

Chapter 6

Land

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Chapter 6

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6.1 INTRODUCTION

South Africa's historical background places the land resources under tremendous political, socio-economic, and environmental pressure. All these pressures emanate from the past inequitable land distribution and ownership, spatial mismatch in land management, and the past unsustainable land use practices. Therefore, an in-depth understanding of major drivers of land transformation and change should take consideration of the following:

- Land resource poverty and its inappropriate use;
- Exploitation of mineral reserves to drive the country's economy;
- Poor spatial and land use planning that result in poor agricultural practices, poor transport planning, unsustainable settlements;
- Introduction of foreign substances and species; and,
- Lack of greenfield management or conservation, climate change and/or global warming.

These are key drivers giving effect to the context which underpins reporting on land resources in South Africa. It draws attention to major land uses, socio-political considerations, environmental issues and aspects, and some emerging land



issues in the country. It is within this context that this chapter should be understood.

In brief, the land chapter describes the status of the land resource in South Africa over the last five years. It provides an overview of land cover, land use, environmental impacts on the land resource, current legislative and institutional framework governing the land resource, and finally highlights emerging land issues that require attention in the short to medium term.

Recognition is given to the difficulties of unavailable new data and sufficient scientific body of knowledge of good quality, regarding the land resources in South Africa over the last decade. This is mainly attributed to the very little or not enough scientific attention which has been given to land resources during this past decade. Some *ad hoc* scientific research has been conducted but produced papers have not been synthesized enough into accessible literature. As a result, there is reliance on old management interventions which may not sufficiently reflect the current thinking and threats to the land subject.

First, the overview provided pays attention to status and trends on the available land-cover data, and various land use classifications. Each land cover type such as, forest, woodlands, bushlands, etc. is mapped, described and the trends analysed.

Second, the status and trends of major land use types in South Africa is assessed. Specific emphasis was placed on the four major land use types of agriculture, forestry, urban, and mining. Each key land use type is mapped, described and trends analysed.

Third, the status and trends of land cover and land use types in South Africa described above is used to describe the environmental impact and issues related to each land use type, and the changes in the land use are also discussed. The stresses and impacts that are discussed are for agriculture (i.e. land degradation, desertification, vegetation loss, and spread and prevalence of alien invasive plants), for forestry (i.e. afforestation), for urban land use (i.e. illegal settlements) and for mining (i.e. mining drainage).

Fourth, the legislative and institutional framework governing land resources in South Africa is described. The section provides a description of what tools are available to govern governmental and private land on the key land types. Furthermore, a contextual analysis of the country's framework is presented with the context of population, environment, and development nexus. The section also provides an overview of the key institutional players and governance issues for each land use type.

Fifth, mining land use and associated environmental implications are assessed. The extent of land covered by mining activities, and the potential environmental impacts are determined. Land use change and the general environmental impacts associated with mineral extraction are mapped and presented. Emphasis on the most critical emerging issues in mining are also highlighted and conclusions drawn.

Lastly, attention is given to emerging issues that have been and will be key features of land cover and land use development in the coming years. Issues that require specific attention are highlighted. The following key emerging issues are discussed: land degradation; land restitution and land recapitalization; climate change and rural development; timber shortage; land restitution; skills shortage in technical forestry; and, acid mine drainage as an ever growing concern in the country.

6.2 LAND TRANSFORMATION

South Africa has nine biomes, or broad groupings of vegetation types that share similar ecological characteristics. Each biome has a characteristic climate envelope, or a range and pattern of temperature and rainfall values, within which it occurs (Driver *et al.* 2011). The detailed description on biodiversity is provided in Chapter 7: Biodiversity and Ecosystem Health.

The 2006 SAEO (DEAT 2006) highlighted the following major area statistics of the land cover classes:

- Of the 12.8 million hectares of cultivated areas in South Africa, nearly 10.5 million hectares (82 per cent) is for commercial purposes, 0.8 million ha (only 6.2 per cent) is permanently under cultivation, and more than 10.8 million hectares (85 per cent) is rain-fed;
- Over 0.7 million hectares of land is degraded and left bare by soil erosion (sheet and gully erosion); 4.6 million hectares of natural vegetation are degraded, mainly in indigenous forests, woodlands, and grasslands; a further 0.2 million hectares is degraded by mine tailings, waste rock dumps, and surface-based mining;
- Urban areas comprise mainly formal residential suburbs and townships (1 million hectares) and informal settlements (0.2 million hectares); and,
- Savannahs (woodlands and bushlands) and grasslands cover 25.7 and 19.9 per cent of South Africa, respectively (DEAT 2006).

Land cover data is used to quantify where natural habitat has been irreversibly lost (Driver *et al.* 2011). The best currently available land cover data for South Africa is the SANBI mosaic land cover 2009 (Map 6.1). It is based on the National Land Cover 2000 supplemented with more recent data from provinces and other sources where available.

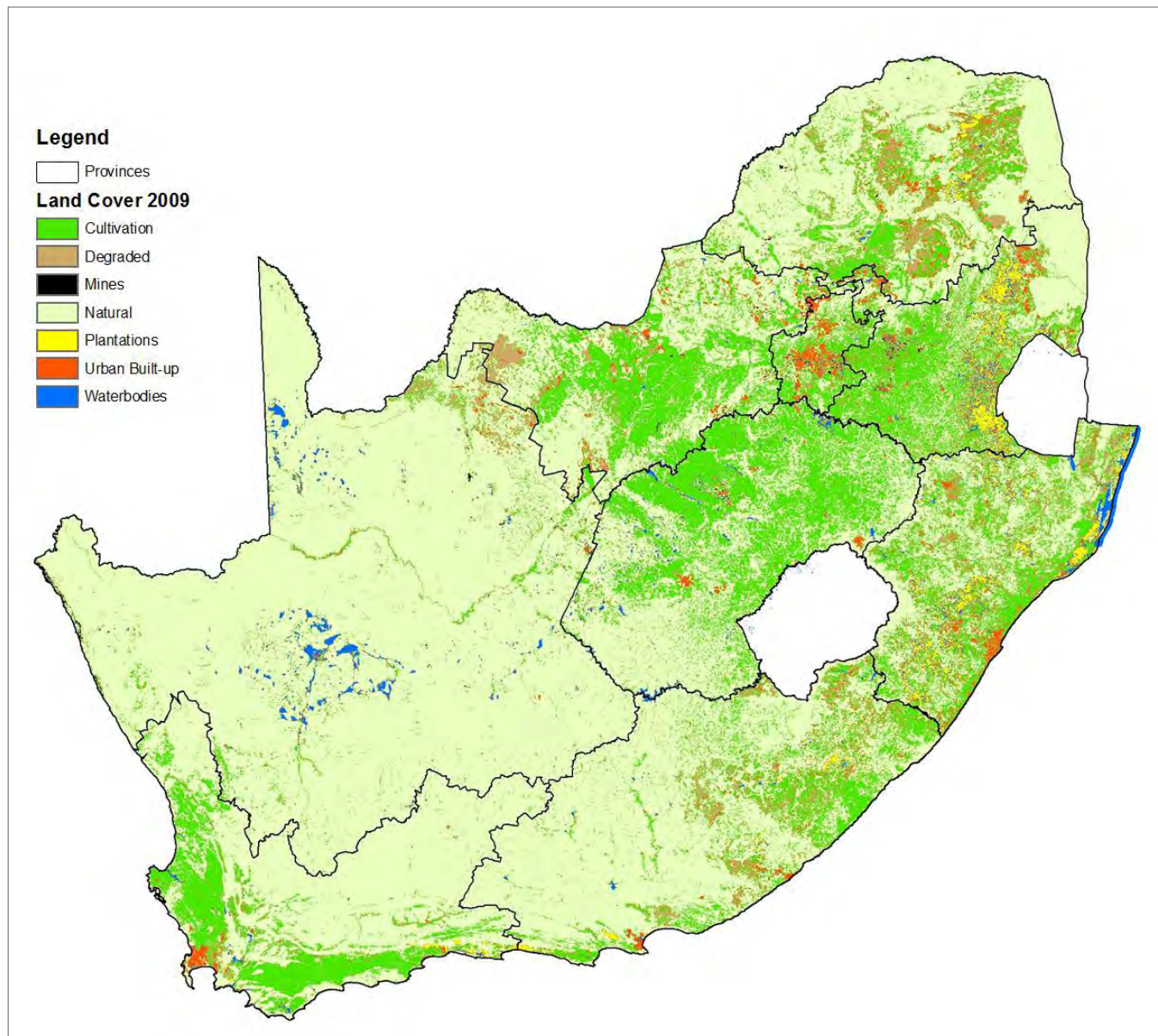
There has been outright loss of natural habitat, over 18 per cent of South Africa's land surface, mostly as a result of cultivation of crops (such as maize, wheat and sugar cane), but also mining, forestry plantations and urban development (Driver *et al.* 2011). In some regions the percentage is much higher and the rates of loss are alarming. For example, in North West, Gauteng and KwaZulu-Natal, if loss of natural habitat continues at current rates there will be little natural vegetation left outside protected areas in these provinces by about 2050.

