 58,7% decrease in gold production over a ten-year period. The total volume of gold sold decreased by 53,2% over a ten-year period from 376 tons in 2003 to 176 tons in 2012.

Figure 4.3.1: Gold production and volumes sold, 2003–2012



	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Production	373	337	295	272	253	213	198	189	180	154
Volumes sold	376	347	270	283	243	199	187	184	186	176

Source: Statistics South Africa. Environmental Economic Accounts Tables.

Table 4.3.1: Gold production and volumes sold, 2003–2012

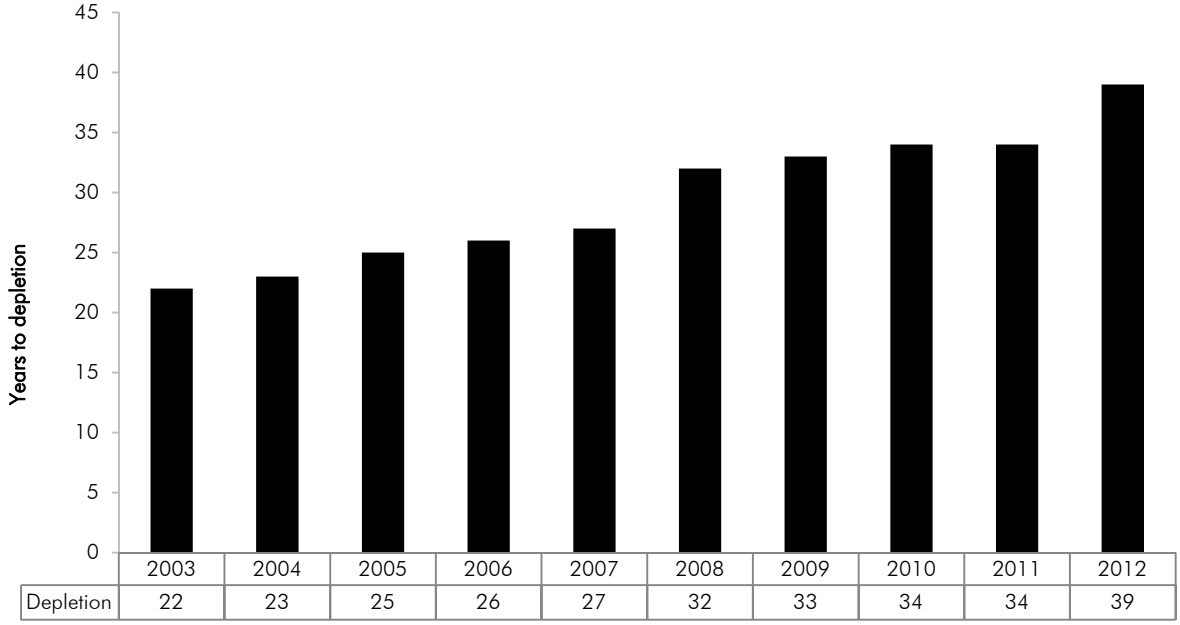
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
					Tons					
Production	373	337	295	272	253	213	198	189	180	154
Volumes sold	376	347	270	283	243	199	187	184	186	176
					% Change from previous period					
Production		-9,7%	-12,5%	-7,8%	-7,0%	-15,8%	-7,0%	-4,5%	-4,8%	-14,4%
Volumes sold		-7,7%	-22,2%	4,8%	-14,1%	-18,1%	-6,0%	-1,6%	1,1%	-5,4%

Source: Statistics South Africa. Environmental Economic Accounts Tables.

4.3.2 Gold years to depletion, 2003 to 2012

The estimated number of years to depletion for proven gold reserves in 2012 was 39 years. In 2003 there were 22 years left to depletion and this increased to 39 years in 2012, which is a 77,3% increase over the ten-year period.

Figure 4.3.2: Gold years to depletion, 2003–2012



Source: Statistics South Africa. Environmental Economic Accounts Tables.

Table 4.3.2: Gold years to depletion, 2003–2012

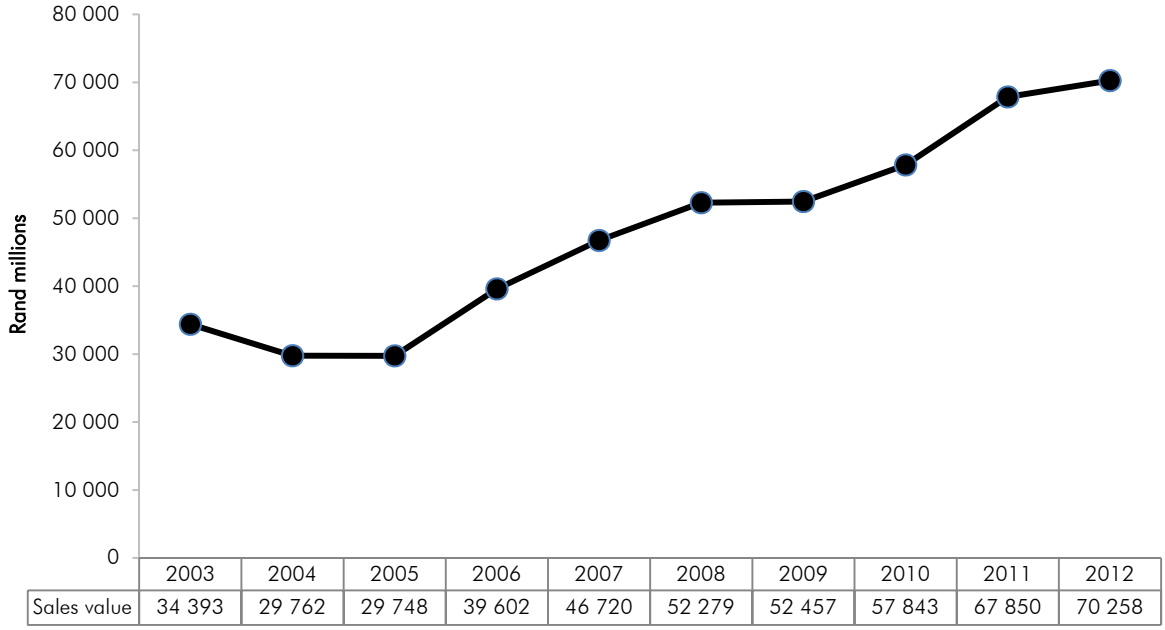
2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Years to depletion									
22	23	25	26	27	32	33	34	34	39
% Change from previous period									
	4,5%	8,7%	4,0%	3,8%	18,5%	3,1%	3,0%	0,0%	14,7%

Source: Statistics South Africa. Environmental Economic Accounts Tables.

4.3.3 Gold sales, 2003 to 2012

The total value of gold sales for 2012 amounted to R70 258 million. This is a 3,5% increase from 2011 sales that amounted to R67 850 million.

Figure 4.3.3: Gold sales, 2003–2012



	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Sales value	34 393	29 762	29 748	39 602	46 720	52 279	52 457	57 843	67 850	70 258

Source: Statistics South Africa. Environmental Economic Accounts Tables.

Table 4.3.3: Gold sales, 2003–2012

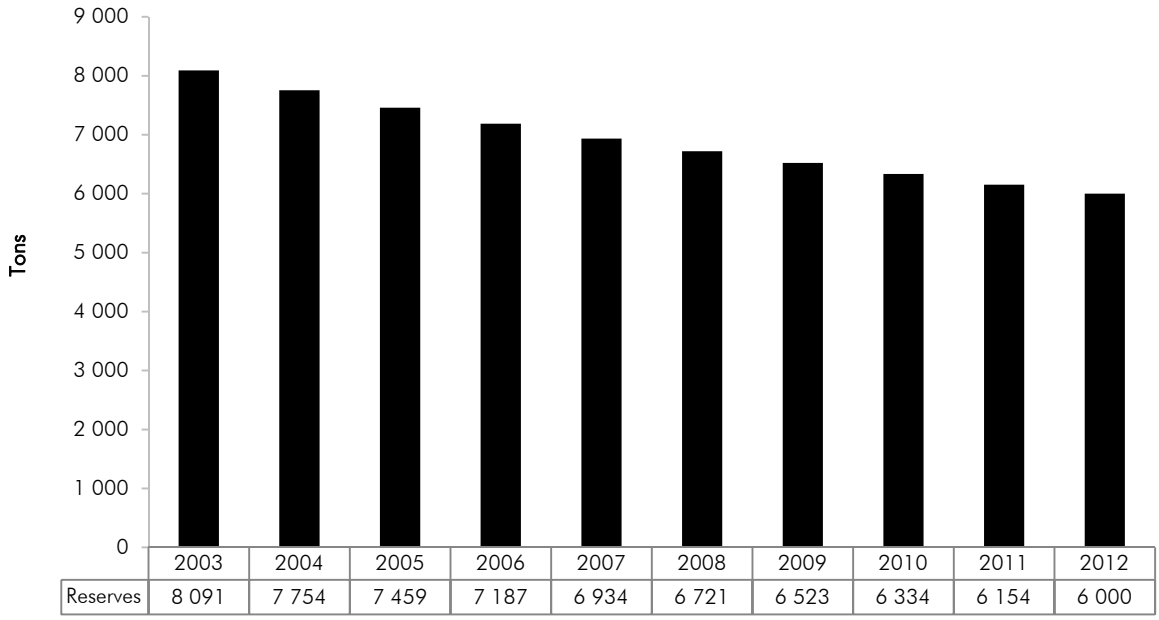
2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Rand millions									
34 393	29 762	29 748	39 602	46 720	52 279	52 457	57 843	67 850	70 258
% Change from previous period									
	-13,5%	0,0%	33,1%	18,0%	11,9%	0,3%	10,3%	17,3%	3,5%

Source: Statistics South Africa. Environmental Economic Accounts Tables.

4.3.4 Gold resource reserves, 2003 to 2012

Proven gold resource reserves were 6 000 tons in 2012. The decrease in proven gold reserves over the ten-year period from 8 091 tons in 2003 to 6 000 tons in 2012 is 25,8%.

Figure 4.3.4: Gold resource reserves, 2003–2012



Source: Statistics South Africa. Environmental Economic Accounts Tables.

Table 4.3.4: Gold resource reserves, 2003–2012

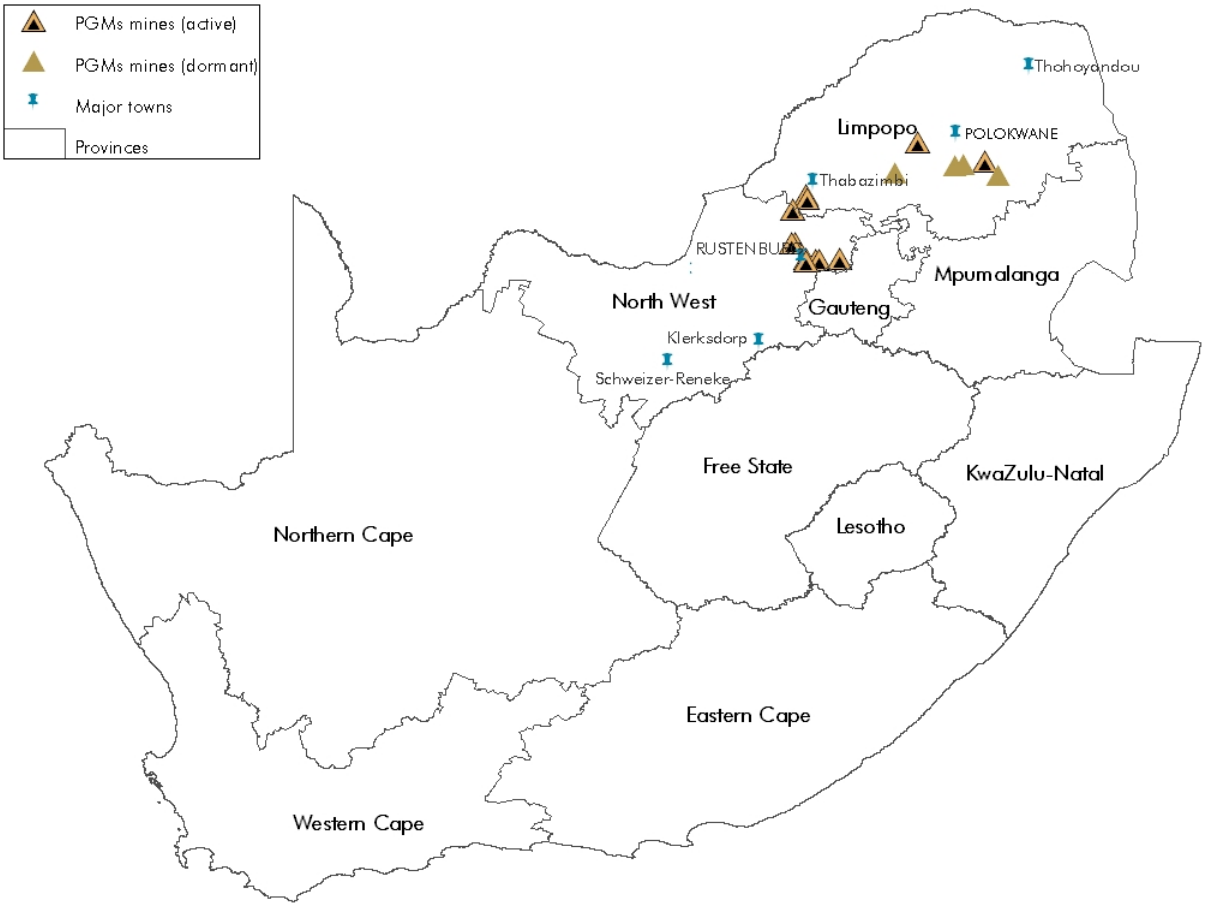
2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Tons									
8 091	7 754	7 459	7 187	6 934	6 721	6 523	6 334	6 154	6 000
% Change from previous period									
	-4,2%	-3,8%	-3,6%	-3,5%	-3,1%	-2,9%	-2,9%	-2,8%	-2,5%

Source: Statistics South Africa. Environmental Economic Accounts Tables.

