DRAFT NATIONAL SPATIAL DEVELOPMENT FRAMEWORK - ANNEXURES

ANNEXURE: NATIONAL SPATIAL FRAMES

ANNEXURE: SUPPORTIVE PROJECTIONS AND MODELS FOR NSDF SPATIAL SCENARIOS

ANNEXURE: SUPPORTIVE CLIMATE CHANGE AND HAZARD MODELS FOR NSDF SPATIAL SCENARIOS

JUNE 2018

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

Contents

Annexure: National Spatial Frames:

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 Guiding Tables.

The Frame Annexure does not provide an extensive diagnostic and synthesis overview. The Frame Annexure is aimed at providing more detail and clarity on the conceptual spatial frame elements, and where relevant an indication of spatial specific extent and location.

Development of Frames

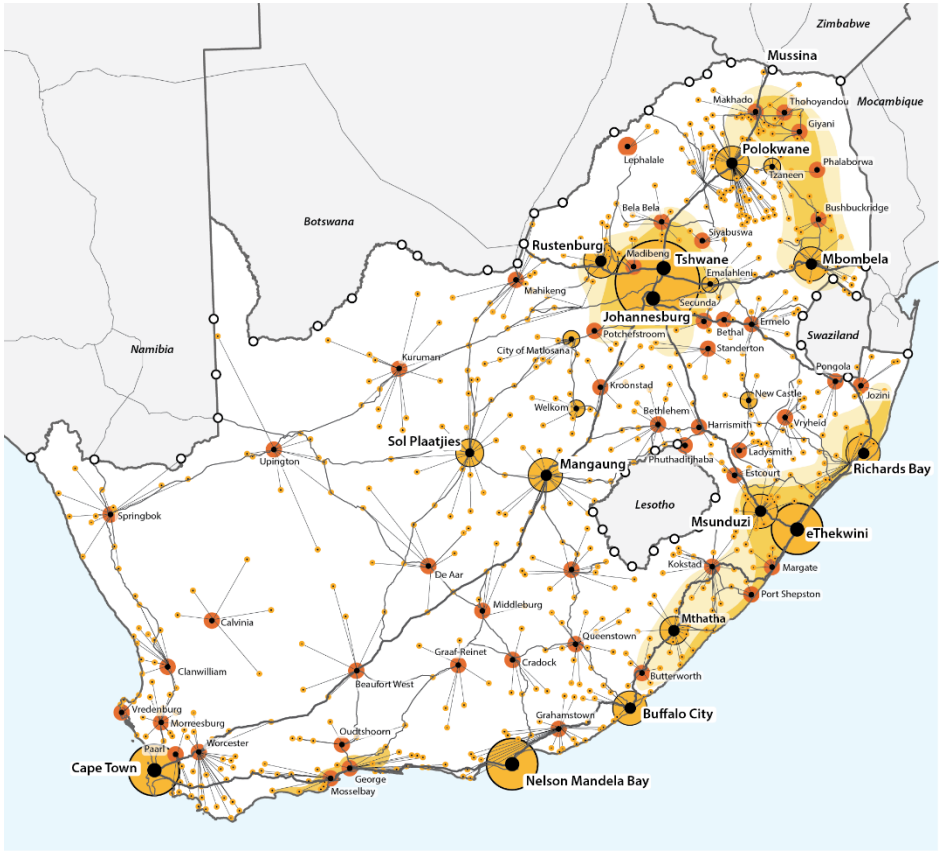
The spatial frame concepts, principles and spatial logic are the primary direction giving elements, with spatial location and extent following from that. The spatial realities, opportunities, challenges and inequalities highlighted in many plans, policies and the large scale NSDF diagnostic were considered. In addition, the following aspects were also considered in developing scenarios and proposals for future national spatial patterns and development:

- Global and inter-regional trends and challenges that adds to the complexity of risks and vulnerabilities and which will significantly impact our future and ability to intervene and bring about change at scale;
- The current and highly significant future role and contribution of places and regions, impacting the national development context;
- The current interdependencies between South Africa and neighbouring countries, as well as between places and regions within the national context;
- Embedded and significant spatial patterns, forces and assets that can be leveraged to bring about transformation at scale;
- Spatial dynamics in specific regions and across the country as a whole that hold significant national scale risks in terms of loss of life, livelihoods, and negative impact on the national economy and well-being of large numbers of people and require timeous and systemic development focus; and
- The implications of the most probable scenarios of population growth and climate change.

Frame 1: Urban Cores and Corridors as Engines and Drivers of Transformation

Spatial Description

Figure Frame 1A: National network of growing urban clusters and corridors



The frame identifies the city-regions and cities that are foreseen to play a critical role in (1) housing the South African population and (2) in the national economy that require focussed intervention (See Table 4).

There are:

- The Gauteng Mega-City 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 Mega-City Region (stretching towards surrounding urban clusters), with more than 6 million inhabitants.
- The 'big four' mega-city regions 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.

Figure Frame 1B: National network of growing urban corridors

Well connected inter-regional and national development corridors and routes (See Table 4).

Consolidated and economic transformation within:

- International Corridors:
  - The Maputo Corridor (N4) between Gauteng and Maputo;
  - N4west leading to Trans Kalahari-corridor passing through Botswana and Namibia to the port of Walvis Bay;
  - The National routes in South Africa from Gauteng to the Durban port (N3) and the Beitbridge border N1 into Zimbabwe (extending from this route is a secondary route to Botswana – the N11 and
- National Connectivity Corridors: N1,N3, N14, N7

Potential new corridors identified comprise the potential development corridors and anchors in Emalahleni-Richards Bay Corridor; Gauteng-Welkom corridor Coastal corridors.

Prioritised routes, ports, harbours, trade and border posts, logistic hubs for maintenance and extension through collaborative and pro-active long term planning and phasing.

- Logistics hubs, ports (airports and harbours) are maintained and expanded to keep pace with national and regional growth and settlement needs.

Table Frame 1A: National network of Urban-Regions and Urban Cores

NSDF NATIONAL URBAN-REGIONS	CSIR Functional Town Area Typology 2018 Based on current profiles and regional locational role SOURCE: CSIR, 2018 Town Area Typology	
	City Region Areas	
Greater Gauteng Urban Region	Ekurhuleni Metro	City of Johannesburg
	City of Tshwane Metro	Functionally linked areas in West Rand, Sedibeng; Bojanala, Fezile Dabi and Nkangala DM
Greater Cape Town Urban Region	City of Cape Town	Functionally linked areas in Stellenbosch Cape Winelands DM
	Functionally linked areas West Coast DM	
Greater eThekwini Urban Region	eThekwini Metro	Functionally linked areas in iLembe, Ugu, Umgungundlovu DMs
Greater Nelson-Mandela Bay Urban region	Nelson Mandela Bay Metropolitan region	
	Cities and Large Regional Centres	
Greater Bloemfontein/ Botshabelo urban region	Bloemfontein/ Botshabelo City Area	
Buffalo City Urban region	East London City Area	
Polokwane Urban Region	Polokwane City Area	
Mmbombela Urban Region	Nelspruit City Area	
Richards Bay Urban Region	Richards Bay Large Regional Centre	
NSDF NATIONAL URBAN CORE AREAS		
Rustenburg Urban Core	Rustenburg City Area	
Pietermaritzburg Urban Core	Pietermaritzburg City Area	
New Castle Urban Core	NewCastle Large Regional Centre	
Tzaneen Urban Core	Tzaneen Large Regional Centre	
Welkom RSC	Welkom Large Regional Centre	
City Matlosana/Stilfontein Urban Core	Klerksdorp/Stilfontein Large Regional Centre	
Emalahleni Urban Core	Witbank Large Regional Centre	
	Regional Service Centres	
Sol Plaatjies Urban Core	Kimberley Regional Service Centre	
Hazy View Urban Core	Hazy View Regional Service Centre	
King Williams Town Urban Core	King Williams Town Regional Service Centre	
Mthatha Urban Core	Mthatha Regional Service Centre	

