# ANNEXURES: DRAFT NATIONAL SPATIAL DEVELOPMENT FRAMEWORK

## SEPTEMBER 2018

**NSDF**
national spatial development framework

rural development & land reform
Department:
Rural Development and Land Reform
REPUBLIC OF SOUTH AFRICA

planning, monitoring & evaluation
Department:
Planning, Monitoring and Evaluation
REPUBLIC OF SOUTH AFRICA

NDP 2030

# Contents

# Annexure A: Supportive Information on Spatial Models

This Annexure is not exhaustive and only provides limited information in support of the NSDF 2018 report.

## Regional Spatial Frame, Indicators and Settlement Pattern Model

The Mesozone set is a demarcation of South Africa into a complete grid of 25 000 spatial units. These mesozones are not uniform in shape but aims to be approximately the same size (~50km2). These mesozones were created in such a way that they fit completely within the current municipalities and other significant geo-economic and historic area demarcations. The zone boundaries correspond with major travel barriers (such as rivers) as well as 'break lines' between sparsely populated areas (such as mountains) and areas with medium to high levels of human activity (such as fertile valleys or built up areas).The various datasets are assigned to mesozones based on an algorithm developed by the CSIR and which is based on the principles of dasymetric mapping. An approach based on dasymetric mapping principles is used to calculate population distribution. The 1996 (EAs), 2001 (SPs), 2011 (SPs) and 2016 (SPs) population figures are the input data for the respective years which are then re-aligned to the mesozones to create a comparable time series data set. The Spot Building Count (SBC), ESKOM being the data custodian, is used as the secondary dataset to predict the underlying statistical service of the origin data.

The GVA data for the different economic sectors are produced on local municipal level by Quantec. The municipal level data is then assigned to the mesozones using the principles of dasymetric mapping where secondary data representing the potential points where production is occurring are used to re-assign the economic production data to the mesozones. he total employment index per mesozone is derived from the GVA index discussed above.The way in which this was calculated was by firstly calculating the ratio of the of GVA production per sector to the employment figure per sector for each local municipality. The employment and GVA data for the different economic sectors are produced on a local municipal level by Quantec. This factor is then multiplied with the economic production values per mesozone.

Over the last couple of years, the CSIR, together with a number of other role players, has invested in building capability to provide spatial planning, analysis, modelling and platform support to government, with a focus on strengthening strategic regional, inter-regional and intergovernmental planning, resource allocation and monitoring and evaluation in South Africa.

In 2015 the updated CSIR/ SACN functional settlement typology was published that provided a mechanism to identify, calculate and analyse a set of development information and trends pertaining to the range of towns and cities, as well as high density rural settlements across South Africa. It enabled an understanding and analyses of the network of settlements, towns and cities and the hierarchical and functional relationships between them, especially related to government and economic service provision and migration. Given the fact that spatially comparable administrative information covers wall-to-wall municipal jurisdiction areas, the functional town area demarcation and town profiling was used extensively as basis to describe and compare cities

and towns across South Africa, as well as town growth trends in support of government policy. This inter alia includes use within the Chapter 8 in the NDP, 2012; the IUDF, 2015, the SACN SOCR, 2016 and DRDLR Social Facility Toolkit, 2016.

In February 2018 CSIR made available an update and rework of the settlement typology, that included:

- updated socio-economic indicators on the CSIR Meso-Frame to 2016;
- an indication of potential roles of towns within their regional contexts, based on an analyses of national and regional gateways and anchors conducted with Economic Development Department in 2014;
- a finer description and identification of small towns and growing rural settlements, considering their service role in local hinterlands not merely their population size. This was informed by the CSIR Social Facility Settlement Prioritisation, 2016; DRDLR Social Facility Toolkit, 2016 and SALGA Small Town Regeneration Programme, 2017-2018;
- The typology were also updated to include new and growing settlement areas by using the unique CSIR Settlement Footprint created in support of the CSIR Green Book, 2018. In this process, the built up area of each settlement had been demarcated using a combination of satellite imagery, housing point data and fine grained statsSA population data sets, clearly demarcating built up areas that enable more accurate calculation of population and profiling of settlement dynamics.

The typology enables calculating the population and the economy of functional town areas, comparing town areas relative to non –town areas and exploring regional and spatial inter-relations. It also enables temporal and spatial comparison regardless of boundary area at regional scale. For access to spatial frame, and socio-economic indicators, see http://stepsa.org/socio_econ.html#Indicator . For access to CSIR South Africa Functional Town Typology, see van Huyssteen, E. Green, C. Sogoni, Z., Maritz, J. and McKelly, D. South African Functional Town Typology (CSIR 2018 v2). Available at http://stepsa.org/socio_econ.html#Indicator

# Population Projections and Spatial Location Modelling

Population projections and location specific scenario modelling for South Africa has been undertaken by the CSIR which has been made available to the NSDF (CSIR/IRDC Green Book on Climate Change Adaptation 2018) and used to explore the most likely spatial implication of population projection scenarios for low and high in-migration scenarios. This considers population growth as well as migration patterns and spatial locational attraction.

Utilising the CSIR Green Book Project Population Growth Projections (2018) for the NSDF enabled:

(1) Utilising **South African context specific and scientifically verified national population growth projections at country level up to 2050 for two growth scenarios** (a medium and high growth scenario – both verified with expert reference groups).

(2) It also enabled utilising the **downscaled medium and high population growth scenarios at provincial and district scales**, developed through the CSIR Green Book Project **to understand most probable regional growth pressures for 2035 and 2050**.

(3) Utilising the novel and innovative **settlement growth model** – developed by the CSIR to derive settlement level population projections. This model has been developed to utilise provincial and district scale population growth projections to model settlement growth. The model utilises a highly innovative gravity model, based on "population potential". The latter is a measure of the "attractive force" of a particular grid cell for further population growth. The expectation of different rates of change for the different settlement types was accounted for in the model

making use of the spatial attraction of existing agglomeration economies and concentrations, using the CSIR Functional Town Typology, 2018 and CSIR Open Settlement Footprint, 2017 as basis.

(4) The **results of the Population Projections and CSIR Town Growth Model was used in the NSDF 2018** as a **"Without Intervention National Settlement Scenario" to determine most likely growth pressures for settlements in South Africa.**

(5) The "Without Intervention National Settlement Scenario" and model results were used to **construct an alternative "NSDF Settlement Scenario" and envisaged sustainable national settlement growth outcome.** This alternative NSDF Settlement Scenario was informed by significant the national development objectives, the national spatial vision, the national spatial development concepts, outcomes as attractors and global and national risks as push factors.

The CSIR Green Book modelling approach, inputs and high level results are set out in Figure 1.

The model uses the CSIR Green Book Population Projection. Prof L. van Tonder, the lead expert for the CSIR, 2018 Projections has been proven to be consistently accurate over time if compared to World Bank and United Nations Projections. The modelled national population projection is indicated in Figure 2. High and medium scenarios refer to international in-migration scenarios. National population projections clearly illustrate the need to plan for at least a 30% increase in population by 2050, with the medium scenario indicating a population of 75 million by 2050 and a higher in-migration scenario, a population of 80 million by 2050. This can have significant spatial implications, with population projected to grow primarily in urban core and secondary cities and large towns.

CSIR, 2018 National level projections and multi-scale modelling approach to enable South Africa's first national scale town/city level projections
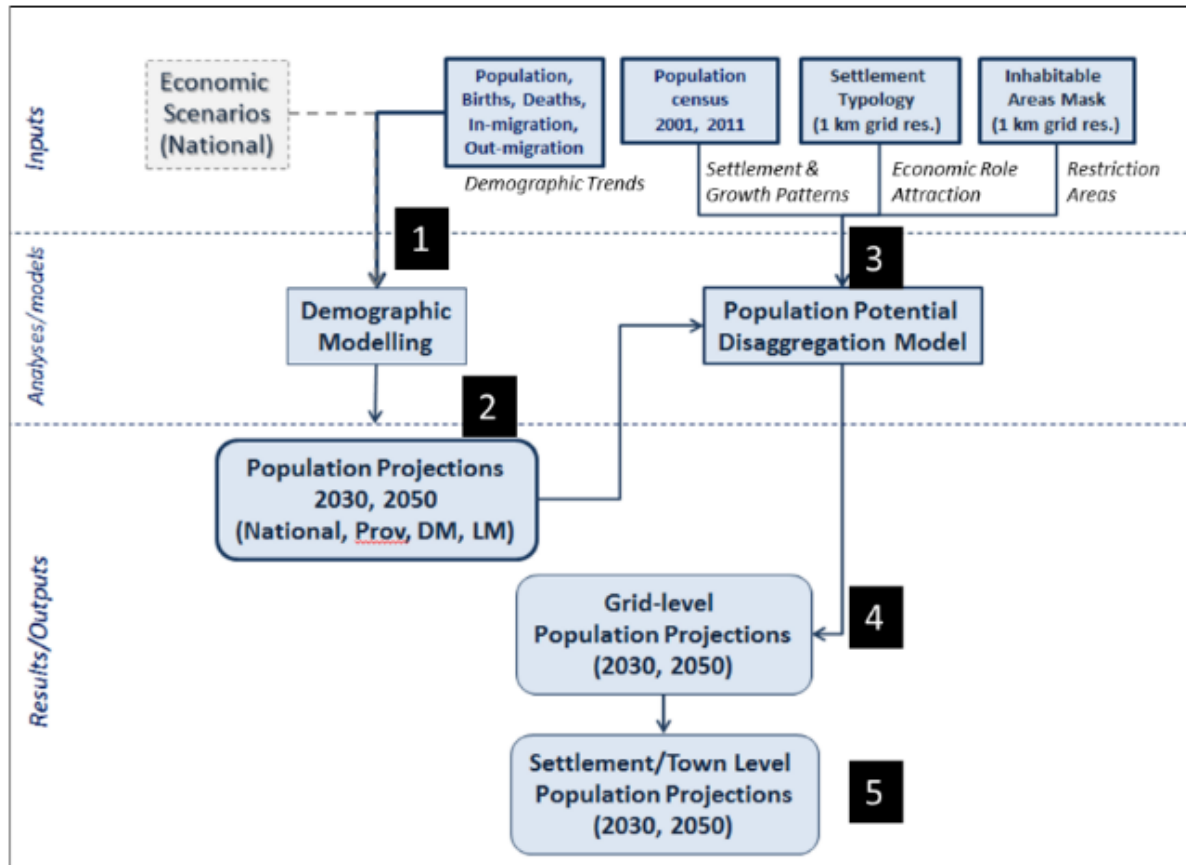
Step 1: National Demographic Modelling

Step 2: Downscaled Projections for National, Provincial, District and Local areas

Step 3: Population potential locational disaggregation model

Step 4: Grid level – modelled population projections

Step 5: Functional town area – modelled population projections

The provincial and district results (Figure 3 and 4) were used as inputs for the location specific modelled results at settlement level. In addition to demographic trends the gravity model developed by the CSIR currently enables consideration of:

- past settlement growth patterns,
- an economic attraction pull factor depending on the role of a settlement/town or city (using the CSIR, Town Area Typology, 2018 town demarcations and profiles); and
- location specific exclusion areas.