4.4 Platinum Group Metals

South Africa is the world's largest producer of platinum, with major producers being Anglo American Platinum (Amplats), Anooraq, Impala Platinum (Implats), Northam Platinum, Aquarius Platinum and Lonmin. PGMs include six components, namely platinum, palladium, rhodium, ruthenium, iridium and osmium. They are divided according to their densities into a heavier category (platinum, iridium and osmium) and a lighter group (palladium, rhodium and ruthenium).[6] The vast majority of primary PGM production is from South Africa.[12] The platinum metals have outstanding catalytic properties. They are highly resistant to wear and tarnish, making platinum, in particular, well suited for fine jewellery. Other distinctive properties include resistance to chemical attack, excellent high-temperature characteristics, and stable electrical properties. All these properties have been exploited for industrial applications.[12] The key findings for the PGM mining industry are focused on production, years to depletion, volumes sold, value of sales, and resource reserves over a ten year period from 2003 to 2012.

Map 4.4.1: Geographic locations of PGM mines

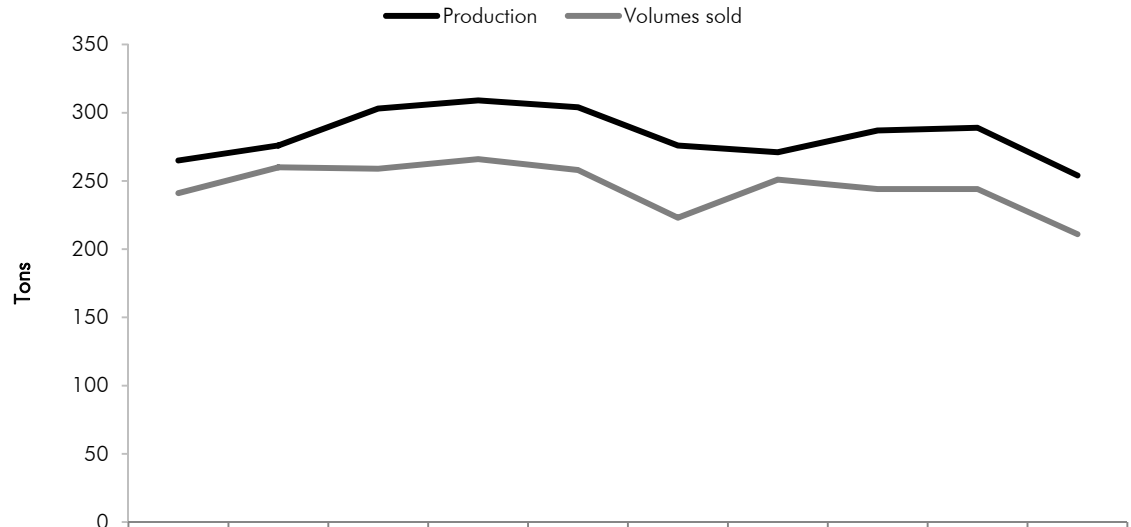


Source: Statistics South Africa.

4.4.1 PGM production and volumes sold, 2003 to 2012

PGM production decreased from 265 tons in 2003 to 254 tons in 2012. This is a 4,2% decrease in PGM production over a ten-year period. The total volume of PGMs sold decreased by 12,4% over a ten-year period from 241 tons in 2003 to 211 tons in 2012.

Figure 4.4.1: PGM production and volumes sold, 2003–2012



	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Production	265	276	303	309	304	276	271	287	289	254
Volumes sold	241	260	259	266	258	223	251	244	244	211

Source: Statistics South Africa. Environmental Economic Accounts Tables.

Table 4.4.1: PGM production and volumes sold, 2003–2012

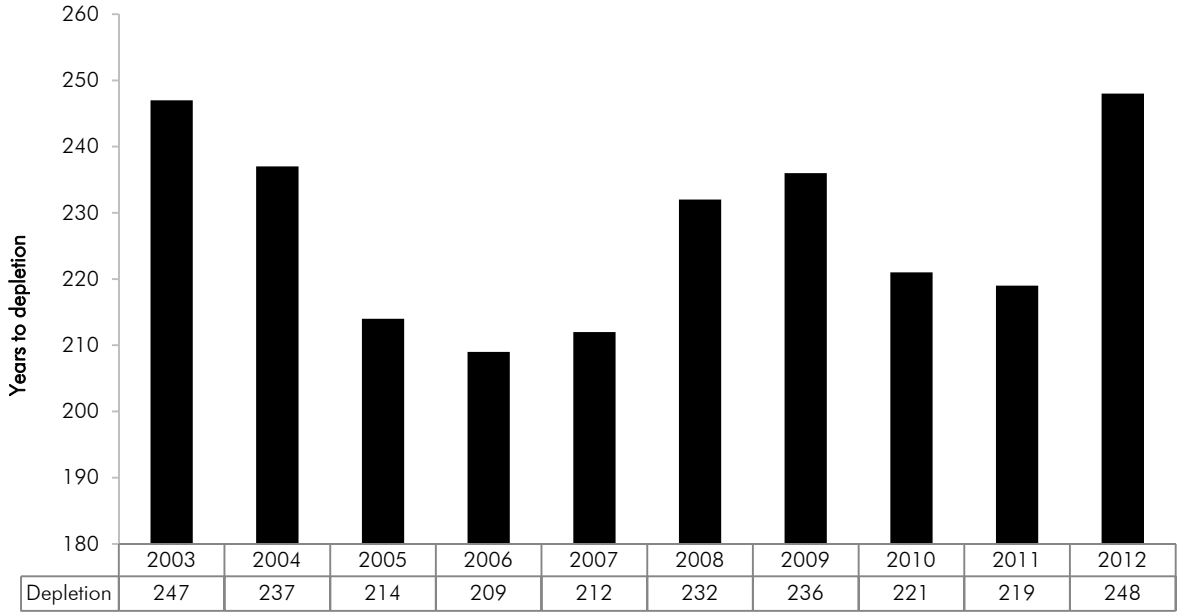
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
					Tons					
Production	265	276	303	309	304	276	271	287	289	254
Volumes sold	241	260	259	266	258	223	251	244	244	211
					% Change from previous period					
Production		4,2%	9,8%	2,0%	-1,6%	-9,2%	-1,8%	5,9%	0,7%	-12,1%
Volumes sold		7,9%	-0,4%	2,7%	-3,0%	-13,6%	12,6%	-2,8%	0,0%	-13,5%

Source: Statistics South Africa. Environmental Economic Accounts Tables.

4.4.2 PGM years to depletion, 2003 to 2012

The estimated number of years to depletion for proven PGM reserves in 2012 was 248 years. In 2003 there were 247 years left to depletion, increasing to 248 years in 2012, which is a 0,4% increase over the ten-year period.

Figure 4.4.2: PGM years to depletion, 2003–2012



Source: Statistics South Africa. Environmental Economic Accounts Tables.

Table 4.4.2: PGM years to depletion, 2003–2012

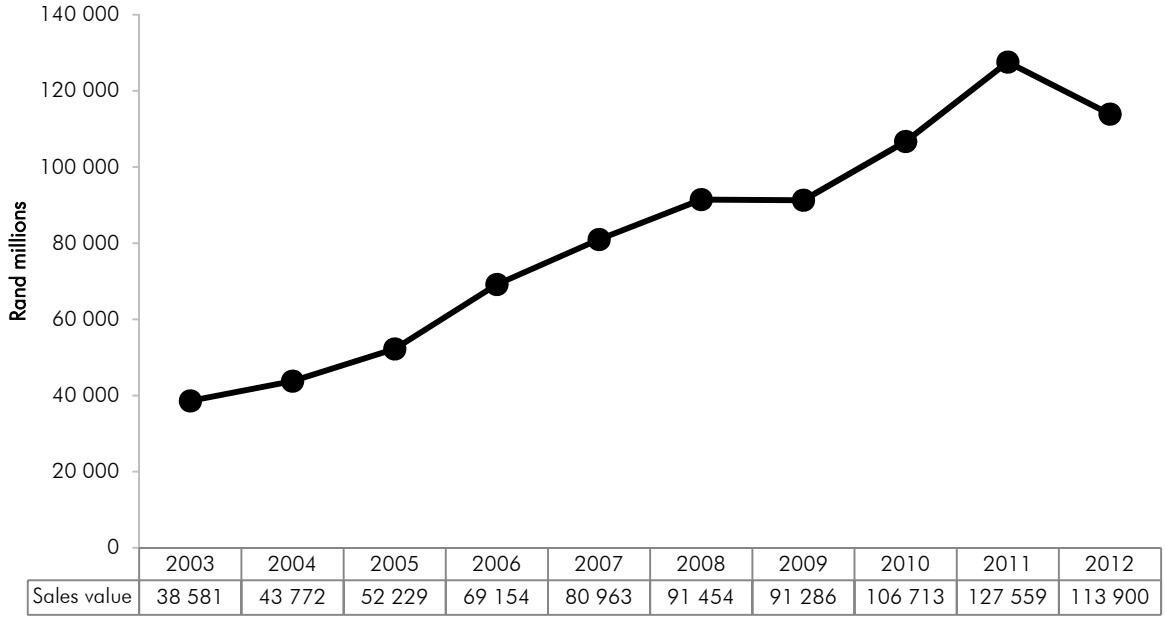
2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Years to depletion									
247	237	214	209	212	232	236	221	219	248
% Change from previous period									
	-4,0%	-9,7%	-2,3%	1,4%	9,4%	1,7%	-6,4%	-0,9%	13,2%

Source: Statistics South Africa. Environmental Economic Accounts Tables.

4.4.3 PGM sales, 2003 to 2012

The total value of PGM sales for 2012 amounted to R113 900 million. This is a 10,7% decrease from 2011 sales that amounted to R127 559 million.

Figure 4.4.3: PGM sales, 2003–2012



Source: Statistics South Africa. Environmental Economic Accounts Tables.