Table Frame 1B: National network of growing development and urban growth corridors

URBAN CORRIDORS AND REGIONS	NSDF NATIONAL URBAN-REGIONS & CORE AREAS	REGIONAL DEVELOPMENT ANCHORS
Central innovation and mining belt around Greater Gauteng	Greater Gauteng Urban Region Rustenburg Urban Core Emalahleni Urban Core	
Central Urban clusters:	Greater Bloemfontein/ Botshabelo urban region Kimberley Urban Core	
Eastern Coastal corridors (N2)	Richards Bay Urban Region Greater eThekwini Urban Region Mthatha Urban Core Buffalo City Urban region King Williams Town Urban Core Greater Nelson-Mandela Bay Urban region	Margate-Port Shepstone Urban Corridor
Maputo Corridor: (N4) between Gauteng and Maputo and N4west leading to Trans Kalahari-corridor passing through Botswana and Namibia to the port of Walvis Bay.	Gauteng Urban Region Rustenburg Urban Core	
South Coast Corridor	Greater Cape Town Urban Region	George-MosselBay Urban Corridor
Eastern Escarpment Clusters	Polokwane Urban Region, Mmbombela Urban Region, Hazy View Urban Core, Tzaneen Urban Core	
Central to Coast Development Corridors		
National routes in South Africa from Gauteng to the Durban port (N3)	Greater eThekwini Urban Region, Pietermaritzburg Urban Core	
Gauteng to Richards Bay	Emalahleni Urban Core, New Castle Urban Core, Richards Bay Urban Region	
Gauteng to Welkom	Welkom RSC, Klerksdorp/Stilfontein Urban Core	
Beitbridge border N1 into Zimbabwe (extending from this route is a secondary route to Botswana – the N11)		

Significant plans, studies and sources that informed the spatial frame

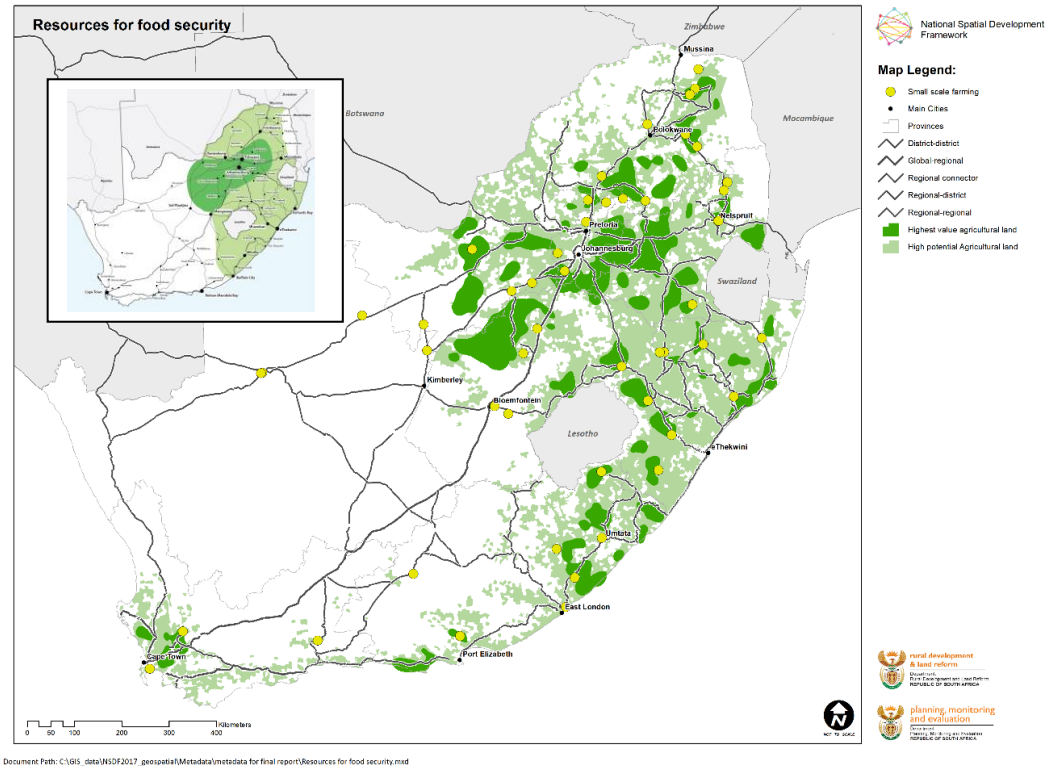
Guidance for national urbanisation patterns, nodes and corridors have been informed by a range of policies and plans. Spatially explicit national plans, initiatives and strategies. This includes:

- 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:
    - Projected urbanisation and population growth
    - International and national trade, logistic centres (land, sea and air ports)
    - Mining, manufacturing and industrial centres
    - Gateway functions as government services, provincial capitals and education centres
    - Knowledge economy and research centres
    - Service economy and green economy size and opportunities
    - International tourism nodes
- NSDF **Spatial vision and settlement pattern scenario based re-modelling of regional patterns of projected urban population distribution** (CSIR, 2018. Population Projections).
- 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.
- 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
- 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
    - Transnet, 2016. National ports plan 2016;
    - TRANSNET. (2016). 30-year Long-term Planning Framework (Chapter 4 Port Development Plan). Johannesburg:
    - TRANSNET Group; Department of Transport. 2015. National Transportation Plan. Department of Transport;
    - 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.
    - 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);
    - Brand, A. and Drewes, JE. 2018. Spatial Corridor Model (SCM) – structuring economic spaces in South Africa.

Frame 2: Productive Rural Regions and Regional Development Anchors as Foundation of National Transformation

Spatial Description

Frame 2.a. Agri- and Resource Enterprise Resource Regions



Document Path: C:\GIS_data\NSDF2017_geospatial\Metadata\metadata for final report\Resources for food security.mxd

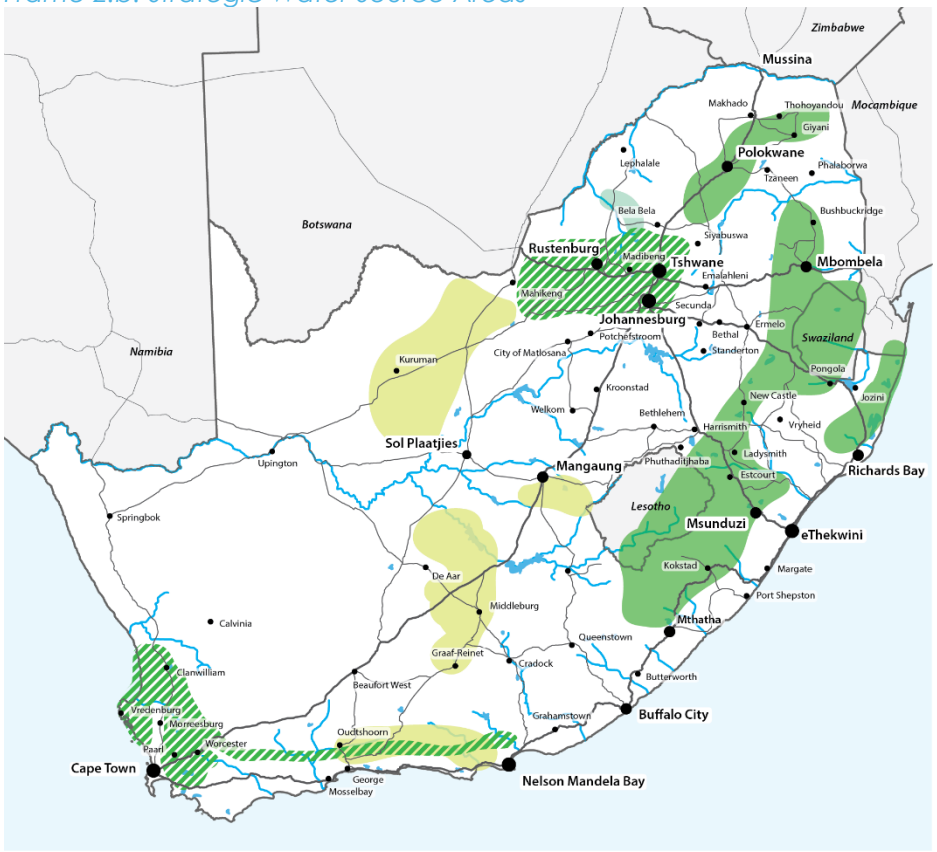
The plan uses high potential agricultural land currently cultivated as one of the basis to set up potential sites for small scale farming schemes.

