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ABBREVIATIONS AND ACRONYMS

ACDI	African Climate and Development Initiative
ARC	Agricultural Research Council
CA	Conservation Agriculture
CCT	City of Cape Town
CRLR	Commission for Restitution of Land Rights
CSIR	Council for Scientific and Industrial Research
DALRRD	Department of Agriculture, Land Reform and Rural Development
DFFE	Department of Forestry, Fisheries and Environment
DMR	Department of Mineral Resources
GDP	Gross Domestic Product
GDPR	Gross Domestic Product per Region
GHG	Greenhouse Gas(es)
GIS	Geographic Information Systems
LUPA	Land Use Planning Act 3 of 2014
NAP	National Action Programme
PERO	Provincial Economic Review and Outlook
PSDF	Provincial Spatial Development Framework
PV	Photovoltaic
SANBI	South African National Biodiversity Institute
SDF	Spatial Development Framework
SEA	Strategic Environmental Assessment
SoEOR	State of the Environment Outlook Report
SPLUMA	Spatial Planning and Land Use Management Act 16 of 2013
UNFCCC	United Nations Framework Convention on Climate Change
WC	Western Cape
WCCCRS	Western Cape Climate Change Response Strategy

WCG	Western Cape Government
WFP	World Food Programme
WUI	Wildland Urban Interface
WWF	World Wide Fund for Nature

GLOSSARY

Agricultural potential	According to Schoeman and Scotney (1987) agricultural potential is what is agriculturally possible on a piece of land and is "a measure of possible productivity per unit area, per unit time, achieved with specified inputs of management".
Agrochemical	A chemical used in agriculture, such as a pesticide or a fertilizer.
Biodiversity	The variability among living organisms from all sources, including terrestrial, marine and other aquatic ecosystems, and the ecological complexes of which they are part. The term also includes diversity within species, between species, and of ecosystems.
Carrying capacity	The maximum population of a given organism that a particular environment can sustain.
Climate Change	As commonly used, refers to "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods" (United Nations Framework Convention on Climate Change (UNFCCC)).
Conservation	The maintenance of environmental quality and functioning.
Conservation Agriculture	Conservation agriculture aims to achieve sustainable and profitable agriculture and subsequently aims at improved livelihoods through the application of the three conservation agriculture principles: minimal soil disturbance, permanent soil cover and crop rotations.
Consumption	The purchase and/or use of goods and services.
Degradation	The reduction or loss of the biological or ecological productivity of an area (see Desertification).
Desertification	The degradation of land in arid, semi-arid, and dry sub-humid areas, resulting from various factors including climatic variations and human activities.
Development	A process of change that represents planned progress of some kind. For example, developing the economy of a region or country can take place through the expansion of economic activities, the improvement of people's skills, or job creation.
Drivers	These are the primary agents driving change in the environment, and they may be human induced or natural. They include the underlying socio-economic and political agents of change, such as population growth and the desire for increased consumption. Drivers can also be described as 'wants' as deriving from human and economic activities. Some indirect drivers such as governance structures, socio-cultural perceptions, population demographics and technological dependence can also be included. Driving forces emanating from natural processes (e.g. solar cycles) are possible, but are typically too infrequent, not well understood or operate over timescales that are not

	easily related to the 4-yearly reporting framework of the State of Environment Report.
Ecological footprint	A measure of the 'load' imposed by a given population on nature. It represents the land area of average quality needed to sustain current levels of resource consumption and waste discharge by that population. The bigger the footprint the greater the impact that it represents.
Ecosystem	A dynamic system of plant, animal (including humans), micro- organism communities, and their non-living physical environment interacting as a functional unit. The basic structural unit of the biosphere, ecosystems are characterised by interdependent interaction between the component species and their physical surroundings. Each ecosystem occupies a space in which macro-scale conditions and interactions are relatively homogenous
Ecosystem services	Ecological processes or functions having monetary or non- monetary value to individuals or society. These are frequently classified as (i) supporting services such as productivity or biodiversity maintenance, (ii) provisioning services such as food, fibre, or fish, (iii) regulating services such as climate regulation or carbon sequestration, and (iv) cultural services such as tourism or spiritual and aesthetic appreciation.
Environment	In terms of the National Environmental Management Act "NEMA" 107 of 1998 (as amended) "Environment" means the surroundings within which humans exist and that are made up of: (i) the land, water and atmosphere of the earth; (ii) micro-organisms, plant and animal life;(iii) an part or combination of (i) and (ii) and the interrelationships among and between them; and (iv) physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and wellbeing.
Environmental degradation	The reduction of the capacity of the environment to meet social and ecological objectives and needs.
Environmental health	Well-being based on the health of the environment, both natural and built.
Food security	According to the Food and Agricultural Organisation of the United Nations, food security is a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life.
Forestry	The practice of growing and managing forest trees for commercial timber production. It includes the management of specifically planted forests and of native or exotic tree species, as well as the commercial use of existing indigenous forests.
Fynbos	Afrikaans word for 'fine-leaved bush' - an evergreen, hard-leaved mediterranean type shrubland found in the Western and Eastern Cape provinces of South Africa
Greenhouse Gas	Any gas that absorbs infrared radiation in the atmosphere, thus allowing heat to enter the earth's atmosphere but not to leave it.