Table 4.4.3: PGM sales, 2003–2012

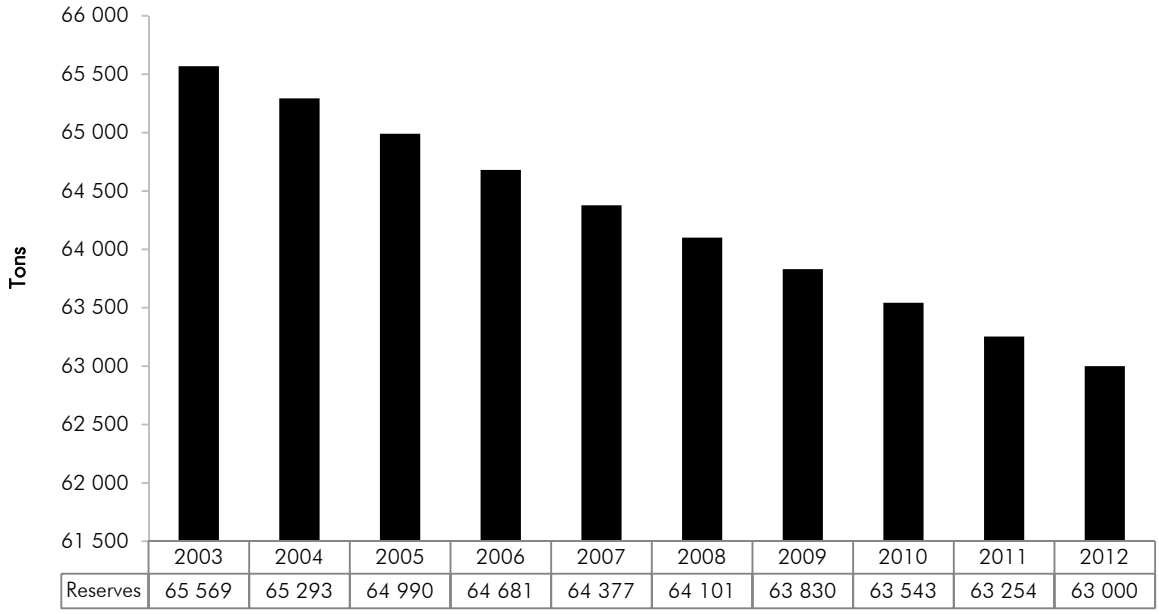
2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Rand millions									
38 581	43 772	52 229	69 154	80 963	91 454	91 286	106 713	127 559	113 900
% change from previous period									
	13,5%	19,3%	32,4%	17,1%	13,0%	-0,2%	16,9%	19,5%	-10,7%

Source: Statistics South Africa. Environmental Economic Accounts Tables.

4.4.4 PGM resource reserves, 2003 to 2012

Proven PGM resource reserves were 63 000 tons in 2012. The decrease in proven PGM reserves over the ten-year period from 65 569 tons in 2003 to 63 000 tons in 2012 is 3,9%.

Figure 4.4.4: PGM resource reserves, 2003–2012



Source: Statistics South Africa. Environmental Economic Accounts Tables.

Table 4.4.4: PGM resource reserves, 2003–2012

2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Tons									
65 569	65 293	64 990	64 681	64 377	64 101	63 830	63 543	63 254	63 000
% Change from previous period									
	-0,4%	-0,5%	-0,5%	-0,5%	-0,4%	-0,4%	-0,4%	-0,5%	-0,4%

Source: Statistics South Africa. Environmental Economic Accounts Tables.

Chapter 5 – Indicators

5.1 Overview

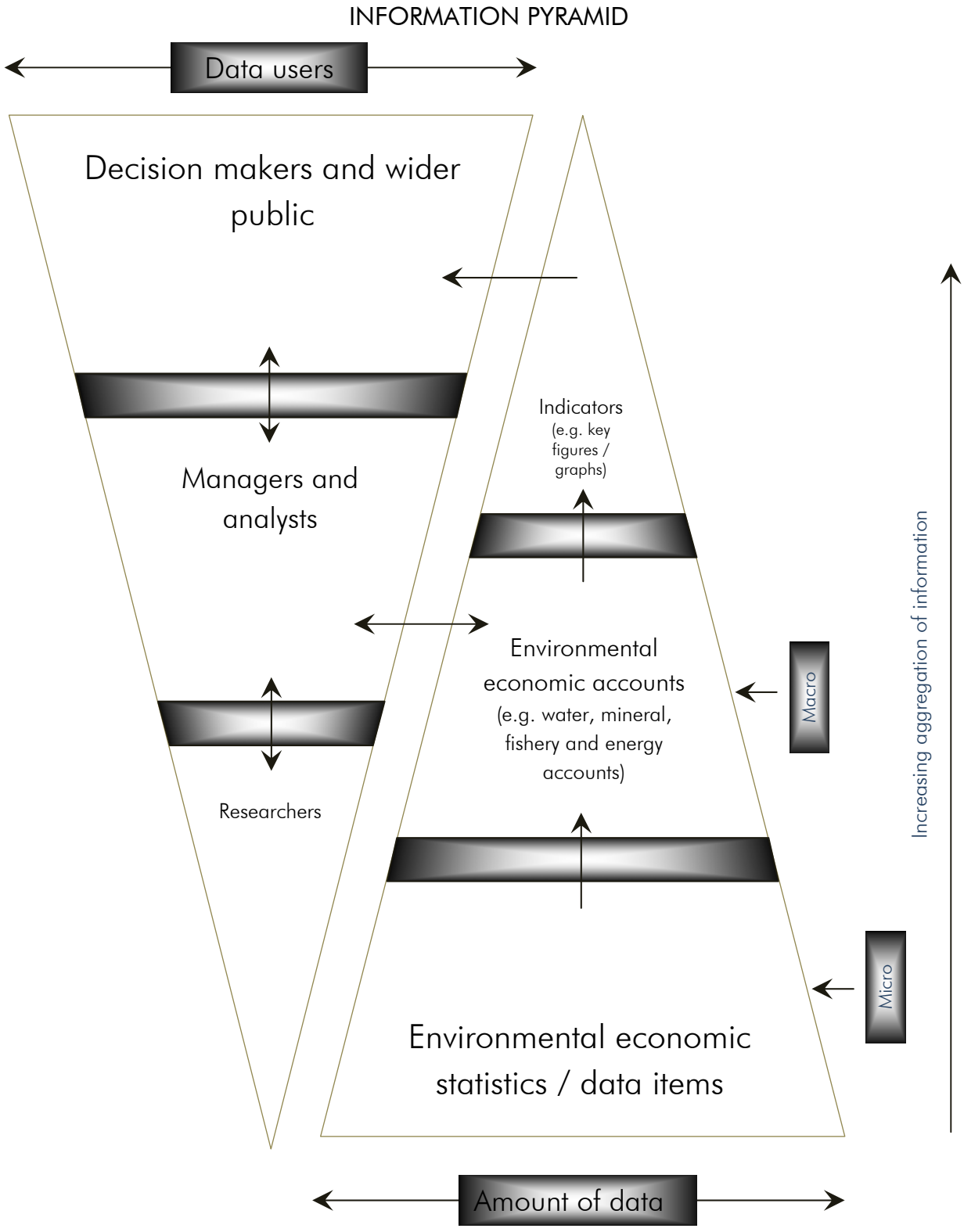
Environmental objectives cannot be pursued without an awareness of the consequential socio-economic effects. The understanding of these linkages is achieved by integrating environmental and socio-economic information. Robust measurement frameworks are required to show the bigger picture, identify gaps and draw connections with other socio-economic statistics. On the information side, data items flow into standard tables and supplementary tables of the SEEA. From these tables, headline indicators and indicators on specific subjects or industries are developed. Data users are managers, analysts and researchers who provide advice and research findings to decision makers and the wider public (Figure 5.1).

The SEEA is an internationally adopted framework with analytical potential that lends itself to the development of indicators calling on a wide range of data, which can provide insight and guidance to policy makers in both the economic and environmental sectors. While the SEEA does not attempt to define a given set of indicators of sustainable development, compiling such sets is now common in many countries and international organisations. Often the SEEA framework can provide relevant information and provide the background for a set of indicators that is more consistent than independently selected indicators, and which provides better linkages between indicators of environmental pressures and responses. Similar to the main national accounts, the SEEA accounts provide a score-keeping function from which key indicators can be derived and used in the analysis of policy options. The accounts provide a sound basis for the calculation of measures, which may already be included in sets of sustainable development indicators, but they may also be used to develop new indicators, such as environmentally-adjusted macro-aggregates which would not otherwise be available. The UNSD has on-going development with regard to SEEA Parts 2 and 3. Part 2 of the SEEA deals with applications and extensions to the central framework. Countries are encouraged by the UNSD to implement the SEEA, as it is a valuable and practical framework.

The indicators included in this document are mainly derived from the environmental economic accounts tables that are developed for environmental economic accounts. However, other environmental indicators that link to the economy or society will be identified to give a broader picture of the linkages and effects between the natural environment and the human and economic environment.

The indicators for fisheries and minerals are derived from the environmental economic accounts tables. The indicators relating to the census and access to water sources are from the Stats SA Census 2011[13] results and the NFEPA. The intention is to link the environment to the economy and society to show robust information on the impacts created by human and economic activities.

Figure 5.1: Information Pyramid



Sources: United Nations, 2012. *International Recommendations for Water Statistics*. United Nations, New York, 2012. Australian Bureau of Statistics, 2012. A systems approach to supporting environmental sustainability, Canberra, Australia.

5.1.1 Hake: Sustainability of hake (*Merluccius paradoxus and M. capensis*) stocks, 1992 to 2013

Description

Catch levels and closing stock for hake (*Merluccius paradoxus* and *M. capensis*) and TAC for fish and fish farming.

Linkages

This indicator is linked to biodiversity themes and the United Nations Convention on the Law of the Sea of 10 December 1982, as well as the Commission for Sustainable Development indicator 'Maximum sustained yield for fisheries'.

Selection criteria

The indicator met the following criteria:

- Good quality data, available at minimal cost;
- Provides information to measure important issues;
- Information presented to be easily understood;
- Relates to goals, targets and objectives;
- Provides timely information to allow for responses;
- Relevant to policy and management needs in South Africa;
- Accurate, reliable, and scientifically sound data;
- Data available and accessible in the long term;
- Data of correct spatial and temporal extent, and time series; and
- Data collection process has minimal environmental impact.

Measurement

Units	Spatial scale	Frequency
Tons	National	Annually

Figure 5.1.1 shows the correlation between the closing stock (exploitable biomass) and the set TAC level. From 1992 the TAC level was gradually set at higher levels each year until 2002 (166 000 tons). At first the closing stock (exploitable biomass) continued on a steady trend (1992 to 1996). In 1997 the closing stock (exploitable biomass) began to decline and maintained this decreasing trend until reaching 419 000 tons in 2005. From 2009 the closing stock (exploitable biomass) started a recovering trend through to 2013 (617 000 tons). There is about a 3-year lag time before there are positive responses in the closing stock (exploitable biomass) due to the dropping of the TAC levels.

Figure 5.1.1: Hake: Closing stock and total allowable catch, 1992–2013

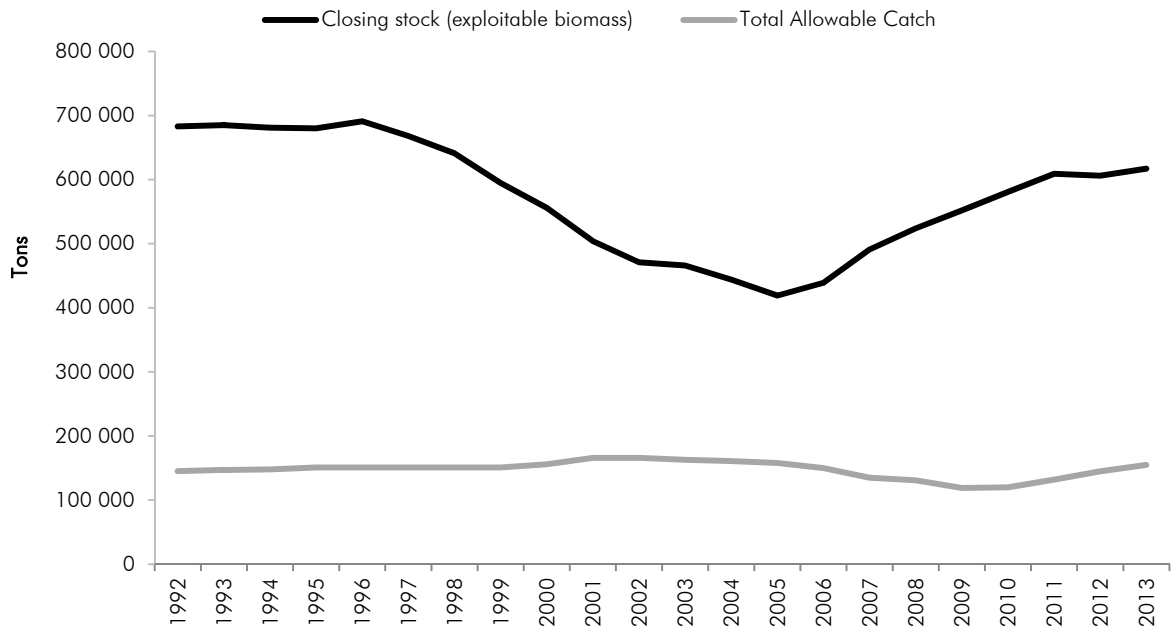


Table 5.1.1: Hake: Closing stock and total allowable catch, 1992–2013

1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Closing stock (exploitable biomass) (Tons)										
683 000	685 000	681 000	680 000	691 000	668 000	641 000	595 000	556 000	504 000	471 000
Total allowable catch (Tons)										
145 000	147 000	148 000	151 000	151 000	151 000	151 000	151 000	156 000	166 000	166 000

2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Closing stock (exploitable biomass) (Tons)										
466 000	444 000	419 000	439 000	491 000	524 000	552 000	581 000	609 000	606 000	617 000
Total allowable catch (Tons)										
163 000	161 000	158 000	150 000	135 000	131 000	119 000	120 000	132 000	145 000	155 000

Data sources and references

- Statistics South Africa. Environmental Economic Accounts Tables.
- Department of Agriculture, Forestry and Fisheries (DAFF), Marine Resource Assessment and Management (MARAM), and the University of Cape Town, Department of Mathematics and Applied Mathematics.
- Marine Stewardship Council (MSC), 2009. *MSC Fishery Fact Sheet: South Africa hake trawl fishery, 2009*. Website: www.msc.org

5.1.2 West Coast rock lobster: Sustainability of West Coast rock lobster (*Jasus lalandii*) stocks, 1992 to 2013

Description

Closing stock for West Coast rock lobster (*J lalandii)* and TAC for fish and fish farming.