Identified areas of high and moderate land capability, dense settlement areas and high potential for agri-resource enterprise development. Considering 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 Frame 2.

The selection of suitable sites for small scale farming 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 important.
- Proximity to cities and identified growth regions 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 LRAD programs cluster in proximity. Only areas with slopes of less than 6% were selected.

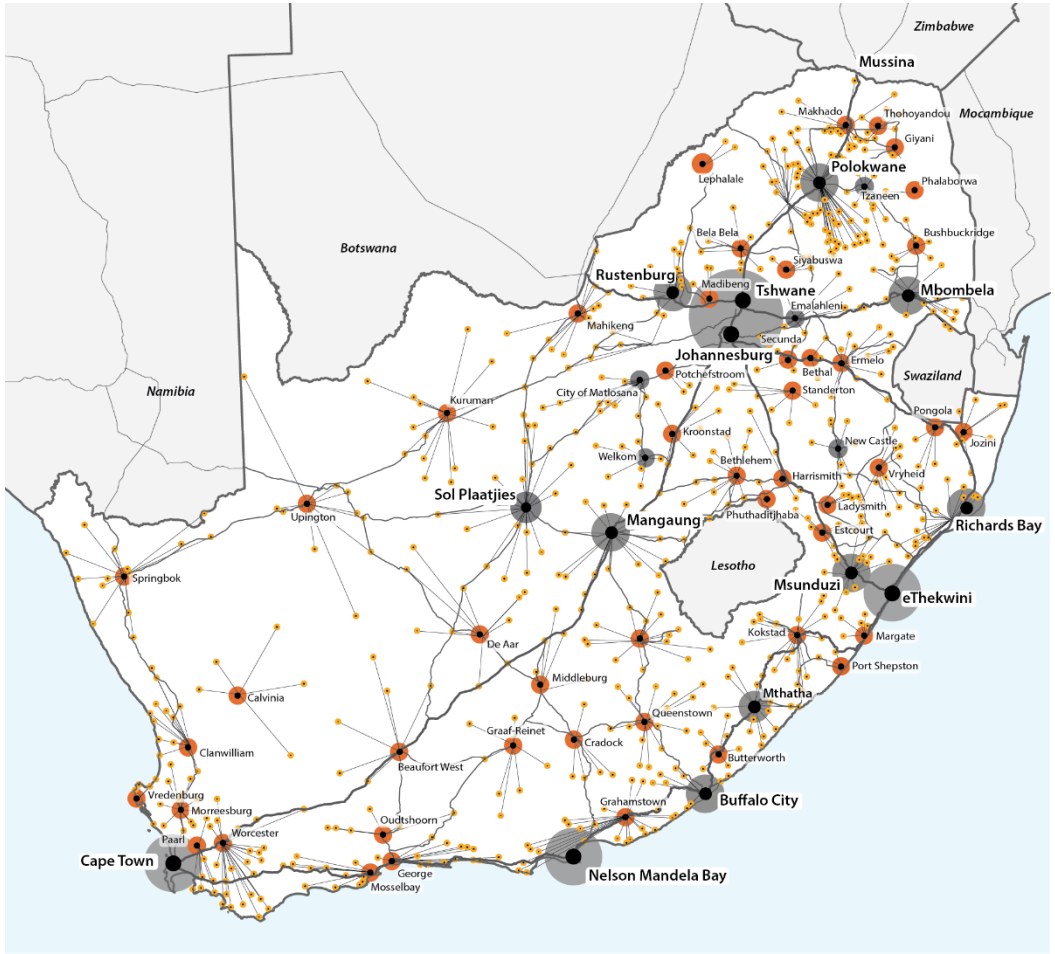
Frame 2.b: Strategic Water Source Areas



Strategic Water Service Areas (SWAs) contribute significantly to the overall water supply of the country. They are our water factories, supporting growth and development needs that are often a long distance away from the SWSAs themselves. Land uses that reduce stream flow or affect water quality (e.g. mining, plantations, overgrazing) should be avoided in SWSAs, wetlands should be kept in good condition or rehabilitated, and invasive alien plants should be cleared.

These are areas that 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.

Frame 2.c:Rural-Urban Anchors, Service Centres



Regional and rural typography, road distance access and improved rural connectivity and distance analyses assisted identifying growth centres that can play the role of strategically located regional and rural anchors (See connectivity lines in Frame 2c).

Table Frame 2A: Selected well-located nodes of settlement and service consolidation

Rural-Urban Anchors and Regional Service CeRural-Urban Anchors and Regional Service Centres	
Bela Bela RSC	Paarl/Wellington RSC
Bethal RSC	Pennington/
Bethlehem RSC	Scottburgh RSC
Brits RSC	Phalaborwa/
Bushbuckridge RSC	Namakgale RSC
Butterworth RSC	Phuthaditjhaba RSC
Dennilton/Siyabuswa RSC	Port Shepstone/Margate RSC
Ermelo RSC	Potchefstroom RSC
Estcourt RSC	Queenstown RSC
George RSC	Secunda RSC
Grahamstown RSC	Standerton RSC
Knysna RSC	Stanger RSC
Kroonstad RSC	Thohoyandou RSC
Ladysmith RSC	Upington RSC
Makopane RSC	Vredenburg RSC
Middelburg RSC	Vryheid RSC
Mmabatho RSC	Worcester RSC
Mossel Bay RSC	
Oudtshoorn RSC	

Significant plans and studies on which the spatial patterns in the frame was based