The projections have been downscaled and methodology tested with a simulation of 2001-2011 population data that provided very high levels of accuracy (98% for district level and 95% for settlement level). See diagrams below.

The results of the "Without Intervention National Settlement Scenario" (Population Projections and CSIR Green Book Town Growth Model Results) as used in the NSDF 2018 are set out in Figure 5.

The results of the alternative "NSDF Settlement Scenario" and envisaged NSDF sustainable national settlement growth outcome is juxtaposed with the "Without Intervention National Settlement Scenario" model results in Figure 6.

*Figure 2: National level projections*
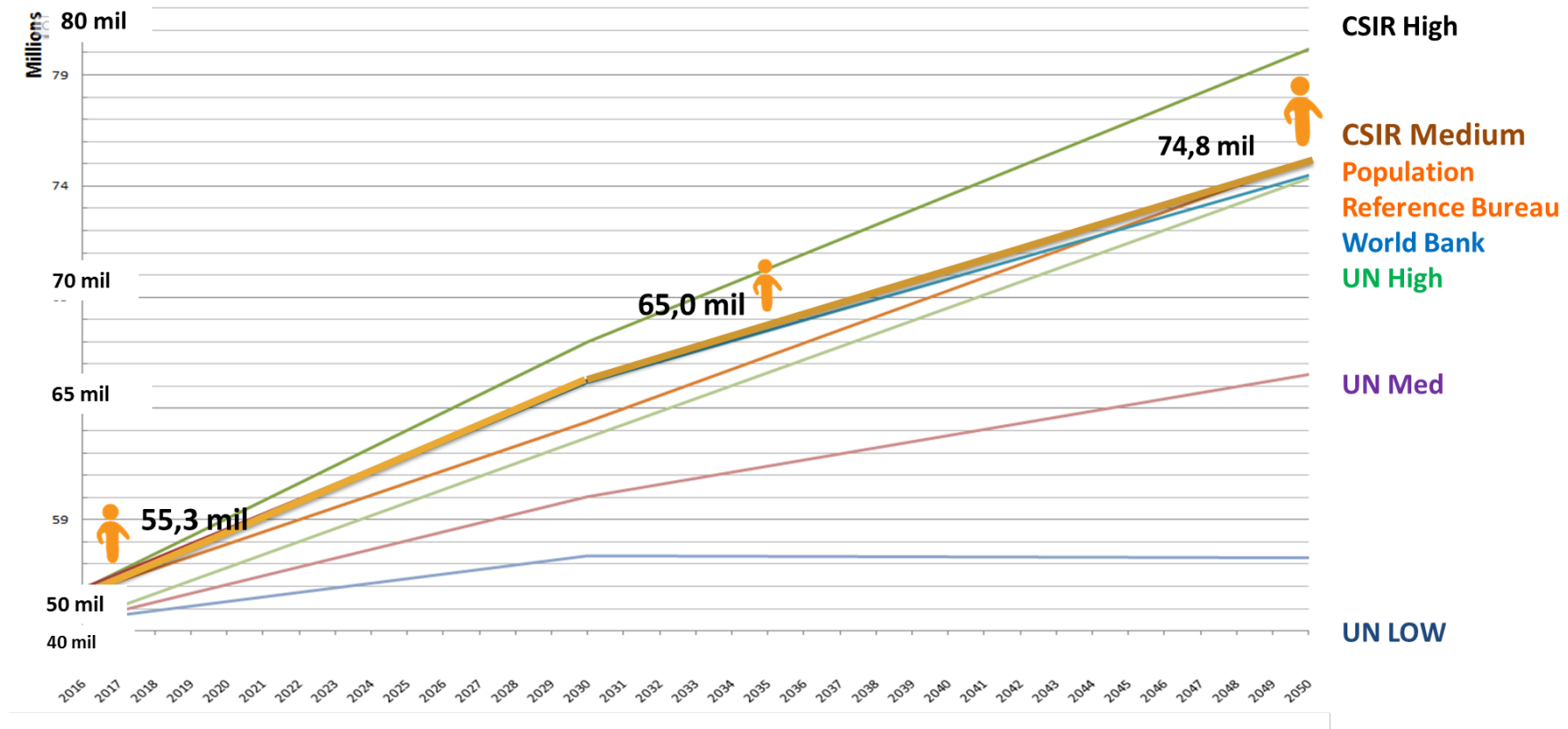


SOURCE: CSIR, 2018. Green Book, Population Projections.

*Figure 3: Provincial level projections in millions of people*

## CSIR, 2018 Downscaled Cohort Component Projections for Provinces

|  | 2016 | | 2030 | | 2050 | |
|---|---|---|---|---|---|---|
|  | Med | High | Med | High | Med | High |
| EC | 6,89 | 6,93 | 7,93 | 8,13 | 9,02 | 9,56 |
| FS | 2,75 | 2,77 | 2, 86 | 2, 94 | 2, 99 | 3, 16 |
| GT | 13,39 | 13,48 | 16,67 | 17,14 | 20,30 | 21,79 |
| KZN | 10,91 | 10,99 | 12,85 | 13,19 | 14,75 | 15,80 |
| LIM | 5,71 | 5,75 | 6,59 | 6,76 | 7,09 | 7,57 |
| MP | 4,30 | 4,33 | 5,11 | 5,24 | 5,91 | 6,26 |
| NC | 1,19 | 1,19 | 1,31 | 1,34 | 1,39 | 1,47 |
| NW | 3,97 | 3,99 | 4,55 | 4,61 | 5,12 | 5,48 |
| WC | 6,23 | 6,27 | 7,41 | 7,58 | 8,53 | 9,02 |
| Total | 55,33 | 55,70 | 65,27 | 66,99 | 75,10 | 80,14 |

SOURCE: CSIR, 2018. Green Book, Population Projections.

CSIR, 2018 Downscaled Cohort Component Projections for District
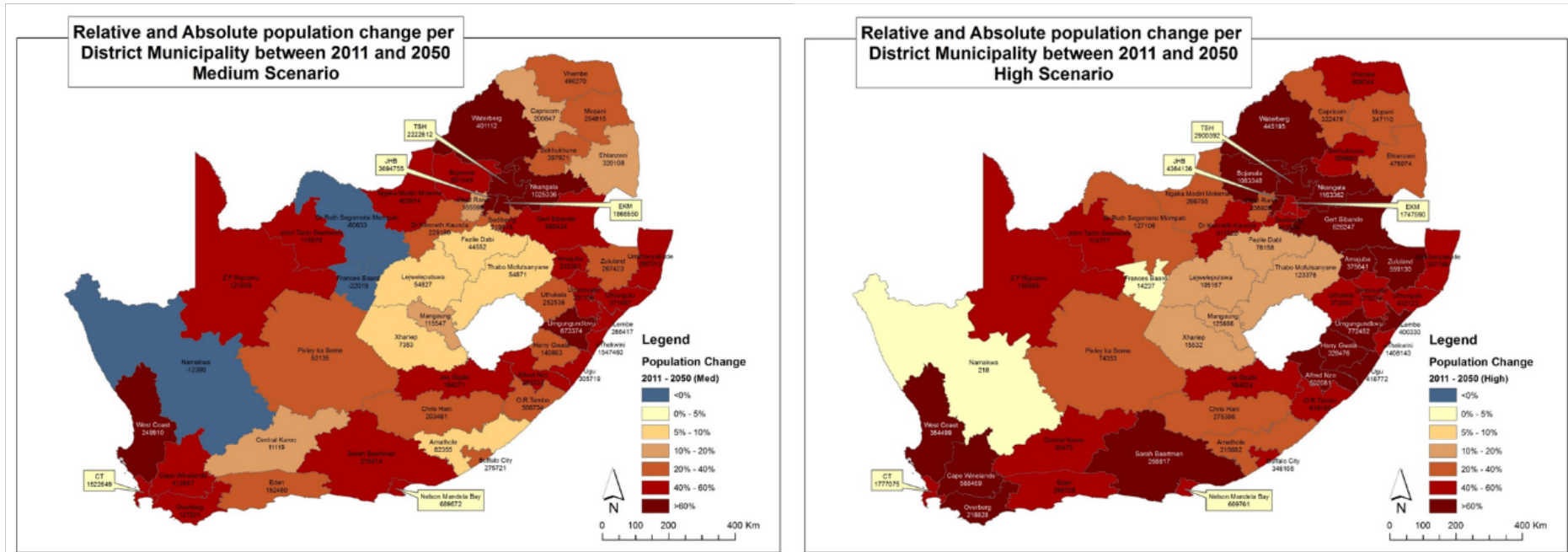
SOURCE: CSIR, 2018. Green Book, Population Projections.

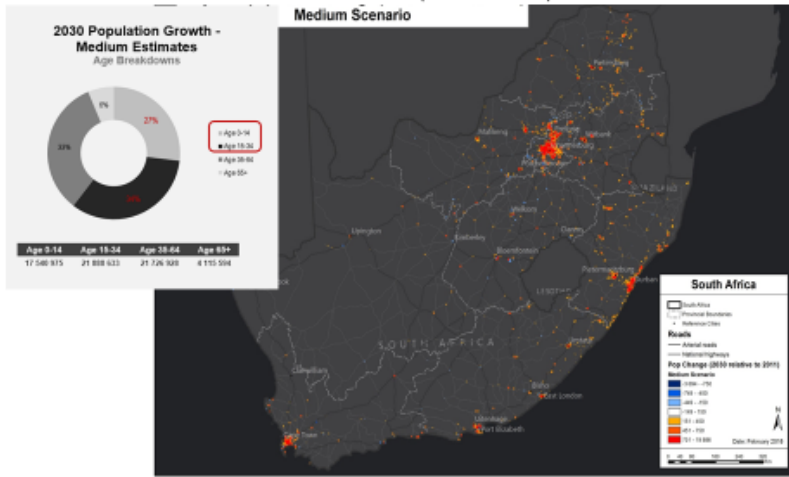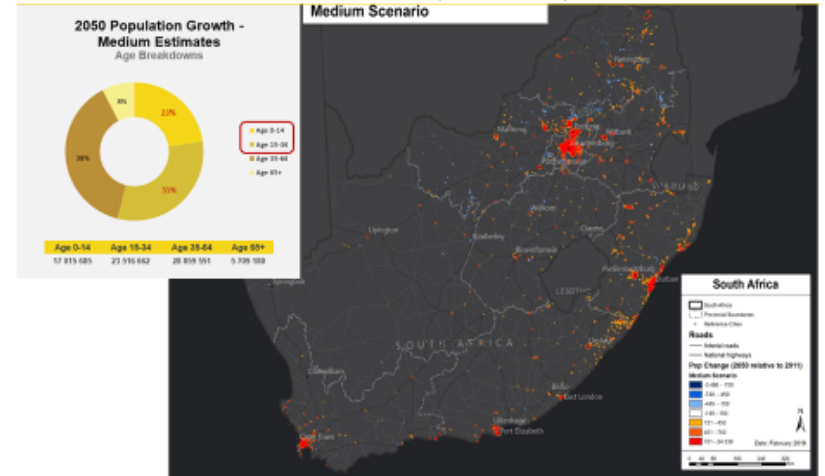*Figure 5: CSIR, Green Book Settlement level projections for 2030 and 2050*



SOURCE: CSIR, 2018. Green Book, Settlement Population Growth Projections.