It is estimated that close to 18 per cent of South Africa's natural land cover is transformed, mainly by cultivation (10.4 per cent), degradation of the natural cover (4.5 per cent), urban land use (1.5 per cent), and forestry (1.4 per cent). Map 6.1 shows the existing land cover in South Africa (DEAT 2006). Recently, the natural land cover situation may have changed. Such reasonable changes may have not been sufficiently

recorded. As such, natural land cover transformation and land degradation trends could not be sufficiently depicted.

One means of monitoring population growth, agricultural production, and the increasing demand on natural resources is through land cover change mapping. Modern Earth Observation technologies, especially those Earth Observation datasets comprising a multi-year data archive, lend themselves to land cover change studies.

Land use profoundly influences the productivity and condition of land, as well as its biodiversity integrity. Land cover change, which reflects an underlying change in land use, is therefore an important indicator of the condition of terrestrial ecosystems (DEA 2006).



Map 6. 1: Land cover map
Source: SANBI (2009)

6.2.1 Land use

Land use, defined as the sequence of operations carried out with the purpose to obtain goods and services from the land, can be characterized by the actual goods and services obtained as well as by the particular management interventions undertaken by the land users. Socio-economic market forces generally determine land use; however it is still bound by biophysical constraints imposed by the ecosystems in which they occur (Pretorius 2009).

Land use is one of the most important pressures leading to land change and degradation, which directly affect its status, and impacts on goods and services provided by the land. The

land use pattern therefore provides an important context for the understanding of land use change, opportunities and degradation. To characterize land use in a systematic way allows evaluating the various aspects of land use change and degradation, particularly when information is related to ecosystem characteristics and socio-economic attributes (Pretorius 2009).

At regional and global scales, information on land use can be indirectly derived from agricultural census data, land cover information and from maps of the biophysical resource. Few databases are available that allow the characterization of the land management interventions themselves. For instance

information on mechanization or fertilizer used is often only available as national statistics. In fact only data for irrigation, livestock presence and protected areas are consistent global databases available which allow refining the mapping and characterization of land use (Pretorius 2009).

Cropland covers the main areas in the Western Cape, Free State, Mpumalanga, and North West (Map 6.2). However, it forms the smallest area proportion of the Northern Cape due to aridity. Dry provinces tend to have greater areas of grazing lands or veld than the wetter provinces. The Northern and Eastern Cape (especially in the west) possess on average the highest proportion of grazing lands.

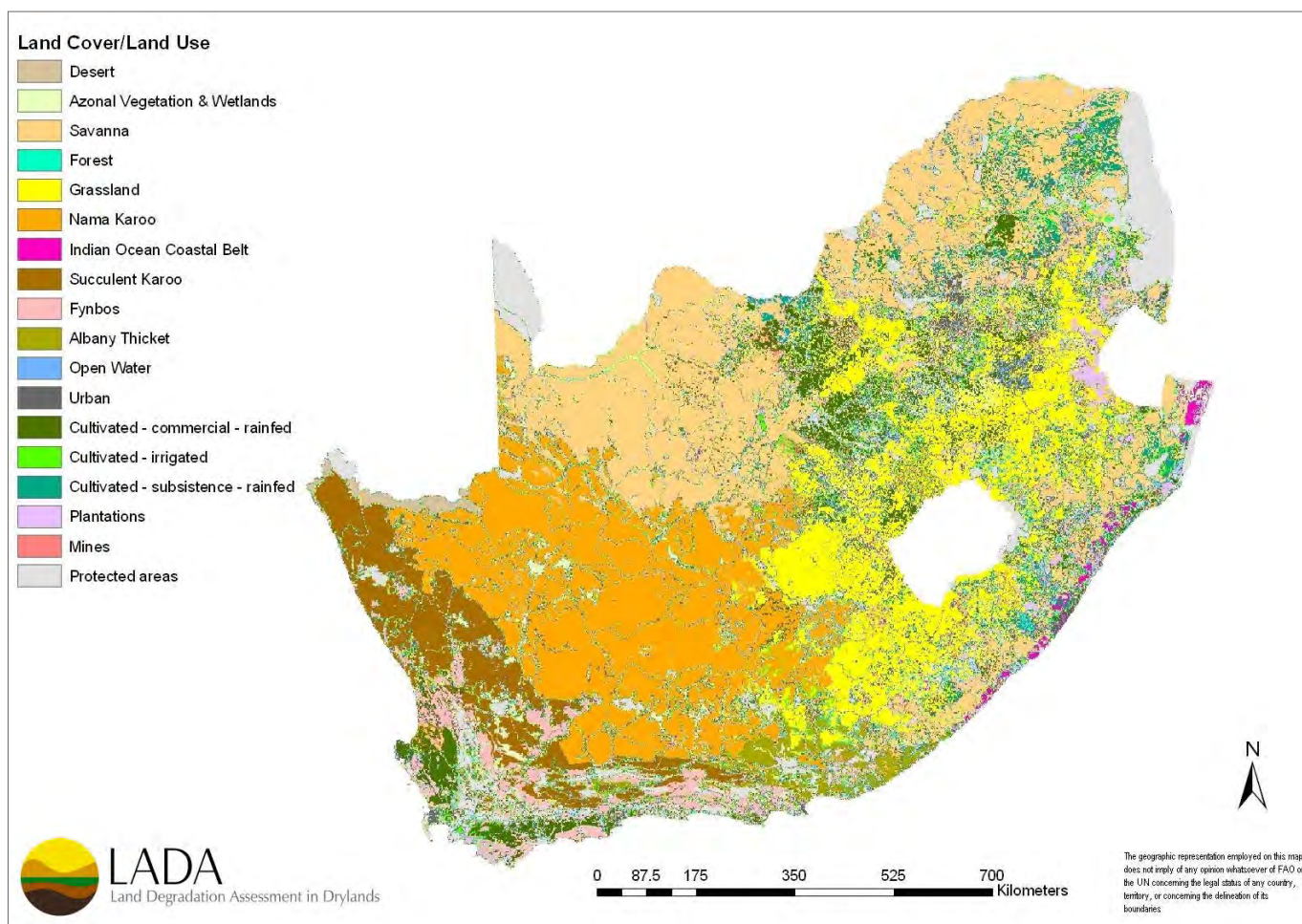
The Free State, KwaZulu-Natal, Limpopo, and North West all have between 54 and 58 per cent of land used for grazing. Gauteng has less than 20 per cent of its area used for grazing. Commercial forests occupy the greatest area in KwaZulu-Natal and Mpumalanga, while they are absent from the Free State, Gauteng, and the arid Northern Cape and North West. Conservation areas are greatest in Mpumalanga but do not make up more than three per cent in any of the other provinces.

Gauteng possesses by far the greatest proportion of settlement area in South Africa. The Northern Cape has particularly low settlement areas while all the other provinces range between five and 14 per cent (Hoffman & Todd 2000).

Section 6.2.2 to 6.2.5 presents the status and trends of the four major land use types in South Africa, namely agriculture (or croplands), forestry, urbanization and mining.

6.2.2 Urbanization

The importance of the expanding urban land use area in South Africa is underlined by an ecological footprint associated with urban land use activities. According to Ros (2007) settlement in South Africa can be classified into five urban land categories (Table 6.1).



Map 6. 2: Land use systems in South Africa
 Source: FAO (2012)

Table 6. 1: Overview of urban land use classification in South Africa

Type	Hierarchy of settlement	Defining criteria	Examples
Pre-dominantly urban	Metropolitan area	Population is greater than 1,000,000 individuals. Has a strong, diverse economy.	Johannesburg, Cape Town, eThekweni, Tshwane and Ekurhuleni.
	Secondary cities	Population is between 250,000 and 1,000,000 individuals. Has a strong, diverse economy base.	Nelson Mandela, Emfuleni and Bloemfontein.
	Large towns	Population between 25,000 and 250,000 individuals. Economic base is focused on limited products/services.	Buffalo City, Pietermaritzburg and Mogale City.
	Small towns	Population is between 2,000 and 25,000. Economic base is focused on limited products.	Cers, Underberg, Port Edward, Uptington, Ficksburg, Vryburg, Cullinan and Bethal.
Rural	Rural villages	Varying population, clusters or dispersed, with few urban amenities and formal economic activities and mostly in former homeland areas.	
	Agricultural land	Farming areas and non-urban.	

Source: Ros (2007)

Urban growth in South Africa is accelerating. Concerns about this relate to the deterioration in quality and reliability of energy services available to the poor as a whole but particularly to the growing population in the urban and peri-urban areas. Population densities in these areas make people vulnerable to health threats due to limited access to cleaner energy.

The urbanization trend followed by South Africa is ahead of the global trend and that of sub-Saharan Africa. Due to this trend and the repealing of apartheid legislation that restricted movement, land ownership, and promoted tribal land occupation arrangements (e.g. Bantustans), there is a larger population movement towards urban areas. However, the population of the country remains stratified along the lines of inequality. This is mainly because race, gender, and class characterize it.

South Africa is also ranked amongst the most unequal societies in the world. It is estimated that 13 per cent of the population live in conditions similar to first world countries, whilst the majority remains in poor living conditions. The outcome of the apartheid spatial planning practices has seen many urban settlements in the country without proper functionality to provide services to the majority of the poor. There is a general lack of access to amenities and livelihood opportunities. It was only after 1986 that rural-urban migration amongst black South Africans was encouraged (ERC 2008).