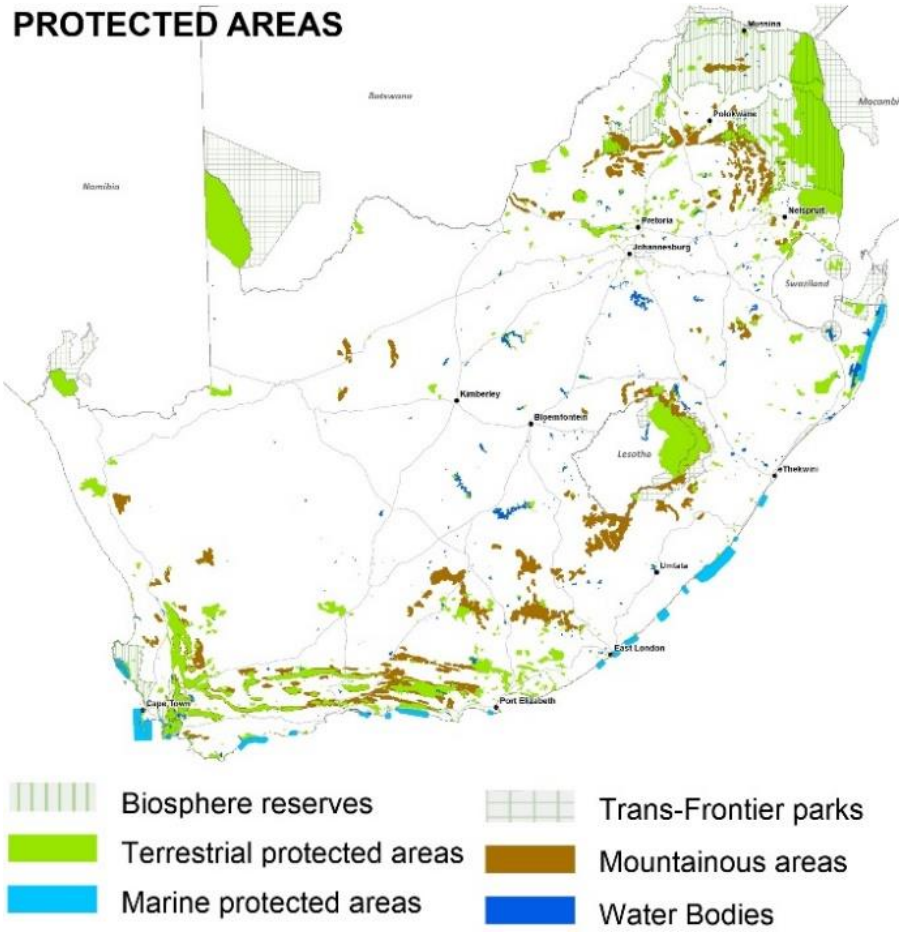
Guidance for national urbanisation patterns, nodes and corridors have been informed by a range of policies and plans. Spatially explicit national plans, initiatives and strategies. This includes:

- 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)
- Urban core regions were identified based on 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 Integrated Urban Development Framework Implementation: 37 Intermediary City Municipalities were considered in selecting key regional centres and anchors towns in NSDF Spatial Scenario
- Rural regional anchors was identified based on 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.
- Selection of regional growth centres and rural anchors considered regions envisioned to facilitate national urbanisation (central, eastern and coastal regions), and identified growth and development corridors. (See Frame 1.2 and 1.1).
- The modelled location of projected population growth has been adapted to model a population pattern scenario to support the NDP Goals and NSDF Vision
- Consolidation of urbanisation in urban-regions, cores and development corridors, with a strong emphasis on mutual supported productive rural regions
- Existing national investments: Including Industrial Development Zones, Spatial Economic Development Zones, Agri-Hubs, Aqua focus areas.
- Rural growth centres and anchors were selected based on the 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.
- SA CSIR MesoZone 2018v1 Dataset: Available at http://stepsa.org. Available at http://stepsa.org see http://stepsa.org/socio_econ.html#Indicator
-

Frame 3: National Ecological Infrastructure System as enabling infrastructure for a shared and sustainable resource foundation

Spatial Description

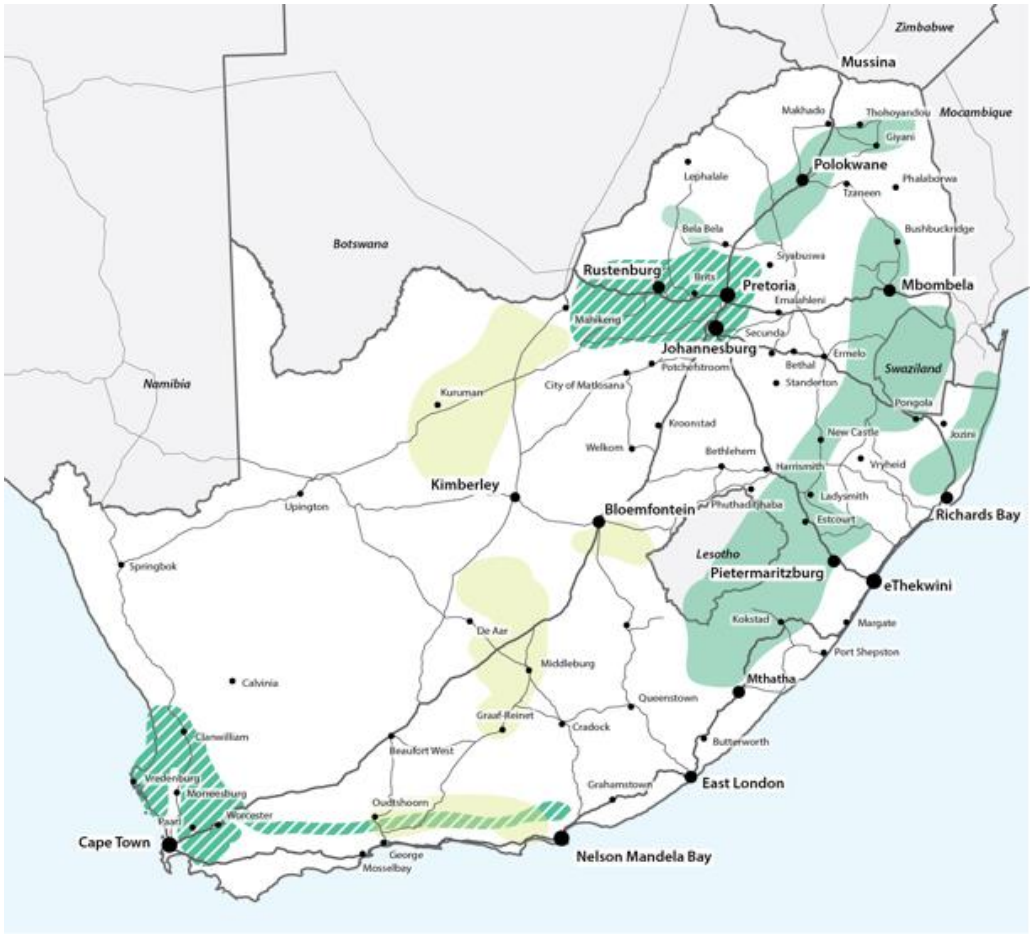
Figure 3a National Ecosystem Resource Protection Areas



Protected Areas as base for the ecological infrastructure includes:

- Official National Protected areas – Terrestrial and Marine protected areas;
- Transfrontier Parks;
- Biosphere reserves;
- National Fresh Water Protected Areas (Water bodies)
- Mountainous areas, largely natural due to slopes and typography