*Figure 6: National Settlement Patterns and 2050 Growth Scenarios - without Intervention and NSDF Spatial Vision*

**Existing Settlement Pattern 2016 Population (CSIR, 2018)**
**Settlement Scenarios 2050 Medium Population Growth Projection (CSIR, 2018)**
**(1) "Settlement Growth without Intervention"** (Settlement Growth Model, CSIR: Green Book 2018)
**(2) "Settlement Growth with NSDF Spatial Vision"** (NSDF Settlement Scenario, CSIR 2018)

- 2016 Population (Existing Spatial Pattern)
- 2050 Population (Medium Scenario - Settlement Growth no Intervention)
- 2050 Population (Medium Scenario - Settlement Growth with NSDF Spatial Vision)

Urban Regions
Cities
Large Towns
Medium Sized Towns
Small Service Towns & Settlements
Small Towns
Rural Settlements
Sparsely Populated Area

SOURCE: CSIR, 2018. Functional Town Area Typology, 2018; CSIR, 2018. Green Book, Settlement Population Growth Projections; CSIR, 2018. NSDF Vision Settlement Population Growth Scenario

# Climate Change Projections

Climate change is a term that generally refers to a shift in weather phenomena associated with an **increase** in global average temperatures that would have occurred normally over long time periods. Human intervention, however, is rapidly affecting the average surface temperatures, which in turn are resulting in changes to climate patterns.

## Overview of methodology

Down Scale Climate Modelling were conducted by Prof Francois Engelbrecht, CSIR. The 8 km resolution projections were obtained by further downscaling of the CSIR's existing set of 50 km resolution CORDEX (Coordinated Regional Downscaling Experiment) projections of future climate change. These CORDEX projections are for two emission level mitigation scenarios, namely Regional Concentration Pathway 8.5 (RCP8.5; low mitigation) and RCP4.5 (high mitigation). For each of these emission pathways, six global circulation models (GCMs) that contributed to Assessment Report Five (AR5) of the Intergovernmental Panel on Climate Change (IPCC) were downscaled to 50 km resolution over the globe, as part of the CSIR's contribution to CORDEX.

In the Greenbook project, all these simulations (twelve ensemble members in total) were downscaled further to 8 km resolution over South Africa. The projections are analysed statistically in the Green Book of South Africa Climate Change Projection report and the implications for South Africa are discussed. The uncertainty range described by these projections is still to be described within the context of the much larger, but lower resolution ensemble of AR5 GCM projections.

## Results and Implications

In order to sufficiently identify the spatial implications of climate change for South Africa, several fine scaled climate change projections were recently undertaken as part of a project entitled: "Settlement design guidelines for climate change adaptation in South Africa" (Council for Scientific and Industrial Research, 2016)[1]. The resulting projections generally predict severe temperature increases for Southern Africa. It is especially the northern and the western parts of South Africa that can expect significantly hotter average temperatures and more very hot days per year by 2050. By the end of the century, temperature increases of between 4 and 7°C can be expected over the interior of the country.

Furthermore, generally drier conditions and the more frequent occurrence of dry spells are plausible over parts of the interior as indicated in Figure 7. Areas most affected by decreases in rainfall are the Western Cape (winter rainfall region), parts of the Northern Cape, central part of the Eastern Cape and areas in Mpumalanga along the eastern escarpment as well as parts of the Limpopo Province.

Increase in annual-average near-surface temperatures are projected to occur over large parts of South Africa, including the western interior and northern parts of South Africa. This is critical as the central and northern parts of the interior are important agriculture production areas currently. Aligned with the increase in temperatures is the likely increase in high fire-danger days, heat-wave days and very hot days and drier conditions referred to above.

[1]

For the period 2021-2050 relative to the period 1971-2000, (under low mitigation), rainfall is projected to increase over the central interior and east coast. This is most likely to go hand in hand with extreme rainfall events which have significant implications for infrastructure, flooding and water availability. Severe climate events are likely to endanger lives and cause damage to the built environment, which would have knock-on effects on economic development and negatively impact service delivery and sustainable development in the areas of greatest need. The negative impacts are not likely to be limited to the agricultural sector. The shift in rainfall patterns, together with rising temperatures and atmospheric carbon dioxide is likely to enhance vegetation growth in some regions, which could result in bush encroachment in Savannah regions – the Kruger National Park is one area at risk. This could change ecosystem and population dynamics, leading to a change in plant and animal communities (Griffin, 2012).
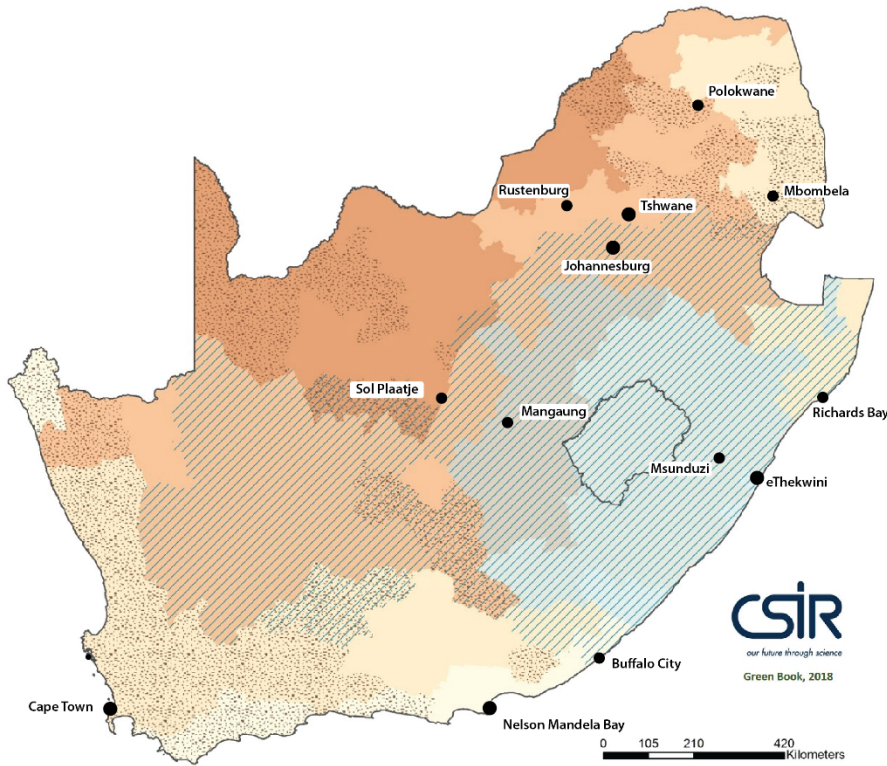
Climate change does pose a significant threat to South Africa's current water resources, food security, health, established infrastructure, as well as its ecosystem services and biodiversity. Considering South Africa's high levels of poverty and inequality, these impacts also pose critical challenges for national development (Ziervogel, et al., 2014).

Climate change also has serious long-term implications for human habitation and the productivity of agriculture. These projections suggest an increasingly important role for the central and south-eastern part parts of the country for (1) human settlement and (2) food production. To accommodate both, a concerted 'national spatial compaction, shrinking, and sharing-drive' will be required. Changing climate could also benefit areas allowing different crops to be cultivated in areas not previously possible. See consolidated summary map based on the projections done through the CSIR Greenbook (2018) below.

Bibliography:

- CSIR, 2018 Green Book Climate Change Projections, CSIR (2018)

- Griffin, J. (2012, April 3). *The Impact of Climate Change on South Africa* . Retrieved June 13, 2018, from Climate System Emergency Institute:; ttps://www.climateemergencyinstitute.com/cc_s_africa_griffin.html

- Ziervogel, G., New, M., Archer van Garderen, E., Midgley, G., Taylor, A., Hamann, R., et al. (2014). Climate change impacts and adaptation in South africa. *WIREs Climate Change*, 605-620.

*Figure 6. CSIR, 2018 Green Book Climate Change Projections, CSIR (2018*
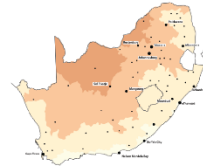
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- SOURCE: Green Book Climate Change Projections, CSIR (2018)

# Annexure B: Spatial Descriptions in Support of National Spatial Development Framework

## Purpose and role of Spatial Frame Annexure

The Annexure provides some of the spatial specific information and base considerations in support of the National Spatial Frame and sub-frames. The Frame Annexure does not provide an extensive diagnostic and synthesis overview. The Frame Annexure is aimed at providing more detail and clarity on conceptual spatial frame elements, and where relevant, an indication of spatial specific extent and location.

## Spatial Descriptions of Settlements Type

### Significant Urban Regions and Cities

The frame identifies the **urban-regions and cities** that are foreseen to play a critical role in (1) housing the South African population and (2) in the national economy and that require focussed intervention (Table 1)

- Key Regions are based on projected future population growth and climatic conditions: The Gauteng Urban Region (and surrounding cities in the urban-innovation belt) with a population agglomeration in an urban region likely to be home to about 22 million people.
- Cape Town Urban Region (stretching towards surrounding urban clusters), with more than 6 million inhabitants.
- The 'urban region and big cities along the South African East Coast, eThekwini Urban Region, Nelson Mandela Bay, Buffalo-City and Richards Bay Urban Regions, would need to play a critical role for consolidated urban livelihoods for more than 8 million South Africans.

