



DRIVERS

2 Drivers of change



In using the DPSIR Framework, the 3rd SAEO Report will commence by describing the underlying social and economic activities that lead to environmental change. These are the drivers. Drivers are essentially primary or secondary driving forces that cause environmental change and determine the extent to which human activities influence the environment (Maxim *et.al.*, 2009). A driving force is a need and can be explored as the need for food, energy, housing and water. Briefly, **Drivers** and **Pressures** contribute to prevailing **States** of the environment. This enables us to predict future **Impacts** and therefore apply adaptive management practices and put adequate **Response** measures in place, to address changes in future environmental conditions.

Most resources required to address the “need” are obtained from the environment and the environment is made up of a complex set of components and interactions. The environment exists as a composition of soil, nutrients and water that provide a suitable environment for fauna and flora. All components of the environment do not work singularly, they work in complex combinations, interacting and modifying the effects of one another. Humans also contribute to and influence the complex state of the existing environment through anthropogenic means. This is undertaken through the social environment in which human activities such as agriculture, industrialisation and housing cause an observed environmental change.

The primary driving forces that are discussed are population growth and societal structures (arrangement whereby humans interact). The primary driving forces induce developments in secondary driving forces, which are human activities that trigger pressures and impacts on environmental resources.

In order to be able to maintain stability and synergy within the environment, all activities are supposed to be carried out in a sustainable manner. Sustainable development therefore, refers to the need to enhance synergy between the environment, the economy and social aspects. If one of these systems are comprised, for example reduced water availability, then the synergy is disconnected for the economic and social systems which results in lack of sustainability thereby triggering negative pressures and impacts on environmental resources.

2.1 Human population growth

Human population growth is one of the principle drivers affecting the environment and economy through dominating societal needs. The population estimates for South Africa indicate a total of 56, 522,000 (StatsSA, 2017). Continuous trends of human population growth are projected to add 2.5 billion people to the world’s population by the year 2050 (Phakathi and Sietchiping, 2015).

Figure 1 illustrates an increased rate of growth for the South African population between 2003 and 2017. The estimated overall growth rate increased from approximately 1.17% between 2003 and 2004 to 1.61% between 2016 to 2017 (StatsSA, 2017). The exponential human population growth rate provides an indication of population changes, which influences South Africa’s natural resource availability and overall environmental state.

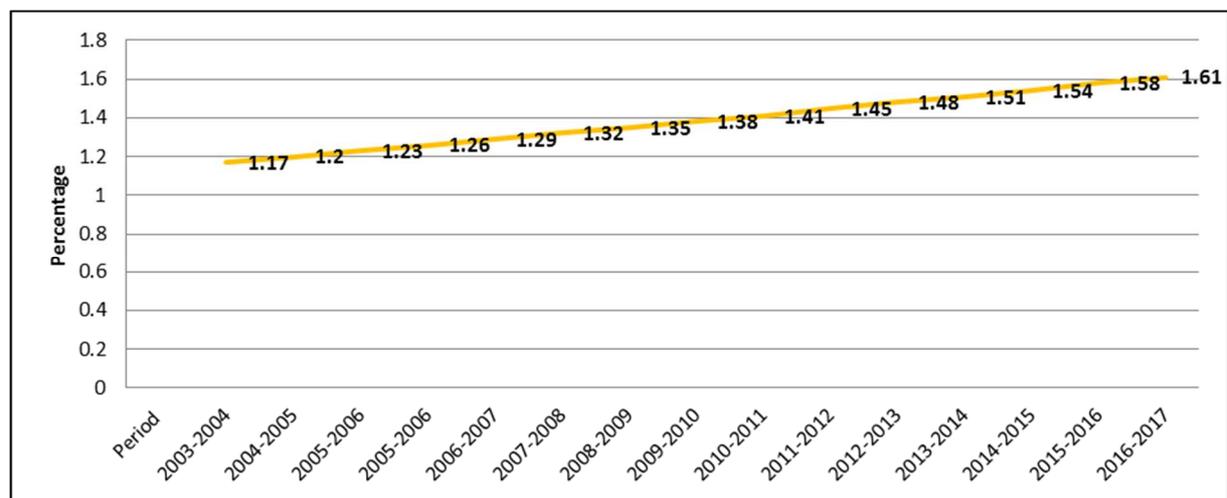


Figure 1: South Africa’s Population Growth over time 2003-2004 to 2016-2017 (StatsSA, 2017)

The growth rate of South Africa’s ageing population (the elderly identified as being 60+) is also increasing over time. As seen in Table 1, the proportion of elderly in South Africa is on the increase and this is indicative in the estimated growth rate over time rising from 1.34% for the period 2002–2003 to 2.99% for the period 2016–2017. Given the fluctuation in fertility, the growth rate among children aged 0–14 declined between 2002 and 2005 and thereafter increases between 2006 and 2017. The implications of a stronger elderly population and in increase in children aged 0 -14 has significant influence over social, economic and environmental development as well as increased needs for healthcare and transportation facilities for the elderly (UN Habitat, 2016). The increased demand for addressing an increasing populations needs has an environmental footprint such as the release of greenhouse gases and increased requirements for land for housing, agriculture, industrial development and social infrastructure development. Social development and higher living standards bring a need for increased infrastructure such as road traffic and increased domestic consumption.

Table 1: Population growth trends per age group in South Africa (Source: StatsSA, 2017)

Period	Children 0-14	Youth 15-34	Elderly 60+	Total %
2002-2003	-0.85	2.48	1.34	1.17
2003-2004	-0.50	2.35	1.45	1.20
2004-2005	-0.16	2.18	1.60	1.23
2005-2006	0.21	1.96	1.74	1.26
2006-2007	0.45	1.73	1.87	1.29
2007-2008	0.58	1.61	2.11	1.32
2008-2009	0.74	1.49	2.30	1.35
2009-2010	0.84	1.36	2.46	1.38
2010-2011	0.94	1.24	2.59	1.41

Period	Children 0-14	Youth 15-34	Elderly 60+	Total %
2011-2012	1.23	1.02	2.69	1.45
2012-2013	1.39	0.87	2.75	1.48
2013-2014	1.46	0.78	2.90	1.51
2014-2015	1.44	0.68	2.95	1.54
2015-2016	1.54	0.32	2.98	1.58
2016-2017	1.56	0.18	2.99	1.61

As discussed, human population growth has significant direct and indirect consequences on the environment. Another area capturing the influences of human population growth is that a large population has the capacity to serve as an engine to a country's economic growth and development (Gauteng Provincial Treasury, 2013). Economic growth in the industrial space however, creates environmental consequences in the form of increased water and energy consumption. Likewise, agricultural growth and practices pose significant risks on water and air pollution.

Increases in the human population not only have consequences on the environment but can also be related to increases in traffic congestion, waste generation resulting in air, water and land pollution. Broadly, the burning of fossil fuels adds to greenhouse gas emissions, contributing to air pollution and climate change concerns.

2.1.1 Uneven distribution of population growth

Error! Reference source not found. and Table 2 illustrates South Africa's human population per province. According to StatsSA (2017) population growth is increasing within South Africa's provinces. The provincial estimates indicate that Gauteng has the highest share of the human population followed by Kwa-Zulu Natal and the Western Cape. The Northern Cape has the smallest population (2.0%), followed by the Free State which has the second smallest share of the South African population, constituting 5.0% of the human population. Gauteng, having the highest human population, is also a major coal and industrial hub for South Africa. Environmental concerns in Gauteng include salinity and pollution (nutrient and physical). In lieu of this, Gauteng's water resources are under pressure. More needs to be understood spatially in relation to natural resources and the human population, since this can form the basis for establishing sustainable development.

Table 2 also represents the square kilometres of each province and the population density of each province which is determined by the number of people living per square kilometre per province (South African Market Insights, 2017). The dense nature of many large cities can also have a profound influence on anthropogenic heat emissions which is linked to wealth, energy consumption, and regional climatic conditions.

Table 2: Population density per province (2017) (South African Market Insights, with data sourced from StatsSA)

Province	Population	Percentage population (%)	Square kilometres	Population density
Eastern Cape			168 966	38.5
Free State	6 498 700	11.5	129 825	22.3
Gauteng	2 866 700	5.1	18 178	785.2
KwaZulu-Natal	14 278 700	25.3	94 361	117.3
Limpopo	11 074 800	19.6	125 755	45.9
Mpumalanga	5 778 400	10.2	76 495	58
Northern Cape	4 444 200	7.9	372 889	3.3
North West	1 214 000	2.1	104 882	36.8
Western Cape	3 856 200	6.8	129 462	50.3
Total	6 510 300	11.5	1 220 813	Average: 46.30

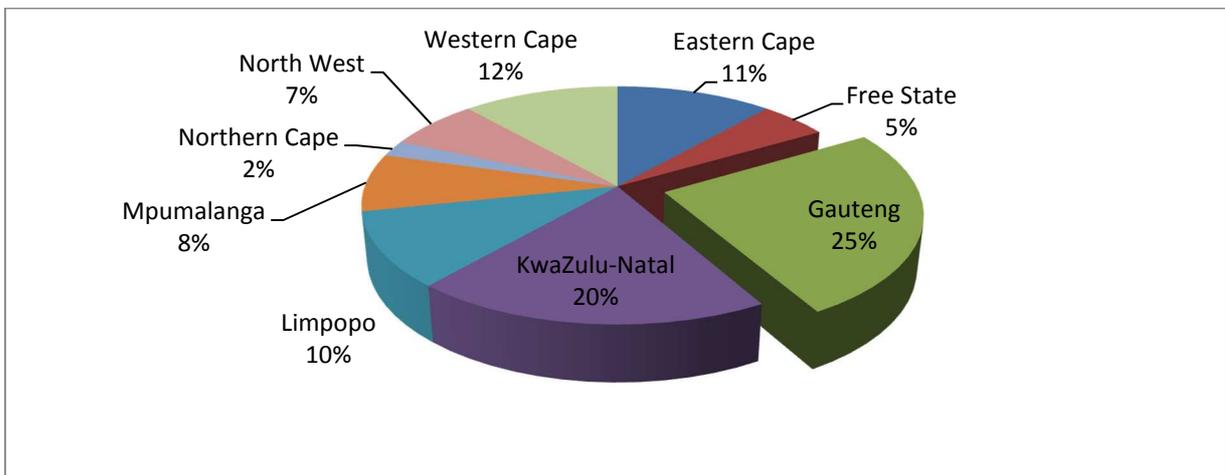


Figure 2: Population estimate at mid-year 2017 (Source: adapted from StatsSA, 2017)

Figure 3 shows spatial representation of South Africa's population density per year from 2002 to 2015. The density was determined by the number of people living in each province per square kilometre. According to South African Market Insights (2017) data, the Northern Cape has the lowest population density despite having the largest land mass. The Gauteng province has the smallest land mass and has the highest population density compared to all other provinces (South African Market Insights, 2017). There are on average about 650 people living per square kilometre in Gauteng. KwaZulu-Natal is the second most densely populated province, with figures indicating 100 people per square kilometre, whilst trends for Mpumalanga show that there are around 50 people living per square kilometre (South African Market Insights, 2017). The North West, Free State and Eastern Cape provinces have substantially low densities, whilst Western Cape and Limpopo have medium-low densities.