As such, most of the urban centres and cities were not geared up or ready for the population influx. Most people found themselves relegated to the periphery of these cities. This created challenges on urban sprawl and led to the rise of informal settlements and/or slums, depriving people access to basic services. Furthermore, these high concentrations of informal settlement have since become an epitome of poverty.

With the high influx of people into cities, provision of services such as access to clean water, sanitation, and affordable energy for the poor has also become increasingly important. Most

of the urban and peri-urban settlements in South Africa are faced with the challenge of formal housing, illegal electricity connections, safety and land tenure. There is a predominant use of coal in the cities with resultant secondary emissions that impact negatively on the air quality (indoor and ambient) in these areas. Most of the cities found themselves having to deal with cases of electrocutions, voltage surges and blackouts (ERC 2008).

6.2.3 Agriculture

Land and agricultural production have been highlighted as critical for economic growth and poverty reduction. For example, it has been emphasized that most African economies are heavily reliant on agriculture and natural resources for a significant share of GDP, national food needs, employment and export revenue (Mutangadura 2007).

South Africa has a two-tiered economy, one with characteristics of developed countries and the other with only the most basic infrastructure. This two-tiered economy is also prevalent in the agricultural economy; a well-developed commercial sector co-exists with a predominantly subsistence agricultural sector.

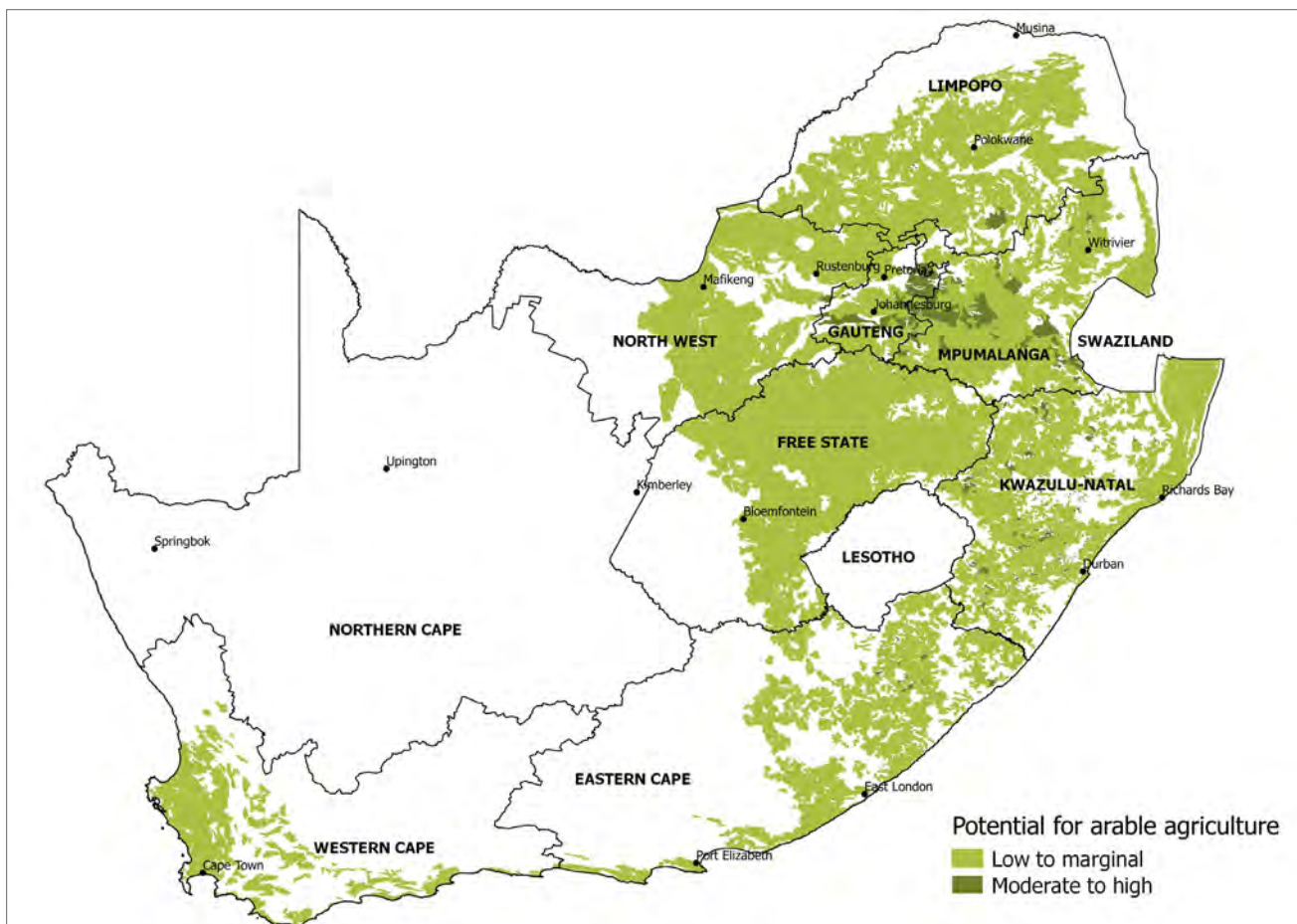
The total land area of South Africa is 127 million hectares of which 82 per cent (100 million hectares) is agricultural land. Only 14 per cent of agricultural land (14 million hectares) receives sufficient rainfall for arable crop production, while the remainder is used for extensive grazing, forestry, and wildlife/nature conservation. Only 1.35 million hectares (less than ten per cent of total arable land) are under irrigation but produces a significant proportion of the country's total agricultural output, notably in horticultural and vegetable production and viticulture (FAO 2005).

Agricultural activities range from intensive livestock crop production and mixed farming, to cattle ranching in the bushveld, and sheep farming in the more arid regions. 68 per cent of the agricultural land is mainly suitable for extensive

livestock farming, but livestock are also kept in other areas, usually in combination with other farming enterprises. Stock breeders concentrate mainly on developing breeds that are well adapted to diverse weather and environmental conditions. The livestock sector contributes almost half of all agricultural output (FAO 2005).

It can be seen from Map 6.3 that areas of moderate to high arable potential occur mainly in the eastern part of the country,

in Mpumalanga and in Gauteng. Scattered patches also occur in KwaZulu-Natal, Eastern Cape, and Limpopo. Low to marginal potential areas occur in the eastern-half of the country and in parts of the Western Cape. There are large areas in the drier parts of the country that are being cultivated. These include areas in the south-western Free State, the western parts of the Eastern Cape, and North West, but are not classified as having any potential for arable agriculture (DEAT 2006).



Map 6.3: Potential for arable agriculture

*Note: This map has been adopted from the 2006 South Africa Environment Outlook. Recent updated maps could not be found.
Source: DEAT (2006)*

6.2.4 Forestry

DAFF (2011) provides a detailed perspective on the state of the national forest assets. The following provides a brief synthesis of the current state of the forest resources in South Africa.

South Africa's forest resources are primarily classified into three main forest types according to their use, namely: natural or indigenous forests, which are valued for their high biodiversity; the wooded savannah woodlands; and, commercial timber plantations. All of these forest types play an important environmental role in soil protection (this is not in comparison to any vegetation cover e.g. native or agricultural land cover) and act as carbon sinks for storing carbon, thereby mitigating the effects of climate change.

The South African forest resources are spread over some of the poorest areas in the country, covering a land surface area of over 40 million hectares.

Natural forest types in South Africa are generally fragmented and cover a very small percentage of the country's land surface. They are estimated to cover nearly half a million (492,700 ha) or 0.4 per cent of the country's land surface. On the other hand, the forest biome is the smallest of all biomes, but constitutes the highest biodiversity. Natural forests are predominant in KwaZulu-Natal and the Eastern Cape. The extent of natural forest areas remains fairly stable, at least according to the National Land Cover data sets, though there is evidence of insignificant decline in certain areas and expansion in others (DAFF 2011). The extent and distribution of indigenous forest and woodland areas by forest type and class is presented in Table 6.2.

Table 6. 2: The extent and distribution of indigenous forests and woodland area by type and class

Natural forest type	Area (ha)	Woodland class	Area (ha)
Albany Amotale Mistbelt Drakensberg Montane	22,046.37 64,221.09 1,926.36	High Altitude Acacia	18,442,443
Eastern Cape Dune Eastern Mistbelt	10,940. 58 41,841. 86	Low Altitude Acacia	4,092,504
Eastern Scarp KwaZulu-Natal Coastal	33,750.17 21,089. 11	Ghaap Plateau	2,335,628
Kwazulu-Natal Dune Licuati Sand	12,359.89 24,275.67	Kuruman	1,294,580
Lowveld Riverine Mangrove	11,401. 28 2,392. 70	Southern Rhenosterveld	129,293
Mpumalanga Mistbelt Northern KwaZulu-Natal Mistbelt	32,772.36 5,323. 42	Waterberg	967,868
Northern Mistbelt Pondoland Scarp	19,203. 65 12,337.00	Combretum	8,390,374
Southern Cape Afrotperate Swamp	68,563.35 3,021.77	Soutpansberg	395,874
Transkei Coastal platform Transkei Mistbelt	61,484.01 30,249.74	Spekboom	1,493 ,76
Western Cape Afrotperate Western Cape Milkwood	4,731.06 2,499.74	North Succulent Mouth Succulent Mopane	1,279,392 920,317 1,230,299
TOTAL	492,699.76	TOTAL	40,971,848

Source: DAFF (2011)

The benefits derived from natural forests are difficult to express in monetary terms. However, the specialist furniture industry in Knysna, Western Cape, based on 25,000 m³ of indigenous timber per year, contributes an annual amount of R20 million to the GDP. The rate at which natural forests are declining or expanding is unknown but property development and land invasions, noticeable in some parts of the country, seem to be the major threats to our natural forests (DAFF 2011).