Linkages

This indicator is linked to biodiversity themes and the United Nations Convention on the Law of the Sea of 10 December 1982, as well as the Commission for Sustainable Development indicator 'Maximum sustained yield for fisheries'.

Selection criteria

The indicator met the following criteria:

- Good quality data, available at minimal cost;
- Provides information to measure important issues;
- Information presented to be easily understood;
- Relates to goals, targets and objectives;
- Provides timely information to allow for responses;
- Relevant to policy and management needs in South Africa;
- Accurate, reliable, and scientifically sound data;
- Data available and accessible in the long term;
- Data of correct spatial and temporal extent, and time series; and
- Data collection process has minimal environmental impact.

Measurement

Units	Spatial scale	Frequency
Tons	National	Annually

Figure 5.1.2 shows the correlation between the closing stock (exploitable biomass) and the set TAC level. From 1992 the TAC level was gradually set at higher levels each year until 2004 (when it peaked at 3 527 tons). The closing stock (exploitable biomass) followed a recovery trend from 1992 to 2002. In 2004 the closing stock (exploitable biomass) began to decline, maintaining this decreasing trend until reaching 16 636 tons in 2007, and showed some fluctuations till it reached 16 661 tons in 2013.

Figure 5.1.2: West Coast rock lobster: Closing stock and total allowable catch, 1992–2013

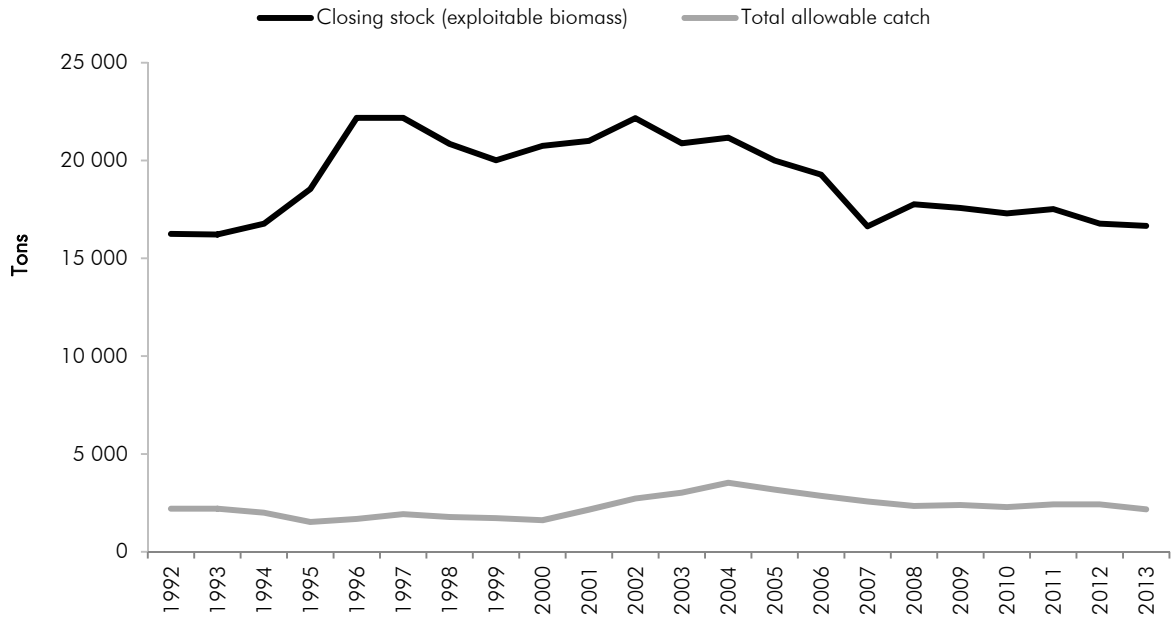


Table 5.1.2: West Coast rock lobster: Closing stock and total allowable catch, 1992–2013

1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Closing stock (exploitable biomass) (Tons)										
16 249	16 218	16 765	18 543	22 181	22 188	20 850	20 015	20 751	21 010	22 165
Total allowable catch (Tons)										
2 200	2 200	2 000	1 520	1 675	1 920	1 780	1 720	1 614	2 151	2 713

2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Closing stock (exploitable biomass) (Tons)										
20 885	21 170	19 997	19 282	16 636	17 766	17 575	17 303	17 517	16 773	16 661
Total allowable catch (Tons)										
3 016	3 527	3 174	2 857	2 571	2 340	2 393	2 286	2 426	2 426	2 167

Data sources and references

- Statistics South Africa. Environmental Economic Accounts Tables.
- Department of Agriculture, Forestry and Fisheries (DAFF), Marine Resource Assessment and Management (MARAM), and the University of Cape Town, Department of Mathematics and Applied Mathematics.
- Department of Agriculture, Forestry and Fisheries (DAFF), 2013. *West Coast Rock Lobster: Description of sector*. Department of Agriculture, Forestry and Fisheries, Pretoria.

5.1.3 Coal: Employment rate compared with production, and output sales in the coal mining sector, 1995 to 2012

Description

Production/extraction of coal, number of workers employed and output sales[a1] in the coal mining sector.

Linkages

This indicator is linked to South Africa's labour force and the employment rate in the country as well as compensation of employees for the mineral industry.

Selection criteria

The indicator met the following criteria:

- Good quality data, available at minimal cost;
- Provides information to measure important issues;
- Relates to goals, targets and objectives;
- Relevant to policy and management needs in South Africa;
- Data available and accessible in the long term; and
- Data of correct spatial and temporal extent, and time series.

Measurement

Units	Spatial scale	Frequency
Number of employees Production extraction (thousand tons) Output Sales (Rand millions)	National	Annually

Table 5.1.3 and Figure 5.1.3a show the production/extraction of coal and the number of employees in the coal mining industry from 1995 to 2012. Figure 5.1.3b shows the production/extraction of coal and output sales in the coal mining industry from 1995 to 2012. Over the period of 18 years, coal production/extraction increased by 25,7% from 205 639 117 to 258 575 793 tons. Employment in the coal mining industry increased by 34,1% from 62 064 employees in 1995 to 83 240 in 2012. Output sales increased by 702,8% from R12 998 million in 1995 to R104 345 million in 2012.

[a1] The environmental economic accounts uses the term output sales to be consistent to the terminology in the SEEA Central Framework.

Figure 5.1.3a: Production/extraction of coal and employment in the coal mining industry, 1995–2012

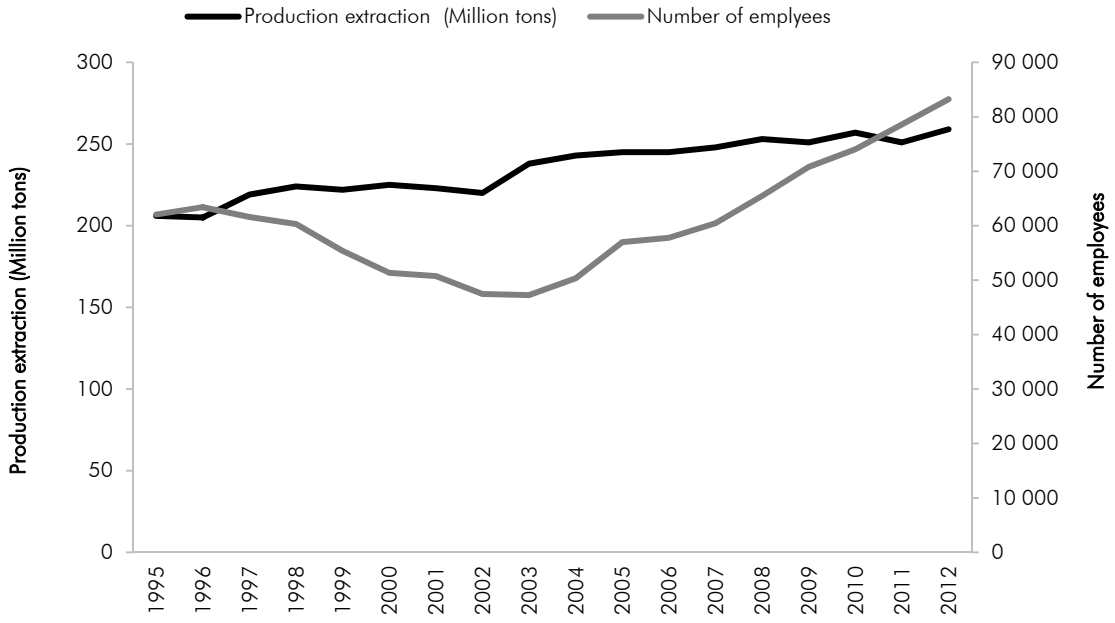


Figure 5.1.3b: Production/extraction of coal and output sales in the coal mining industry, 1995–2012

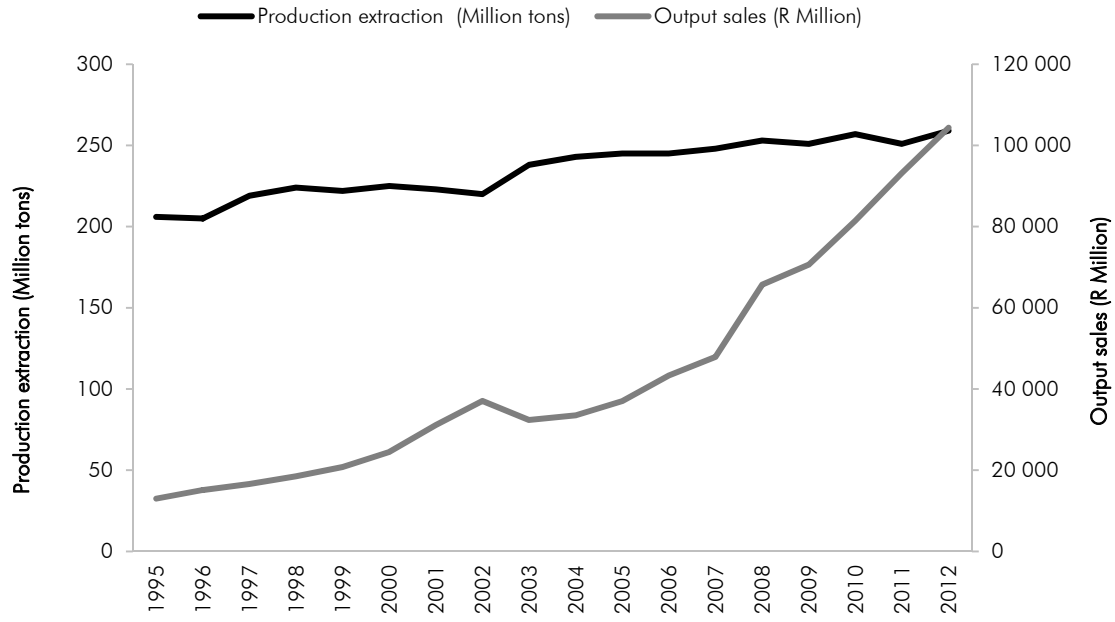


Table 5.1.3: Production/extraction of coal, employment and output sales in the coal mining industry, 1995–2012

1995	1996	1997	1998	1999	2000	2001	2002	2003
Production extraction (Million tons)								
206	205	219	224	222	225	223	220	238
Number of employees								
62 064	63 397	61 607	60 309	55 378	51 346	50 740	47 469	47 239
Output sales (Rand millions)								
12 998	15 122	16 586	18 480	20 769	24 479	31 095	37 053	32 380
2004	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Production extraction (Million tons)								
243	245	245	248	253	251	257	251	259
Number of employees								
50 327	56 971	57 778	60 439	65 484	70 791	74 025	78 579	83 240
Output sales (Rand millions)								
33 505	37 042	43 329	47 919	65 668	70 607	81 462	93 214	104 345

Data sources and references

- Statistics South Africa. Environmental Economic Accounts Tables.
- Department of Mineral Resources, 2011/2012. *South African Minerals Industry*.
- Government Communication Information System, 2014. *South Africa Yearbook 2013/14*.