Provinces such as Gauteng have an influx of migrants however, insufficient infrastructure to meet the demands of the people. An increase in infrastructure development necessitates increases in land use

which results in environmental consequences. Moreover, increases in human population in Gauteng leads to increases in pollution which affects soil, air and water. A province such as the Northern Cape, which has sufficient land capability, is underutilised (DAFF, 2016a). The land is primarily earmarked as being arable land which can result degradation of land, over-abstraction of water and water quality issues. Fundamentally, uneven distribution of the human population in South Africa alludes to disparities in sustainable planning.

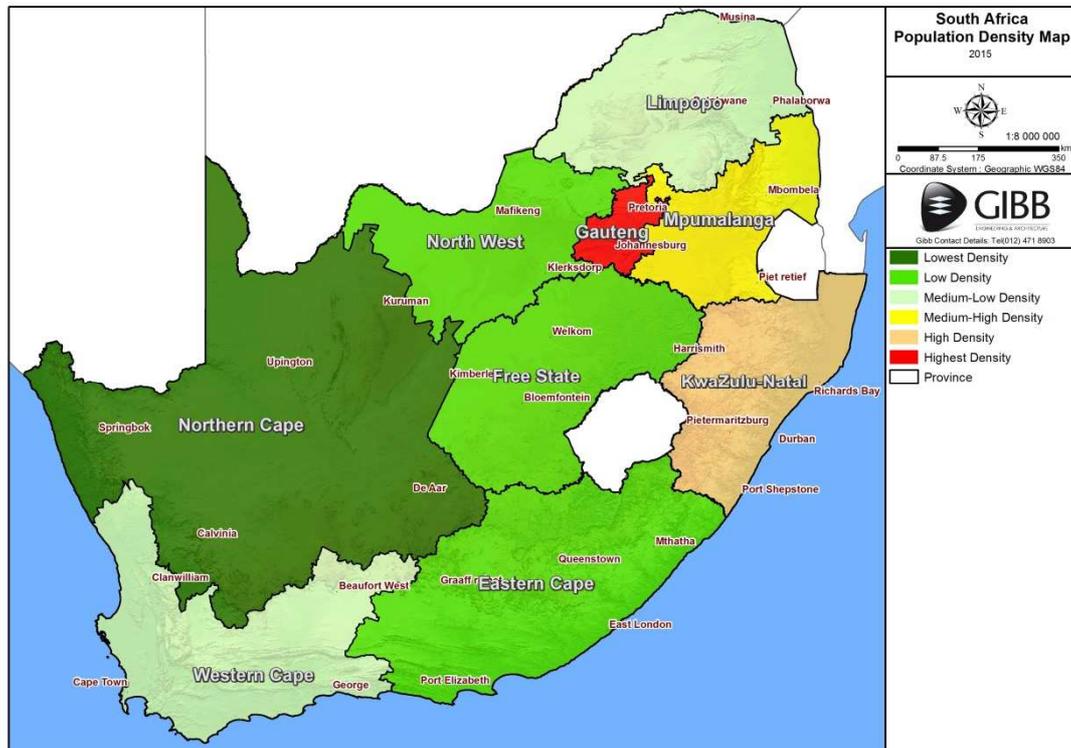


Figure 3: Population Density per Province 2015 (South African Market Insights, 2017)

What's happening at city level?

There has been evidence of increased densities across the City of Tshwane, City of Johannesburg and Ekurhuleni Metropolitan Municipality, which may have a detrimental impact in some locations (Pieterse *et.al.*, 2016). For example, in areas such as Alexandra, the mushrooming of backyard housing increased densities beyond the design capacity of the municipal services infrastructure. Some entrenched spatial patterns include concentration around economic nodes, and development concentration in key nodes and along key corridors. There has also been increasing concentration of people within urban centres and central areas of the city region. In the case of Tembisa (Ekurhuleni Metropolitan Municipality), it is centrally located between the three cities, there have been significant concentrations of people, which could be attributed to its proximity to economic nodes (Pieterse *et.al.*, 2016).

2.1.2 Migratory patterns

One of the major effects of population growth and density is migration and to some extent regional migration. According to the African Development Bank (2011), migration will become a significant part of Africa's human and economic landscape between 2011 and 2050. An understanding of

migration patterns in South Africa as well as the implications thereof is important for planning for the population of the areas to and from which people migrate (StatsSA, 2015). The White Paper on International Migration for South Africa indicates that slowing down the growth rate of migration may be impossible and that international migration may be beneficial if managed in an efficient and secure manner that is respectful of human rights (DHA, 2017). The global movement of people, information, ideas, technology and capital provides opportunities as a nation while at the same time producing risks (DHA, 2017).

International migration is driven by factors, such as socio-economic development and political instability or change. South Africa continues to attract high volumes of international visitors and migrants from all over the world. In 2011, more than 12.3 million foreign nationals arrived in South Africa, this figure increased to 15.6 million in 2016. The majority of these movements involve Southern African Development Community (SADC) nationals (DHA, 2017).

The major factors contributing towards regional migration are demographic and economic inequalities (GPG, 2016). Migration therefore remains a key mechanism for people to respond to imbalances which characterises our economy and therefore economic reasons are the main drivers of migration (DSD, 2015). Figure 7 displays that Gauteng and Western Cape received the highest number of migrants between 2011 and 2016. The Eastern Cape, Free State and Limpopo experienced net population outflows. Due to its relatively larger population size, Gauteng attains the highest number of in and out flows. In addition, the number of international migrants entering the provinces was highest in Gauteng, with Western Cape ranking second (StatsSA, 2017).

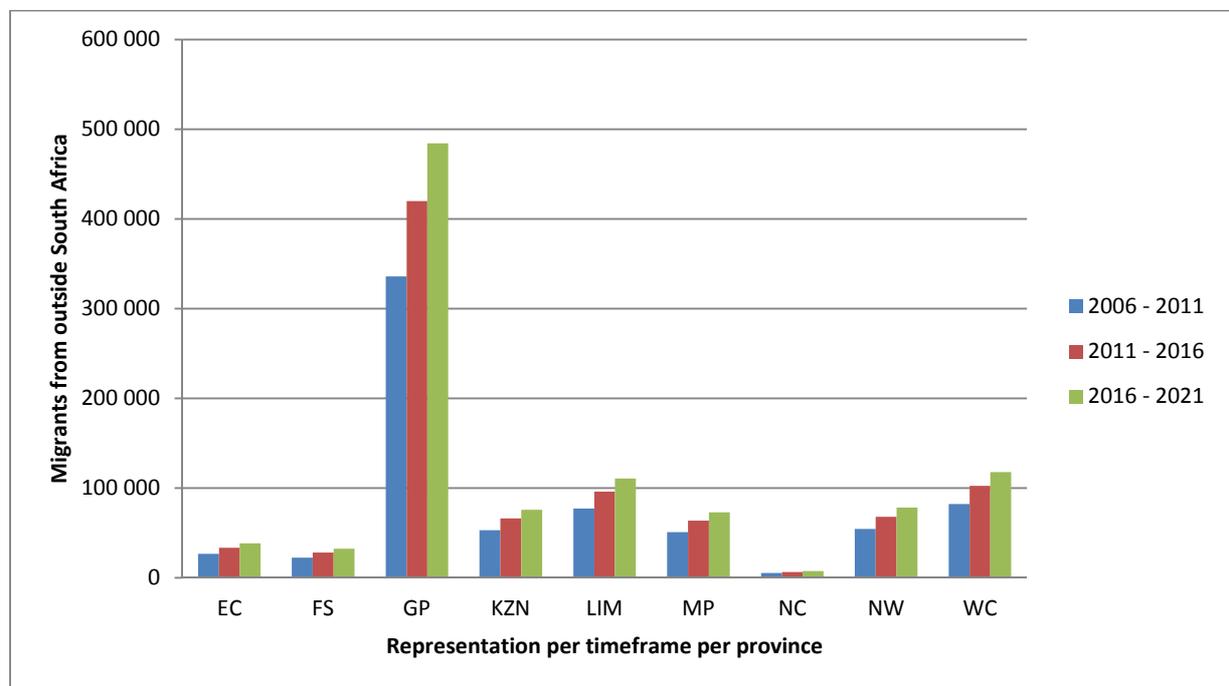


Figure 4: Migrants from outside South Africa (StatsSA, 2017)

The distribution of the provincial population, in particular, plays a significant role in relating environmental concerns at provincial levels. To this extent and as seen in Table 3, Gauteng and

Western Cape are estimated to experience the largest inflow of migrants, 1, 595, 206 and 485, 560, respectively (StatsSA, 2017).

Table 3: Estimated provincial migration streams (2016 - 2021) (StatsSA, 2017)

IN	OUT									Out-migrants	Net migration
	EC	FS	GP	KZN	LIM	MP	NC	NW	WC		
EC	0	18 240	149 693	100 139	13 830	16 501	7 928	36 915	172 401	515 647	-324 213
FS	7 952	0	82 409	8 018	6 688	10 359	9 033	23 214	12 434	160 107	-12 860
GP	49 690	43 374	0	75 313	85 180	82 199	12 552	98 714	97 853	544 875	1 050 230
KZN	23 077	12 012	236 363	0	8 235	32 772	2 788	11 007	34 576	360 830	-537 064
LIM	4 652	6 036	307 929	7 754	0	46 279	2 420	30 662	11 722	417 454	-138 606
MP	4 893	5 553	134 036	13 438	24 972	0	2 471	16 485	10 423	212 271	73 407
NC	4 501	9 100	18 519	5 834	2 722	4 460	0	13 082	18 614	76 832	5 670
NW	5 391	12 244	116 633	6 346	20 694	12 362	24 521	0	9 471	207 662	109 599
WC	52 871	8 353	64 890	14 229	5 842	7 596	13 310	8 742	0	175 833	309 729
International	38 407	32 335	484 634	76 054	110 684	73 150	7 478	78 441	118 066		
In-migrants	191 434	147 247	1 595 106	307 125	278 847	285 678	82 501	317 262	485 560		

Migration can be regarded as an instrument of development, having the potential to facilitate economic, social and political freedom in that people choose where to live and how to contribute to a particular country or region. Consequences of migration include the lack of basic infrastructure, depletion of social, natural and economic resources and the inability of the country to accommodate the needs of a growing population which also puts pressure on the receiving environment. (StatsSA, 2015). Environmental conditions too have an influence on habitat and increased stress on natural resources creates influences migratory patterns. (Alem *et.al.*, 2016). Such examples include drought and water scarcity which may result in farming communities moving away from dry and arid land (Alem *et.al.*, 2016). The need to understand migration patterns in South Africa is imperative for evaluating current socio-economic development plans of the country but it is also necessary for evaluating future strategic planning for the country. Unmanaged migration trends in South Africa can have socio-economic impacts which will affect resource efficiency and prevent South Africa from achieving climate resilience (DEA, 2016). Migration is therefore an important aspect to be considered in achieving a sustainable balance in demographic processes.