### National Network of Regional Development Anchors

Regional and rural typography, road distance and access analysis under conditions of improved rural connectivity and distance analyses assisted in identifying growth centres that can play the role of strategically located regional and rural development anchors.

Selection of regional development anchors (Table 2) envisioned broad regions to facilitate national urbanisation (central, eastern and coastal regions), and identified growth and development corridors. Provincial plans and strategic focus areas, as well as existing national investments: Including Industrial Development Zones, Spatial Economic Development Zones, Agri-Hubs, Aqua focus areas were also taken into consideration.

Rural development anchors were also informed by the network of towns that play strategic regional roles as identified on the basis of nationally comparative town profiles developed as part of the CSIR, 2018 Town Area Typology. The location of regional development anchors also look into consideration of key national transport routes and the relation to networks of Regional Service Centres and Service Towns, as outlined in the town area typology. The latter are strategically located to act as government and economic service centres within the surrounding service hinterland areas, as attractors of urban consolidation and form the bulk of the identified rural service centres.

*Table 1: Description of current and growing cities and big towns as a basis for envisaged NSDF settlement vision.*

## NATIONAL URBAN REGIONS AND NODES

NSDF national urban regions and nodes have been identified on the basis of existing and projected high growth **1. City regions**, **2. Cities and large regional centres** and a select few **3. Regional service centres**, as defined in the CSIR, South Africa Functional Town Typology – 2018. These areas will be home to the majority of the population in future. Excepted to house 61% of the country's 2050 population (CSIR, 2018. NSDF Vision Settlement Population Growth Projection).

| URBAN REGIONS | | NATIONAL URBAN CORES | SMALLER URBAN CORES |
|---|---|---|---|
| **Population**:> 3 million people AND **Economic output** > R40 816 mill/yr (2013 - *Metros/International Gateways with continuing significant population and economic share.* | | **Cities:** Population: >500 000 and Economic output >R7 900mill/yr (2013), | **Very Large Regional Centers**: Population: >300 000 and Economic output >R4 000mill/yr (2013) <br><br> **Large Regional Centers**: Population: >100 000 and Economic output >R1400mill/yr (2013) |
| **Greater Gauteng Urban Region** | Ekurhuleni Metro; <br><br> City of Johannesburg <br><br> City of Tshwane Metro and <br><br> Functionally linked areas in West Rand, Sedibeng; Bojanala, Fezile Dabi and Nkangala DM | Nelson Mandela Bay Metropolitan region <br><br> Bloemfontein/ Botshabelo City Area <br><br> Nelspruit City Area <br><br> Rustenburg City Area <br><br> East London City Area <br><br> Polokwane City Area <br><br> Richards Bay Large Regional Centre <br><br> Pietermaritzburg City Area | Newcastle Large Regional Centre <br><br> Tzaneen Large Regional Centre <br><br> Witbank Large Regional Centre <br><br> Klerksdorp/Stilfontein Large Regional Centre |
| **Greater Cape Town Urban Region** | City of Cape Town and Functionally linked areas in Stellenbosch Cape Winelands DM and West Coast DM | | **Regional Service Centres**: Population: >100 000 and Economic output >R1100mill/yr (2013) |
| **Greater eThekwini Urban Region** | eThekwini Metro and <br><br> Functionally linked areas in iLembe, Ugu, Umgungundlovu DMs | | Kimberley <br> Hazyview Regional Centre <br> King Williams Town Regional Centre <br> Mthatha Regional Centre <br> Middelburg Regional Centre |

*Table 2: Description of current settlement network as a basis for envisaged NSDF national network of Regional Development Anchors.*

## Regional Development Anchors

NSDF national network of regional development anchors have been identified on the basis of exiService Towning and projected high growth towns, Service Townrategic location etc. as set out in Annexure. The basis has been the network of Regional Growth Centres and significant Service Towns within the CSIR, South Africa Functional Town Typology – 2018.

Regional Growth Centres are made up of Regional Service Centres and a selection of regionally significant Service Towns. Selection of the service towns considered formal economy and population growth.

Population variation between 15 000 to juService Town over 100 000 people and economic output >R270mill (2013)

Excepted to house 14% of the country's 2050 population (CSIR, 2018. NSDF Vision Settlement Population Growth Projection).

| | | | | |
|---|---|---|---|---|
| Aliwal North Service Town | De Aar Service Town | Kokservice Townad Service Town | Musina Service Town | Queenservice Townown |
| Barberton Service Town | Dennilton/Siyabuswa Regional | Kroonservice Townad Regional Service | Oudtshoorn Regional Service | Regional Service Centre/Town |
| Beaufort Weservice Town | Service Centre/Town | Centre/Town | Centre/Town | Secunda Regional Service |
| Service Town | Ermelo Regional Service | Kuruman Service Town | Paarl/Wellington Regional | Centre/Town |
| Bela Bela Regional | Centre/Town | Ladysmith Regional Service Centre/Town | Service Centre/Town | Springbok Service Town |
| Service Centre/Town | Eservice Towncourt Regional | Lephalale Service Town | Pennington/Scottburgh Regional | Service Townanderton |
| Bethal Regional Service | Service Centre/Town | Lichtenburg Regional Service | Service Centre/Town | Regional Service Centre/Town |
| Centre/Town | George Regional Service | Centre/Town | Phalaborwa/Namakgale | Swellendam Service Town |
| Bethlehem Regional | Centre/Town | Lusikisiki Service Town | Regional Service Centre/Town | Thohoyandou Regional |
| Service Centre/Town | Giyani Service Town | Lydenburg Service Town | Phuthaditjhaba Regional Service | Service Centre/Town |
| Brits Regional Service | Graaf-Reinet Service Town | Makhado Service Town | Centre/Town | Ulundi Service Town |
| Centre/Town | Grahamservice Townown | Makopane Regional Service | Piet Retief Service Town | Upington Regional Service |
| Burgersfort | Regional Service Centre/Town | Centre/Town | Plettenberg Bay Service Town | Centre/Town |
| Bushbuckridge Regional | Groblersdal Regional Service | Manguzi | Pongola Service Town | Vredenburg Regional Service |
| Service Centre/Town | Centre/Town | Matatiele Service Town | Port Shepservice | Centre/Town |
| Butterworth Regional | Harrismith Service Town | Mmabatho Regional Service | Townone/Margate Regional | Vryburg Service Town |
| Service Centre/Town | Jozini | Centre/Town | Service Centre/Town | Vryheid Regional Service |
| Calvinia | | Moorreesburg Service Town | Potchefservice Townroom | Centre/Town |
| Clanwilliam | | Mossel Bay Regional Service | Regional Service Centre/Town | Worceservice Towner |
| Cradock Service Town | | Centre/Town | | Regional Service Centre/Town |

*Table 3: Description of current settlement network as a basis for envisaged regional networks of Rural Service Centres.*

| Rural Service Centres |
|---|
| This group consists of service towns, small service towns and settlements |
| **Population:** Varies in nodal settlement, large population in direct hinterland |
| Excepted to house 5% of the country's 2050 population. (CSIR, 2018. NSDF Vision Settlement Population Growth Projection). |
| E.G. Middelburg EC, Mtubatuba, Barkley East, Bizana etc. |
| *See stepSA.co.za for a separate list for a full list of 271 towns.* |

| Other Settlements | |
|---|---|
| | This category includes the rest of the towns and settlements which were not included in the above categories. This includes: small towns, dense rural and spare settlements. |
| | **Population:** Less than 20 000 people in town itself. Population even less in the dense/sparse rural hinterland. |
| | Excepted to house 20% of the country's 2050 population |
| E.G. Hogsback, St Helena Bay, Tabankulu, Thornhill, Hofmeyer etc. | *See stepSA.co.za separate list for a full list of 346 towns and settlements.* |

## Regional networks of consolidated and well-connected rural service centres

**Rural service centres (Table 3)** across South Africa were **identified based on network of towns** that play strategic regional roles as identified **on the basis** of the CSIR, 2018 Town Area Typology and recently developed priority towns for social investment within the DRDLR Rural Social Facility Toolkit project.

The town area typology is also used for the identification of potential regional roles for medium and small towns in support of SALGA's Small Town Regeneration Strategy. The role of towns informs the Integrated Urban Development framework Implementation: SALGA Small Town Strategy. Identified points of growth and or existing development act as points of settlement consolidation in rural areas especially in areas of high value agricultural and ecological infrastructure.

## Spatial Description of *Agricultural Heartland, Agri-Enterprise Regions and Eco-Resource Production Regions*

### Agricultural Heartland Areas

The frame firstly refers to the "Central Agricultural Heartland" – which includes all identified high value production and high potential agricultural land in the central part of the country (See Figures 7 and 8).

The area is identified on the following inputs, a) crop fields from the National Department of Agriculture as well as b) land capability 2016 from the National Department of Agriculture.