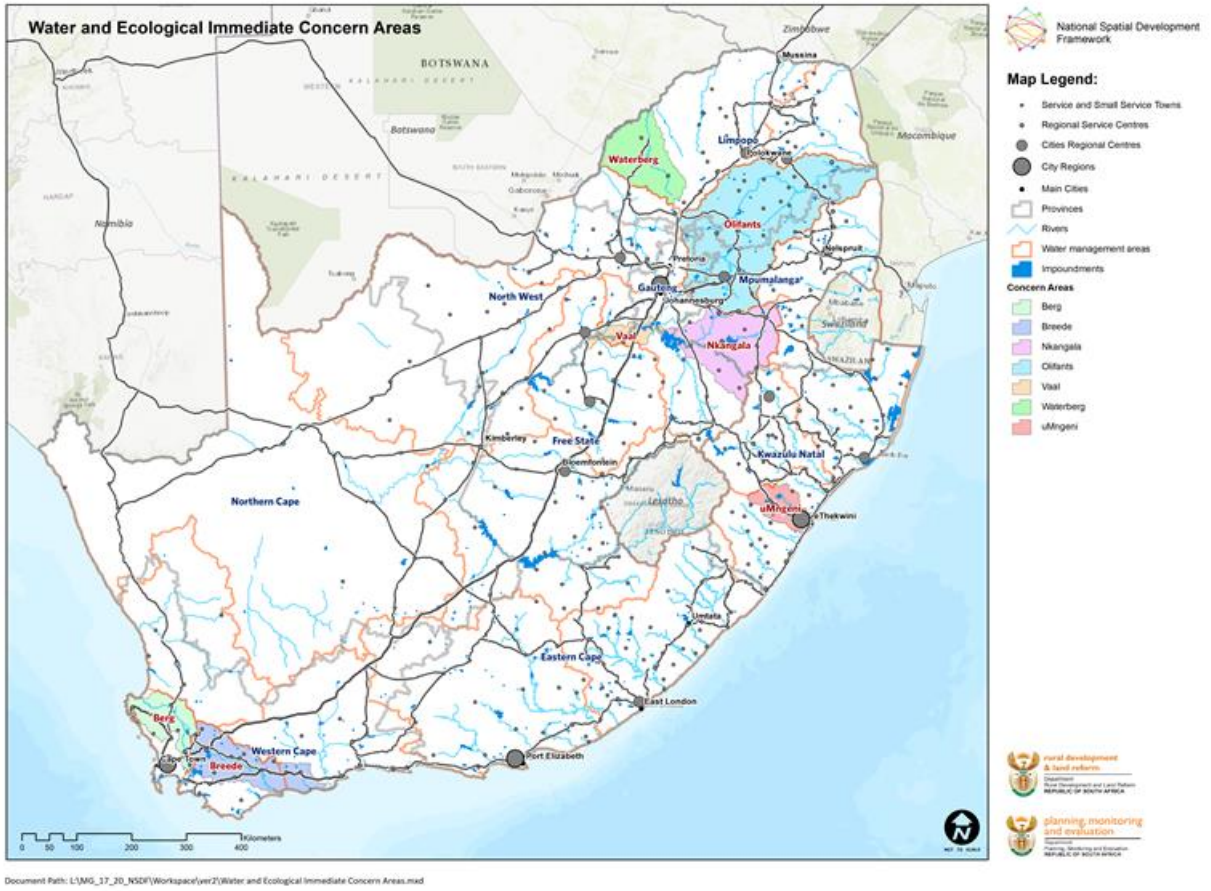
Figure 3b: Resource rich strategic water sources areas



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. 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. y and

Figure 3c: Strategic competition and Focus Areas : Water stressed catchments



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). These are areas that 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.

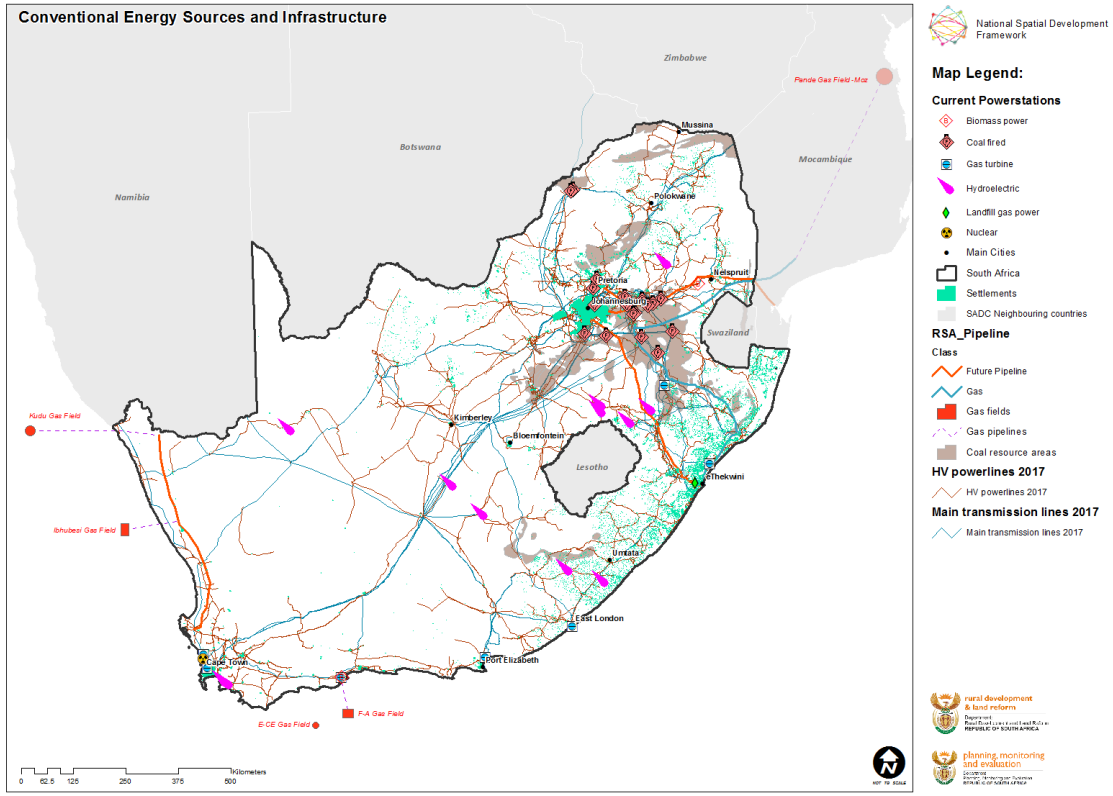
Significant plans and studies on which the spatial patterns in the frame was based

- Nel et al. 2017 – paper on socio-economic significance of SWSAs just published in Ecosystem Services
- Atlas of Freshwater Ecosystem Priority Areas in South Africa (Nel et al, 2011) – SWSAs are referred to as "high water yield areas" in this Atlas, and were mapped using slightly different method based on older data, but the key "so what" messages are the same. The text below is adapted mainly from the Atlas.
- 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

Frame 4: National connectivity and economic infrastructure networks as enabling infrastructure for a shared, sustainable and inclusive economy

Spatial Description

Figure 4a: Infrastructure to support national energy mix, flows and security



The network infrastructure (see 'Conventional Energy Sources and Infrastructure' on the left) 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