(a) Rural-urban continuum

Another major effect of population growth and density is rural-urban migration. Urban and rural spaces are generally categorised by the types of activities that occur within each land space. It is

through their functioning that they are generally treated as separate entities, with planning done at different levels. The establishment of the rural-urban continuum with regard to sustainable planning plays a significant role in the future planning, developments, formation and growth of human settlements.

South Africa continues to experience high rates of urbanisation. Since 1994, South Africa has experienced a wave of migration from the countryside to city regions in search of better employment opportunities (Wolpe and Reddy, 2015). It is estimated that more than half of humankind live in cities and the number of resident in urban areas are growing by nearly 73 million every year (UN Habitat, 2015).

Urban areas are key concentration points of people and economic activities, and are drivers of socio-economic changes, and are the principal points of growth and development (StatsSA, 2016). The trends indicate that most South Africans find themselves in urban areas with continued high rates of migration out of the northern areas/provinces and east coast towards Gauteng and the Western Cape. These patterns of movement in population exert pressure on existing housing, municipal service delivery and infrastructure resources particularly for metropolitan areas (StatsSA, 2016). In addition, this will exacerbate the fact that the majority of the new residents into urban areas will be poor (CoCT, 2012). Whilst urbanisation is occurring, environmental degradation is occurs simultaneously. Both the positive and negative environmental effects of urbanisation are illustrated in Figure 5.

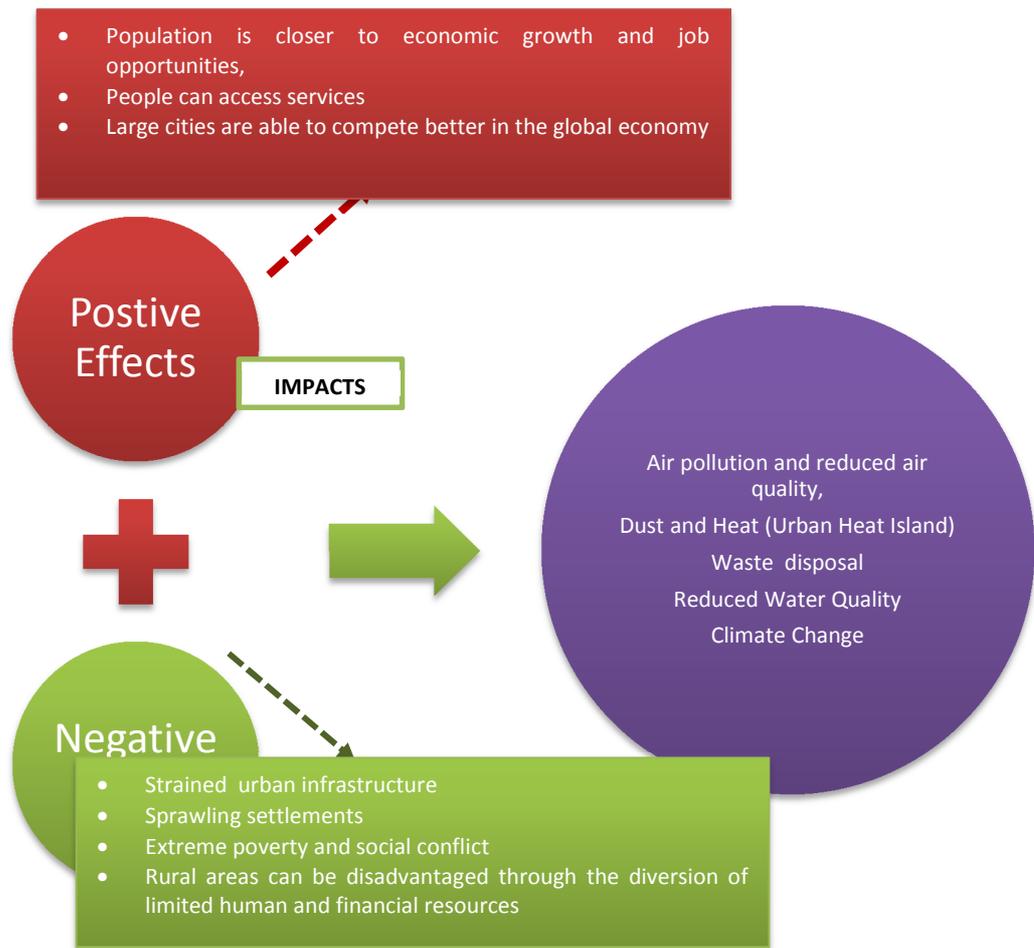


Figure 5: Effects of Urbanisation (SACN, 2016)

Despite these shifts in population, many rural areas remain densely populated, with continued extension of the built environment. This leads to the formation of assets in the form of dwellings, which lacks the expansion of economic activities and reduction of poverty (StatsSA, 2016).

(b) Population distribution in urban areas

The percentage of urban population in South Africa has grown drastically since 2005 with 59.5% of the population living in urban areas at that time. This trend has increased over the years with over 60% of the population living in urban areas. Figure 6 shows that South Africa is forecasted to reach an urban population growth of 77.4% by the year 2050 (UNDESA, 2014; Wolpe and Reddy, 2015).

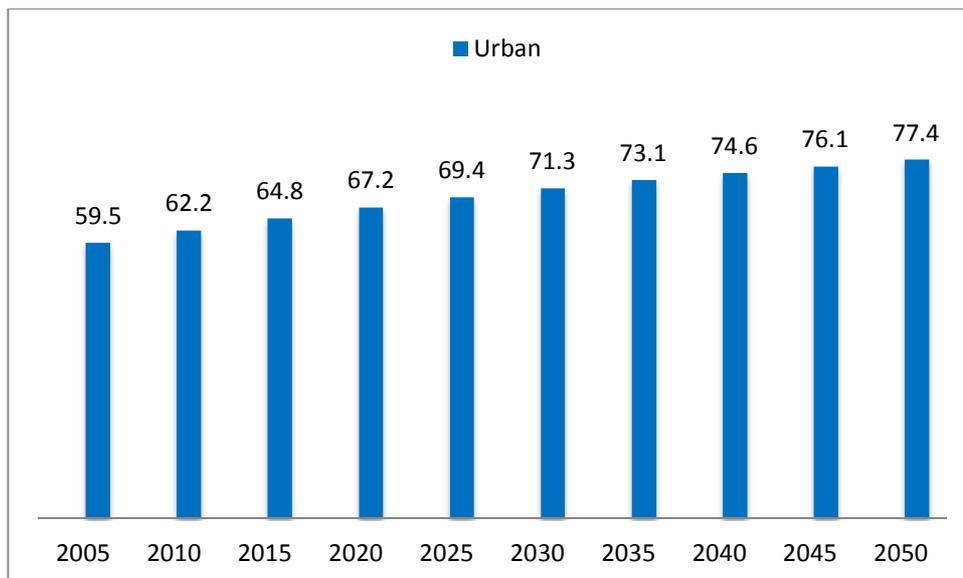


Figure 6: Percentage of Population residing in Urban Areas in South Africa 2005-2050 (UNDESA, 2014)

Whilst the growth in urban areas means that less people will be located in rural areas, a new set of pressures are introduced. These include factors such as the increase in urban footprints, the demand for land and an increased demand for food. This results in competition and demand for natural resources in many forms such as food, fodder, raw materials and fuel sources. The demand for natural resources such as water is also a factor which places increased pressure on land.

Population shifts and rapid urbanisation has resulted in human activity which has a significant impact on the environment; such as increased amounts of municipal wastewater which affects water quality, if not treated adequately, which in turn affects aquatic life and agriculture and humans who reside in these areas. The rising population is exerting pressure on the need for housing and service delivery infrastructure and resources particularly in metropolitan areas (StatsSA, 2016).

Urbanisation also leads to a sequence of physical phenomena which may result in local environmental stresses such as urban heat islands, (higher temperatures at night as compared to the rural areas in outlying areas), and local flooding which can be exacerbated through climate change. The resultant impact of urbanisation on the environment can be difficult to manage as the ecological footprints of urban areas may cross into other provinces. As such, if urbanisation is properly managed it could bring about opportunities for growth, social inclusion, and building of sustainable communities and human settlements. The impacts that result from urbanisation needs to be comprehensively planned for at all levels of government, including the city and regional level, businesses as well as communities.

(c) Population distribution in rural areas

Rural areas are losing migrants in the face of increased unemployment, job security on commercial farming lands, landlessness and overcrowding in former homelands, failing agricultural productivity, soil erosion, droughts and natural disasters such as strong flooding (DSD, 2015). Rural human settlements are vulnerable to changes in the production capacity of the land but are also extremely

reliant on natural and available scarce water resources; likewise flooding have catastrophic results for these settlements . Natural disasters are expected to become increasingly erratic with increasing changes in the climate. Figure 7 below indicates that rural population in South Africa is decreasing. However, migrants still maintain strong ties with rural areas of their origin. Although some migrants may not own permanent accommodation in urban areas, they still tend to migrate back to rural settlements and secondary cities in other provinces. This provides an indication that rural areas continue to have an importance in terms of place of security, family, history, and cultural roots.

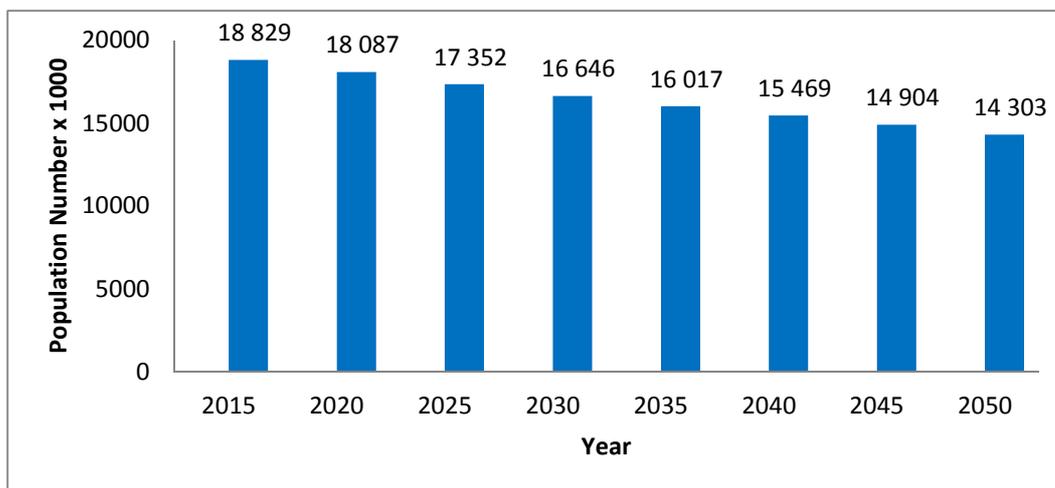


Figure 7: Population residing in rural areas in South Africa and Projections for 2050 (UNDESA, 2014)

2.1.3 Housing

The shortage of houses in South Africa is challenging and has resulted from the growing urban populations and unemployment. This has resulted in the creation of informal settlements and urban sprawl. As much as Reconstruction and Development Programme (RDP) houses were meant to address housing shortages due to urbanisation, this was not effective in addressing the housing challenges. The urban areas of South Africa face many challenges of informal settlements in hope of eventually securing employment. This results in settlements creating pockets of poverty within urban areas which exerts pressure on housing provision, basic services and transport services.