Gross Domestic Product per Region	A subnational gross domestic product for measuring the size of a region's economy.
Impacts	'Impacts' describe the consequences of the good or bad state of elements of the environment for sustainability, specifically on humans, the economy, ecosystems, as well as other environmental systems, and could include regional or global effects. For example: high levels of indoor air pollution may result in respiratory tract infections; land degradation may lead to decreased food production, increased food imports, increased fertilizer use, malnutrition and siltation of aquatic systems. The impacts should be seen as changes that are occurring within environmental, economic or social systems and their ability to perform functions or services for society.
Indicator	A measure that helps to assess the extent of the success with which goals are being achieved. Based on complex information or data, indicators are often used in State of the Environment reports to measure how resources are being managed.
Land degradation	Reduction or loss in arid, semi-arid and dry sub-humid areas, of the biological or economic productivity and complexity of rain-fed cropland, irrigated cropland, or range, pasture, forest and woodlands, as a result of land uses or from a process or combination of processes, including processes arising from human activities and habitation patterns such as: (i) Soil erosion caused by wind and/or water; (ii) Deterioration of the physical, chemical and biological or economic properties of soil; and, (iii) Long-term loss of natural vegetation (see Soil degradation).
Land capability	Land capability is defined as "the most intensive long-term use of land for purposes of rainfed farming determined by the interaction of climate, soil and terrain".
Land reform	Redistribution of land to recognize the rights of all citizens.
Land transformation	The conversion of land, normally from natural habitat to human uses such as agriculture or settlements.
Migration	Movement of all or part of a population to and from a geographical area. The movement may be temporary or permanent.
Non-renewable resources	Resources that do not renew themselves in a human time-scale and cannot be replenished once exhausted, such as fossil fuels and copper.
Pollution	The accumulation of harmful or poisonous substances in the environment that leads to environmental degradation.
Population growth	An increase in the number of organisms or species. In human demography, the population growth rate refers to the annual growth rate of the population calculated from mid-year.
Poverty	A certain level of material deprivation below which a person suffers physically, emotionally, and socially.
Pressures	The human activities and processes that act on the environment and cause environmental change. They are distinct from the driving forces

	since they relate directly to the use and exploitation of natural resources, as opposed to the driving forces, which determine the scope or extent of the pressures. Effectively, the pressures satisfy the 'wants' or driving forces. Pressures can be divided into three main types: (i) excessive use of environmental resources; (ii) changes in land use; and (iii) emissions (of chemicals, waste, radiation, noise) to air, water and soil.
Resilience	The capacity of a social-ecological system to cope with a hazardous event or disturbance, responding or reorganising in ways that maintain its essential function, identity, and structure, while also maintaining the capacity for adaptation, learning, and transformation.
Response	The societal actions taken collectively or individually to ease or prevent negative environmental impacts, correct damage or conserve natural resources. Responses may include policy and regulatory action, environmental or research expenditures, public opinion and consumer preferences, changes in management strategies and the provision of environmental information.
Smallholder farmer	Smallholder farmers are defined as those farmers that produce more product than their own requirements and sell the excess, either directly to consumers or supply products to collection centres or co-operatives, which generally process and market the products. Within the smallholder sector, farmers can fluctuate between subsistence and commercial, depending on numerous factors.
Soil degradation	The declining productivity of soils through physical, chemical, or biological deterioration resulting from a combination of physical factors such as drought, management factors such as cultivation of marginal land or overstocking, and historical and socio-economic factors such as inequitable distribution of land (see Land degradation).
Soil erosion	The loss or movement of soil by agents such as running water, wind, and gravity.
State	The 'State' describes the actual condition of the environment resulting from the pressures. For example, air quality in terms of the level of air pollution, and proportion of degraded area of land. The 'State' is described in terms of both current state and trends over time. A study of environmental trends will reveal whether the state of the environment is getting better or worse. It also indicates how quickly changes are happening (the rate of change) and whether rates of change are increasing or decreasing.
Sustainable agriculture	To be sustainable, agriculture must meet the needs of present and future generations, while ensuring profitability, environmental health, and social and economic equity.
Sustainable development	Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.
Wildland Urban Interface	Areas in which urbanisation intermingle with wildland vegetation and functioning ecosystems.