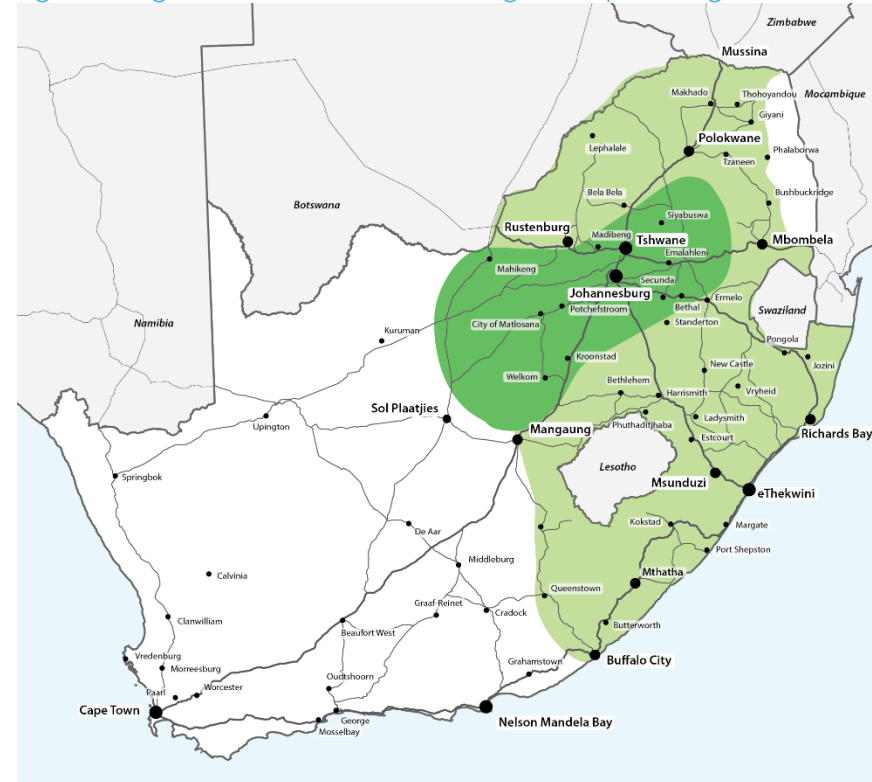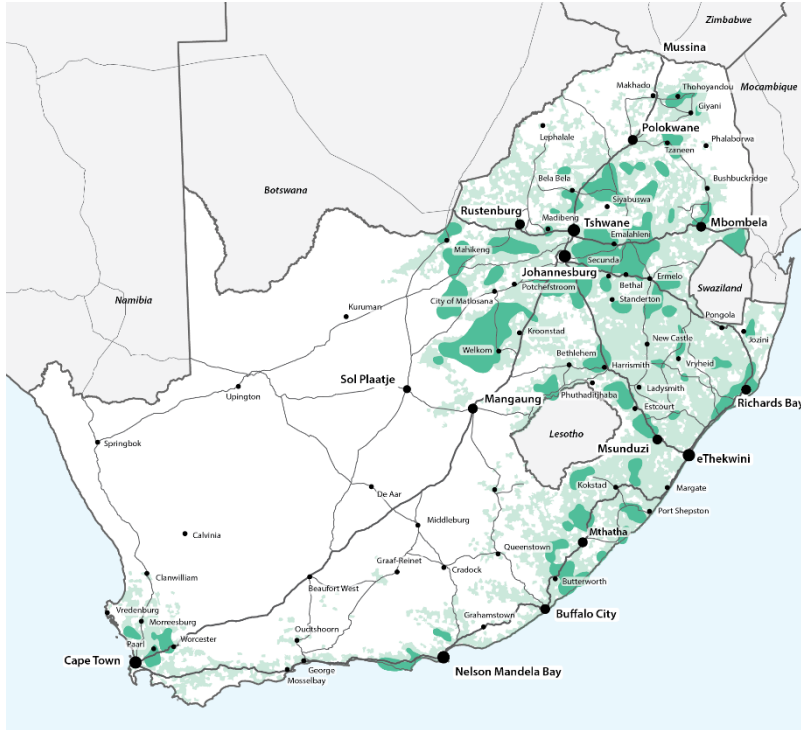*Figure 7: Agricultural Heartland and Agri-Enterprise Regions*

Crop fields with a land capability index value of 8 and more were selected to represent intermediate to high value agriculture land in the country. NOTE: The National Department of Agriculture is currently in the process of an update of this data layer and will form the basis of this sub-frame.

## Agri-Enterprise Resource Regions

Identified areas of high and moderate land capability, dense settlement areas with high potential for agri-resource enterprise development and water availability (See Figures 7 and 8).

It once again considers a) crop fields from the National Department of Agriculture as well as b) land capability 2016 from the National Department of Agriculture. Crop fields with a land capability index value of 8 and more were selected to represent intermediate to high value agriculture land in the country. NOTE: The National Department of Agriculture is currently in the process of an update of this data layer and will form the basis of this sub-frame.

In addition, it documents current productive land, (currently cultivated), as well as market access to densely settled and new growth areas, were considered as one of the indicators to set up potential sites for small scale farming schemes.

The selection of suitable sites for small scale farming were influenced by the following criteria and considerations:

- High potential agricultural land based on land capability.
- Agriculture infrastructure in existence or planned. High priority was given to planned Agri-hubs and agro-processing, proximity to fresh produce markets and other processing facilities.
- Proximity to cities and identified growth regions were of utmost importance for the sustainability of small scale farming. This includes proximity of social facilities like schools, health and social support.
- Availability of sources of water, e.g. located downstream from existing dams to ensure good gravity feed. Areas where Land Reform and Agriculture Development (LRAD) programs cluster in proximity. Only areas with slopes of less than 6% were selected.

Cognizance should be taken of the broad spectrum of agricultural activity in South Africa, and the need for differentiated responses at each level. Levels of agricultural activity in this regard are represented in the

pyramid on the following pages. This spectrum of agricultural activity is categorised according to scale and intensity of production, ranging from large commercial producers at the peak to smaller scale producers towards the base.

*Figure 9: Viable small scale farming and transformation from below as key input in shaping significant "agri-enterprise resource regions"*
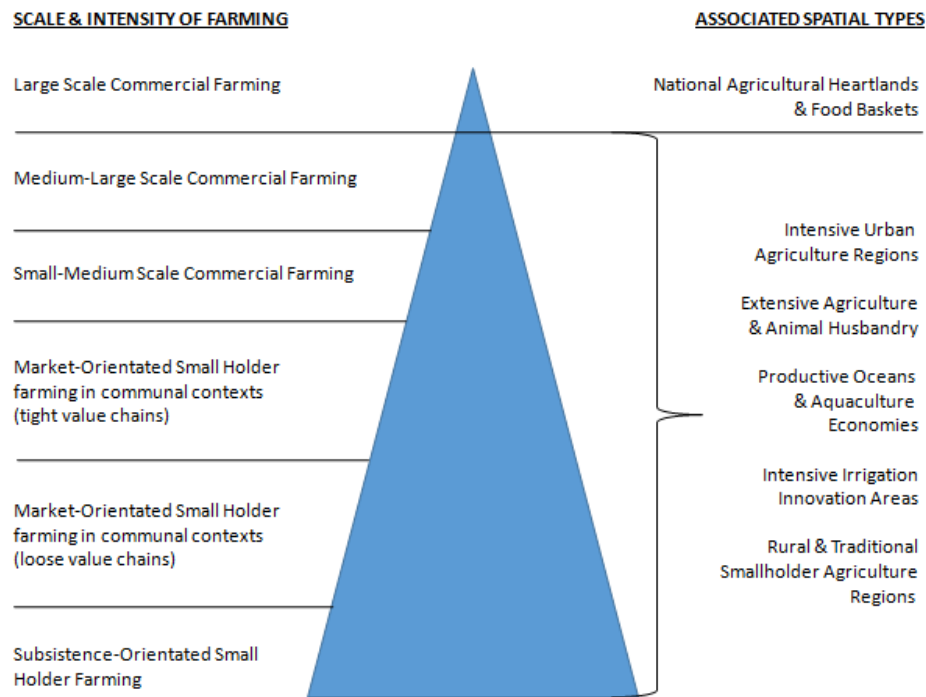


Key to the approach is a small-scale farming model, indicative of a 'transformation-from-below' approach; one that is espoused by a variety of specialists and academics on the topic of agrarian reform in South Africa. A potentially renewed emphasis on transformation-from-below for agrarian reform will require a spatially differentiated and targeted approach that factors both contextual and comparative advantages of

region and place (Figure 9). Viable small scale farming and transformation from below was thus a key input in shaping significant "agri-enterprise resource regions"

Central to the spatial logic on this frame are the following:
- Maintenance of national agricultural heartlands in the interests of national food security
- The prioritisation of lower order agricultural development areas that exhibit greater cumulative levels of spatial advantage in terms of:
  o Agricultural productivity, crop suitability and viability
  o Proximity to existing consumption and production chains
  o Accessibility to higher order settlement typologies
  o Accessibility to supporting agricultural infrastructure
  o High population densities
  o Effective agricultural development through agrarian and land reform will require recognition of and concerted efforts around the following:
  o The need to realign and combine models of agrarian and land reform at a policy level:
  o Define the role of land reform as an instrument to facilitate land access and security of tenure for agricultural development.
  o Optimise the role of stakeholder-based land reform.
  o Steer land reform policy towards boosting productive land use among the rural poor.
  o Renew emphasis on 'transformation-from-below' for widespread grassroots impact on poverty and unemployment:
  o Facilitate the conversion of underutilized land in communal areas into small scale and/or commercial production.
  o Incorporate indigenous knowledge systems for agriculture in traditional areas in a way that factors traditional spatial relationships between settlement and agricultural practice.
  o Spatial targeting approach that factors the contextual and comparative advantages of region and place:

- o Pick and support commercial agriculture sectors and regions that have the highest potential for growth and employment.
- Focus on strategic agricultural development areas where expanded irrigation is possible through improved water management and new water schemes.
- Focus support on agricultural development areas that have comparative advantage in terms of proximity and access to production and consumption chain networks, e.g. Regional Development Anchors, Rural Service Centres.
- Provide strategic developmental support for potential new production and consumption chains in dense rural hinterlands.

## *Spatial Description of* Eco-Resource Production and Livelihood Regions

There are areas that need to play a key role in resource economies as well as management of national ecological infrastructure – with specific land-development and management implications.

These are areas that are nationally significant for ecological as well as "resource critical regions" for other purposes such as mining, agriculture, settlements, heritage and tourism areas.

The areas are typically under stress from an ecological perspective. They are are under pressure in terms of their resilience, but also in terms of the impact of development and risk to critical biodiversity areas (CBA1) and associated ecological service areas such as Strategic Water Source Areas.

The Eco-Resource Production and Livelihood Regions are characterised by the prominence of Strategic Water Service Areas (SWAs), which contribute significantly to the overall water supply of the country – not merely to the region itself.

These areas are our water factories, supporting growth and development needs that are often a long distance from the SWSAs themselves. Land

uses that reduce stream flow or affect water quality (e.g. mining, sprawling settlements, plantations, overgrazing) should be avoided in SWSAs; wetlands should be kept in good condition or rehabilitated, and invasive alien plants should be cleared.

The areas provide unique opportunities for agri-enterprises, eco-enterprises, and activities including small scale arming, wildlife ranching, marine economies, tourism and restoration related job creation opportunities.