South Africans live in a wide range of housing types, which includes, formal, freestanding dwellings, apartments, formal and informal backyard dwellings and informal or squatter settlements (DoH, 2014). Informal types of dwelling are typically built with locally available materials (corrugated iron, plastics and cardboard etc.) (StatsSA, 2012), while a traditional dwelling is comprised of materials that are naturally available; such as clay, mud, reeds or other materials which are naturally available.

Figure 8 indicates that 79.3% of households lived in formal dwellings in 2016 followed by 13.9% in informal dwellings and 5.9% in traditional dwellings (StatsSA, 2016a). The highest concentration of households living in formal dwellings was observed in Limpopo (91.9%), Mpumalanga (86.5%), and the Northern Cape (84.6%) provinces respectively. Approximately one-fifth of households lived in informal dwellings in North West (20.8%), and Gauteng (19.8%). Traditional dwellings were most prevalent in Eastern Cape (22.9%) and KwaZulu-Natal (15.7%).

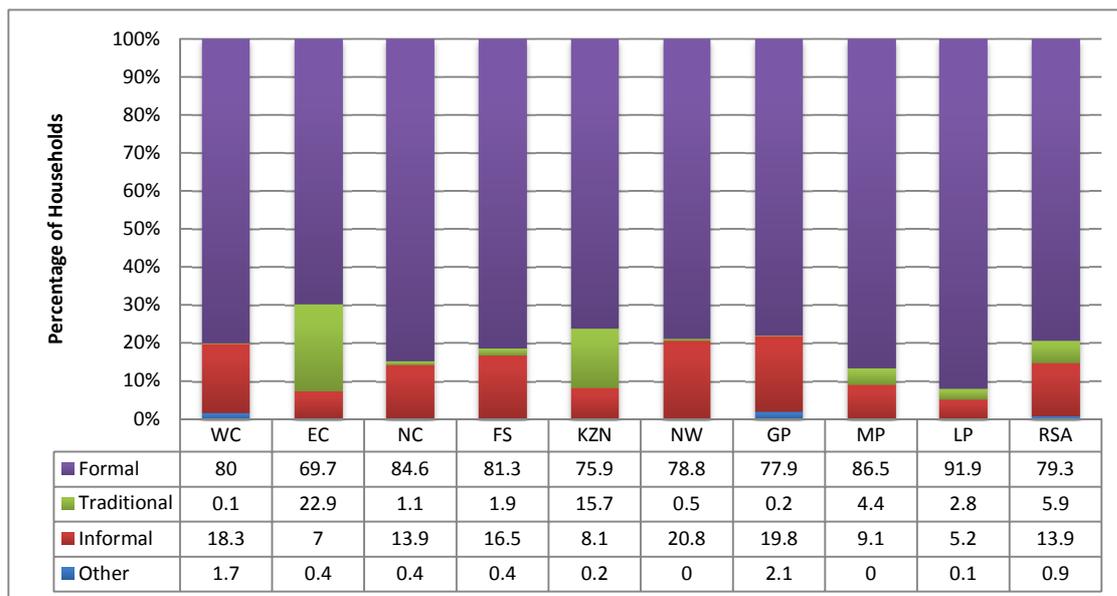


Figure 8: Percentage of households that lived in Formal, Informal and traditional dwellings in 2016 by province(StatsSA, 2016a)

Figure 9 displays an increase in formal and informal dwellings in South Africa in 2016 compared to 2007, while traditional dwellings decreased by 9.4%. This trend is in line with urbanisation trends globally and the increase in informal dwelling as shown in Figure 9 is a result of people moving into bigger city regions which supplements the need for human settlements. As a result of this, the increase in informal dwelling stems from the need for shelter.

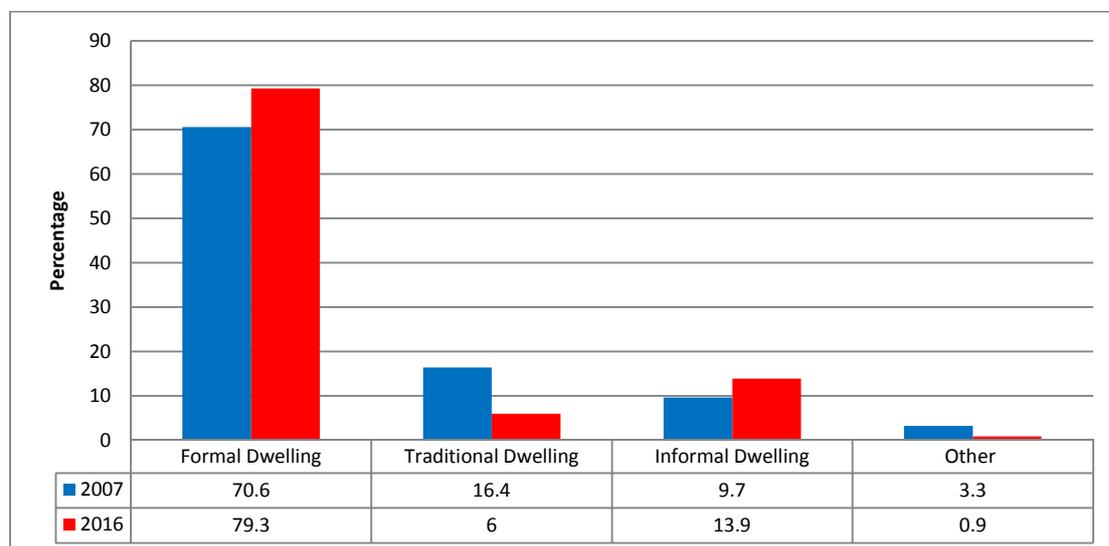


Figure 9: Main type of dwelling per household between 2007 and 2016 (StatsSA, 2016a)

High concentrations of people including infrastructure in urban areas pose a high risk of economic losses, health and safety risks, even in the event of extreme events. In rural settlements, support may be limited and these areas are also vulnerable to intensified weather patterns. Dwellings situated along South Africa’s coastline are found to be vulnerable to sea-level rise, sea storms, floods and sea surface temperature changes (DoH, 2014). Additionally, Informal settlements often practice the

burning of wood; coal and paraffin as a source of energy which can lead to health impacts and deteriorated air quality, which contributes toward climate change.

Informal housing is a challenge and is often poorly designed and in some areas located in risky grounds such as dolomite, mine dumps, and even sand dunes. In most instances, bulk infrastructure and services are often lacking the optimal requirements for health and safety (DoH, 2014). To adequately address housing needs for the non-formal dwellings (traditional, informal and other), considerations should include implications on the environment.

2.2 Economic development

South Africa is categorised as a middle-income emerging market (individuals earning average salaries) with a relatively abundant supply of natural resources. Natural resources that are of concern include water, arable and grazable land for farming activities. Some sectors, such as the financial and legal sectors, are well-developed, while other sectors such as communication infrastructure, energy and transport are inadequate to support the growing population. Moreover, technological advances are lacking where social and financial costs may be too high. An example of this is observed in the agenda where South Africa will experience a deceleration of coal-based energy versus the benefits of supplementing coal-based energy with renewable energy systems.

Economic growth has decelerated in recent years, slowing to an estimated 0.3% in 2016 (AfDB *et.al.*, 2017). South Africa, being one of Africa's largest economies took a slump in mining and quarrying which resulted in the decelerated growth. As seen in Figure 10, Gross Domestic Product (GDP) and the demand thereof is declining. The implications of such a decline are far-reaching such that existing issues are further exacerbated, such as job losses which may lead to increases in informal dwellings, resulting in the reliance on natural resources. Economic growth however, was projected to continue to be weak in 2017 before picking up moderately in 2018, as private consumption and exports rise (OECD, 2017). The South African economy grew by 2.0% in the third quarter of 2017, down from a revised 2.8% in the second quarter of 2017. Inflation has been above target, due to the rand depreciation and rising food prices, but is easing (OECD, 2017).

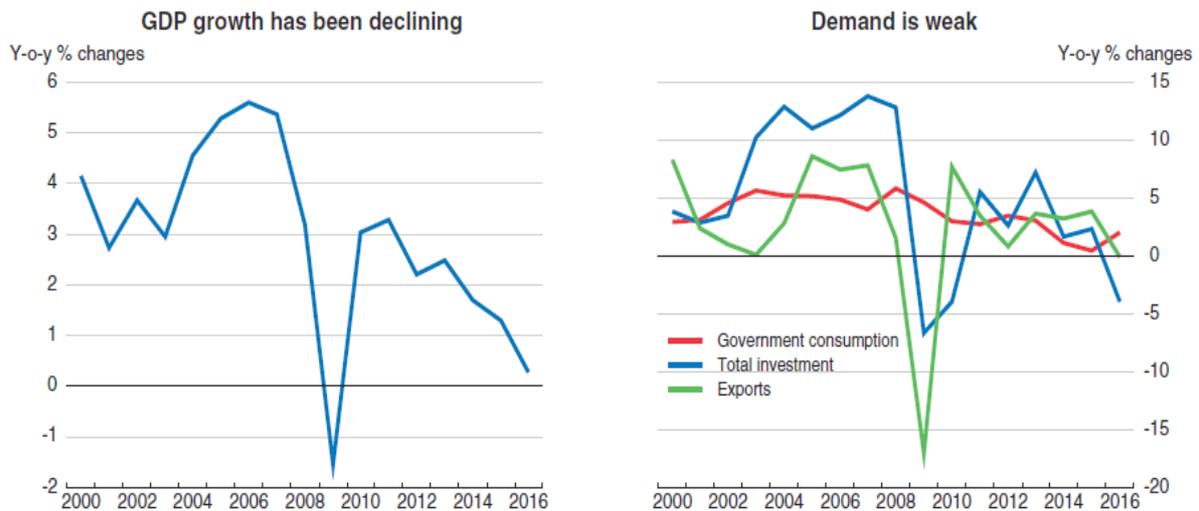


Figure 10: Gross Domestic Product (GDP) and Demand (Source: OECD, 2017)

Gauteng remains the economic heartland of South Africa, given that it generates a third of the GDP of the country. The province remains a central hub for commercial activities and is a leader for other sectors such as finance, commerce, manufacturing, Information and Communications Technology (ICT) and media (GGDA, 2014). Three of South Africa's nine provinces, Gauteng, KwaZulu-Natal and Western Cape, have contributed 65% towards the economy of South Africa, with Gauteng's contribution increasing slightly over time (David *et.al.*, 2018).

South Africa's economic policy has focused on controlling inflation; however, the country faces constraints that also limit economic growth, such as skills shortages, declining global competitiveness, and frequent work stoppages due to strike action (OECD, 2017). The government faces growing pressure from urban and rural constituencies to improve the delivery of basic services to low-income areas, to increase job growth, and to provide education at affordable prices. International investors are concerned about the country's long-term economic stability; as of December 2016, most major international credit ratings agencies placed South Africa only one level above junk bond status (CIA, 2017, OECD, 2017).