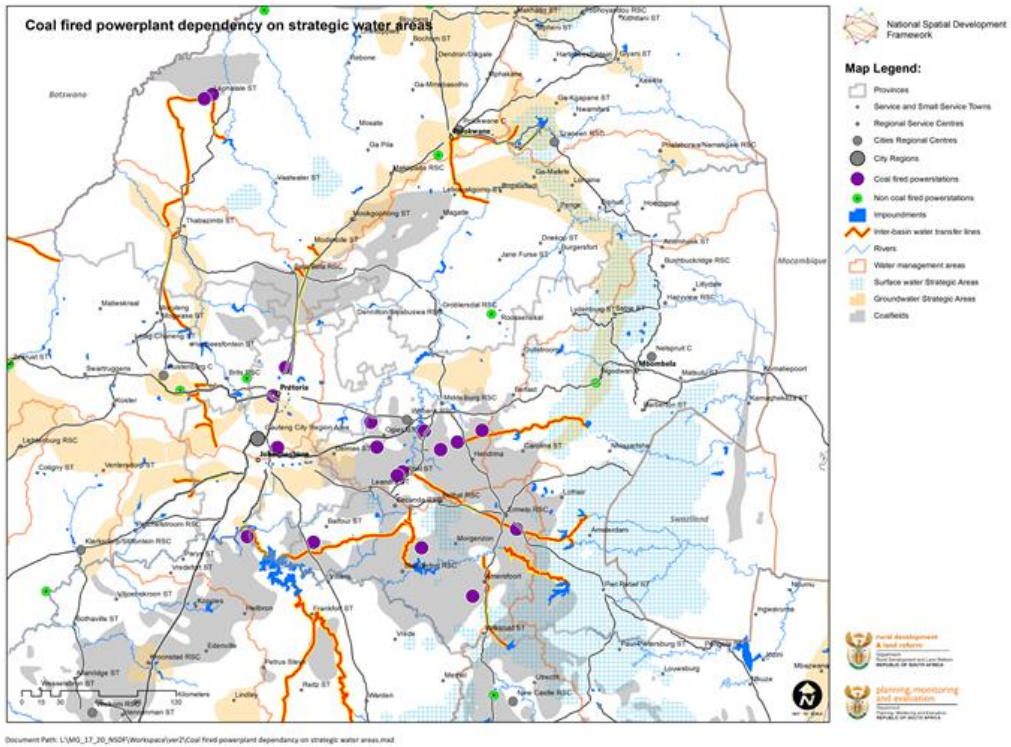
Transmission networks:

- Existing pipeline for crude oil and gas;
- Future pipeline for gas;
- Main transmission lines.

Existing gas fields and coal resource areas.

The infrastructure network to support national energy flows and increased energy mix and existing national and regional networks, as well as current and future settlement patterns.

Figure 4b: Strategic Focus Areas for Energy Transition



Mpumalanga Coal Fields transition focus area:

- 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
- Regional economic diversification and transition focus areas require shared forecasting, phasing, pro-active and regional scale economic transition planning, scenario development and enterprise development between multiple role players and institutions.

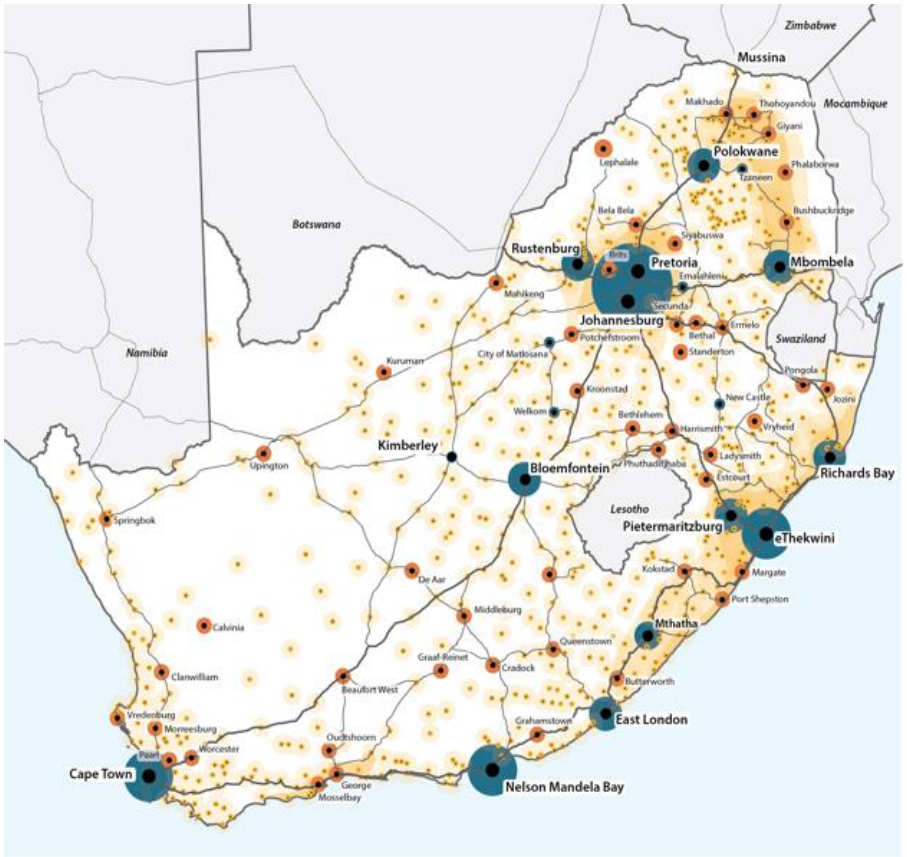
Significant plans and studies on which the spatial patterns in the frame was based

- 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.
- Current studies and proposals exploring 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, Bio-Energy Atlasses.

Frame 5: National Social Service and Settlement Infrastructure System in support of national well-being

Spatial Description

Figure 5a: Prioritised Rural Service Centres



Rural service centres across South Africa were **identified based on network of town**s with strategic regional roles as identified **on the basis** of nationally comparative town profiles developed in the CSIR, 2018 Town Area Typology. **Service Towns, as outlined in the town area typology**, that are strategically located to act as government and economic service centres within the surrounding service hinterland areas, as attractors of urban consolidation, form the bulk of the identified rural service centres.

A **network of consolidated and well connected rural service centres** needs **to be supported and developed** within densely developed **traditional authority areas.** Such a network of rural nodes and towns have been identified by using the CSIR, 2018 Town Area Typology and recently developed priority towns within the DRDLR Rural Social Facility Toolkit

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.

Table 5b: Identified network of Small Service Centres

Identified network of Small Service Centres for settlement consolidation and service access location and provision				
Rural service centres across South Africa were **identified based on network of towns** with strategic regional roles as identified **on the basis** of nationally comparative town profiles developed in the CSIR, 2018 Town Area : Service Centres				A **network of consolidated and well connected rural service centres** within densely developed **traditional authority areas.**
Acornhoek ST	Fort Beaufort ST	Jeffreys Bay ST	Stutterheim ST	Burgersfort
Aliwal North ST	Frankfort ST	Kamaqhekeza ST	Swellendam ST	Calvinia
Barberton ST	Franschhoek ST	Kokstad ST	Taung ST	Clanwilliam
Beaufort West ST	Giyani ST	Kuruman ST	Thabazimbi ST	Cofimvaba
Bizana ST	Graaf-Reinet ST	Middelburg (E.C.) ST	Ulundi ST	Ixopo
Caledon ST	Grabouw ST	Moorreesburg ST	Umzinto ST	Jozini
Ceres ST	Greytown ST	Musina ST	Ventersdorp ST	Laingsburg
Cradock ST	Harrismith ST	Mutale ST	Vredendal ST	Maclear
De Aar ST	Hermanus ST	Piketberg ST	Vryburg ST	Manguzi
Delmas ST	Idutywa ST	Robertson ST	Xitlhtlani ST	Matatiele ST
Dundee ST	Iziqolweni ST	Springbok ST	Zeerust ST	Mount Ayliff
Eshowe ST	Jane Furse ST	Sterkspruit ST		

Significant plans and studies on which the spatial patterns in the frame was based

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. This includes:

- Nationally comparative town profiles developed in the CSIR, 2018 Town Area Typology.
- Rural Service Centres were identified based on 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.
- Rural growth centres and anchors were selected based on the 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.
- SA CSIR MesoZone 2018v1 Dataset: Available at http://stepsa.org. Available at http://stepsa.org see http://stepsa.org/socio_econ.html#Indicator