5.1.4 Gold: Employment rate compared with production, and output sales in the gold mining sector, 1995 to 2012

Description

Production/extraction of gold, number of workers employed and the output sales in the gold mining sector.

Linkages

This indicator is linked to South Africa's labour force and the employment rate in the country as well as compensation of employees for the mineral industry.

Selection criteria

The indicator met the following criteria:

- Good quality data, available at minimal cost;
- Provides information to measure important issues;
- Relate to goals, targets and objectives;
- Relevant to policy and management needs in South Africa;
- Data available and accessible in the long term; and
- Data of correct spatial and temporal extent, and time series.

Measurement

Units	Spatial scale	Frequency
Number of employees Production extraction (tons) Output Sales (Rand millions)	National	Annually

Table 5.1.4, Figure 5.1.4a and Figure 5.1.4b show the production/extraction of gold, the number of employees in the gold mining industry and output sales from 1995 to 2012. Gold production/extraction shows a gradual decrease over the period from 1995 to 2012. In 1995 gold production was 524 tons and it decreased to 154 tons in 2012, which is a decrease of 70,6%. Employment in the gold mining industry also decreased by 62,6%, from 380 086 employees in 1995 to 142 201 employees in 2012. It seems that there is a cause and effect between gold production/extraction and the number of employees. Output sales increased by 173,2% from R25 714 million in 1995 to R70 258 million in 2012.

Figure 5.1.4a: Production/extraction of gold and employment in the gold mining industry, 1995–2012

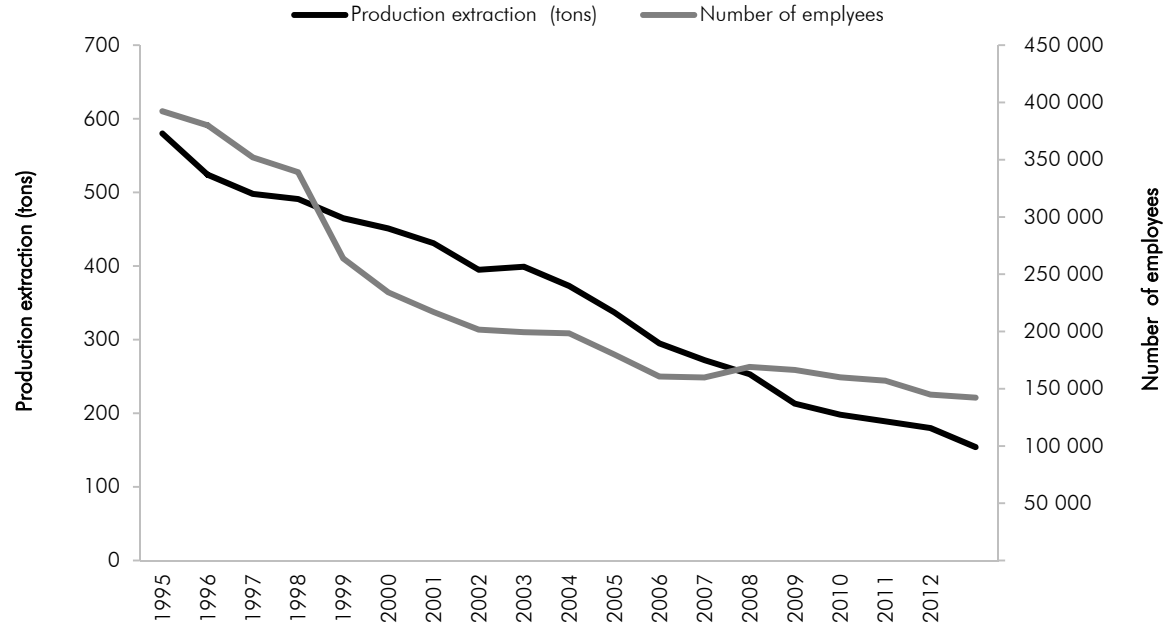


Figure 5.1.4b: Production/extraction of gold and output sales in the gold mining industry, 1995–2012

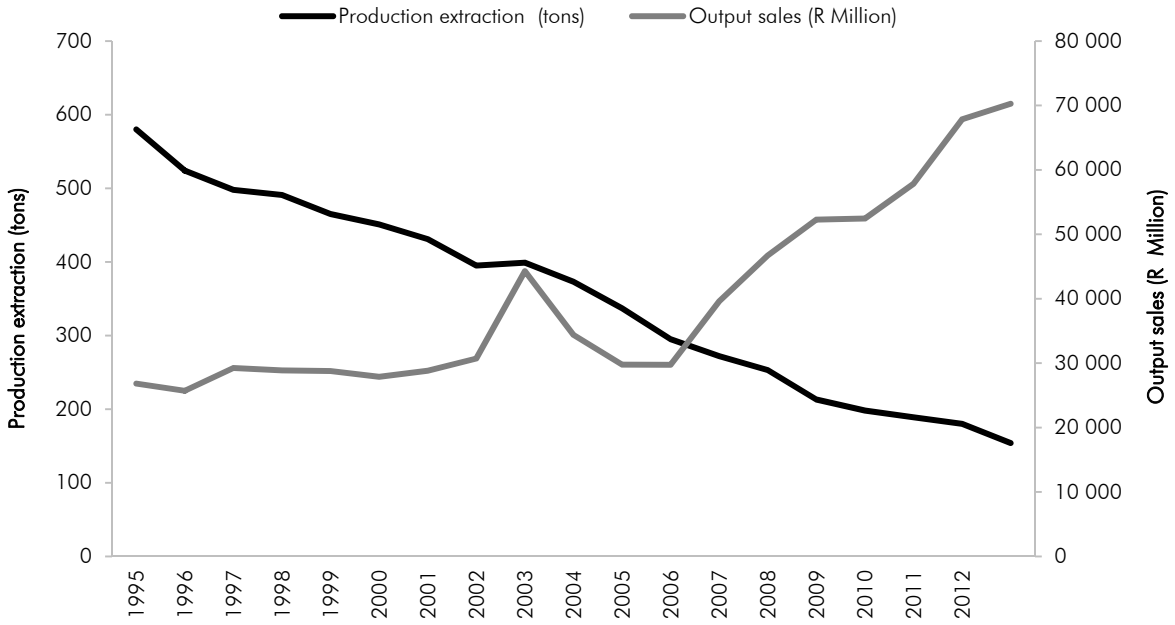


Table 5.1.4: Production/extraction of gold, employment and output sales in the gold mining industry, 1995–2012

1995	1996	1997	1998	1999	2000	2001	2002	2003
Production extraction (tons)								
524	498	491	465	451	431	395	399	373
Number of employees								
380 086	352 039	339 078	263 869	234 206	216 982	201 673	199 378	198 465
Output sales (Rand millions)								
25 714	29 238	28 881	28 788	27 893	28 825	30 704	44 269	34 393
2004	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Production extraction (tons)								
337	295	272	253	213	198	189	180	154
Number of employees								
179 964	160 634	159 782	169 057	166 424	159 925	157 019	144 799	142 201
Output sales (Rand millions)								
29 762	29 748	39 602	46 720	52 279	52 457	57 843	67 850	70 258

Data sources and references

- Statistics South Africa. Environmental Economic Accounts Tables.
- Department of Mineral Resources, 2011/2012. South African Minerals Industry.
- Government Communication Information System, 2014. South Africa Yearbook, 2013/14.

5.1.5 PGMs: Employment rate compared with PGM production, and output sales in the platinum mining sector, 1995 to 2012

Description

Production/extraction of platinum, number of workers employed and the output sales in the platinum mining sector.

Linkages

This indicator is linked to the South Africa's labour force and the employment rate in the country as well as compensation of employees for the mineral industry.

Selection criteria

The indicator met the following criteria:

- Good quality data, available at minimal cost;
- Provides information to measure important issues;
- Relates to goals, targets and objectives;
- Relevant to policy and management needs in South Africa;
- Data available and accessible in the long term; and
- Data of correct spatial and temporal extent, and time series.

Measurement

Units	Spatial scale	Frequency
Number of employees Production extraction (tons) Output Sales (Rand millions)	National	Annually

Table 5.1.5, Figure 5.1.5a and Figure 5.1.5b show the production/extraction of PGMs, the number of employees in the PGM mining industry and output sales from 1995 to 2012. Over the 18 year period, PGM production/extraction increased by 38,8% from 183 tons in 1995 to 254 tons in 2012. Similarly, employment increased by 116,2% from 91 258 employees in 1995 to 197 847 employees in 2012. Output sales increased from R7 839 million in 1995 to R113 900 million in 2012.

Figure 5.1.5a: Production/extraction of PGMs and employment in the PGM mining industry, 1995–2012

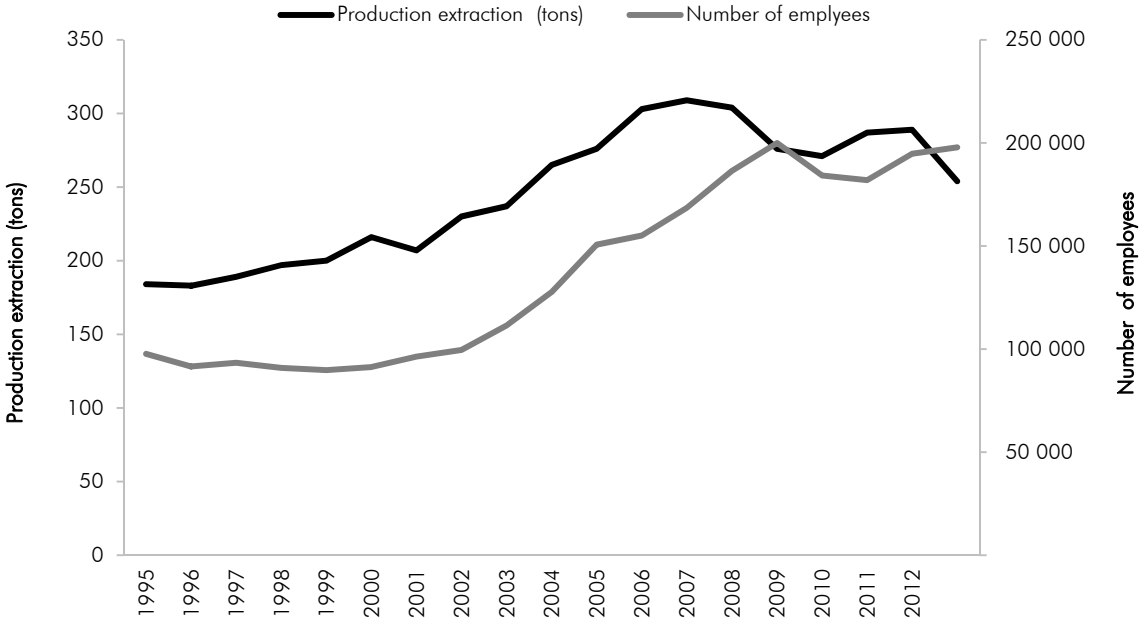


Figure 5.1.5b: Production/extraction of PGMs and output sales in the PGM mining industry, 1995–2012