The largest portion of the country's forestland is made up of Savannah, which cover about 39 million hectares. This forest type covers a large land surface within the boundaries of protected areas and also occurs in communal areas. Savannahs serve as habitat for a diverse group of wildlife. The woodland Savannah provides direct and indirect benefits to the country's population due to their provision of goods and services. It mainly serves as a safety net for rural communities, providing opportunities in eco-tourism (DAFF 2011).

Apart from its known protective function, woodlands also provide for the basic needs of rural communities, especially the rural poor who are mostly dependent on forests for their livelihoods. These communities fulfil their specific needs by sourcing building materials, fuel wood, wild fruits and medicinal plants from woodlands. It is estimated that over 80 per cent of the rural communities in South Africa rely on forests biomass for fuel. There are about 28 million people who use traditional medicine and require security of supply (DAFF 2011).

These basic demands pose a serious threat towards sustainability of woodlands. It is currently estimated that 1.5 million rural households are still without electricity. This trend is expected to remain unchanged for the next 20 years and the reliance on forests will continue. It is further evident that degradation and deforestation of woodlands can also be attributed to rural poverty and illiteracy levels (DAFF 2011).

South Africa remains the third most diverse country in the world. Therefore, woodlands and forests provide the required protection to the key natural resources such as soil and water. The secondary benefit becomes the natural beauty and aesthetics that are contributed by wildlife and opportunities for outdoor recreation. The Cape Floristic Kingdom has the highest recorded species diversity of any similar-sized temperate or tropical region worldwide, making it the world's 'hottest hotspot', meaning that it is an area where high levels of species richness, endemism, and threat coincide. The Kathu Forest in the Northern Cape consists mainly of camel thorn trees (*Acacia erioloba*), and is known for its exceptional size and density of tree cover. However, literature indicates that biodiversity is under tremendous threat in South Africa, with a substantial proportion of natural habitat already having been totally transformed into other land uses (DAFF 2011).

Commercial timber plantations cover approximately 1.3 million hectares of the country, constituting about 1.1 per cent of South Africa's forest land. Over 80 per cent of timber plantations occur in the three provinces of Mpumalanga, Eastern Cape and KwaZulu-Natal. Approximately 68 per cent of the area covered by plantation estates in South Africa is

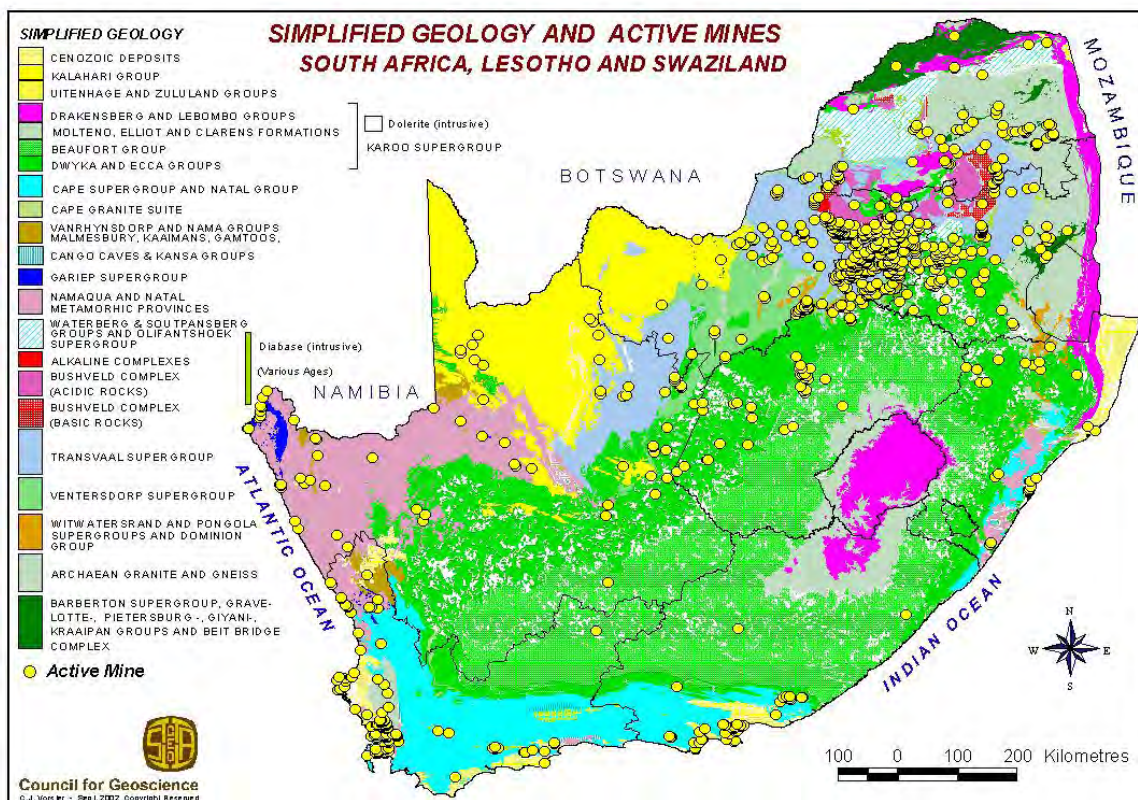
planted with exotic tree species. The balance of these estates contains natural vegetation, including natural forests that have to be protected (DAFF 2011).

It is apparent from the extract from the State of Forest Report, 2011, that forestry remains one of the critical natural assets that require attention in South Africa.

6.2.5 Mining

South Africa holds the world's largest reserves of gold,

platinum-group metals, chrome ore, and manganese ore, and the second largest reserves of zirconium, vanadium and titanium. The sector spans the full spectrum of the five major mineral categories i.e. precious metals and minerals, energy minerals, non-ferrous metals and minerals, ferrous minerals, and industrial minerals. The country furthermore has world-class primary processing facilities covering carbon steel, stainless steel, and aluminium, in addition to gold and platinum (GDACE 2008) (Map 6.4).



Map 6. 4: Simplified mining locality map

Source: Council for Geoscience (2008)

The South African mining industry is long recognized as the most prominent sector, despite the fact that it is only the sixth largest contributor to total GDP at present. It is still regarded as the largest employer.

South Africa's mineral industry, based mainly on gold, diamonds, coal, and recently, platinum-group metals, has made an important contribution to the national economy.

Gold: South Africa held its position as the world's largest gold producer in terms of extraction for more than a century. In 2009 China became the leading gold producer, while gold production in South Africa was ranked number five in the world. South African gold production decreased from 675 tonnes in 1980 to 198 tonnes in 2009, which represents a 71 per cent decrease over a 29-year period. Even though the production of South African gold has been decreasing, the output (sales) has shown an increase over the years. The output revenue of gold was R45,992 million in 2008 but increased by six per cent to R48,696 million in 2009 (StatsSA 2012).

Platinum group metals (PGM): this group constitutes a family of six chemically similar elements, which include 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). South Africa's platinum-group metal production (extraction) has increased by 138 per cent from 114 tonnes in 1980 to 271 tonnes in 2009. PGM export sales for 2008 totalled R77,904 million and decreased by 31 per cent to R53,459 million in 2009. Platinum-group metals output (sales) for 2009 amounted to R57,782 million (StatsSA 2012).

Coal: In 2009, South African mines produced 251 million tonnes of coal, which constitutes an increase of 118 per cent from 115 million tonnes in 1980. In 2008, coal production (extraction) was 253 million tonnes. Of the 2009 coal production, 185 million tonnes were sold domestically at a value of R34,463 million, with export sales totalling 60 million tonnes at a value of R30,935 million. South Africa had approximately 30,408 million tonnes of proven coal reserves,



which places the country as the sixth-largest holder of proven coal reserves in the world (StatsSA 2012).

Mining activities cover most parts of the country's land area, and are spread over South Africa based on the distribution of the various major geological formations (Map 6.4). The key areas utilized for mining, according to the Mining and Environmental Impact Guide (GDACE 2008) include:

- The *Witwatersrand Basin* and its sediments, which is the largest known repository of gold on earth but which also yield uranium, silver, pyrite and osmiridium;
- The *Bushveld Igneous Complex* with a suite of mafic and ultramafic rocks and which hosts more than half of the earth's chrome ore and platinum group metals, as well as significant deposits of vanadium, iron, titanium, copper and nickel. Its acidic rocks contain fluorspar, tin and copper mineralization whilst the aluminium-rich rocks adjacent to the Complex host vast quantities of alusite;
- The *Transvaal Supergroup* which contain enormous resources of dolomite and limestone together with more than three quarters of the world's exploitable manganese and some lead/zinc deposits;
- The *Karoo Supergroup* sediments which contain extensive coal resources used in the generation of the bulk of the country's electricity;
- *Kimberlite Intrusions* of various ages which have yielded, and continue to yield, significant quantities of diamonds;
- The *Phalaborwa Complex* which hosts the world's largest deposits of high-grade vermiculite as well as significant quantities of phosphates, copper, iron, titanium and zirconium; and,
- *Coastal dunes and sands* some of which host high-grade alluvial diamonds as well as vast quantities of titanium, iron and zirconium.