Annexure: Supportive Projections and Models for NSDF Spatial Scenarios

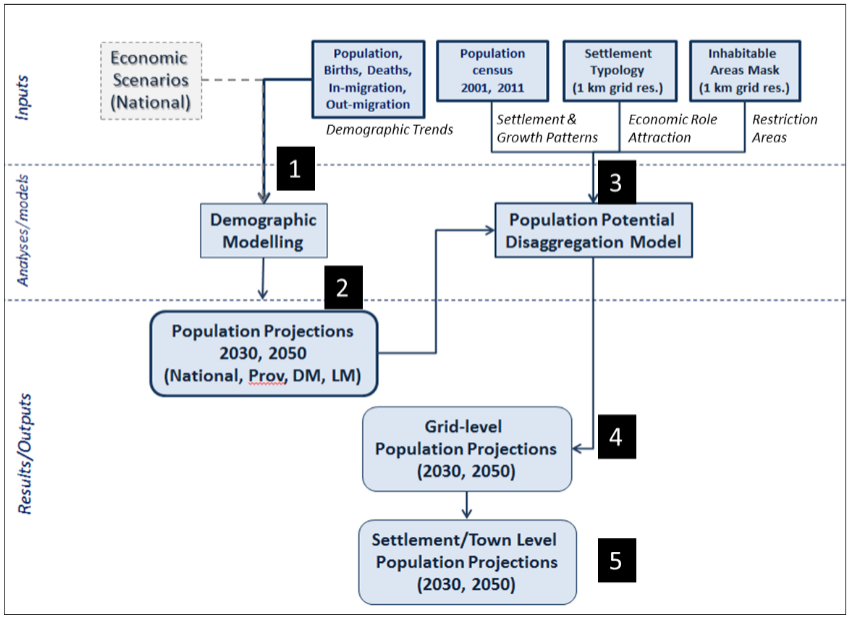
Population Projections

Overview of methodology

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 (considering population growth as well as migration patterns and spatial locational attraction).

The modelling approach, inputs and high level results are set out in the following diagram.

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

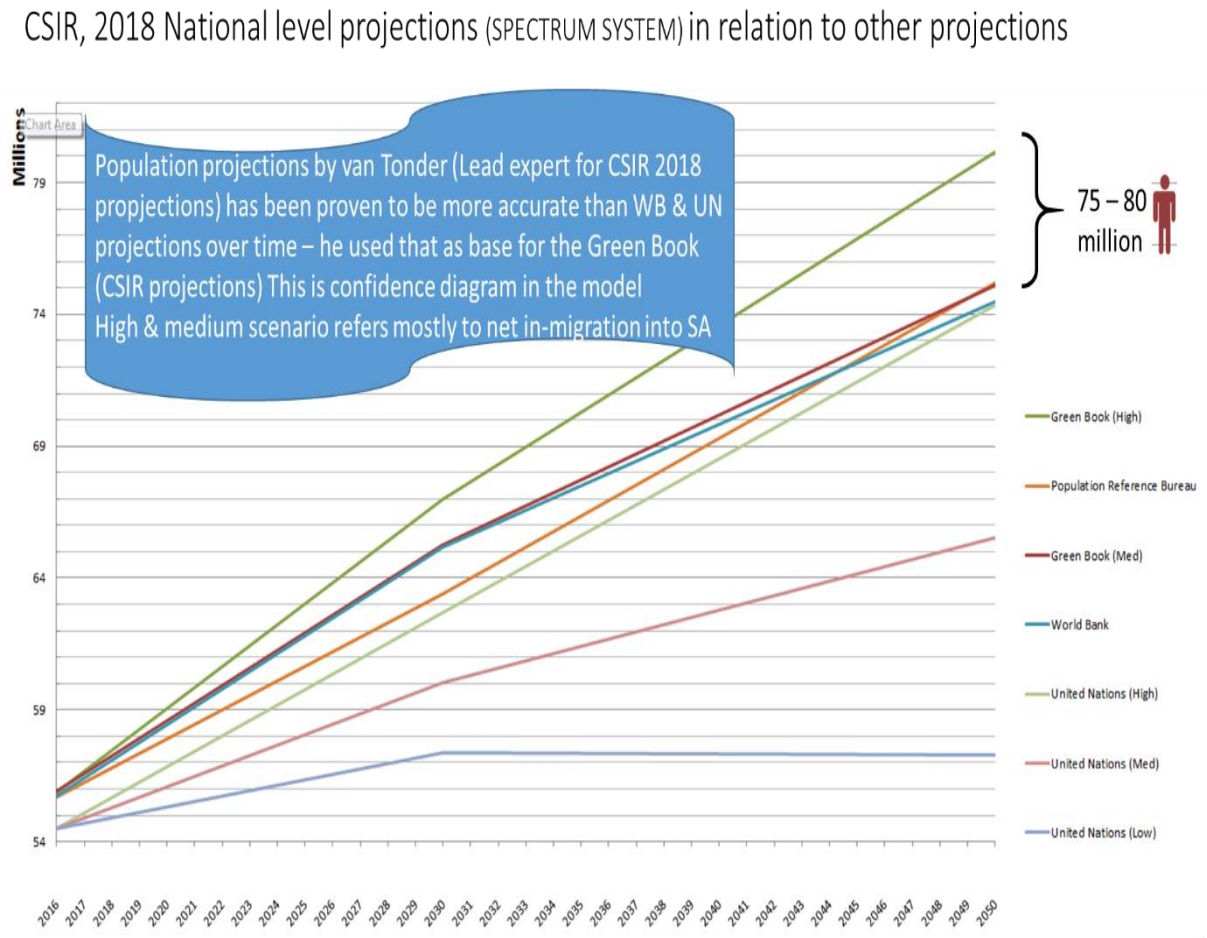
Step 3: Population potential locational disaggregation model

Step 4: Grid level – modelled population projections

Step 5: Functional town area – modelled population projections

Population Projection Results

Projection 1: National level projections



Population projection by van Tonder (Lead expert for the CSIR, 2018 Projections) has been proven to be consistently accurate over time if compared to World Banh and United Nations Projections.

The modelled national population projection is indicated on the diagram. 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 medium scenario indicating a population of 75million by 2050 and a higher in-migration scenario, a population of 80million by 2050. This might have significant spatial implications with population projected to grow primarily in urban core and secondary cities and large towns.

Projection 2: Provincial level projections

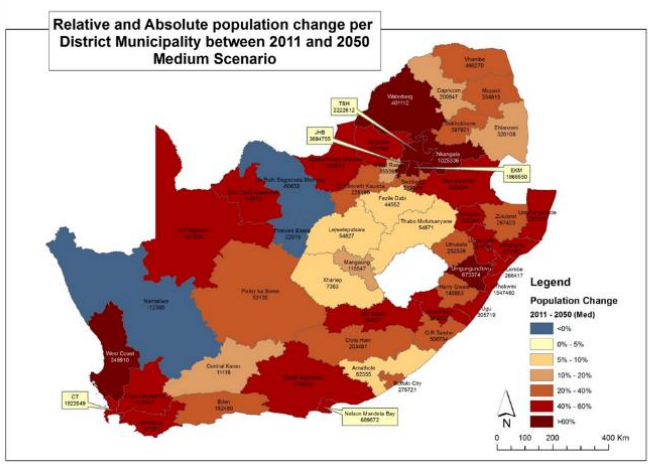
CSIR, 2018 Downscaled Cohort Component Projections for Provinces