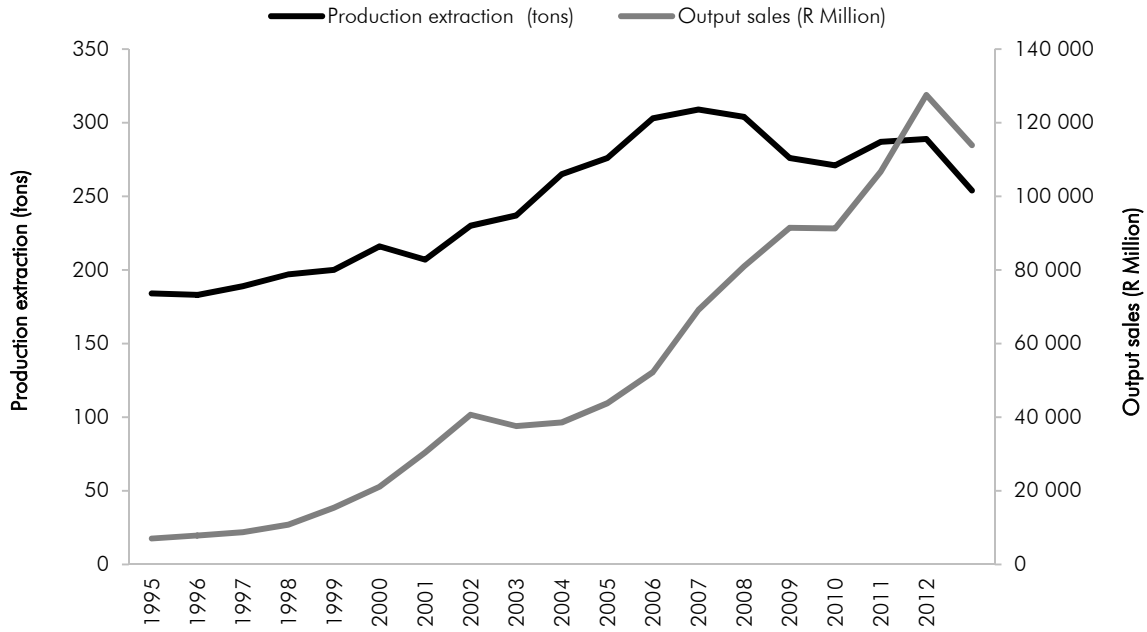


Table 5.1.5: Production/extraction of PGMs, employment and output sales in the PGM mining industry, 1995–2012

1995	1996	1997	1998	1999	2000	2001	2002	2003
Production extraction (tons)								
183	189	197	200	216	207	230	237	265
Number of employees (thousands)								
91 528	93 304	90 876	89 781	91 269	96 273	99 575	111 419	127 672
Output sales (Rand millions)								
7 839	8 727	10 777	15 392	21 113	30 388	40 652	37 554	38 581
2004	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Production extraction (tons)								
276	303	309	304	276	271	287	289	254
Number of employees (thousands)								
150 630	155 034	168 530	186 411	199 948	184 163	181 969	194 745	197 847
Output sales (Rand millions)								
43 772	52 229	69 154	80 963	91 454	91 286	106 713	127 559	113 900

Data sources and references

- Statistics South Africa. Environmental Economic Accounts Tables.
- Department of Mineral Resources, 2011/2012. *South African Minerals Industry*.
- Government Communication Information System, 2014. *South Africa Yearbook, 2013/14*.

5.1.6 Access to water sources, population density with NFEPA rivers

Description

The indicator shows different types of water sources that are accessible to people from different provinces in the country and the population density. The municipality is the major water service provider in all the provinces, with Gauteng having the biggest municipality supplier. Boreholes are also used in some other provinces such as Limpopo, North West and KwaZulu-Natal, followed by the river as the main source of supply in provinces like Eastern Cape and KwaZulu-Natal. Northern Cape has a smaller population with less modified and clean natural river conditions. Gauteng has a high population density and the river condition is C, i.e. largely modified. Other water sources such as dams, springs, rain water, tankers as well as water-vendors are used in all the provinces. Water sources like boreholes, rivers and dams are mostly used by farmers for the irrigation purposes. The sources of water serve as alternatives to tap water, which is mainly inside dwelling units or in the yards.

Linkages

Mining and industrial sectors are operating in Gauteng, which is directly linked to poor river conditions. The correlation between the NFEPA rivers and the population density is that the larger the population in the province the more degraded the river ecosystem becomes and *vice versa*.

The indicator is linked to energy because during energy production from coal, the river conditions are affected due to the greenhouse gas (GHG) emissions that are released in to the atmosphere, causing air pollution. The energy supplied from the hydropower stations also has an impact on the river conditions, since there is water circulation that causes the water to be less drinkable.

There is also a link between the minerals and river conditions, especially during the extraction of coal from the environment as well as during the transportation of coal to different power stations. These activities result in the release of carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) in to the atmosphere, causing the loss of ecosystem services. During the extraction of minerals, ground water systems are affected by mining spills, causing water contamination.

The indicator links to fisheries as well. Once the water is contaminated, it becomes harmful to the species living within that river ecosystem. The fisheries are also affected by the generation of energy, causing poor living conditions for fish species.

Selection criteria

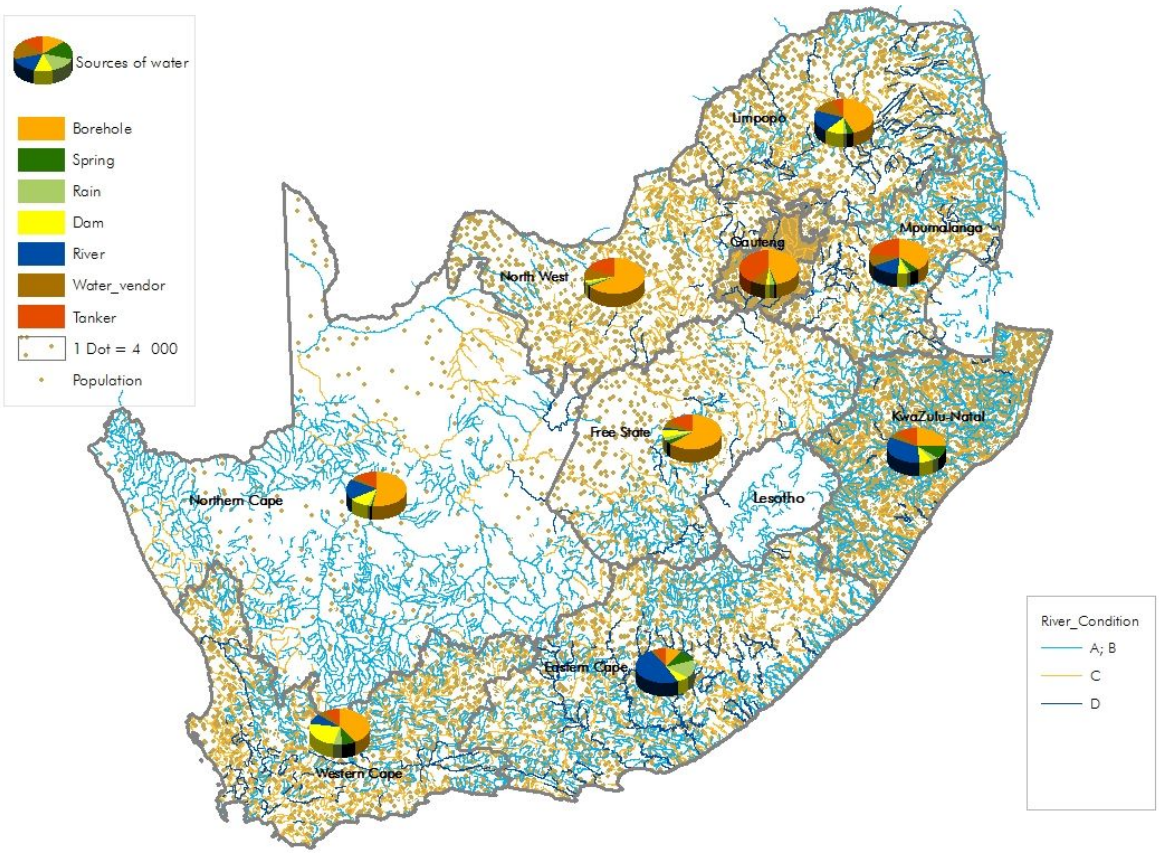
The indicator met the following criteria:

- Data available and accessible in the long term;
- Data collection process has minimal environmental impact;
- Data available at no cost;
- Provides information to measure important issues relating to water supply services;
- Relates to goals, targets and objectives; and
- Relevant to policy and management needs in South Africa.

Measurement

Units	Spatial scale	
Million m^3	National	Annually/5 year period

Map 5.1.6: Access to water sources, population density with NFEPA rivers



Data sources and references

- Statistics South Africa, 2012. *Census 2011, P0301*. Pretoria.
- South African National Biodiversity Institute, 2011. National Freshwater Ecosystem Priority Areas (NFEPA).

5.1.7 Total population with access to piped (tap) water

Description

The indicator shows the total population with access to piped water and no access to piped water at all in each province with the NFEPA rivers. Gauteng has the biggest population within the country followed by KwaZulu-Natal, with Northern Cape having the smallest population. The figures on the map show large numbers of people with piped water in the dwelling units in Gauteng, followed by small numbers with no access to piped water at all. A very small number of people with no access to piped water in all the provinces indicates improvement of water service delivery with reduced backlog. Although Gauteng and other provinces experience modified river ecosystem conditions, people still have access to tap water that is clean and drinkable since the water goes through purification processes.

Linkages

The indicator is linked to minerals because during mining extraction ground water is affected by the mine dump and chemical spills. The poor river conditions have an impact on the fish species and threaten lives within the marine habitat.

Selection criteria

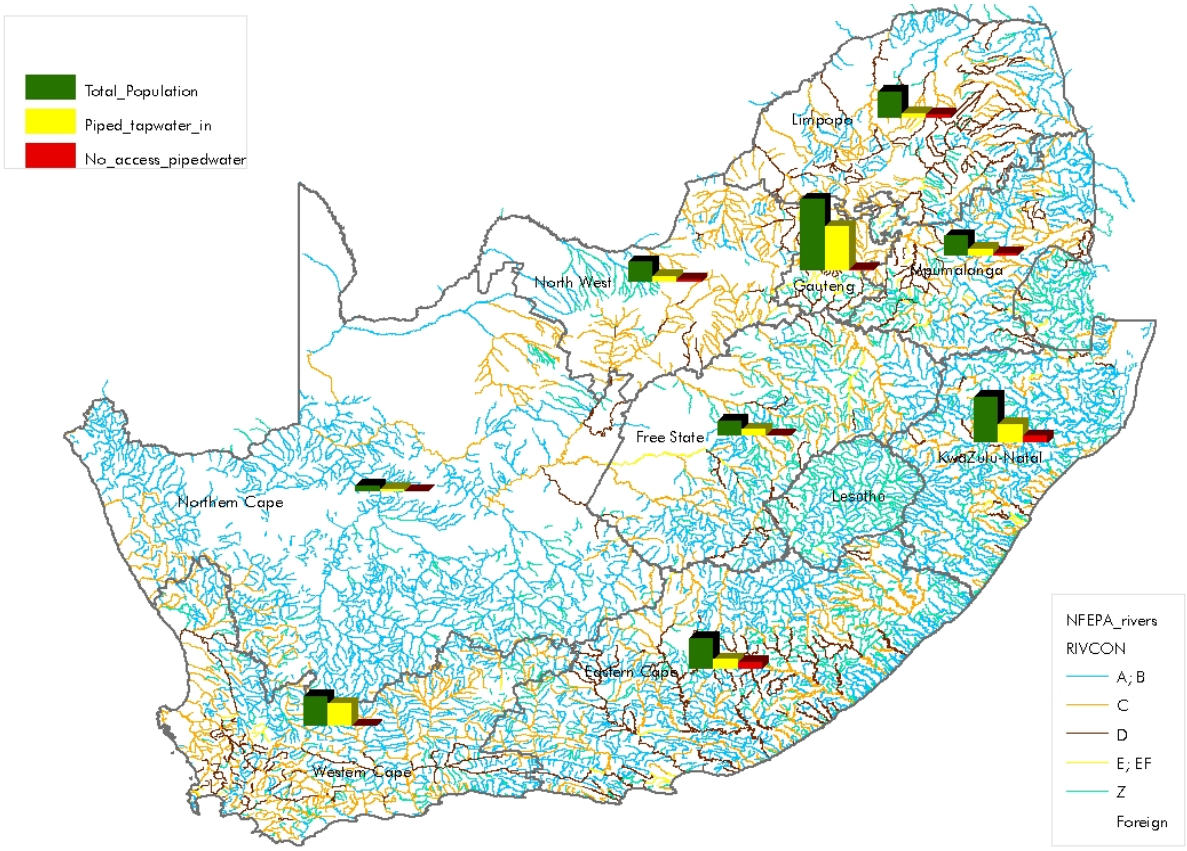
The indicator met the following criteria:

- Data available and accessible in the long term;
- Data collection process has minimal environmental impact;
- Data available at no cost;
- Provides information to measure important issues relating to total population and water supply services;
- Relates to goals, targets and objectives; and
- Relevant to policy and management needs in South Africa.