2.2.1 Poverty and unemployment

Wide inequalities based on the levels of wealth lead to different patterns of consumption and waste generation in South Africa. The poor tend to have a greater dependence on the immediate (natural) environment, whereas the wealthy often create large, unsustainable environmental footprints. For example, while the wealthiest people are able to purchase imported food thus creating a large environmental footprint; the poor do not have sufficient buying power for this luxury. The poor are largely reliant on the production of food from subsistence agriculture. The poor are also more vulnerable to environmental degradation and will bear the burden of climate change impacts. While a key feature of South Africa's developmental state is to ensure that all South African citizens have access to basic needs such as water, housing and sanitation, there are high levels of inequality and poverty, which has left a large proportion of the population without access to basic services and resources (StatsSA, 2017a).

Table 4 below depicts the poverty headcount¹ for the majority of the provinces between 2006 and 2015. On average the poverty headcounts indicate that majority of the provinces increased between 2011 and 2015, except for Mpumalanga, which had a decline over this period. Mpumalanga has been the only province to experience a decline in poverty headcounts which remained consistent, 75.0% in 2006, 72.8% in 2009, 63.8% in 2011 and the recent trends show 59.3% in 2015. Trends across other provinces indicate that there is a similar decreasing trend between 2006 and 2011 before an increase in 2015.

Table 4: Poverty Headcount by province, 2006-2015 (StatsSA, 2017a)

	Poverty Headcount			
	2006	2009	2011	2015
Total	66.6	62.1	53.2	55.5
Eastern Cape	76.6	77.1	69.0	72.9
Free State	62.0	68.1	52.4	54.9
Gauteng	44.5	38.6	30.6	33.3
KwaZulu-Natal	76.8	72.2	65.4	68.1
Limpopo	82.4	82.3	70.1	72.4
Mpumalanga	75.0	72.8	63.8	59.3
Northern Cape	74.5	69.2	58.2	59.0
North West	69.1	68.3	59.9	64.3
Western Cape	50.2	41.3	33.7	37.1

Despite the decline in poverty levels during 2006 and 2011, the levels of poverty in South Africa increased in 2015 (StatsSA, 2017a). The upper boundary poverty lines (R992 per person per month, 2015 prices), indicates that one out of every two South Africans were poor in 2015. The poverty headcount increased to 55.5% in 2015 from 53.2% in 2011. This translates into 30.4 million South Africans living in poverty in 2015 (StatsSA, 2017a).

According to StatsSA (2017a), the Food Poverty Line (FPL) is the rand value below which individuals are unable to purchase or consume enough food to supply them with the minimum per-capita-per-day energy requirement for adequate health. The lower boundary poverty line (LBPL) and upper boundary poverty line (UBPL) are derived using the FPL as a base, but also include a non-food component. Individuals at the LBPL do not have access to resources to obtain or consume both adequate food and non-food items and are therefore forced to sacrifice food to obtain essential non-food items (StatsSA, 2017a). Meanwhile, individuals at the UBPL can purchase both adequate levels of food and non-food items (StatsSA, 2017a).

¹ National poverty headcount ratio is the percentage of the population living below the national poverty lines. National estimates are based on population-weighted subgroup estimates from household survey (<https://www.indexmundi.com/facts/indicators/SI.POV.NAHC>)

Figure 11 shows poverty distribution across South Africa per local municipality. The demand for and ability of municipalities to provide basic services are influenced by income distribution amongst households (StatsSA, 2017a). Poor municipalities are often forced to confront large service delivery backlogs and have limited financial and human resources (StatsSA, 2017a). The highest headcounts of poverty were observed for Intsika Yethu (27.7%), Msinga (24.5%), Umzimvubu (24.2%), Port St Johns (23.4%), Engcobo, Ntabankulu (both 23.3%), and Mbizana (22.8%). Understanding poverty is vital as it contextualises the ability of residents to pay for services, and the ability of municipalities to deliver those services (StatsSA, 2017a).

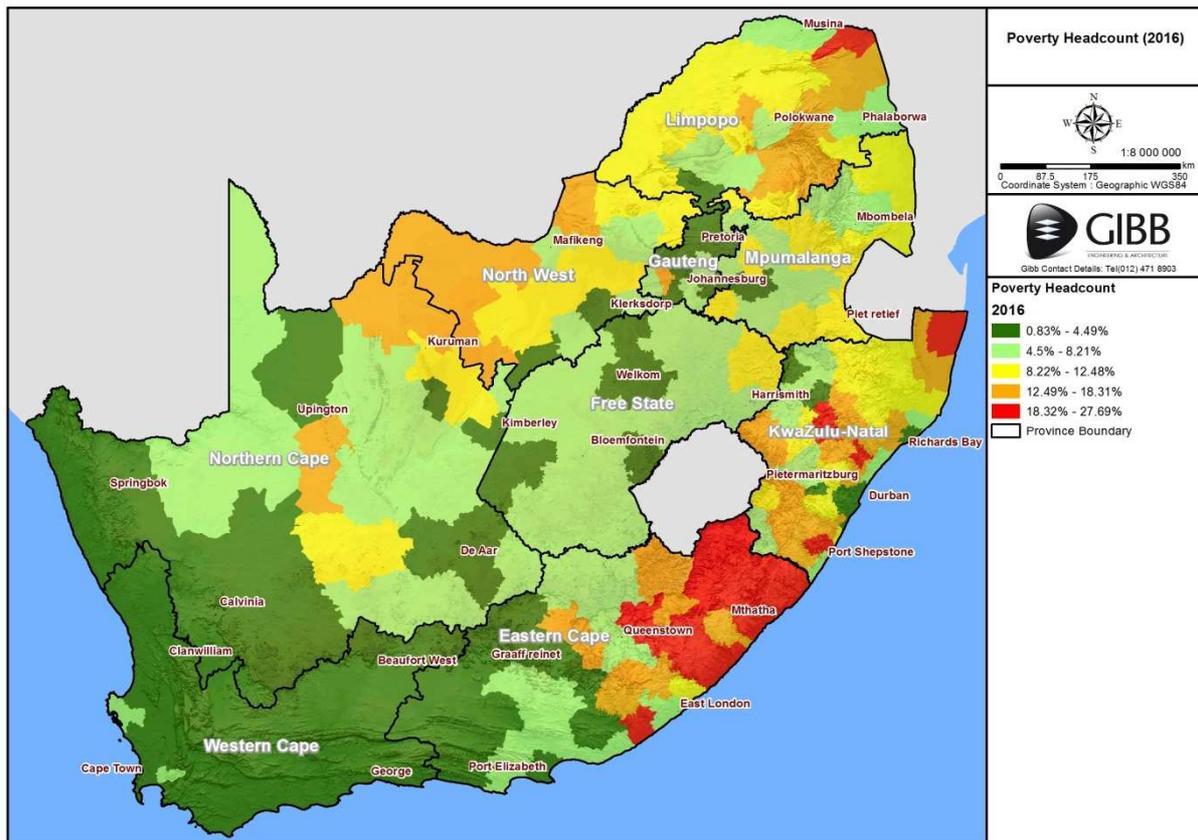


Figure 11: Percentage of household poverty by local municipality, 2016 (Adapted from StatsSA, 2017a)

Unemployment is also a factor which may contribute to poverty. According to StatsSA (2017b), the number of unemployed persons increased by 433,000 in the first quarter of 2017. On a quarterly basis the official unemployment rate has increased by 1.2% (StatsSA, 2017b). Education and skills are the key factors that remain at the centre of the country's unemployment crises (National Treasury, 2017). Unemployment amongst 18-29 year olds averaged at 43% in the fourth quarter of 2016 and according to National Treasury (2017), 75% of university graduates remain unemployed as compared to 27% who have completed matric. There are lack of opportunities to enter the labour force in order to gain experience, together with poor education and limited networks resulting in unemployment amongst young work-seekers (National Treasury, 2017).

In the first quarter of 2017, quarterly increases in the official unemployment rate were observed in four of the eight metropolitan municipalities, with the highest increase being recorded in City of Tshwane by 2.6%. As compared to quarter one in 2016, Ekurhuleni and Nelson Mandela Bay

metropolitans recorded the biggest decreases in the official unemployment rates at 3.7 and 3.1 percentage points respectively (StatsSA, 2017b).

How does poverty and unemployment affect the environment?

Despite migratory patterns into business hubs; unemployment, poverty, and inequality remain a challenge in South Africa. As a driver, these aspects have significant impacts on the environment. The reliance of the human population on the environment increases as unemployment and poverty levels increase. Reliance leads to the depletion of natural resources and the burning of fossil fuels which leads to the release of greenhouse gas emissions. Poor communities are generally unaware of the harmful ways in which natural resources are utilised, such as the deforestation and soil erosion. Another way in which the environment is affected is through water pollution which leads to changes in aquatic ecosystems and can be harmful to human health.

The drive to improve poverty often leads to infrastructure development such as housing, basic services and social infrastructure (schools). Although infrastructure development has an environmental footprint, the reliance of poor communities on natural resources is reduced, controlled or eliminated. On the other hand, infrastructure development must be designed in manner that considers the sustainability of said infrastructure.

2.2.2 South Africa's contribution toward Bio-economy

The term bio-economy encompasses biotechnological activities and processes that translate into economic outputs. In 2014, South Africa released its first Bio-economy Strategy which identified three key economic sectors: agriculture, health and industry (DST, 2013). Despite the strategy having the potential to reduce dependence on fossil fuels, increase employment in skilled areas, improve on food yields, improve economic returns on natural resources and improve technologies (closed loop farming, biorefineries processing), there are risks incurred that have the potential to create environmental concerns (WWF, 2017). The risks include increased consumption of biological resources (increased land conversion and water use, loss of biodiversity and ecosystem services), carbon neutrality, nutrient cycling, technological issues, regulatory discrepancies, food scarcity and issues around resource availability (WWF, 2017). Risks are expanded on in terms of bioprospecting in South Africa. Bioprospecting refers to the discovery and manufacturing of new products based on biological resources and uses indigenous knowledge and the confidentiality of genetic information for advancements (DST, 2013). The environmental effects of biotechnological advances should also be considered during bioprospecting.

South Africa is the third most biologically diverse country in the world and therefore has one of the largest natural capital assets and many of our resources have very good commercial potential (DEA, 2016a). The Wildlife Economy in South Africa is focussed on the sustainable use of indigenous biological resources, including biodiversity-derived products for trade and bioprospecting, the hunting industry, agriculture and agro-processing of indigenous crops and vegetables and livestock breeds and indigenous marine resources and fisheries (DEA, 2016a). Additional products with commercial potential for industrial or pharmaceutical application are micro-organisms, marine organisms, gums

and resins and venoms (DEA, 2016a). Other biodiversity-based products include bee-keeping products (honey, wax, propolis and royal jelly), mopane worms and ostrich egg shells and feathers.

The wildlife sector has been growing consistently faster than the general economy, contributing R3 billion to the GDP in 2014 (DEA, 2016a) and this should be considered a red flag for the need to assess the impacts of this on biodiversity in South Africa. The wildlife sector comprises three sub-sectors, wildlife ranching, recreational wildlife activities and wildlife products (DEA, 2016a). Wildlife ranching may have a positive influence on biodiversity although land management practices would need to be sound to ensure the land can support the biodiversity. Recreational activities such as game viewing would also have a positive influence while activities such as hunting and wildlife products can have a negative influence if not regulated and done in a sustainable manner.