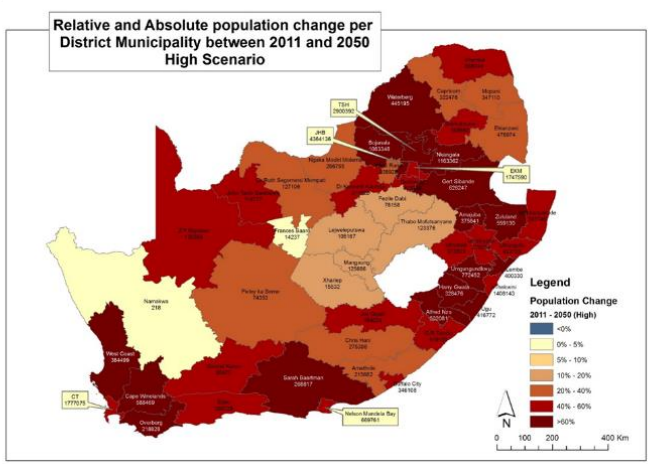
	2016		2030		2050	
	Med	**High**	**Med**	**High**	**Med**	**High**
EC	6,89	6,93	7,93	8,13	9,02	9,56
FS	2,75	2,77	2, 86	2, 94	2, 99	3, 16
GT	13,39	13,48	16,67	17,14	20,30	21,79
KZN	10,91	10,99	12,85	13,19	14,75	15,80
LIM	5,71	5,75	6,59	6,76	7,09	7,57
MP	4,30	4,33	5,11	5,24	5,91	6,26
NC	1,19	1,19	1,31	1,34	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

The results of the downscaled national projections for provincial and district scales are set out in the following two projections.

Projection 3: District level projections

CSIR, 2018 Downscaled Cohort Component Projections for District (cohort-component projections)





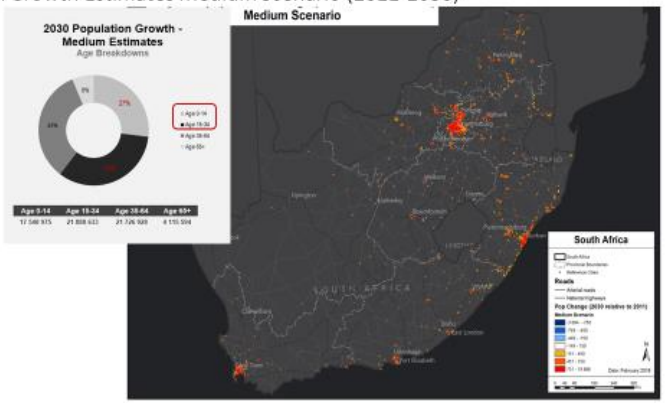
The district results were used as inputs for the location specific modelled results at settlement level. In addition to demographic trends the gravity model developed by the CSIR currently enables consideration of

- 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.

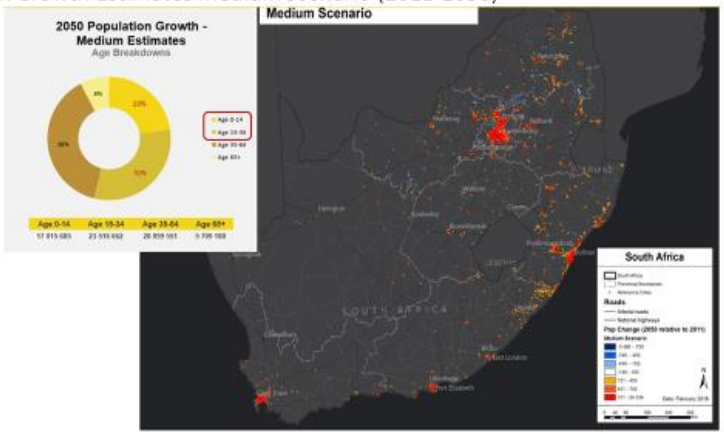
The projections have been downscaled and methodology tested with a simulation of 2001-2011 population data that provided very high levels of accuracy (98% for district level and 95% for settlement level). See Diagrams bellows.

Projection 4: Settlement level projections

CSIR, 2018 Downscaled Cohort Component Projections at Settlement Scale: 2011-2030 Population Growth Estimates Medium Scenario (2011-2030)



CSIR, 2018 Downscaled Cohort Component Projections at Settlement Scale: 2011-2030 Population Growth Estimates Medium Scenario (2011-2050)



Referencing:

- **CSIR, 2018. Population Projections**, CSIR (2018)

Annexure: Supportive Climate Change and Hazard Models for NSDF Spatial Scenarios

Climate Change Projections

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. The projections are for two 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 this 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

Climate change is a term that generally refers to a shift in weather phenomena associated with an increase in global average temperatures that would occur 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. 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.

Generally drier conditions and the more frequent occurrence of dry spells are plausible over parts of the interior as indicated in figure 6. Areas most affected by decreases in rainfall is 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 and parts of the Limpopo province.

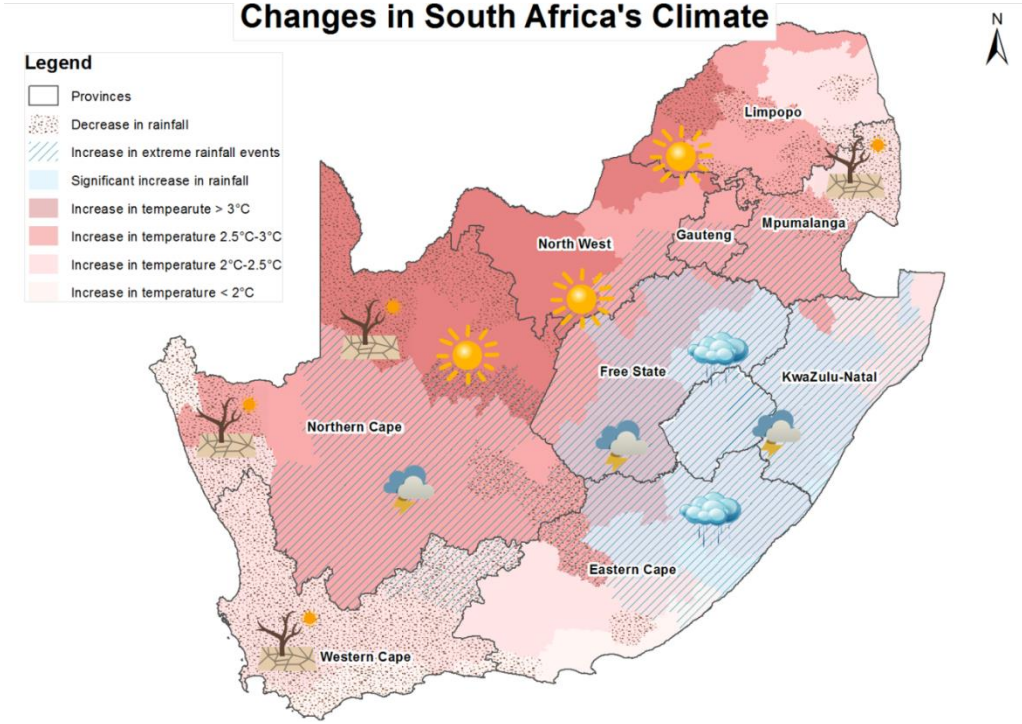
Increases in annual-average near-surface temperatures are projected to occur over large parts of South Africa, including the western interior and northern parts of South Africa. This is critical as the central and northern parts of the interior are important agriculture production areas currently. Aligned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

---

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

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)[2].

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)[3].



CSIR, 2018 Greenbook Climate Change Projections, CSIR (2018)

[2] 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

[3] 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.

It also has serious long-term implications for human habitation and the productivity of agriculture. At the same time, 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 some areas allowing different crops to be cultivated in areas not possible previously.

Referencing

- CSIR, 2018 Greenbook Climate Change Projections, CSIR (2018)