## Spatial illustration of national significant energy infrastructure as part of national connectivity network

Infrastructure network to support national energy flows from existing gas fields and coal resource areas, as well as an increased energy mix and existing national and regional networks, as well as current and future settlement patterns. The network infrastructure (see 'Figure 9) primarily consists of:

- Power generation and stations
- Coal fired power stations
- Hydroelectricity power-stations
- Gas turbines
- Nuclear power stations
- Bio-mass power
- Landfill gas power
- Transmission networks:
- Existing pipeline for crude oil and gas;
- Future pipeline for gas;
- Main transmission lines.
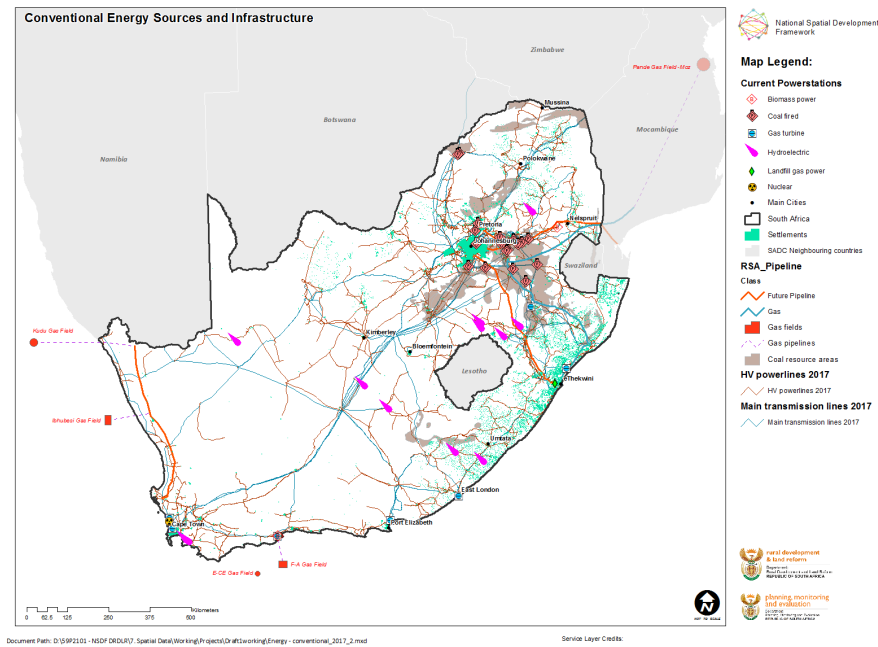
- Transfrontier Parks;
- Biosphere reserves;
- National Fresh Water Protected Areas (Water bodies)

Figure 10: National Protected Areas
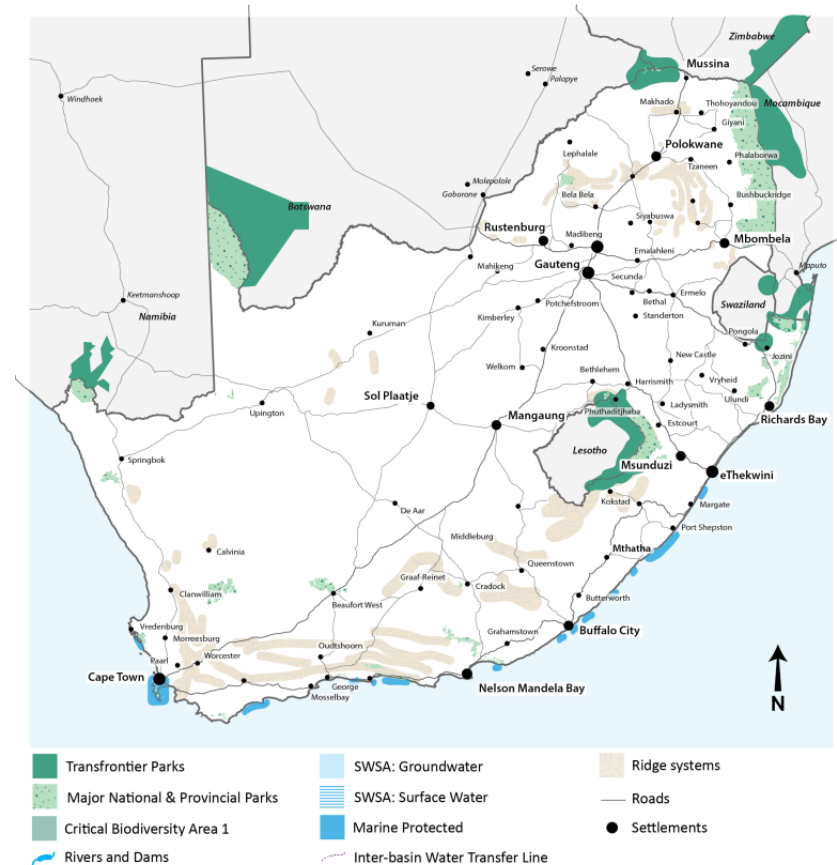


## Additional Spatial Descriptions of National Ecological Infrastructure Network

### Spatial Description of National Protect Areas

**National Protected Areas** as base for the ecological infrastructure includes:

- Official National and major Provincial Protected areas – Terrestrial and Marine protected areas;

## *Spatial Description of National* Environmental Management Areas

Management and productive use of Critical Biodiversity Areas (CBAs) (Figure 10) and Strategic Water Source (SWS) areas (Figure 11) and National Fresh Water Bodies (Figure 11) have been identified as Priority National Ecological Infrastructure Regions that are of national importance and development.

Figure 11: Critical Biodiversity Areas
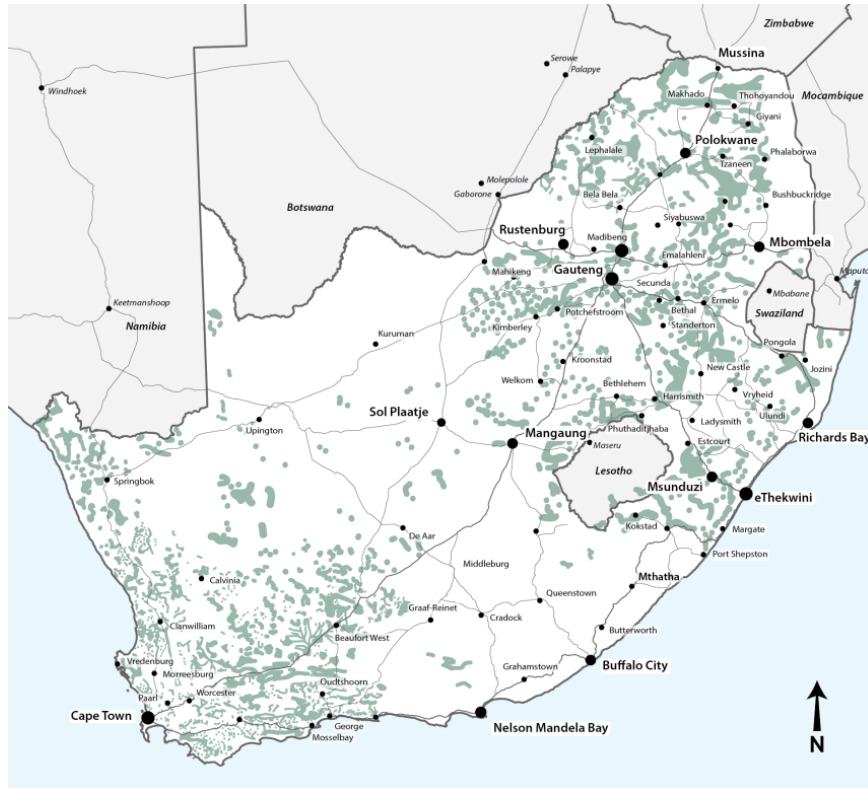


Figure 12: Strategic Water Source Areas, National Fresh Water Bodies
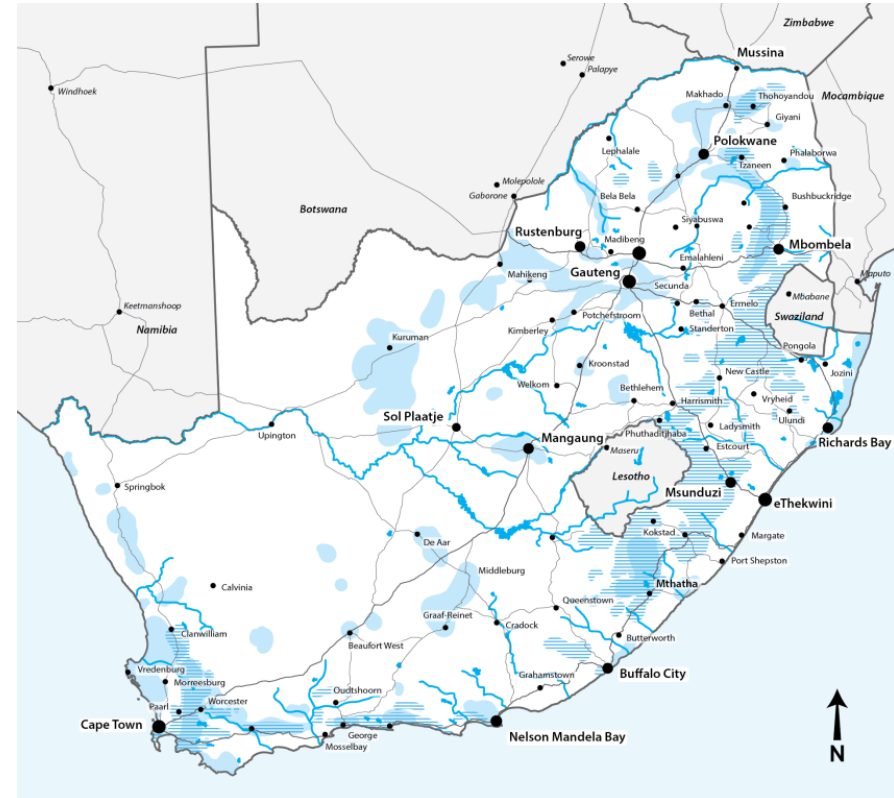


The Strategic Water Source Areas (SWSAs) contribute significantly to the overall water supply of the country. They are identified in Atlas of Freshwater Ecosystem Priority Areas in South Africa (Nel et al, 2011). The World Wild Life Fund's 2015 report on SWSAs provide detail descriptions of individual SWSAs.

- In the Southern and West Coast region and the Central heartland areas, these areas largely coincide with high productive

agricultural, urban growth, mining activities and critical bio-diversity areas.

- Along the eastern coast and inland areas and in the north of the country, strategic water source areas have to be managed within productive agriculture, densely settled and also traditional settlement areas.

Mountainous areas, largely natural due to slopes and typography

Management needs to consider restoration, green enterprise and service delivery, tourism and game farming activities.

Strategic Groundwater Areas in the central and arid regions are critical for many towns that are dependent on scarce groundwater sources.

The system of National Fresh Water Bodies and management guidelines are set out in the

*Spatial Illustration of Significant Inter-Basin Water Transfer Lines*

Nationally significant inter-basin water transfer lines and dependent cities have been identified and are set out on Figure 13.