The bioprospecting industry includes the harvesting of resources, processing and trade, and final domestic product. This industry could have severe negative effects on biodiversity if not regulated and conducted in a sustainable manner. Mass cultivation will contribute to loss of habitat with the land needed for cultivation, and wild individual populations are at risk if wild harvesting is not done sustainably.

Illegal bioprospecting activities

South Africa experiences a number of illegal activities that are categorised as being brown (pollution and waste), green (biodiversity and protected areas) or blue issues (integrated coastal management). Under the green issues portfolio, biodiversity compliance and enforcement was tracked and illustrated for rhino's, elephants, cycads and other species (DEA, 2017). The most profound cases are the rhinoceros. As seen in Figure 12, the number of rhino's poached began to incline in 2008. A number of these cases are as a result of international demand for rhino horns. Interventions between 2015 and 2016 have seen a small decline of 10.3% (DEA, 2017). Despite the decline of rhino's poached between 2015 and 2016, the numbers are still very high as compared to the numbers illustrated prior to 2008.

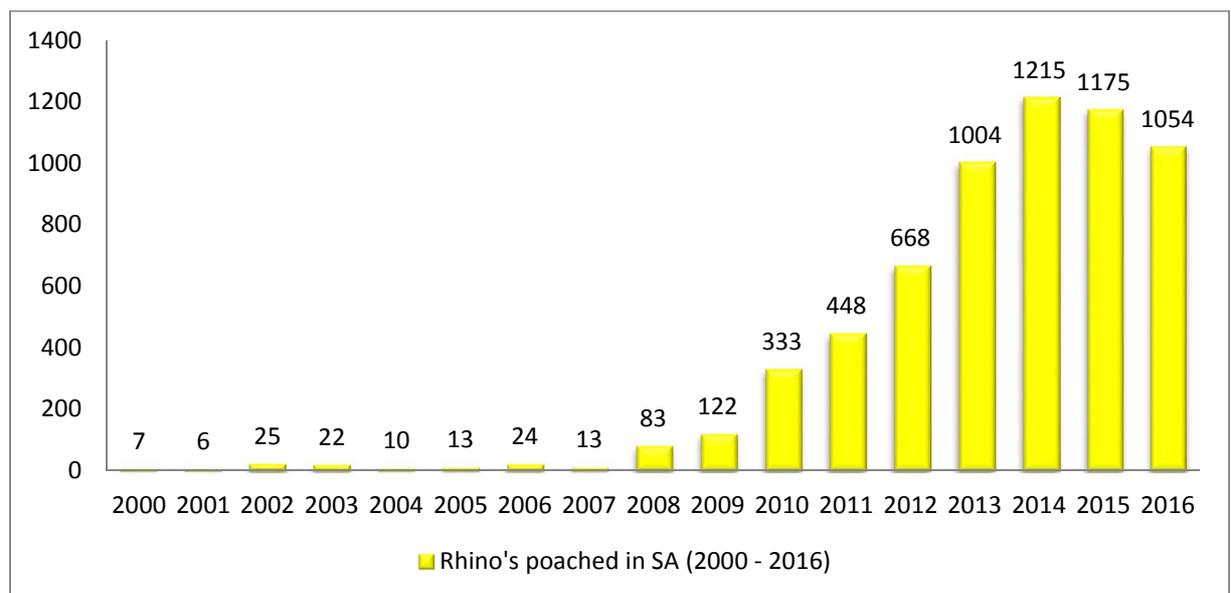


Figure 12: Number of rhinoceros poached in South Africa (Source: adapted from DEA, 2017)

Strategic thinking for framing advancements in bio-economy are supported but, at policy level more integration is required between policies to develop a more coherent vision for bio-economy (WWF, 2017). While policy related challenges exist, South Africa is still progressive in addressing land reform, which can significantly impact on food security for the country.

Progress in South Africa, since the implementation of the Bio-economy Strategy, has seen much work done in relation to waste. These technological initiatives include waste to energy, biofuels, improvements in food and feed in the agricultural sector, improvements in fine chemicals and valorisation. Despite these initiatives, there is much in terms of biotechnological advancements that could increase efficiencies while reducing the environmental risks.

2.3 The growing demand

2.3.1 Demand for food

The growing population and evidence of a decline in farm yields are contributing to a growing threat of food insecurity in, not only South Africa, but the rest of the African continent. Challenges of the rising costs of farming relating to the agricultural inputs, ineffective utilisation of available agricultural land, the increasing threat of climate change and inadequate investment in agricultural production, all pose a threat to food security (DAFF, 2015).

Similar to global trends, land for agriculture and urbanisation is fast becoming intertwined. Smallholders, for example, are spread between former homelands, urban and commercial farming areas. The vast majority of land in South Africa, form part of the former homelands, which consists of thousands of hectares of underutilised arable land (DAFF, 2015a). The Household Food Insecurity Access Scale, which is aimed at determining households' access to food, showed that the percentage of South African households with inadequate or severely inadequate access to food decreased from 23.9% in 2010 to 22.3% in 2016 (StatsSA, 2017).

2.3.2 Demand for energy

Even though the country's modern infrastructure supports a relatively efficient distribution of goods to major urban centres, unstable electricity supplies impede growth. Load shedding and resulting rolling blackouts gripped many parts of South Africa in late 2014 and early 2015 because of electricity supply constraints due to technical problems at some generation units, unavoidable planned maintenance, and an accident at a power station (CIA, 2017).

Demand growth informs planning for capacity and energy type requirements. The energy demand forecast from 2017-2022 is shown in Figure 13. The demand forecast done by Eskom for South Africa, indicates a moderate forecast with Compounded Average Growth Rate (CGAR) of 2.0% whereas the low forecast's CGAR is 0.4%, reflecting a lower than anticipated growth rate.

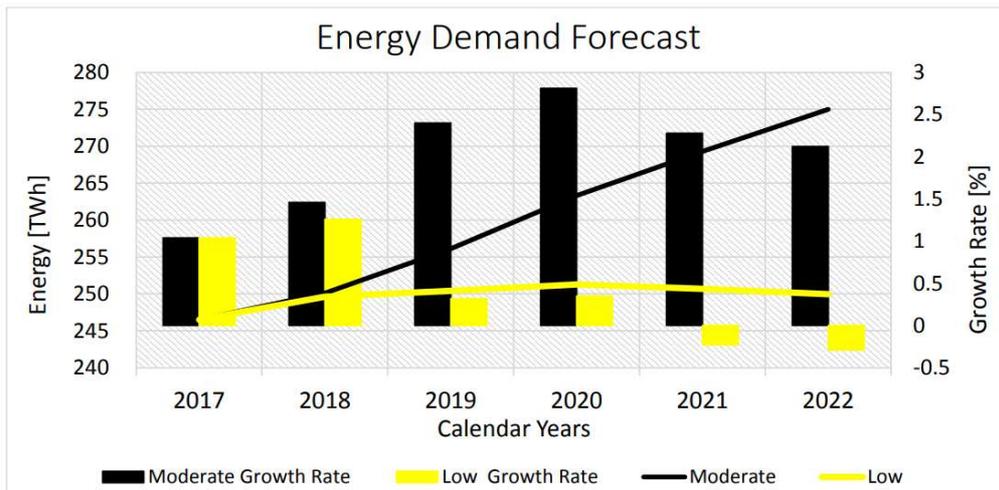


Figure 13: Energy demand forecast (Source: Eskom, 2017)

Consumption patterns as well as the amount of energy needed, household sizes, urbanisation trends and age of population influences the amount of electricity needed by a population (LEDET, 2016). As the population increases, increased electricity is needed for activities such as industrialisation, transportation as well as household activities. This places strain on the environment and its natural resources. Increased industrialisation will result in an increase in emissions released into the atmosphere over an extended period, resulting in the intensification of climate change.

The supply sources developed to meet the demand will result in various pressures on the environment, the extent of pressures will be determined by efficiencies in generation, and the source of energy used to supply this demand. Eskom's Medium Term System Adequacy Outlook (MTSAO 2018-2022) concludes that the current system is adequate to meet the demand, and has in-fact excess capacity when comparing supply to the demand compounded average growth rate of 2.0% (base case projections) up to 2022. This is attributed to Energy Availability Factor (EAF) improvements, new-build programme's commercial operation dates that were met earlier than planned, and the lower demand. Eskom reports an excess in supply capacity and the surplus may be increased if plant infrastructure is expanded beyond 50 years – a figure contested by independent studies indicating 2030 as a time horizon for some of the plant infrastructure (USTDA, 2017). Regardless, planning to accommodate for increase in demand for energy necessitates a solution that is inclusive of coal-based energy, renewable energy sources and adequate energy storage solutions. The effects of a sustainable energy mix may have implications on water consumption trends.

(a) Cost of energy

Electrification may bring about a better quality of life as households would revert from domestic burning, which would reduce indoor and ambient air pollution, and reduce domestic burning related health impacts. Yet, the provided electricity must be affordable, or more affordable than other available energy sources (Eskom, 2018).

Energy demand is related to energy efficiencies, and energy efficiency reduces cost of energy systems, thus if efficiency increases and cost reduces, demand could reduce (RSA, 2016). Energy efficiency is

vital to a country's development as efficiency affect policy goals, energy security, and sustainable economic and environmental development (IEA, 2017). Where efficiencies increase, less spending is needed on energy imports, and reduces household expense on energy (IEA, 2017).

Eskom's air quality offsets programme has found, in KwaZamokuhle in Mpumalanga, that both replacing residents old coal stoves together with housing insulation is needed with an electricity subsidy before domestic coal burning reduces. If a subsidy is provided without removing coal stoves increases the use of coal (Eskom, 2018).