Measurement

Units	Spatial scale	Frequency
Million/ Million m^3	National	Annually/5 year period

Map 5.1.7: Total population with access to piped (tap) water



Data sources and references

- Statistics South Africa, 2012. *Census 2011, P0301*. Pretoria.
- South African National Biodiversity Institute, 2011. National Freshwater Ecosystem Priority Areas (NFEPA).

5.1.8 Piped (tap) water services and NFEPA rivers

Description

The indicator shows piped (tap) water services within provincial boundaries with the NFEPA rivers. The NFEPA rivers indicate that Northern Cape is the only province with unmodified river conditions, with other provinces having moderate to largely modified river conditions. Gauteng and Western Cape are the two provinces with large numbers of the population with access to piped water within dwelling units. Limpopo, Mpumalanga, Free State, North West as well as Northern Cape are provinces that have large populations with access to piped water within their yards, and this is characteristic to rural areas in these provinces. Eastern Cape has the largest number of people without access to piped water, followed by KwaZulu-Natal, Mpumalanga, Limpopo and North West. Most people in these provinces are likely to fetch their water from rivers, dams, reservoirs, springs, water tankers and other sources shown in Map 6.

Linkages

The indicator is linked to minerals because during mining extraction ground water is affected by the mine dumps and chemical spills. The poor river conditions have an impact on the fish species and threaten lives within the marine habitat. Eastern Cape has a hydroelectric power station which plays a vital role in river conditions within the province. The river condition is classified under category C, which indicates that the river ecosystem is moderately modified.

Selection criteria

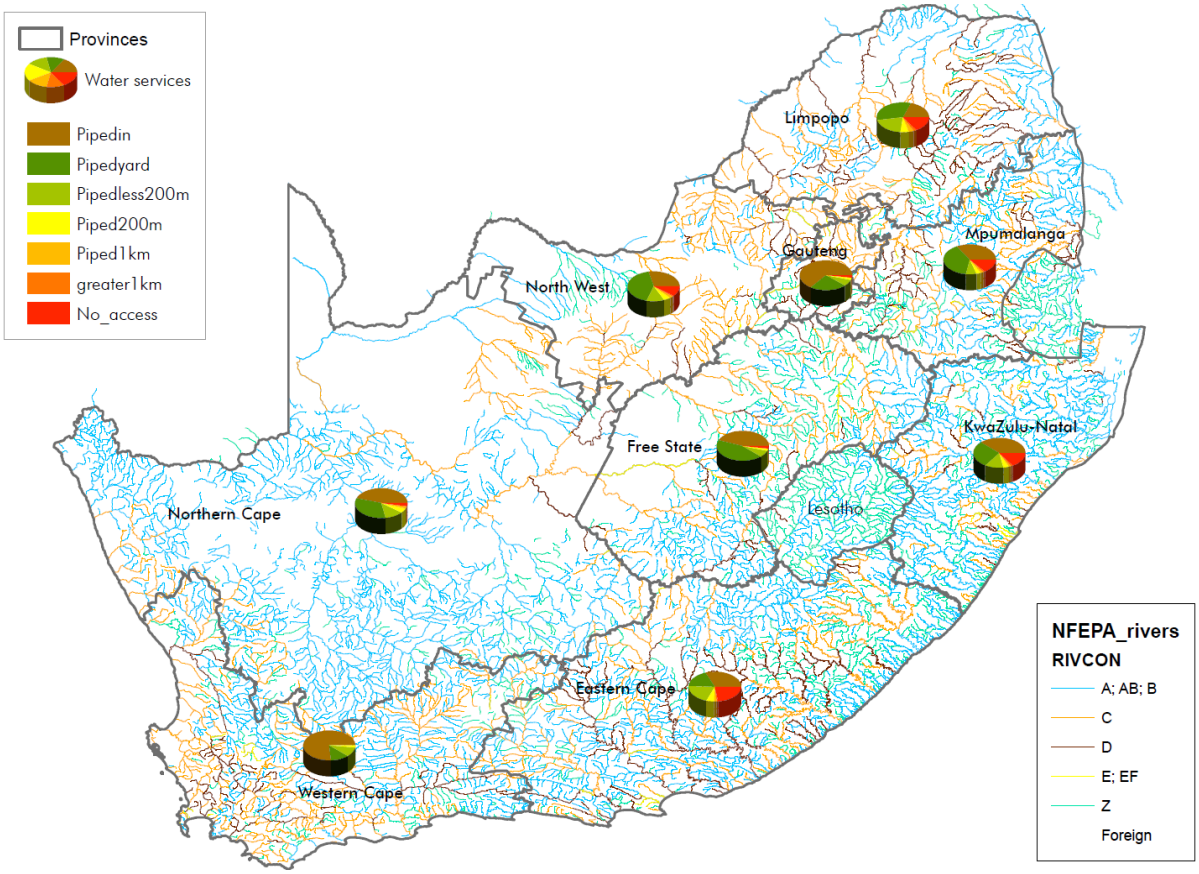
The indicator met the following criteria:

- Data available and accessible in the long term;
- Data collection process has minimal environmental impact;
- Data available at no cost;
- Provides information to measure important issues relating to water supply services;
- Relates to goals, targets and objectives; and
- Relevant to policy and management needs in South Africa.

Measurement

	Spatial scale	Frequency
Million m^3	National	Annually/5 year period

Map 5.1.8: Piped (tap) water services and NFEPA rivers



Data sources and references

- Statistics South Africa, 2012. *Census 2011, P0301*. Pretoria.
- South African National Biodiversity Institute, 2011. National Freshwater Ecosystem Priority Areas (NFEPA).

5.1.9 Mining, Energy power plants and NFEPA rivers

Description

The indicator shows the location of mining industries, energy power plants as well as the NFEPA rivers. These mines mainly extract minerals such as coal, gold and PGMs from both open cast and underground mines. The minerals are measured in terajoules for international comparison. Most of the provinces with mining sectors show river condition C (i.e. moderately modified), which is not good for drinking unless some sort of purification is used. Northern Cape has river condition A-B (i.e. unmodified and largely natural) with no mining actitivties in operation and no power plants to affect the river ecosystem condition.

Linkages

The correlation between the NFEPA rivers and the mining industry is that the mining activities have an impact on the river ecosystem condition due to the water use return flows from mining. Coal mines, platinum group metal mines as well as gold mines are concentrated in the northern part of the country.

Selection criteria

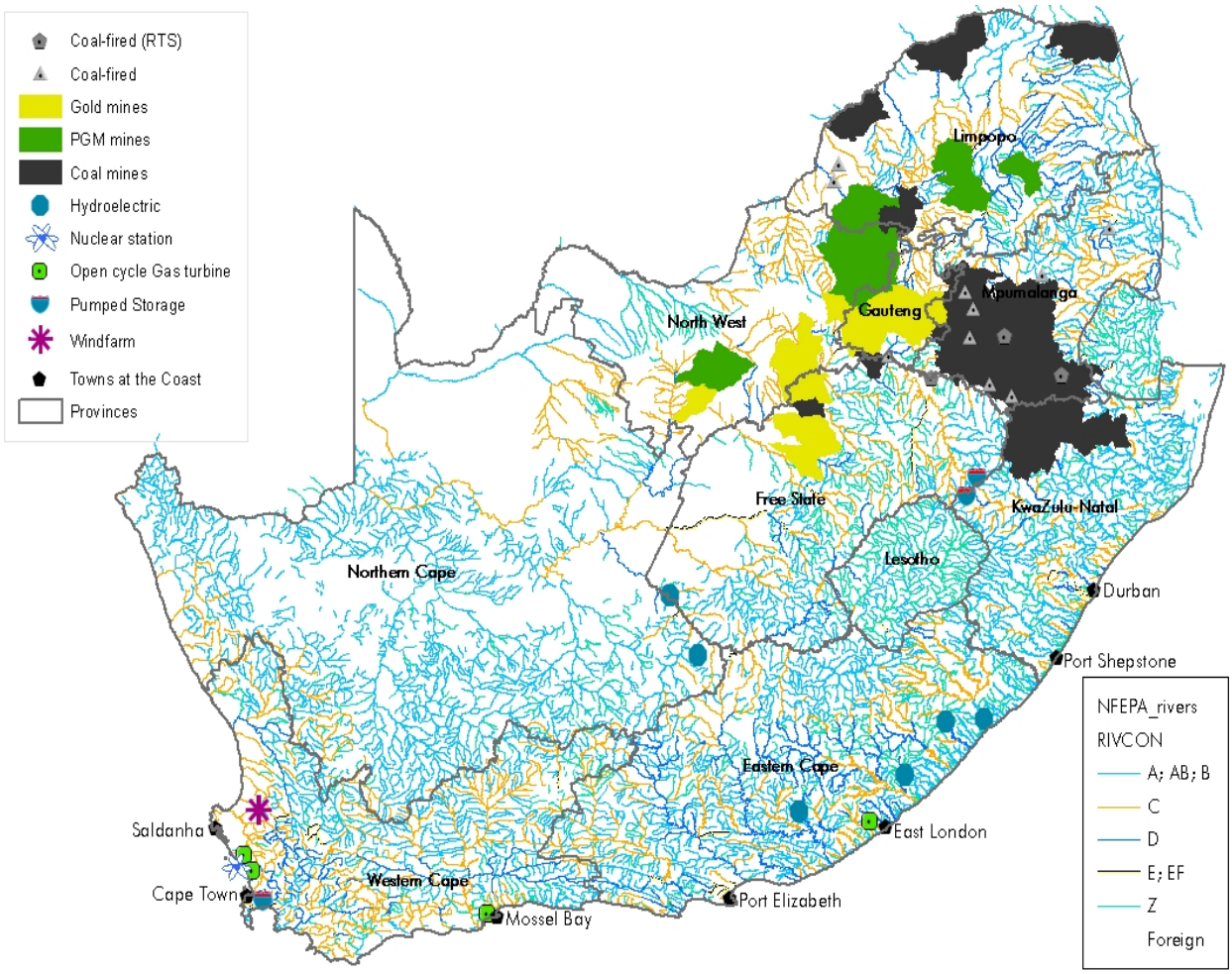
The indicator met the following criteria:

- Data available and accessible in the long term;
- Data collection process has minimal environmental impact;
- Data available at no cost;
- Provides information to measure important issues relating to mining, energy power plants and river ecosystems;
- Relates to goals, targets and objectives; and
- Relevant to policy and management needs in South Africa.

Measurement

Units	Spatial scale	Frequency
Terajoules/Million m^3	National	Annually

Map 5.1.9: Mining, Energy power plants and NFEPA rives



Data sources and references

- Statistics South Africa, 2012. *Census 2011, P0301*. Pretoria.
- South African National Biodiversity Institute, 2011. National Freshwater Ecosystem Priority Areas (NFEPA).
- Council for Geoscience, 2009. Digital Metallogenic Map of Precious Metals, Chrome, Diamond and Germstones in the Republic of South Africa and Kingdoms of Lesotho and Swaziland.

5.1.10 South Africa's energy intensity

Description

The ratio of aggregate energy use to GDP, often called 'energy intensity' or the 'energy ratio', is an indicator of energy efficiency, sustainability of energy use, or technological development. The aggregate ratio depends as much on the structure of the economy as on the energy intensities of sectors or activities, and changes in the ratio over time are influenced almost as much by changes in the structure of the economy as by changes in sector energy intensities. It is therefore a fairly robust measurement tool.

Linkages

The energy intensity indicator could be linked to the SDGs since energy is needed to achieve sustainable development. In order to ensure environmental sustainability, energy security requires effective management. The indicator also links to the economy, specifically GDP. The SEEA-Energy considers the depletion of energy resources such as coal, oil and gas as a cost to the nation, and provides measures of income and production that report on the sustainability of energy production. A further link exists with mineral deposits where coal is extracted to generate electricity.

Selection criteria

The indicator met the following criteria:

- Data available and accessible in the long term;
- Data collection process has minimal environmental impact;
- Data available at no cost;
- Provides information to measure important issues;
- Information presented to be easily understood;
- Relate to goals, targets and objectives; and
- Relevant to policy and management needs in South Africa.

Measurement

Units	Spatial scale	Frequency
Tetajoules/Megajoules	National	Annually

The total primary energy supply decreased from 8 647 126 TJ in 2002 to 6 007 644 TJ in 2010 – a decrease of 31% over the nine years (Table 5.1.10). The energy intensity decreased from 6,99 in 2002 to 2,41 in 2010 (Figure 5.1.10). High energy intensities indicate a high price or cost of converting energy into GDP. Low energy intensities indicate a lower price or cost of converting energy into GDP. The energy intensity of a process (energy consumed per unit of output) is the inverse of the 'energy efficiency' of the process (output per unit energy consumed).