Figure 13. Significant *Inter-Basin Water Transfer Lines*
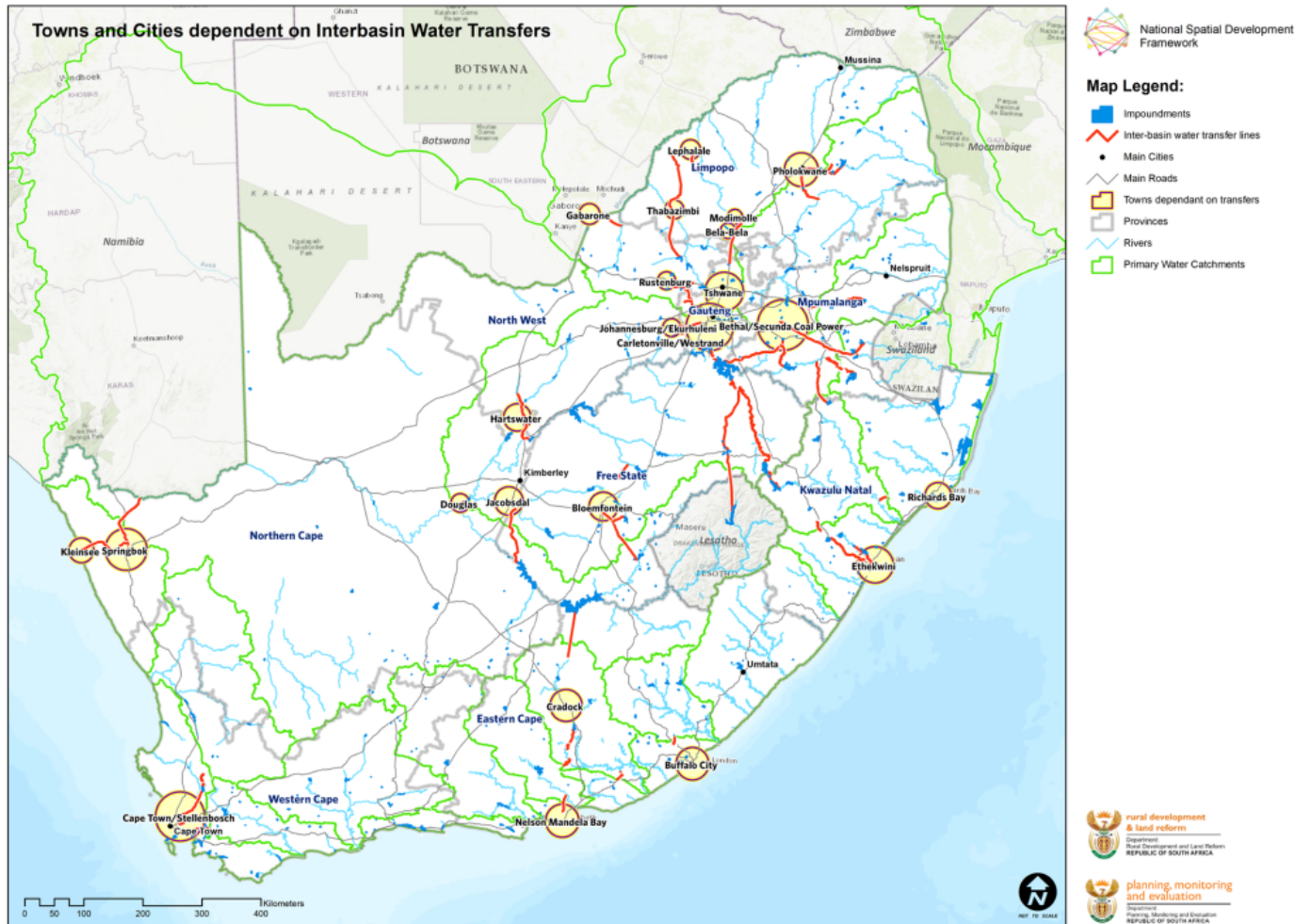
# Additional Spatial Description of National Resource Risk Areas

National resource risk areas (See Figure 14) are both nationally significant and under stress from an ecological perspective, but are also "resource critical regions" for other sectors such as mining and agriculture. These areas are under pressure in terms of their resilience, but also in terms of the impact of development and risk to critical biodiversity areas (CBA1) and associates ecological service areas.

Priority Focus Areas: Stressed Catchments and densely populated Strategic Water Source Areas

Strategic Focus Areas: The risks associated with inter-regional interdependencies are clearly evident in significant national scale ecological core "competition" areas in

- Ekangala region (Mpumalanga) (SWSA, coal mining, high potential agricultural land),
- Greater uMngeni region (KZN) (water supply for Ethekwini, intensive agriculture, expanding settlements.),
- Waterberg region (Limpopo) (mining, water and future expansion driven as national priority) and the
- Olifants Water Management Area (Mpumalanga and Limpopo) (big irrigation scheme, major water quality issues, mining pressure).
- The Berg and Breede River Catchments.

*Figure 14 National Resource Risk Areas*



*Figure 14 National Resource Risk Areas*
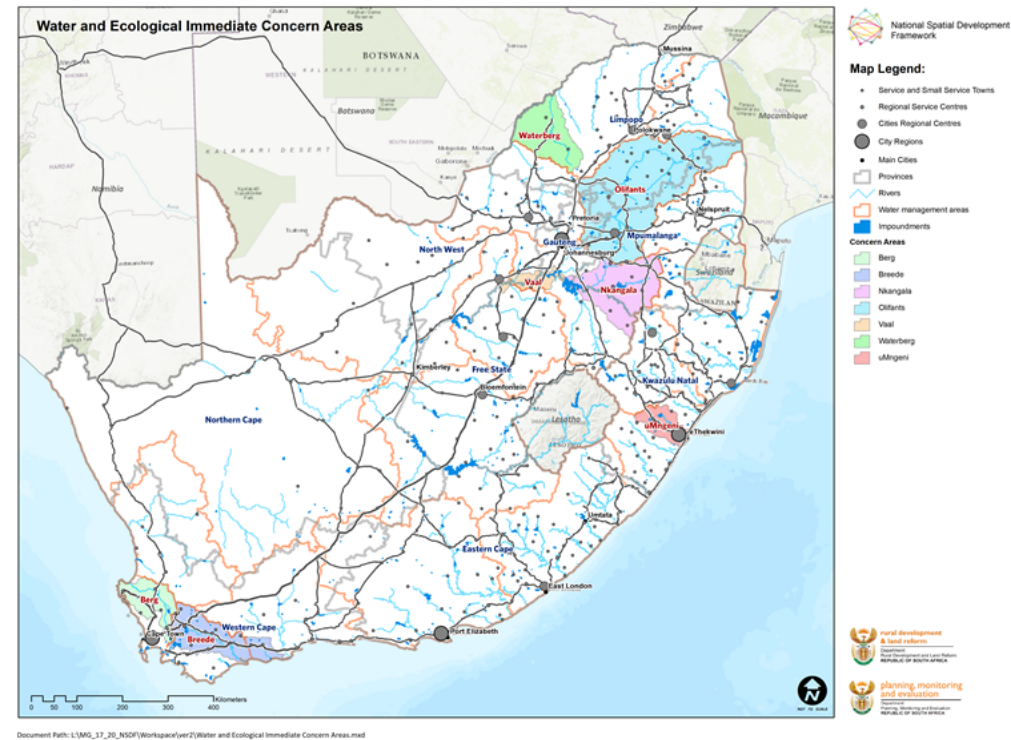
The Mpumalanga Coal Mining and Coal Fired Power Plant region will be under increased pressure for environmental considerations, possible decline in demand in coal and large scale employment under threat. Coal Fired Power Station Dependency on Water Transfers.

Areas require (1) regional economic diversification and transition, and (2) shared forecasting, phasing, pro-active and regional scale economic transition planning, scenario development and enterprise development between multiple role players and institutions.

# Significant plans, studies and sources that informed the spatial specific selection of frame elements

## *National Urban and Settlement Network*

Guidance for national urbanisation patterns, nodes and corridors have been informed by a range of policies and plans. Spatially explicit national plans, initiatives and strategies. That includes:

- Current **metropolitan, city and secondary cities** (SOCR, 2016; SACN Secondary Cities Work);
- **Existing urban densities and size of population and economy in functional urban regions** (city areas) and cities on the basis of nationally comparative town profiles developed in the CSIR, 2018 Town Area Typology.
- **Network of cities with international gateway functions** as identified using the EU International Gateway Indicators (see Matfield, et al. 2014 and EDD, 2014 and EU, 2014). These primarily consider:
  - o Projected urbanisation and population growth
  - o International and national trade, logistic centres (land, sea and air ports)
  - o Mining, manufacturing and industrial centres
  - o Gateway functions as government services, provincial capitals and education centres
  - o Knowledge economy and research centres
  - o Service economy and green economy size and opportunities
  - o International tourism nodes
- NSDF **Spatial vision and settlement pattern scenario based re-modelling of regional patterns of projected urban population distribution** (CSIR, 2018. NSDF Vision Settlement Population Growth Projection).
- SADC. (2015). SADC Industrialization Strategy and Roadmap 2015 - 2063. Gabarone: SADC.
- Southern African Development Community. (2012). Regional Infrastructure Development Master Plan. Gabarone: SADC.
- **Selection of regional growth centres considered regions envisioned to facilitate national urbanisation (central, eastern and coastal regions), and identified growth and development corridors. (See Frame 1.2 and 1.3).**
- The **Integrated Urban Development Framework Implementation: 37 Intermediary City Municipalities** are also expected to play a key role as future urban regions, cities and regional anchor towns in NSDF Spatial Scenario.
- Department of Human Settlements Spatial Master Plan (guiding land release and investment through the Housing Development Agency)
- International journal of urban and regional research, still to be published.Cilliers, J. 2018. Made in Africa: Manufacturing and the Fourth Industrial Revolution. Institute of Security Studies. In Africa and the Wolrd Report. April. 2018
- Council for Scientific and Industrial Research. (2016). Settlement design guidelines for climate change adaptation in South Africa. CSIR. Pretoria: CSIR.
- Snowball, Collins and Tarentaal. (2016). Transformation and job creation in the cultural and creative industry in SA, SACO.
- South African Cities Network (SACN). (2014). *Outside the core: Towards and understanding of Intermediate Cities in South Africa*. South African Cities Network: Johannesburg.
- South African Cultural Observatory (SACO). (2016). The Role of Cultural and Creative Industries in Regenerating Urban and Rural Space and Economies in South Africa: A case Study Approach. Submitted to the Department of Arts and Culture.