6.3 ENVIRONMENTAL IMPACTS

Land is under continuous transformation because it is host to most or all human activities. This transformation is a reflection of indicators of land resource-use trends, associated environmental issues that require attention which need to be understood and managed. Below some environmental issues and impacts associated with the land resources within the main four land use categories of South Africa are discussed.

6.3.1 Land degradation and desertification

Degradation continues to threaten the local resource-base upon which rural communal livelihoods depend. Degradation is caused by a combination of unemployment, poverty and an absence or failure of land use regulation. The degradation observed in the communal lands is thus principally a consequence of high population densities aggravated by the oppressive apartheid system rather than the outcome of traditional communal pastoralism (Wessels 2011).

6.3.2 Land cover and vegetation loss

Land cover or vegetation loss in South Africa, is both human induced and/or naturally occurring. The causes range from fire to floods, droughts, natural competition, native grazing, clearing, harvesting, ground and nutrient disturbance including erosion, biomass harvesting and salinity, for example due to grazing pressure, competing ecosystem disturbances such as invasion by introduced species and pollution poisoning.

Monitoring and evaluation reports indicate that the commercial forest areas are showing a slight decrease in area at an average rate of 0.9 per cent a year. There are various factors attributed to the decrease in size of plantation areas. This decrease can be attributed to a number of factors such as underreporting by landowners, low levels of compliance with

environmental legislation, land use changes, and improved technology used for mapping purposes (DAFF 2011).

Pests, diseases, alien invasive vegetation, and fires, particularly in plantations, threaten forest health and vitality in South Africa. For instance, reported and recorded damages by insects on plantations during 2007 alone were 2,691 ha, and dropped to 1,086 ha in 2008. The Sirex wood wasp (*Sirex noctilio*) is currently the main threat in pine plantations and is spreading northwards at 80 km per annum. The front of the infestation has reached Mbombela (Nelspruit). The tree mortality caused by the wasp was calculated to have resulted in a loss of R153 million to growers and R630 million to processors in terms of potential loss of product output. A steady increase in the incidences of pests and diseases has also been reported in native tree communities (DAFF, 2011).

Veld fires inevitably account for loss of natural assets (vegetation), environmental degradation, displacement of people and loss of biodiversity. The observed trend over the past 25 years shows that forest fires affected an average of 13,437 ha of commercial timber plantations annually with 40 per cent of the area as written-off. In the year 2007 to 2008, the plantation area burnt down was 70,000 ha annually. Trees damaged by fires are prone to diseases (DAFF 2011).

However, there are more intense pressures that can be quantified, e.g. broad-scale clearing. Less intense pressures such as changes in the fire regime, grazing by livestock, selective timber removal, firewood collection, increased soil acidity and intentional clearing of deadwood by fire, are not easily quantifiable. For example, grazing by livestock has the potential to select those palatable native species, whilst changing fire regimes can result in bushfires that lead to the establishment of invasive weed species (DAFF 2011).

6.3.3 Soil erosion and soil transportation

South Africa's soils are generally sensitive, fragile, and climatologically and topographically predisposed to land degradation through soil erosion, which is a natural process until it is accelerated by human activities such as deforestation, overgrazing, forest fires, and construction activities. Over 70 per cent of the South African land surface has been intensely affected by a variety of soil erosion. The most influential factor in land degradation remains poor agricultural or farming methods and land husbandry by both commercial and subsistence farming (Le Roux 2007).

Repeated crop failure and subsequent abandonment of less marginal lands also have important consequences for soil erosion and land degradation. It is, therefore, reasonable to expect that persistent and prolonged soil erosion processes are affecting both the plant species, which can survive in an area, and their rate of growth. Several natural events such as running water or blowing winds also trigger erosion processes.

Soil erosion also results in loss of soil productivity, increased suspended sediments in water bodies, and sedimentation in reservoirs, which consequently affect river ecosystems (Le Roux, 2007). When considered across all land use types, it is clear that soil degradation is perceived as more of a problem in KwaZulu-Natal, Limpopo, and the Eastern Cape, and less

of a problem in the Free State, Western Cape, and Northern Cape (Le Roux 2007).

6.3.4 Alien plant invasion

It is estimated that almost 9,000 plant species have been introduced so far to South Africa. Of these, about 161 species are deemed invasive and cover ten per cent of the country. Since the invasive plants grow by an estimated five per cent a year, their presence has a dramatic effects on native species and ecosystems as well as economic activities in the area. In particular, alien plant species generally consume more water than native species, which poses a major problem to many of the country's ecosystems, agriculture, and local economies. In fact, it is estimated that alien plant species consume as much as seven per cent of South Africa's total run-off (Riccardo 2011). The impact of invasive alien species is discussed further in Chapter 7: Biodiversity and Ecosystem Health and Chapter 8: Inland Water.



6.3.5 Contamination of land

When land becomes contaminated it may become hazardous to people or may no longer support the current land use. This can have major social (e.g. health risks and extreme events) and economic (e.g. loss of productive land, pollution clean-up costs) impacts that need to be mitigated.

Table 6.3 shows that there has been a consistency in the volumes of fertilizers introduced into the natural ecosystem to support agriculture, which indicates that the problem of soil contamination due to use of fertilizer has been more or less the same in the last five years.

Table 6. 3: Fertilizer sales in South Africa 2005 to 2010

Year	Physical amount	Nitrogen	Phosphorus	Potassium	Total N+P+K	NPK share (%)
2005	1,654,996	347,260	69,587	96,995	513,842	31.0
2006	2,072,877	428,719	88,913	126,963	644,595	31.1
2007	2,013,708	439,480	83,996	113,634	637,110	31.6
2008	1,862,487	424,123	80,728	92,487	597,338	32.1
2009	1,858,454	414,304	78,795	92,320	585,419	31.5
2010	1,728,362	398,192	70,828	88,299	557,319	32.2

Source: Fertilizer Society of Southern Africa (2011)

Changes in soil pH, size and composition caused by the use of fertilizers often have direct or indirect adverse effects on the chemical fertility of soils, which can lead to a decrease in soil productivity.

6.3.6 Climate change

Global warming is projected to have significant impacts on climate conditions affecting agriculture, including temperature, carbon dioxide, precipitation, and the interaction of these factors (DEA&DP 2008). Details on climate change in South Africa can be found in Chapter 11: Climate Change, but in this section it is important to note that climate change may alter agricultural productivity patterns. These are likely to cause serious consequences on crops and food security.

Predicted changes in climate are expected to:

- Modify agricultural productivity across different farming regions;
- Alter the spatial distribution of climatically suitable growing areas, with certain areas benefiting, while others may find themselves disadvantaged;
- Impose new management practices or adjustment to existing operations;
- Result in a shift in agricultural trade patterns; and,
- Identify new crop opportunities with certain crops having competitive advantages/disadvantages over others (Schulze 2007 cited in DST 2010).

6.3.6.1 Temperature, rainfall, and water resources

Temperature dictates crop production, with optimum growth rates under different upper and lower temperature limits in different seasons. A new temperature regime will affect growing locations, crop yields, planting and harvest dates, and pest or disease incidence. In addition, increased minimum and maximum temperatures imply an increase in potential evaporation, which is likely to have profound effects on dryland and irrigated crop production. Rainfall is critical to agriculture, especially the timing, intensity, and distribution of rainfall throughout the growing season.

Changes in water demand and availability for the agricultural sector will significantly affect farming activities, with western regions predicted to have 30 per cent reduced water availability by 2050 (DST 2010). As such, this is likely to cause an increase

in irrigation demand, particularly in those drier, western parts of the country. As a result, there will be a mounting pressure on water demand.

6.3.7 Field crops

Maize, wheat, and sorghum are the country's most important grain crops. Prominent commercial maize production areas are located in the Free State, Mpumalanga and North West. Wheat is largely produced in the winter-rainfall areas of the Western Cape, and to a lesser extent in the Free State (DST 2010). The greatest impact on production is expected to be in the most marginal areas, where low and irregular rainfall is already experienced. The implications of these projections are significant as many livelihoods depend upon these industries (Midgley *et al.* 2007).

Maize and wheat production is highly dependent on localized climatic conditions. A slightest increase in temperature is likely to reduce production levels by 0.5 t/ha (Schulze 2007). Wheat-producing regions in marginal areas of the winter rainfall region are expected to suffer losses of 15 to 60 per cent by 2030 to 2050, depending on the extent of warming and drying (Midgley *et al.* 2007).



6.3.7.1 Horticulture

The horticultural sector includes deciduous fruit, citrus fruit, vegetables, viticulture, and subtropical fruit. The estimated increase of 2° C in temperature will cause many agriculturally significant areas of the country to experience a 15 to 35 per

cent increase in heat units, especially in the higher-lying mountainous areas in the southern and eastern parts of the country (Schulze 2007).

6.3.7.2 Livestock and pastures

Extensive livestock farming comprises nearly 80 per cent of agricultural land in South Africa, with dairy farming being the most dominant. Any further decline in water availability in these water-stressed areas is likely to impact carrying capacity and may lead to severe livestock loss and a decline in overall productivity (DST 2010).