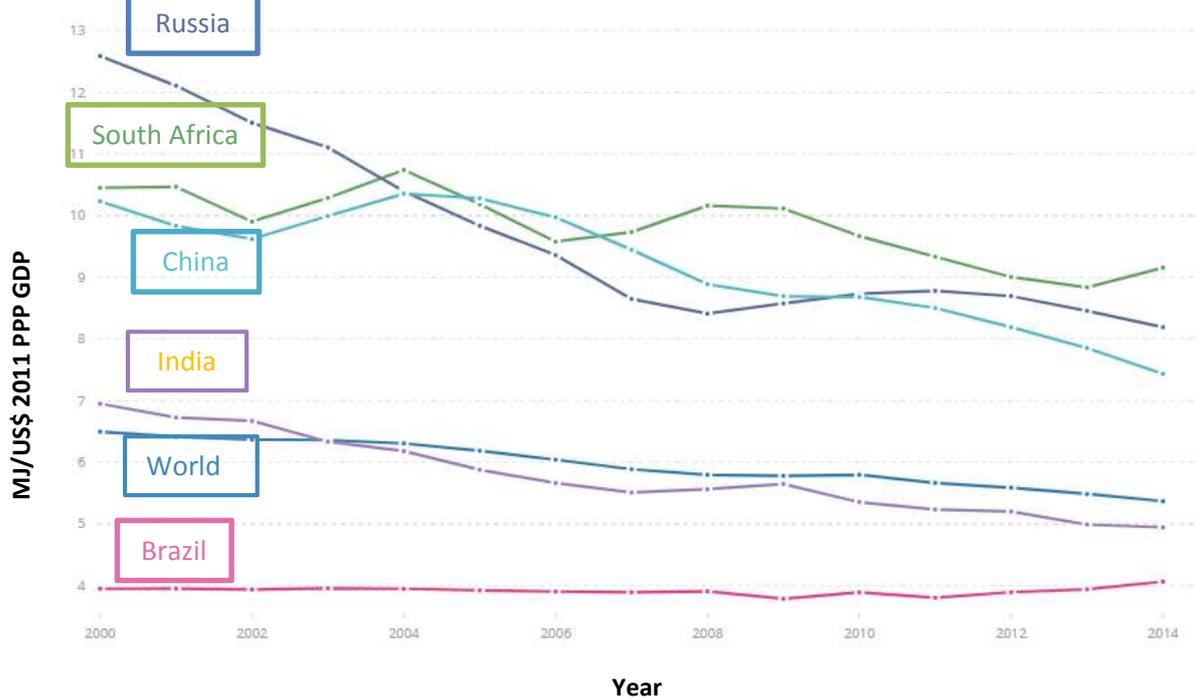
(b) Energy intensity

"The global improvement in energy intensity is the main reason why global energy-related greenhouse gas emissions have levelled off since 2014. Lower energy intensity was responsible for offsetting three-quarters of the increase in emissions due to GDP growth, with the shift to renewables and other low-emission fuels offsetting the other quarter", reports the IEA (2017). This global reduction trend has been 2.1% per year since 2010, versus average annual reduction of 1.3% between 1980 and 2010.

South Africa has made improvements in energy intensity: The trend line in [Figure 14](#) indicates these intensities measured as MJ/\$2011 PPP GDP (with respective years indicated in brackets): 10.54 (2000), improved to 9.669 (2010), improved to 8.837 (2013), but reduced to 9.156 (2014) (The World Bank Group, 2017). The overall improvement was achieved through the country's Energy Efficiency Plan, which had a target of 12% improvement on efficiency by 2015 (UNEP, 2017).

Energy is needed for economic activity, and in South Africa the energy sector contributes to 15% of the GDP, which is the world's 26th largest GDP, but South Africa ranks 16th in the world in primary energy consumption, which reflects that the country has high energy intensity, in fact the country's energy consumption per unit of GDP was double the world average in 2012 and electricity consumption per capita was 40% more than the world average (OECD/IEA, 2015). The National Greenhouse gas emissions inventory draft report of South Africa of 2017 states that this is because: the economy is dominated by large-scale, energy-intensive primary minerals beneficiation industries and mining industries. Furthermore, there is a heavy reliance on fossil fuels for the generation of electricity and significant proportion of the liquid fuels consumed in the country (DEA, 2017c). For South Africa to continue improving, Energy Efficiency Plans have to continue to prevail, and good energy efficiency policies have to be implemented, as is done in China, who's intensities are reduced at a much faster rate than South Africa's and that of the world average (IEA, 2017).

Figure 14: Energy intensity level of primary energy (MJ/\$2011 PPP GDP) (The World Bank Group, 2017)



(c) Access to energy

Access to energy improves the well-being and quality of life of people as all aspects of life depend on energy, including cooking, lighting, heating, and transportation. Access to energy improves services such as health care, and education, and importantly, it provides opportunities with which income can be generated and employment be created through delivery of services and product manufacturing (RSA, 2016). Without access to electricity, livelihoods are affected as people have to resort to alternative sources of fuel for heating and cooking, leading to domestic burning, such as biomass, coal, and paraffin, which causes direct emissions, affecting air quality in communities, and results in related health impacts.

2.3.3 Demand for water

Water resources are dwindling due to a number of reasons that are interconnected. Two major reasons are the growing human population and climate change (Ziervogel *et.al.*, 2014; Galvin *et.al.*, 2015). As indicated in Figure 15, South Africa is recognised as a “water stressed” country. In addition, South Africa is fast approaching physical water scarcity by the year 2025 (WWF-SA, 2017). As a result of water stress, South Africa walks an uncomfortable tightrope between socio-economic development and the protection of its water resources (Walter *et.al.*, 2011).

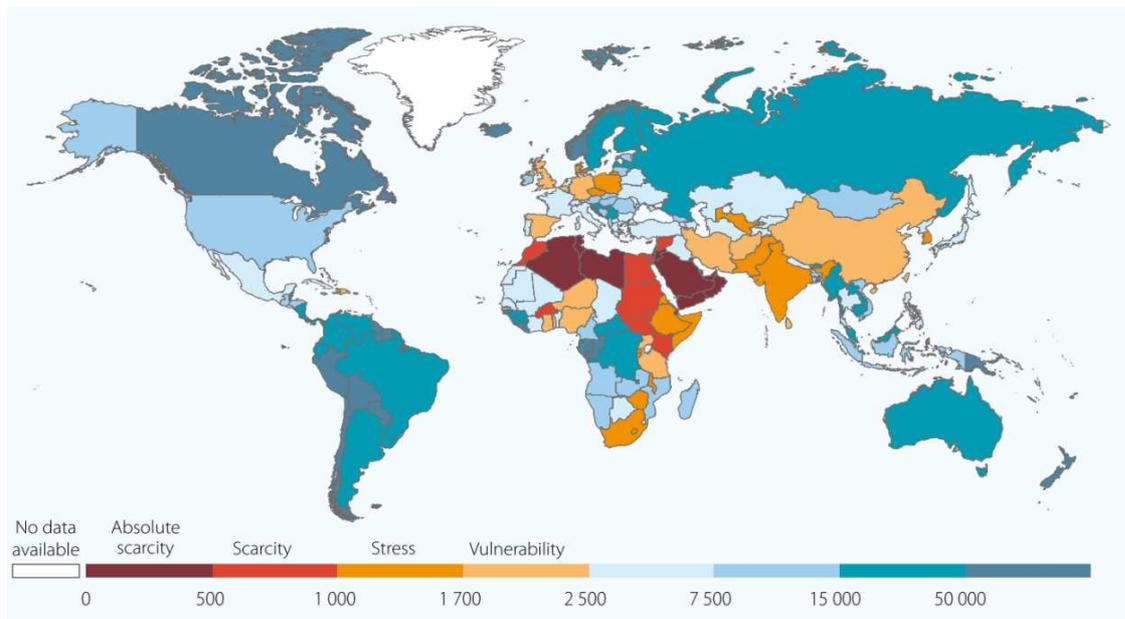


Figure 15: Total renewable water resources (per capita in m³) (Source: WWAP, 2015)

Fundamentally, human population growth drives the demand for water in various sectors such as industry (mining, and manufacturing), energy generation, agriculture, aquaculture and households. Furthermore, in a country that is at present “water stressed” due to low natural precipitation, runoff and water reservoir infrastructure, water security challenges are further exacerbated by climate change and escalating water abstraction. Water pollution is also a major problem with a wide-spread negative impact on the environment. The root of which stems from agricultural practices which also leads to soil pollution, social and industrial practices such as the use of non-biodegradable microbeads, urban and agricultural encroachment, deforestation, damming of rivers, destruction of wetlands, energy generation, accidental spillages, sewage and inadequate wastewater treatment practices.

In order to meet the demands for a growing population, increased water supply is required for industrial processes as well as for household usage to meet individual needs. The demand for water places strain on South Africa as it is already a water stressed country (Pegram and Eaglin, 2011). With the increase of climate change intensifying weather events such as drought, this will place pressure on water resources in the country.

The interconnectedness of the pressures faced by South Africa in the water space is further exacerbated by the demand-side for water. The demand for water is expected to increase annually by 1% (WWF-SA, 2017); as human population numbers increase so does the demand for water by various sectors is expedited. Apart from human population and economic growth patterns, certain parts of South Africa are already faced with growing water demands and insufficient potable water sources to meet these demands (Haigh et al., 2010; Pegram and Eaglin, 2011).

Water requirements are however, increasing as the demand for energy increases, food security becomes challenging and municipal demands for water intensify. As seen in Figure 16, increasing the supply will not be sufficient to meet the growing demand for water. Figure 16 indicates that by 2030 the gap between supply and demand increases to over 3.5km³, with a small reduction to 3.2km³ in 2035 (WRC, 2014). The modelled reduction took into consideration an expected drop in coal

production due to increased growth in the renewable energy sector. The implications of such constraints may lead to the water being over-exploited, which may have an impact on the environmental resilience of aquatic ecosystems, water quality and economic development. Although hydropower is an option for renewable energy, the water situation does not make this a viable option for South Africa.

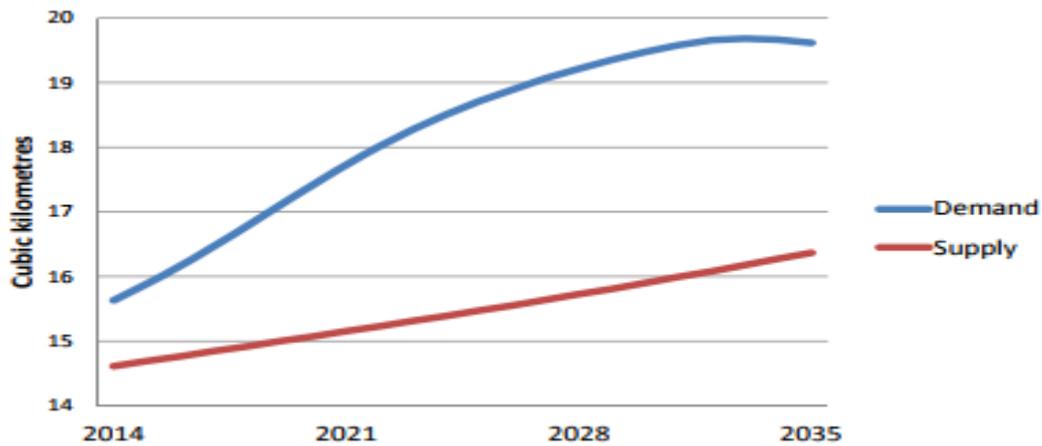


Figure 16: South Africa's increasing gap between water demand and supply (Source: WRC, 2014)

In an effort to curb demand and plan effectively for future demands, some sectors are making advances in the development on strategies. For example, growth in the energy sector is supported by the introduction of alternative sources of energy such as biogas generation (WRC, 2015/2016). Strategies such as carefully-managed water rationing and restrictions or the introduction of subsidies to incentivise the adoption of water technologies are found to be most appropriate for the industrial and agricultural sectors (WRC, 2016).

(a) Access to water services, drinking water and sanitation

According to the South African Constitution, every citizen has the right to sufficient water and an environment that is not harmful to their health or well-being, and the access to safe drinking water is seen as a basic human right (Rodda *et.al.*, 2016). Government plays an important role in providing households with basic needs such as water, food and sanitation to ensure that residents receive a good quality of life. If the provision of such services is limited, it poses a risk towards the receiving environment (GDARD, 2017). According to the South African Human Rights Commission (SAHRC, 2014), there are existing challenges in ensuring provision of water and sanitation services especially to households situated within informal settlements as they lack adequate infrastructure to support these services. In order to ensure good health and well-being for human beings, access to safe and sufficient water as well as sanitation is vital (Rodda *et.al.*, 2016).