- South African Cultural Observatory (SACO). (2016).The mapping of the South African creative economy: A baseline. Submitted to the Department of Arts and Culture.
- South African Cultural Observatory (SACO). (2017). Macroeconomic impact assessment and analysis of South Africa's cultural and creative industry (CCI) and creative. Submitted to the Department of Arts and Culture.
- Southern African Development Community (SADC). (2012). Regional Infrastructure Development Master Plan. Gabarone: SADC
- Southern African Development Community (SADC). (2015). SADC Industrialization Strategy and Roadmap 2015 - 2063. Gabarone: SADC.
- South African National Biodiversity Institute (SANBI). (2016). Framework for Investment in Ecological Infrastructure.
- Selection of **priority corridors, harbours, ports and trade posts** as well as government investment areas (such as SEZs) and inter-regional corridors and networks as outlined in
  - o Transnet, 2016. National ports plan 2016;
  - o TRANSNET. (2016). 30-year Long-term Planning Framework (Chapter 4 Port Development Plan). Johannesburg:
  - o TRANSNET Group; Department of Transport. 2015. National Transportation Plan. Department of Transport;
  - o Amos, S. (2010). The role of South Africa in SADC regional integration: the making or braking of the organisation. *Journal of International Commercial Law and Technology*, 124-131.
  - o Brand, A. 2017. The use of corridor development as a strategic and supporting instrument towards the development of national space economies. Potchefstroom: NWU (Unpublished Thesis – PhD);
  - o Brand, A. and Drewes, JE. 2018. Spatial Corridor Model (SCM) – structuring economic spaces in South Africa.

- **Selection of regional development anchors**:
  - o Rural regional anchors was identified based on a network of towns with strategic regional roles as identified on the basis of nationally comparative town profiles developed in the CSIR, 2018 Town Area Typology. The town area typology is also used for the identification of potential regional roles for medium and small towns in support of SALGA's Small Town Regeneration Strategy. The role of towns informs the Integrated Urban Development Framework Implementation: SALGA Small Town Strategy.
  - o SA CSIR MesoZone 2018v1 Dataset: Available at http://stepsa.org. Available at http://stepsa.org  see http://stepsa.org/socio_econ.html#Indicator

- Council for Scientific and Industrial Research. (2016). *Settlement design guidelines for climate change adaptation in South Africa*. CSIR. Pretoria: CSIR.

## *National Movement and Connectivity Infrastructure*

- Department of Water and Sanitation (DWS). (2017). Draft National Water Plan, DWS (2017: 40-41).
- Transnet, 2016. National ports plan 2016;
- TRANSNET. (2016). 30-year Long-term Planning Framework (Chapter 4 Port Development Plan). Johannesburg:
- Transnet. 2015. Transnet Freight Rail: Road to Rail Strategy Progress: June 2015. Presentation to the Parliamentary Committee on Public Enterprises, Cape Town, South Africa.
- Department of Transport (DoT). 2013. National Household Travel Survey datasets. Pretoria, South Africa.
- Department of Water and Sanitation. National Water and Sanitation Master Plan. Draft 2.6. 2017.

- Department of Transport (DoT). 2015. National Transport Master Plan 2050. Pretoria, South Africa.
- Strategic National South African Infrastructure network and plans, including: IDZs, SEZs, Strategic freight, heavy haul and passenger railway networks, Road network, Ports,
- Green energy suitability – 2017 EGIS data (https://egis.environment.gov.za/) available from the Department of Environmental Affairs. It was processed by CSIR to create areas of focus (2017)
- Hydro Electricity, hydro-electricity, biomass electricity and co-generation electricity, and coal fired power generation sites, provided by ESKOM 2017.
- Settlement data, provided by the Department of Water Affairs, 2017
- Electricity Grid and Coal Fired Power Stations, Eskom 2017
- Pipeline Networks, NATMAP,
- Coal resource areas, Council for Geo-Science
- Renewable Energy Development Zones, as identified investment areas for renewable energy resource investment.
- Ports Regulator of South Africa (PRSA). 2015. South African port capacity and utilisation report 2015/16. Accessed 06 July 2016 at www.portsregulator.org.
- Department of Environmental Affairs. SEA: National corridors for Gas Pipeline corridor and Electricity Grid Infrastructure Extension, 2018.

The green energy infrastructure focus areas, for solar energy, wind energy and as identified in the renewable energy corridors, have been considered as resource potential areas, as set out in the various Wind, Solar, and Bio-Energy Atlases.

## *National Resource Regions and Ecological Infrastructure*

Guidance for national ecosystem and resource regions have been informed by a range of policies and plans. Spatially explicit national plans, initiatives and strategies. This includes:

- Department of Agriculture: Considering a) crop fields from the National Department of Agriculture as well as b) land capability 2016 from the National Department of Agriculture. NOTE: The National Department of Agriculture is currently in the process of an update of this data layer and will form the basis of this sub-frame.
- Land Capability and Agriculture Production (StatsSA, Quantec, CSIR Mesozone, 2017) Department of Agriculture, RSA. 2014. Land capability. (dataset).
- Department: Planning, Monitoring and Evaluation. 2017. Research on the Limited Success of Entrepreneurial Activity by Locals in Townships and Rural Areas. Seven Dialogue Locations: Townships, Rural and Informal Settlement. Research Report conducted for Programme Four: National Planning Commission. October. 2017.
- Report of the High-Level Panel on the Assessment of Key Legislation and the Acceleration of Fundamental Change. (2017). Page 32.
- Commission on the Restitution of Land Rights. (2014/15). Strategic Plan. CRLR.
- DRDLR. (2011). Green Paper on Land Reform.
- African National Congress. (2012). Land Reform Policy Discussion Document. Johannesburg: ANC.
- Department of Energy (DOE). 2015. State of Renewable Energy in South Africa. [Online] available at: http://www.gov.za/sites/www.gov.za/files/State%20of%20Renewable%20Energy%20in%20South%20Africa_s.pdf.
- Department of Environmental Affairs (DEA). n/d. About the green economy. [Online] available at: https://www.environment.gov.za/projectsprogrammes/greeneconomy/about.

- Renewable Energy Independent Power Producer Procurement Programme (REIPPP) - http://www.energyintelligence.co.za/reippp-all-you-need-to-know/
- Renewable Energy Development Zones (REDZ) - https://egis.environment.gov.za/renewable_energy
- Local Action for Biodiversity: Wetlands South Africa – http://biodiversityadvisor.sanbi.org/wp-content/uploads/2016/07/LAB-Wetlands-SA-brochure.pdf
- Important Bird Areas - http://www.birdlife.org.za/conservation/important-bird-areas/iba-map
- Atlas of Freshwater Ecosystem Priority Areas in South Africa (Nel et al, 2011).
- NDP. Chapter 6. Page 196
- Department of Water and Sanitation (DWS). (2017). Draft National Water Plan, DWS (2017: 40-41).
- Transnet, 2016. National ports plan 2016;
- TRANSNET. (2016). 30-year Long-term Planning Framework (Chapter 4 Port Development Plan). Johannesburg:
- Transnet. 2015. Transnet Freight Rail: Road to Rail Strategy Progress: June 2015. Presentation to the Parliamentary Committee on Public Enterprises, Cape Town, South Africa.
- Department of Transport (DoT). 2013. National Household Travel Survey datasets. Pretoria, South Africa.
- Department of Water and Sanitation. National Water and Sanitation Master Plan. Draft 2.6. 2017.
- Greenberg. 2013. Institute for Poverty, Land and Agrarian Strategies, UWC. Page 18
- Greenberg. 2013. Institute for Poverty, Land and Agrarian Strategies, UWC. Page 19
- Cousins (2015), Aliber et al (2017).
- Atlas of Freshwater Ecosystem Priority Areas National Biodiversity Economy Strategy (DEA)

- EWT report (Taylor et al 2016) on wildlife ranching, which includes an assessment of employment in the sector (65 000 jobs in 2014 – see below)
- WWF's 2015 report on SWSAs – for descriptions of individual SWSAs
- SANBI, 2016: Framework for Investment in Ecological Infrastructure)
- Driver, A. Ecological Infrastructure FAQs. Unpublished Presentation. 2017
- Significant programmes, principles, policies or projects relating to environment:
  • Grasslands Programme (SANBI) - https://www.sanbi.org/biodiversity-science/science-policyaction/mainstreaming-biodiversity/grasslands-programme
  • Freshwater Programme (SANBI) - https://www.sanbi.org/biodiversity-science/science-policyaction/mainstreaming-biodiversity/freshwater-programme
  • Succulent Karoo Programme (SANBI) - https://www.sanbi.org/biodiversity-science/science-policyaction/mainstreaming-biodiversity/succulent-karoo-programme
  • Ecological Infrastructure (SANBI). - https://www.sanbi.org/biodiversity-science/science-policyaction/mainstreaming-biodiversity/ecological-infrastructure
  • CAPE Programme (SANBI) conservation of the Cape Floristic Region - https://www.sanbi.org/biodiversity-science/science-policyaction/mainstreaming-biodiversity/fynbos-programme

## *Provincial Plans and Strategies*

Provincial plans and strategies including:

• KwaZulu-Natal, Provincial Growth & Development Plan, 2018

- KwaZulu-Natal, Provincial Growth & Development Strategy, 2016
- Eastern Cape, Provincial Spatial Development Plan, 2010
- Free State, Provincial Spatial Development Framework, 2014
- Gauteng, Provincial Spatial Development Framework, 2017
- Limpopo, Provincial Spatial Development Framework, 2016
- Mpumalanga, Provincial Spatial Development Framework, 2013
- Northern Cape, Provincial Spatial Development Framework, 2012
- North West, Provincial Spatial Development Framework, 2016
- Western Cape, Provincial Spatial Development Framework, 2014

## *Inter-regional , national and long term farmeworks*

- Africa Union Commission. (2015). Agenda 2063: The Africa We Want.
- United Nations. 2016. Habitat III. Quito. 17-20 October 2016.
- United Nations. 2015. Sustainable Development Goals
- SADC. (2015). SADC Industrialization Strategy and Roadmap 2015 - 2063. Gabarone: SADC.
- Southern African Development Community. (2012). Regional Infrastructure Development Master Plan. Gabarone: SADC.
- The Presidency. National Spatial Development Perspective, 2006.
- Department of Co-operative Governance. 2016. Integrated Urban Development Framework. A new deal for South African Cities and Towns.
- Department of Co-operative Governance. 2018. *Localising the New Urban Agenda: South Africa Discussion Document*
- Economic Development Department. 2011. The New Growth Path Framework.
- National Planning Commission. 2012. National Development Plan, 2030. Our Future – make it work.

- National Department of Human Settlements. (2015). Towards a Policy Foundation for the Development of Human Settlements Legislation.
- National Treasury, City Support Programme. (2012). CSP Framework. National Treasury.