6.3.8 Deforestation

Deforestation refers to the loss of trees (DeBlij *et al.* 2007). This simple definition provides an outright problem with regards to the global loss of trees. The problem of deforestation is that the environmental significance and the ecological roles played by the trees and/or other types of vegetation are also lost in the process. South Africa's forests are threatened by a combination of factors including agricultural expansion, commercial harvesting, increased firewood collection, inappropriate land and tree tenure regimes, heavy livestock grazing, and accelerated urbanization and industrialization (DAFF 2011).

The rural and urban demand trend of trees in South Africa suggests that if deforestation continues, trees would have disappeared from communal areas within 20 years. The role played by the rural communities in deforestation is acknowledged but urban demand is also significant. For example, trees are currently consumed through construction, used as herbal medicine and fuel. It is estimated that almost 99 per cent of rural households use firewood despite current efforts on electrification. Tree harvesting at the current rate does not only pose a threat to rural communities, but also destroys habitat and contributes immensely to soil erosion (De Blij *et al.* 2007).

Deforestation occurs almost everywhere in the world for a variety of reasons. In most instances, as in South Africa, trees are removed in order to make way for human settlements. This is also evident in most developing parts of the world (DAFF 2011).

South African forests are important ecological assets as they provide a range of ecological, economic, and social benefits. They further provide for the protection of water and soil resources. Forests are also good carbon storage facilities,

which is later released into the atmosphere and contribute towards a reduction of greenhouse gases. Forests are also regarded as major reservoirs for terrestrial biological diversity (Niamey 2006). They also represent immense cultural values for a large proportion of the country's population. Some South African forests are home to a large variety of people and ethnicities, which originate much of their cultural value-set from their physical surroundings.

Deforestation and forest degradation produced about 20 per cent of the total human-caused greenhouse gas emissions on a yearly basis. If these emissions could be reduced, it would make a significant contribution to achieving the agreed global target of keeping global warming to below 2° C.

Greenhouse gas emissions from deforestation and other forms of forest degradation were one of the key issues facing negotiators and policy makers at the global climate change negotiations, the seventeenth Conference of the Parties (COP 17).

6.3.9 Impacts of urban development

The urban environment is a complex mix of natural elements (including air, water, land climate, flora and fauna) and the built environment (i.e. physical environment constructed or modified for human habitation and activity encompassing buildings, infrastructure and urban open spaces). Urban expansion and growth is changing land cover so that more land is changing from natural or agricultural use to an urban function.

Two environmental characteristics of urban areas should be stressed:

- The dependence of their inhabitants and enterprises on natural resources (for instance agricultural and forestry products, and freshwater) and on natural processes for breaking down or diluting wastes; and,
- The large range of environmental hazards that urban areas can concentrate.

These include biological pathogens (diseases causing agents) in the air, water, soil, or food, chemical pollutants and physical hazards. The high concentration of people and activities can mean high levels of pollution, large volumes of waste and increased environmental health risks for large numbers of people.

Details on human settlements and environmental issues within urban environments are provided in Chapter 5: Human Settlements.

6.4 RESPONSES

6.4.1 Land development, population and environment

The interrelations between population (people), environment (land use) and development (economic activities), should be understood within South African policy and legal context.

South African Constitution (No 108 of 1996): The Bill of Rights as enshrined in Chapter 2 of the Constitution recognizes the basic environmental rights within the context of socio-economic and cultural development. Section 24 of the Bill of Rights deals with the environment, but can also be understood within the context of land development or management. It states that everyone has the right:

“(a) to an environment that is not harmful to their health or well-being; and

(b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that -

(i) prevent pollution and ecological degradation;

(ii) promote conservation; and

(iii) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.”

The Constitution places legal duty on all spheres of government to take reasonable legislative and other measures in ensuring that citizens continue to enjoy their development needs or rights without compromising their environment. In essence, this has got far reaching implication on how land development should be managed.

The National Environmental Management Act (No 107 of 1998): NEMA serves as South Africa’s environmental framework legislation that guides decision-making and administrative actions concerned with the environment. The pursuit of environmental justice and equitable access to environmental resources, benefits and services to meet basic human needs is one of the main principles of NEMA.

Income Tax Act (No 62 of 1968) (the ITA): Implementation of provisions for both social and environmental rehabilitation funds, as prescribed by this Act, still present capacity challenges to Government. Section 37 (a) of the ITA aligns tax policy with environmental regulation. It regulates mining rehabilitation funds created with the sole object of applying their property for the environmental rehabilitation of mining areas, and grants a tax deduction for payments made to such dedicated rehabilitation funds. Section 37(a) requires the assets of rehabilitation funds to be strictly utilized in accordance with their objects (Strydom & McMeekin 2012).

This section was introduced in 2006 and grants a deduction from income tax to mining companies that pay cash into a rehabilitation fund which complies with section 37(a). It imposes strict rules in respect of rehabilitation funds, for example:

- The rehabilitation fund may only apply its assets for prescribed rehabilitation purposes;
- Once the rehabilitation has been completed to the satisfaction of the Minister of Mineral Resources (the Minister), the rehabilitation fund is obliged to transfer its assets to a similar company or trust, or to an account of a company or trust prescribed by the Minister and approved by the Commissioner for the South African Revenue Service (the Commissioner); and,
- Should the rehabilitation fund meet all its liabilities and have sufficient assets to perform the required

rehabilitation, it may transfer any surplus assets to another company or trust approved by the Commissioner.

It is still not clear what happens when the rehabilitation fund is no longer needed, or has fulfilled its purpose and has surplus assets. The tax implications for amending or terminating a rehabilitation fund are also not clarified.

It is a generally accepted principle that mining communities should benefit from the operations taking place in their areas. This is informed by the fact that minerals are regarded to be national patrimony and should therefore benefit the citizens. Therefore, the main challenge for local economic development is how to balance conflicting local interests.

Minerals and Petroleum Resources Development Act (No 28 of 2002): The principles in Chapter 2 of this Act emphasize the importance of population development and the environment. The Act contends that holders of mining and production rights shall contribute towards the socio-economic development of the areas in which they are operating. Chapter 4 of the Act further acknowledges that mining operations must be conducted within generally accepted principles of sustainable development by integrating economic and environmental factors into the planning and implementation of mining projects.

The Spatial Planning and Land Use Management Act (No 16 of 2013) (SPLUMA): The DRDLR has compiled the Spatial Planning and Land Use Management Bill, which was enacted into law during 2013. SPLUMA highlights the State’s obligation to realize the Bill of Rights within the Constitution which implies a land use planning system that is protective of the environment. It further states that sustainable development of land requires the integration of social, economic, and environmental considerations in both forward planning and ongoing land use management to ensure that development of land serves present and future generations.

Spatial Development Frameworks (SDFs) and Land Use Schemes: Tools for Sustainable Land Resource Management: The Bill proposes four levels of the SDFs namely, municipal, regional, provincial and national SDFs. Section 12(1)(m) enjoins the national and provincial spheres of government and each municipality to prepare spatial development frameworks that take cognizance of any environmental management instrument adopted by the relevant environmental management authority. For local spheres of government, in particular, the Bill states that SDFs must include a strategic assessment of environmental pressures and opportunities within the municipal area, including the spatial location of environmental sensitivities, high potential agricultural land and coastal access strips, where applicable.

The *Comprehensive Rural Development Programme* (CRDP) is focused on enabling rural people to take control of their destiny, with support from government, thereby dealing effectively with rural poverty through the optimal use and management of natural resources. This will be achieved through a co-ordinated and integrated broad-based agrarian transformation as well as the strategic investment in economic and social infrastructure that will benefit the

entire rural community. The programme will be successful when it becomes apparent that 'sustainable and vibrant rural communities' are succeeding throughout South Africa. A three pronged strategy to ensure that the Department achieves its objective are:

- Agrarian transformation;
- Rural development; and,
- Land reform.

6.4.2 South Africa's land administration, interventions and responses

The responsibilities for the administration of land in South Africa rest within all spheres of government. Their respective functional responsibilities are summarized herein. This brief overview summary demonstrates how government decisions regarding land are taken.

6.4.3 Land administration

The national government of South Africa has a strategic role to play for spatial planning, land use management, and land development. National government's role is thus primarily that of establishing a coherent, effective framework. Practically, local government exercises land use decision-making powers. Therefore, municipalities are playing the most direct role in spatial planning, land use management and land development.

Local government is responsible for formulating planning frameworks on which decisions on land development is based. Therefore, it is the role of municipalities to authorize and approve land development and land use changes within their jurisdictions. It is only in exceptional cases where local authorities may not approve such developments e.g. where development extends beyond the boundaries of municipalities and where the impacts have national significance (O'Brien *et al.* 2009).

Provinces support the local government, e.g. by development of joint-planning approaches to high-impact and strategically

important land development projects, or the appointment and management of land use tribunals and appeal tribunals. The system of tribunals was first introduced in the South African forestry planning system, and has since been extended and streamlined, e.g. such that today only certain types of land use applications can be decided by the land use tribunals.

The SPLUMA which has been adopted by the National Assembly positions the country to systematically reverse the legacy of poor land management and degradation. The SPLUMA proposes a wall-to-wall land use scheme for all municipalities of the country.