Figure 5.1.10: Energy intensity in Megajoules per Rand, 2002–2010

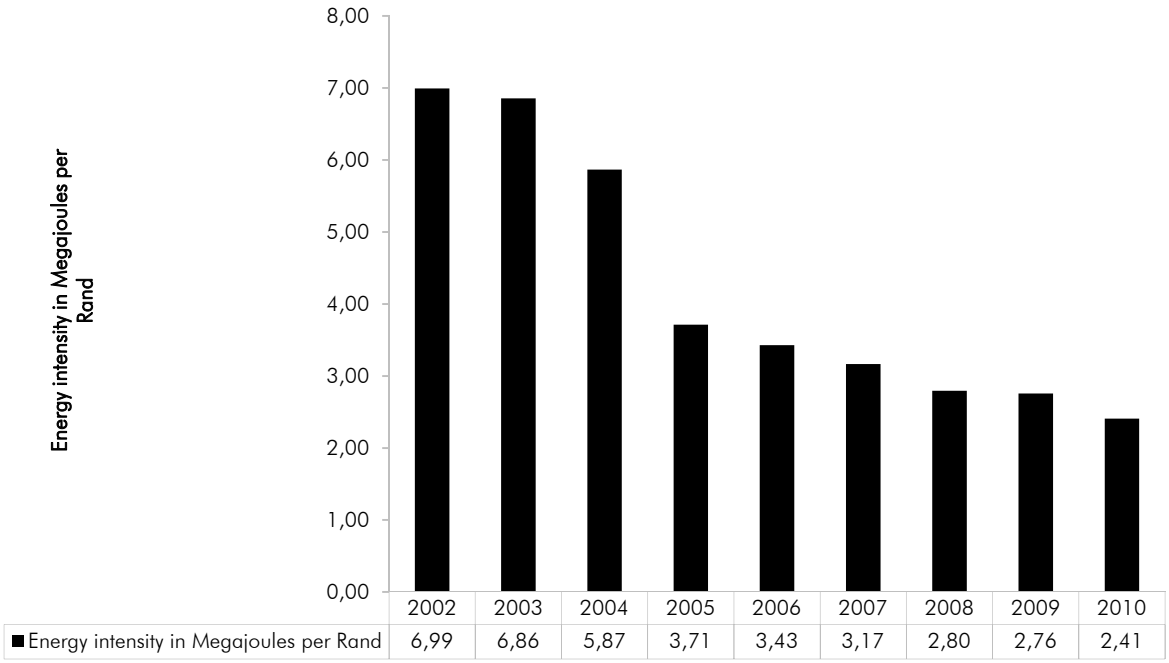


Table 5.1.10: Energy intensity per gross domestic product, 2002–2010

2002	2003	2004	2005	2006	2007	2008	2009	2010
Primary energy supply in Terajoules*								
8 647 126	8 728 384	7 804 789	7 949 201	7 742 673	7 538 066	6 874 635	6 683 347	6 007 644
Gross domestic product at constant prices (Rand millions)								
1 236 270	1 273 129	1 330 390	2 140 471	2 258 757	2 380 979	2 459 238	2 424 053	2 494 860
Energy intensity in Megajoules per Rand								
6,99	6,86	5,87	3,71	3,43	3,17	2,80	2,76	2,41

Excludes imports and electricity; includes coal, crude oil, gas, hydro, nuclear, petroleum products, and renewables and waste.

Data sources and references

- Department of Energy, 2014. *Energy Balances, 2010*. Pretoria.
- Statistics South Africa, 2012. *Energy Accounts for South Africa: 2002-2009*. Discussion document: D0405.1.1.
- Statistics South Africa, 2014. *Quartely Gross Domestic Product, Fourth quarter: 2014, Statistical release P0441*. Pretoria.

References

1 Nel, J., *et al,* 2011. *Atlas of Freshwater Ecosystem Priority Areas in South Africa: Maps to support sustainable development of water resources.* WRC Report No. TT 500/11, Water Research Commission, Pretoria.

2 Driver, A., *et al*, 2012. *National Biodiversity Assessment 2011: An assessment of South Africa's Biodiversity Assessment 2011: An assessment of South Africa's biodiversity and ecosystems. Synthesis report.* South African National Biodiversity Institute & Department of Environmntal Affairs. Pretoria.

3 United Nations, 2014. *System of Environmental-Econimic Accounting 2012 – Experimental Ecosystem Accounting*. New York.

4 United Nations, 2014. *System of Environmental-Economic Accounting 2012 – Central Framework*. New York.

5 Department of Energy, 2009. *Digest of South African Energy Statistics*. Pretoria. Website: www.energy.gov.za

6 Government Communication Information System, 2014. *South Africa Yearbook 2013/14*. Pretoria.

7 Department of Agriculture, Forestry and Fisheries, 2012. *Status of the South African Marine Fishery Resources, 2012*. Cape Town.

8 Statistics South Africa, 2014. *Environmental Economic Accounts Compendium, Report No.: 04-05-20.* Pretoira.

9 Marine Stewardship Council. Website: www.msc.org

10 Statistics South Africa, 2014. *P0441, Gross Domestic Production, 3rd Quarter*. Pretoria.

11 Platinum Group Metals. Website: www.platinumgroupmetals.net/projects/waterberg

12 Hunt, L.B., Lever, F.M., 1969. Platinum Metals: A Survey of Productive Resources to Industrial Uses. *Platinum Metals Review 13(4): 126-138*

13 Statistics South Africa, 2012. *Census 2011, P0301*. Pretoria.

Annexures

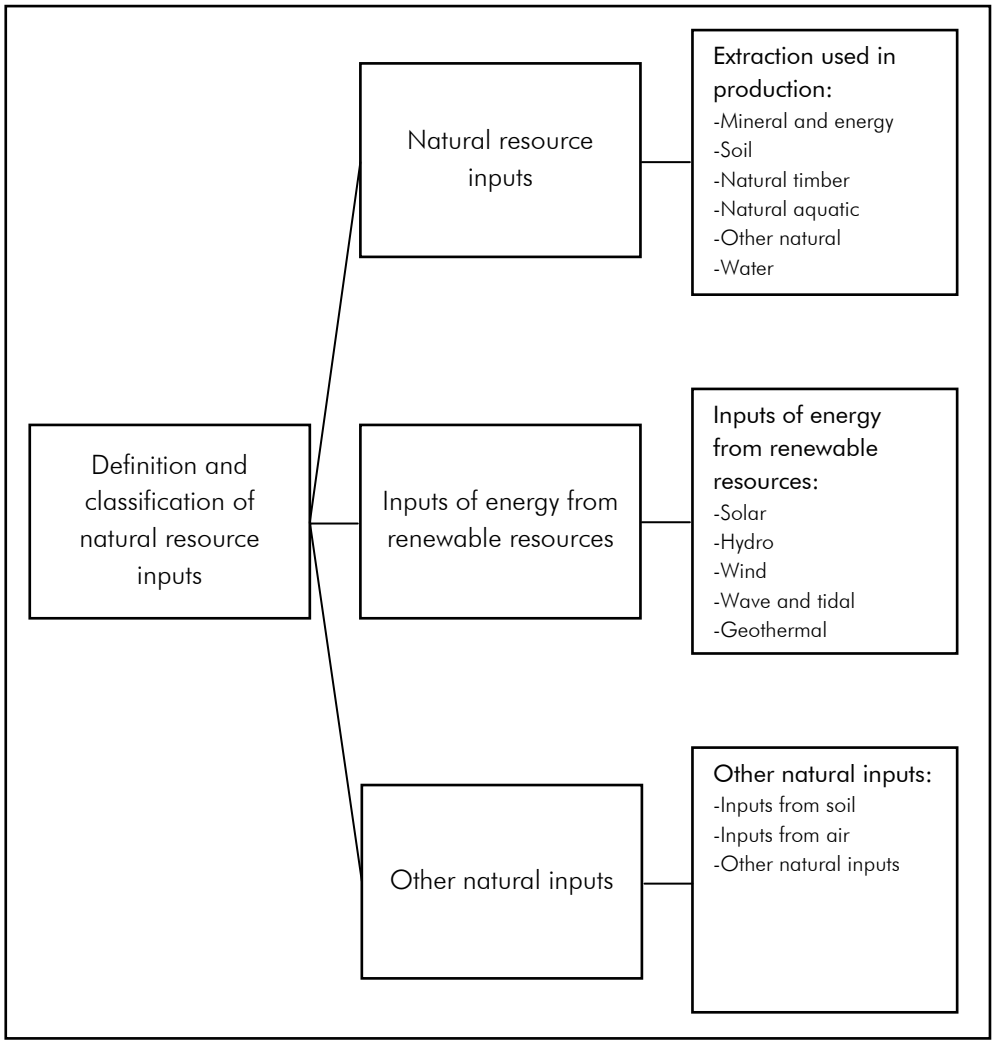
Table A1: Basic form of a physical supply and use table

	Industries	Households	Accumulation	Rest of the World	Environment	Total
Supply table						
Natural Inputs					Flows from environment	Total supply of natural inputs
Products	Output			Imports		Total supply of products
Residuals	Residuals generated by industry	Residuals generated by final household consumption	Residuals from scrapping and demolition of produced assets			Total supply of residuals
Use table						
Natural Inputs	Extraction of natural inputs					Total use of natural inputs
Products	Intermediate consumption	Household final consumption	Gross capital formation	Exports		Total use of products
Residuals	Collection and treatment of waste and other residuals		Accumulation of waste in controlled landfill sites			Total use of residuals

Note: Dark grey cells are null by definition, blank cells may contain relevant flows.

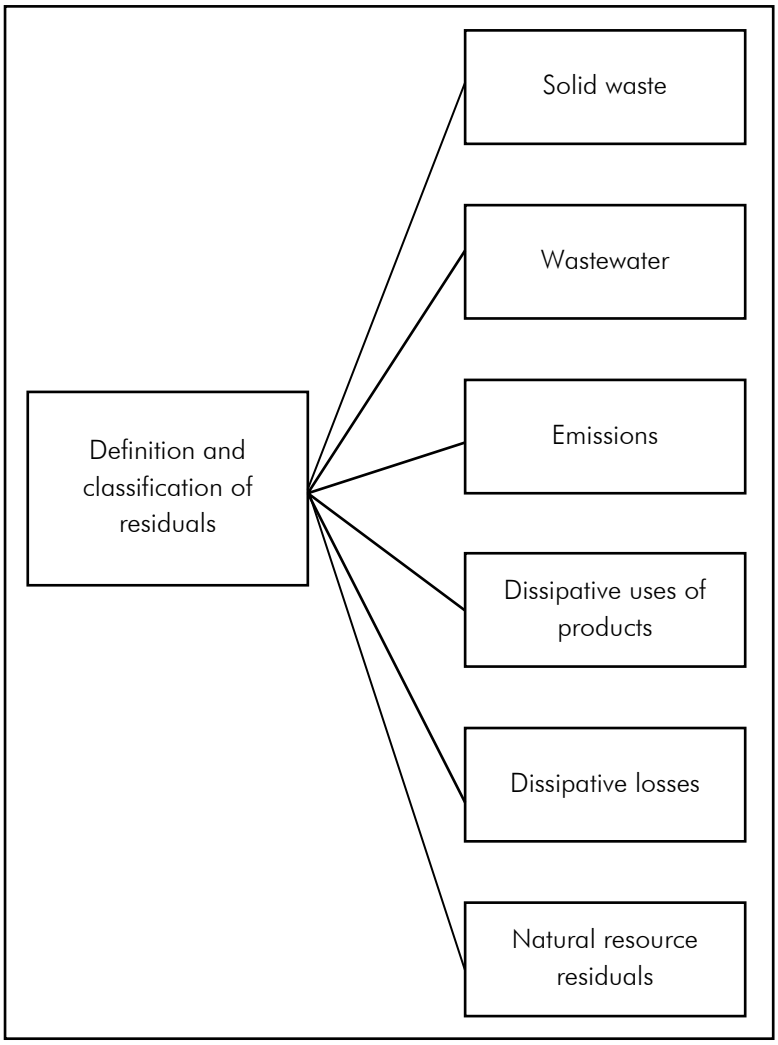
Source: United Nations, 2014. *System of Environmental-Economic Accounting, 2012. Central Framework.* New York.

Figure A1: Definition and classes of natural inputs



Source: United Nations, 2014. *System of Environmental-Economic Accounting, 2012. Central Framework*. New York.

Figure A2: Definition and classification of residuals



Source: United Nations, 2014. *System of Environmental-Economic Accounting, 2012. Central Framework*. New York.