2.4 Developmental needs and associated environmental change

2.4.1 Transport

As the population increases, demand for transport increases (StatsSA, 2013). The increased number of vehicles on the road results in increased emissions, contributing to climate change or intensifying climate change. The transport sector in South Africa constitutes largely of road passenger transport (individuals owning private vehicles), public mini-bus taxi transport, and truck freight, using liquid fuel. Access to, or vehicle ownership increased from 22.9% in 2003 to 28.5% in 2013, contributing to increased fuel consumption and related vehicle emissions (StatsSA, 2017c).

A major challenge with the increase need for transport infrastructure is that more land is required to facilitate the growing demand. From an environmental point of view, the focus is mainly placed on the components of a negative impact of transport: air pollution, noise, soil contamination, harm done to the protected natural areas, and to the landscape. It is relevant when talking about road transport because transport infrastructure usually divides an anthropogenic environment into separate “islets”, thus isolating natural territories and intervening in biological diversity. Moreover, ports in South Africa require regular maintenance; this in in the form of dredging. Dredging activities from an environmental point of view can be significantly impactful if not managed or conducted in a manner that considers aspects such as beach erosion, or alien invasive species transfer.

2.4.2 Industrialisation

Due to the need to meet the demand of a growing population, increased industrial activities are needed. Industrial activities require water and energy placing strain on the environment and its resources. Additionally, increased industrialisation results in increased release of GHGs into the atmosphere. GHG emissions trends are influenced by many factors such as population growth, energy supply, economy, as well as energy-price fluxes. GHG emissions have increased for the period 2000-2012 for South Africa; this is in line with global trends of increased GHG emissions (USAID, 2016; DEA, 2017a). Sources of GHG emissions include electricity generation activities such as coal-fired power stations, emissions from transportation, agricultural emissions and activities from industrialisation.

Economic development and the rise of middle-income earners shifts production and consumption patterns, which have a direct bearing on volumes of waste generated as well as the complexity of waste streams (ISWA, 2015). The complexity and hazard of particular waste streams, such as e-waste, pesticides, asbestos, used oil and plastic items containing heavy metals and also biomedical waste, are drivers of waste technology innovation, but add pressure to local waste management systems, since facilities for their treatment and disposal are often not in place. Increased volumes and complexity of waste streams put added pressure on waste management services and infrastructure, including storage, collection, transfer, recycling, recovery, treatment and disposal. Accelerating waste recycling, waste-to-energy and waste beneficiation will be key response actions to unlocking the possible economic opportunities in the waste sector (DPME, 2017).

Increased industrialization generally leads to increased packaging waste, more hazardous waste types, and increased electronic waste, to name a few waste pressures. This, combined with a ‘new part fitment’ approach, where it is often more expensive to repair a part in equipment or machinery than

it is to replace the whole component, results in increased waste volumes and complexity of the waste stream, as the damaged or worn part is simply removed and discarded.

2.4.3 Mining

Mining has been the main driving force behind the history and development of the South African economy. Despite being a mining and mineral-processing leader, South Africa's mining contribution to the national GDP dropped from 21% in 1970 to 6% in 2011. More recently, market values saw a decline from R560 billion in 2016, to R420 billion in 2017, marking a 25% decline (PWC, 2017). Quarter-on-quarter growth,, however showed an increase of 6.6% growth in the mining industry as a result of increased production for Platinum Group Minerals (PGMs) and gold.

Instability in the form of policy and regulatory processes continues presents challenges in the form of environmental concerns. Despite Acid Mine Drainage (AMD) being a historical and current issue, water resources are severely affected. Moreover, potential concerns relating to the mining industry include erosion, formation of sinkholes, loss of biodiversity and contamination of ground and surface water systems.

2.4.4 Agriculture

As the population increases, the demand for food increases. Increased agricultural practices are required to meet the need of a growing population. In order to meet the demand of food supply, increased agricultural and industrial practices are required.

Maize is the most important grain crop in South Africa, being both the major feed grain and the staple food for a large portion of South Africans. Maize is mainly produced in the Northwest, Free State and Mpumalanga (Baleta and Pegram, 2014). About 43% of maize produced in South Africa is white and the remaining 57% is yellow maize (DAFF, 2016). The largest contributor towards the gross value of field crops for the past five seasons is maize (48.0%), followed by sugar cane (13.2%), wheat (9.7%) and both soya beans and hay (7.4%). The two main white maize-growing provinces in South Africa, namely the Free State and North West provinces, produced about 69% of the white maize harvest in 2015, whereas the Free State and Mpumalanga provinces produced about 64% of the yellow maize harvest. The 2016 season (DAFF, 2016), following an El Niño-induced drought, the Free State and North West provinces produced only 58% of the white maize harvest as it experienced one of its poorest harvests in recent years(DAFF, 2016).

Despite the need for an increase in agriculture, the number of commercial farms in primary agriculture decreased from almost 120 000 in 1950 to around 37 000 (DAFF, 2015). Attributing to the reduction in commercial farming is the importing of cheap products and land reclamation agendas. Together with the decrease the average farm size as well as technology was found to have increased. Additionally, only 12% of South Africa is suitable for growing rain-fed crops, with only 3% of the land being fertile (Baleta and Pegram, 2014).

The estimated volume of agricultural production in 2015/16 was 1.6% less than in 2014/15. The field crop production volume decreased by 12.7%, mainly as a result of decreases in the production of summer crops (maize and sorghum), winter crops (wheat and canola), as well as oilseed crops (soya beans and groundnuts) and sugar cane (DAFF, 2016).

There is a growing threat of food insecurity, not only in South Africa, but also in the rest of the African continent. This threat is further compounded by a growing population and evidence of a decline in farm yields. The challenges of the rising costs of farming relating to the agricultural inputs, ineffective utilisation of available agricultural land (including mismanagement of natural resources), the increasing threat of climate change and inadequate investment in agricultural production, all pose a threat to food security. There is a need to coordinate and integrate all the support provided to subsistence and smallholder producers to ensure the accessibility, stability and availability of food in the context of the National Policy on Food and Nutrition Security (DAFF, 2015).

(i) Fisheries

Type of fishery	Description
Commercial fisheries	Fisheries contribute to South Africa’s economy through job creation and revenue generation. With the increase in human population, there is an increase in the necessity for food provision which results in greater pressure on the fisheries stocks. The main pressures caused by fisheries is that of stock depletion, reduction in biodiversity, by-catch of non-target species (bycatch) and habitat destruction. Fisheries and aquaculture go hand-in-hand as aquaculture also contributes to the economy via job creation and revenue generated.
Recreational fisheries	As a form of eco-tourism, recreational fishing falls into a grey area as some recreational fishing can be either consumptive or non-consumptive. Some fishers extract the fish resource from the environment while other fishers use catch-and-release methods. Some fishers even contribute to oceans science by participating in a catch and release, tagging program run by the Oceanographic Research Institute.

(ii) Aquaculture

Growth in the aquaculture industry does not deplete the natural stocks of fishery species. There are however, pressures exerted on the environment resulting from high densities of a particular species in a demarcated area. These include higher parasite loads, potential for the introduction of alien invasive parasites and the presence of alien invasive species for aquaculture purposes can result in naturalisation of said species. These are however, mostly in controlled dams.

2.4.5 Tourism

The tourism industry is busiest in summer, seeing tourists flocking to South African shores to enjoy the beaches. In 2017, almost 3.5 million travellers passed through South African ports of entry (StatsSA, 2017d). There was a drop from 2016 in the number of foreign travellers coming into the country, with SADC contributing to a significant portion of travellers to South Africa.

The tourism industry has the ability to affect the environments ability to cope in three main areas:

- Depletion of natural resources (water resources, local resources and land degradation);
- Pollution (air and noise pollution, solid waste and littering, sewage and aesthetic pollution);
- Physical impacts:
 - Physical impacts of tourism development (construction activities and infrastructure development, deforestation and unsustainable use of land, marina development)
 - Physical impacts from tourist activities (trampling, anchoring and other marine activities and the alteration of ecosystems by tourist activities)

Ecotourism has assisted South Africa in creating profitable situations, in most instances. By promoting biodiversity, South Africa's riches build the natural economy. Another benefit of ecotourism is that there are opportunities to create jobs, alleviating poverty.

Eco-tourism is a predominantly non-consumptive utilisation of the oceans and coasts (DEA, 2012). The main activities undertaken in eco-tourism at coastal areas are boat-based whale watching, SCUBA diving and shark-cage diving which all contribute to the economy. Boat-based whale and dolphin watching is an industry that was officially regulated since 1999. In 2008, 28 designated areas were allocated and in 2011, 23 operator permits were issued, which are valid for five years, which are now up for review (DEA, 2017b).

2.5 Conclusion

Human population growth is increasing exponentially in South Africa for a number of reasons ranging from South Africa being a popular destination choice for the populace in Africa as well as internationally. The number of individuals entering South Africa has seen significant increases thereby contributing to an already growing population. While international migratory patterns are only one aspect contributing to the growth of the human population, the dynamics of population growth in South Africa contributing toward the increasing numbers is also attributed to the longevity of the elderly population and the variations in the number of births. Provincially, uneven distribution of the human population sees vast numbers of regional and international migration patterns; such as those entering provinces such as Gauteng and the Western Cape. Other provinces experience a greater outflow of the human population, which highlights a great disparity where provinces such as the Northern Cape have a large land mass, with great potential, but has the smallest human population. In essence, the human population is growing, but certain provinces are seeing more growth than in others.

Rising human populations implies increases in requirements such as food, water, energy, jobs and infrastructure (housing, basic services etc.). Human population growth as well as social and economic development in South Africa lead to an increase in the demand for land. The complexities of human population growth in relation to the environment is relatively significant, if not managed sustainably. Interactions of the human population and the environment can be seen 5 issue areas:

- Land-cover change;
- Agricultural land degradation;
- Water resource management;

- Coastal management; and
- Energy and climate change.

These issue areas are detailed in the Pressures, State and Impact chapters. The major implications of the human-environment relationship are recorded in terms of the impact that humans have on the environment, which in turn has a rebound effect on human well-being.

As a result of human population growth there is a drive for increased and sustainable economic growth. Economic growth as well as changing patterns of production, consumption and service delivery rely on environmental resources. Indeed, more resources will be required to sustain both a growing population and to achieve the great strides in economic growth. Concurrently, more funds will have to be allocated to meet the demands of the South African population in terms of health services, education, energy, food, sanitation and transport. While this will contribute to a dynamic economy, undue additional burdens on the environment will also arise. Economic development necessitates growth in tourism, industrial and agricultural expansion and infrastructural improvement, which are all heavy consumers of water and energy as well as generators of waste. The increasing demand in energy results in the use of more fossil fuels for energy production, thereby releasing noxious gases into the atmosphere. Industrial development gives rise to environmental burdens through the release of harmful gases including Greenhouse Gases (GHG) and wastewater.

As a driver, human population growth plays a major role how we conduct ourselves in relation to the environment. Conservation and protection of the environment should be considered in all areas of economic development and general anthropogenic activities.

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