6.4.4 Government interventions and responses

The administration of land in South Africa, even today, is still geared towards addressing the apartheid legacy. This may be viewed as the greatest policy challenges or determination to allow equity ownership to this resource. As such, this section focuses on government efforts to address these.

6.4.5 Land reform programme

Agricultural land is primarily owned either private landowners or communal owners. Land reform is being implemented through three programs: restitution; tenure; and, redistribution. The Department of Rural Development and Land Reform (DRDLR) is responsible for creating and maintaining an equitable and sustainable land dispensation that results in social and economic development in South Africa.

The tenure reform program seeks to validate and to harmonize forms of land ownership that evolved during colonialism and apartheid. It is an attempt to redress the dual system of land tenure in which whites owned land as private property, as opposed to communal land allocation among blacks. The majority of rural blacks lived, and still live, on communal land, registered as the property of the State under the former South African Development Trust (O'Brien *et al.* 2009).



Existing statutes dealing with tenure include the Land Reform (Labour Tenants) Act (No 3 of 1996) and the Extension of Security of Tenure Act (No 62 of 1997). The latter statute intends to achieve secure tenure for rural people living on land owned by others in three ways: (i) protection of occupiers against unfair evictions while regulating the circumstances under which they may be evicted; (ii) protection of other tenure rights of occupiers; and, (iii) facilitation of the provision of off-farm settlement of farm workers (Edward 2008). The human security perspective is particularly relevant in societies confronted by multiple processes of change, such as land tenure and environmental change, and where poverty and inequity are key concerns, as is certainly the case in rural arid, semi-arid and moist areas (some of which comprise southern African savannahs) (O'Brien *et al.* 2009).

Land transfers, under both redistribution and restitution, have accelerated rapidly in recent years but still lag far behind official targets. The long-standing target for land transfer under all aspects of the land reform programme is 24.9 million ha by 2014, equivalent to 30 per cent of white-owned agricultural land in 1994 (estimated at 83 million hectares).

The total amount of land transferred under redistribution during 2006/07 (Table 6.4 and 6.5) is reported as 258,890 ha (Edward 2008). The Department of Performance Monitoring and Evaluation states that between 1994 and December 2011, 3.9 million hectares of land were redistributed through the land acquisition and redistribution programme (this is 15.6 per cent of the target of 24.5 million hectares to be in black hands by 2014).

These figures differ somewhat from the cumulative total for restitution reported by the Commission on Restitution and Land Rights (CRLR) in its own annual report, which was 1,650,851 ha as of 31 March 2007. Land transfers under the tenure reform programme (e.g. to farm dwellers and occupiers of communal land) are not specifically reported for 2006/07 (Table 6.5), but all the indications are that the figure for this category remains minimal (CRLR 2007).

According to the CRLR (2007), close to 3,000 restitution claims were settled during the year 2007. This brought the cumulative number of claims settled to about 75,000 of a total of 80,000 claims lodged (Table 6.6).

Table 6. 4: Land transferred by redistribution and restitution as at 31 March 2007

	Redistribution	Restitution	Total
Hectares	2,299 000	1,897,000	4,196,000
Percentage	54.79	45.21	100.00

Source: Edward (2008)

Table 6. 5: Breakdown of land transfers as at 31 March 2006

	Redistribution	Restitution	Tenure reform	State land	Total
Hectares	1,477,956	1,007,247	126,519	761,524	3,373,246
Percentage	43.81	29.86	3.75	22.58	100.00

Source: Edward (2008)

Table 6. 6: Land claims settled in 2006 to 2007

Year	Claims settled	Households affected	Beneficiaries affected	Land restored	Land cost	Financial compensation	Total grants	Total awards
				(ha)	(R mil)			
2006-2007	2,772	52,071	269,110	579,004	2,845	1,131	650	4,627
1994-2007	74,417	251,862	1,273,043	1,650,851	5,244	4,054	1,470	10,775

Source: DLARD (2007)

Of the cumulative total of claims settled, about 65,000 are classified as urban claims, while around 8,000 are rural. There has been much debate over the years around the consistency, and relevance, of these categories, as they are not referred to in the Restitution of Land Rights Act (No 22 of 1994) or other legislation. Most claims settled to date have been settled by means of cash compensation, rather than restoration of land, particularly in the case of urban claims. Overall, about 70 per cent of claims settled have been settled by means of cash

compensation, and 25 per cent by means of land restoration, with the remaining five per cent being settled by means of an 'alternative remedy' (i.e. developmental assistance and/or alternative land) (CRLR 2007).

For South African tenure reform to adequately address social, economic, and environmental sustainability, it must appreciate livelihood strategies targeted at the beneficiaries. It cannot be based on land policies focused on macro-

economic goals only. Therefore, land reform should target landlessness and inequality. Otherwise it carries a risk to the environment, a threat to livelihood security, and may not address overcrowding nor deliver support services (Clover & Eriksen 2009).

Land restitution might impact on the environment as it may result in a change in the type and intensity of agricultural production or any production system. In most cases, land reform beneficiaries do not have adequate resources and/or skills such that land use selection is poorly done. Under such circumstances, the carrying capacity of land is often neglected thereby leading to land degradation. Other environmental impacts would include possible ground and surface water pollution due to inadequate sanitation where beneficiaries opt for increased settlement, soil erosion due to poor agricultural practices, as well as impacts on the fauna and flora due to much dependence on natural resources for livelihood (DLA 2009).

6.5 EMERGING ISSUES

A number of land related issues that seem to have emerged during the last years are reflected herein.

6.5.1 Land restitution and land recapitalization

There is a growing pressure on government regarding land ownership and transfer to previously disenfranchised communities. Acceleration in dealing with the backlog of land transfers and coming up with some more innovative ways, including legislation, need consideration in the next few years. The challenge is in defining the rights, roles, and responsibilities associated with forest use, which are crucial for the poor to receive an equitable share of the benefits from forestry. Uncertainty also exists on the ground with regard to the powers and responsibilities of traditional authorities and local communities in the management and control of woodlands, indigenous forests and woodlots in communal areas post-1994 (DAFF 2011).

The CRDP is focused on enabling rural people to take control of their destiny, with the support from government, and thereby dealing effectively with rural poverty through the optimal use and management of natural resources. This will be achieved through a co-ordinated and integrated broad-based agrarian transformation as well as the strategic investment in economic and social infrastructure that will benefit all rural communities. The programme will be successful when it becomes apparent that 'sustainable and vibrant rural communities' are succeeding throughout South Africa. The three pronged strategy to ensure it achieves its objectives consists of:

- Agrarian transformation;
- Rural development; and,
- Land reform.

6.5.2 Climate change and rural development

The impact of climate change has a potential to affect the land use patterns and the rural development path the country is taking. More research on climate mitigation options and adaptation for rural communities still needs to be undertaken. The emphasis should be more on adaptation

for rural communities. There is also an urgent need to assess vulnerability of rural communities to the weather variability events that are taking place in South Africa.

The Department of Rural Development and Land Reform is compiling the Climate Change Adaptation Plan for Rural Human Settlement, expected to be available in August 2013. The objectives of the plan are to:

- Identify any interventions needed to ensure effective mainstreaming of climate change considerations into the policy, regulatory, institutional and communications framework of the Department;
- Develop a strategy for mobilizing the resources and developing the capacities required for implementation of the plan;
- Identify and prioritize adaptation responses in terms of climate change risks;
- Identify adaptation options that provide opportunities for job creation and alignment with existing programmes, projects, and institutional arrangements;
- Provide a strategy for management of land that builds the resilience of the most vulnerable rural households to the impacts of climate change;
- Identify areas of interdepartmental collaboration; and,
- Develop a monitoring and evaluation framework for the adaptation plan.

6.5.3 Timber shortage

Over the last few years, several studies have confirmed the fact that the country is now beginning to experience a shortage of timber. The effect of the timber shortage is already evident in some parts of the country, particularly with regard to the sustainability of local sawmilling, pulp and paper operations, and consequently poses a threat to employment opportunities and local economies (DAFF 2010).

6.5.4 Acid mine drainage

Acid mine drainage forms in mining environments when ore and waste materials, containing sulphide minerals, such as pyrite, are exposed to water and oxygen (DWA 2010). This poses a challenge in many parts of South Africa where gold mining has been taking place. The current state, extent, and uncertainty about the potential future threats to surface water or groundwater contamination, will require remedial or mitigation measures to be put in place in the next decade.

6.6 CONCLUSION

A number of conclusions can be drawn from the national status reporting on land resources and land use management in South Africa in the recent years. Key land issues have emerged or been dominant during the last decade in South Africa, issues that require serious and coherent efforts by all key stakeholders in order to be addressed.

Determining trends and changes to land presents a number of difficulties due to unavailable recent data and sufficient scientific body of knowledge of quality, regarding the land resources in South Africa over the last decade. As a result, reporting on the land resources without making some reference to SAEO (DEA 2006) has been unavoidable. There is a general reliance on old management interventions, which

may not sufficiently reflect the current thinking and threats to the land subject, as it exist.

The analysis of land data available, with specific focus on agriculture, forestry, mining, and urban land management system, has led to the following conclusions:

- Land cover data was derived from a combination of existing provincial land cover datasets and new land cover data mapped. South Africa's land cover data still requires an update, for accurate tracking of trends, priority areas for concern, and opportunities for mitigation;
- It is reported that there has been an increase (1.2 per cent) in transformed land, especially associated with urban, cultivation, plantation forestry and mining. On the national basis, the areas of urban, forestry, and mining have all increased over the 15-year period (data from the 2006 SAEO, no new data could be found). There has not been any recent land transformation data identified, to report on the most recent trends on land transformations;
- Land and agricultural production have been highlighted as critical for economic growth and poverty reduction. It has been emphasized, that most of the South African economy can gain significant mileage on agriculture and other natural resources (such as minerals) for a significant share of GDP, national food needs, employment and export revenue. The economic emphasis on agriculture, in line with the green economy discussions currently taking policy shape in South Africa, has a potential to boost the economy and alleviate poverty;
- Land degradation continues to threaten the local resource-base upon which rural communal livelihoods depend. The underlying cause of degradation is a combination of unemployment, poverty, and an absence or failure of land use regulation. Many communal areas in Limpopo, North West, Northern Cape, and Mpumalanga are also severely degraded;
- Monitoring and evaluation reports indicate that the commercial forest areas are showing a slight decrease in area at an average rate of 0.9 per cent a year. There are various factors attributed to the decrease in size of plantation areas due to underreporting by landowners, compliance with environmental legislation, land use change and improved technology used for mapping purposes;
- South African soils remain predisposed to erosion due to poor farming practices, together with erodible soils. When considered across all land use types, it is clear that soil degradation is perceived as more of a problem in KwaZulu-Natal, Limpopo and the Eastern Cape, and less of a problem in the Free State, Western Cape and Northern Cape. Soil erosion risk in South Africa follows topography and is probably overestimated in some areas with steep terrain;
- Water remains a critical limiting factor for agricultural production. This is mainly because South Africa is a semi-arid country with an average evaporation rate exceeding precipitation. As such, the agriculture sector accounts for about 60 per cent of water utilization in South Africa. Changes in water demand and availability will significantly affect farming activities; with western regions predicted to have 30 per cent reduced water availability by 2050; and,

- The government has recently acknowledged the need to improve land reform policies. In order for South African tenure reform to adequately address social, economic, and environmental sustainability, it must appreciate the livelihood strategies targeted at the beneficiaries. It cannot be based on land policies focused on macro-economic goals only. Land reform should target landlessness and inequality, otherwise it carries a risk to the environment, threat to livelihood security, and may not address overcrowding nor deliver supporting services (Clover *et al.* 2009).

6.7 REFERENCES

1. Clover, J., and Eriksen, S. (2009). The effects of land tenure change on sustainability: human security and environmental change in southern African savannas. *Journal for Environmental Science & Policy* 12 (2009) 53–70.
2. Council for Geoscience, (2008). *Strategic Water Management Plan for the Prevention of Water Ingress into Underground Workings of the East Rand Basin – Witwatersrand Mining Area: A summary for the work conducted during the period 2004–2006.*
3. CRLR (Commission on Restitution and Land Rights), (2007). *Annual Report – 2006-07.* Commission on Restitution and Land Rights. Pretoria, South Africa.
4. DAFF (Department of Agriculture, Forestry and Fisheries), (2010). *Annual report 2009/10.* Department of Agriculture, Forestry and Fisheries, Pretoria
5. DAFF (Department of Agriculture, Forestry and Fisheries), (2011). *State of Forest Report.* Department of Agriculture, Forestry and Fisheries, Pretoria.
6. DEA&DP (Department of Environmental Affairs and Development Planning), (2008). *A climate change strategy and action plan for the Western Cape Report.* Cape Town: One World Sustainable Investments.
7. DEAT (Department of Environmental Affairs and Tourism), (2006). *2006 South Africa Environment Outlook: A report on the State of Environment.* Department of Environmental Affairs and Tourism, Pretoria.
8. De Blij, H.J., Murphy, A.B. and Fouberg, E.H. (2007). *Human Geography: People, Place, and Culture (8th Ed.).* New Jersey: John Wiley & Sons, Inc.
9. DLA (Department of Land Affairs), (2009). *Draft Second Edition Consolidated Environmental Implementation and Management Plan.* Department Of Land, Pretoria March 2009.

10. Driver A., Sink, K.J., Nel, J.N., Holness, S., Van Niekerk, L., Daniels, F., Jonas, Z., Majiedt, P.A., Harris, L. and Maze, K. (2011). *National Biodiversity Assessment 2011: An assessment of South Africa's biodiversity and ecosystems. Synthesis Report*. South African National Biodiversity Institute and Department of Environmental Affairs, Pretoria.
11. DST (Department of Science and Technology), (2010). *South African Risk and Vulnerability Atlas*. Department of Science and Technology, Pretoria.
12. DWA (Department of Water Affairs), (2010). *Mine water management in the Witwatersrand Gold Fields with special emphasis on acid mine drainage*. Report to the Inter-Ministerial Committee on Acid Mine Drainage. Pretoria: Department of Water Affairs; 2010.
13. Edward, F. (2008). *Land reform in South Africa. Research Report*. Program for land and agrarian studies research report no. 38. Cape Town, South Africa.
14. ERC (Energy Research Centre): University of Cape Town January, (2008). *The supply of clean energy services to the urban and peri-urban poor*. Prepared for Global Network on Energy for Sustainable Development.
15. FAO (United Nations Food and Agriculture Organization), (2005). *Fertilizer use by crop in South Africa. Land and Plant Nutrition Management services*. Land and Water Development Division, Rome.
16. FAO (United Nations Food and Agriculture Organisation), (2012). *National Land Use Systems*. United Nations Food and Agriculture Organisation. http://www.fao.org/nr/lada/index.php?option=com_content&id=156&Itemid=184&lang=en.
17. Fertilizer Association of Southern Africa (2011). *Fertilizer Consumption in Southern Africa*. Fertilizer Association of Southern Africa. http://www.fssa.org.za/Statistics/Fertilizer_Consumption_in_South_Africa_Oct_2015.pdf.
18. GDACE (Gauteng Department of Agriculture, Conservation and Environment), (2008). *Mining and Environmental Impact Guide*. Gauteng Department of Agriculture, Conservation and Environment. Johannesburg (prepared by staff at Digby Wells and Associates, Growth Lab, and Council for Geoscience).
19. Government of South Africa, (1996). *The Constitution of the Republic of South Africa*, Act No 108 of 1996.
20. Hoffman, M.T. and Todd S. (2000). National review of land degradation in South Africa: the influence of biophysical and socio-economic factors. *Journal of Southern African studies* 26, 743-758.
21. Le Roux, J.J., (2007). Monitoring soil erosion in South Africa at a regional scale: Review and Recommendation *South African Journal of Science* Vol. 103(7-8) Pretoria.
22. Midgley, G.F., Chapman, R.A., Mukheibir, P., Tadross, M., Hewitson, B., Wand, S., Schulze, R.E., Lumsden, T., Horan, M., Warburton, M., Kgope, B., Mantlana, B., Knowles, A., Abayomi, A., Ziervogel, G., Cullis, R., and Theron, A. (2007). *Impacts, vulnerability and adaptation in key South African sectors: An input into the Long Term Mitigation Scenarios process*. LTMS Input Report 5, Energy Research Centre, Cape Town.
23. Mutangadura, G. (2007). *The incidence of land tenure insecurity in Southern Africa: policy implications for sustainable development*. *Natural Resources Forum* 31, 176–187.
24. Niamey. (2006). Niger: Tide Turning On Desertification. (11 October 2006). <http://www.allafrica.com/stories/200610110683.htm> Viewed 15 October 2011.
25. O'Brien, K.L., Quinlan, T. and Ziervogel, G. (2009). Vulnerability interventions in the context of multiple stressors: lessons from the Southern Africa Vulnerability Initiative (SAVI). *Environmental Science and Policy* 12 (1), 23–32.
26. Pretorius, D.J. (2009). . Department of Agriculture, South Africa.
27. Ros, G. (2007). *Overview of Urban Land as a commodity in South Africa: Research findings and recommendations*. Report submitted to Urban Landmark by Mathew Nell and Associates Pty Ltd, June 2007.
28. Schoeman, F. (2010). *A Population Vector-based Reporting Frame on Land Cover in South Africa (1995-2005)*. Unpublished Report no: GW/A/2010?47, ARC-ISCW, Pretoria.
29. Schulze R.E. (2007). *Climate change and the agricultural sector in South Africa: An assessment of findings in the new millennium*. ACRUcons Report 55. School of Bio-resources and Environmental Hydrology Engineering, University of KwaZulu-Natal, Pietermaritzburg.
30. StatsSA (Statistics South Africa), (2012). *Mineral Accounts for South Africa 1980-2009*. Environmental Economic Accounts Discussion Document, Statistics South Africa, February 2012.
31. Strydom B. and McMeekin D. (2012). *Mining rehabilitation funds - what if they are no longer needed?* Thoughts on Section 37(a) of the Income Tax Act. www.polity.org.za Viewed on 26 February 2012.
32. Wessels, K.J. (2011). *Rangelands: Monitoring land degradation with long-term satellite data*. Remote Sensing Research Unit, Meraka Institute and Department of Geography, University of Maryland, and Stephen Prince, Department of Geography, University of Maryland