1 INTRODUCTION

The Food and Agriculture Organization (FAO) Land and Water Bulletin 2 provides a definition of land as a distinguishable area on the earth's terrestrial surface. This definition includes all attributes of the biosphere above or below the surface, comprising near-surface climate, soil and terrain forms, surface hydrology (such as shallow lakes, rivers, marshes, and swamps), near-surface sedimentary layers, associated groundwater reserve, plant and animal populations, human settlement patterns, and physical traces of past and present human activities (such as terracing, water storage or drainage structures, roads, buildings, etc.) (Sims and Sombroek 1997).

In general terms for the South African context though, land can be described as "the terrestrial bio productive system that comprises soil, vegetation, other biota, and the ecological and hydrological processes that operate within the system" (DEAT, 2006). Globally, land resources are under constant pressure from social, political and environmental drivers. This is particularly true in the Western Cape and South Africa, where population growth, urbanisation, urban sprawl and poverty all compound existing spatial constraints. Much of this can be attributed to poor land use planning ascribable to the legacy of segregated, inequitable land use and rights in South Africa.

The Western Cape's land use and land cover are critical factors for understanding the utilisation of the country's natural resources and economic or development trends. The use of land is typically dependent on underlying factors related to land – i.e. topography geology, soils, vegetation cover, and climate – all of which are subject and susceptible to change.

Land degradation is a global problem impacting biodiversity and livelihoods, with profound effects on resource-based livelihoods. As such, it impedes progress towards sustainable development goals (SDGs) as defined by the United Nations (2015) and overcoming climate-related poverty – increased poverty and food insecurity as a result of climate change impacts on land resources. Interrelated biophysical and social factors are driving further land degradation, and, internationally, there is a range of policies and initiatives designed to address these (Mani et al., 2021)

After the Northern Cape, Eastern Cape and Free State Provinces, the Western Cape is the fourth largest province in South Africa. At 129 462 km^2, it comprises 10.6% of the country's total land surface area (DALRRD, 2021) and has contrasting landscapes consisting of large fold mountains, plains and farmland, developed and natural coastlines and semi-desert conditions. In addition to the metropolitan City of Cape Town (CCT) municipality, there are five district municipalities, namely; West Coast, Cape Winelands, Overberg, Garden Route and Central Karoo.

The primary land uses in the province are urban residential, commercial, agricultural (including cultivated areas, grazing and plantations), conservation and industrial. Most of the larger urban areas are located close to the coast and near agricultural resources. Inland, where land is generally less productive, settlements are typically smaller and more isolated.

The key landscape types in the Western Cape include :

- A long, high-energy/dynamic, scenic coastline;
- Fertile coastal plains (the West Coast, Agulhas Plain and Southern Cape);
- A spine of mountains (Hottentots Holland, Groot Winterhoek, Cederberg, Hex River, Riviersonderend, Langeberg, Langkloof, Outeniqua and Swartberg Mountains, with incised river valleys such as the Bitou, Hex, and Breede Valleys and Gamkaskloof);
- A series of inland (plateau) plains (the Tankwa Karoo, Little Karoo and Great Karoo);

- A second range of mountains in the interior (the Bokkeveld, Roggeveld and Nuweveld Mountains); and
- Great plains extending into the Northern Cape Province.

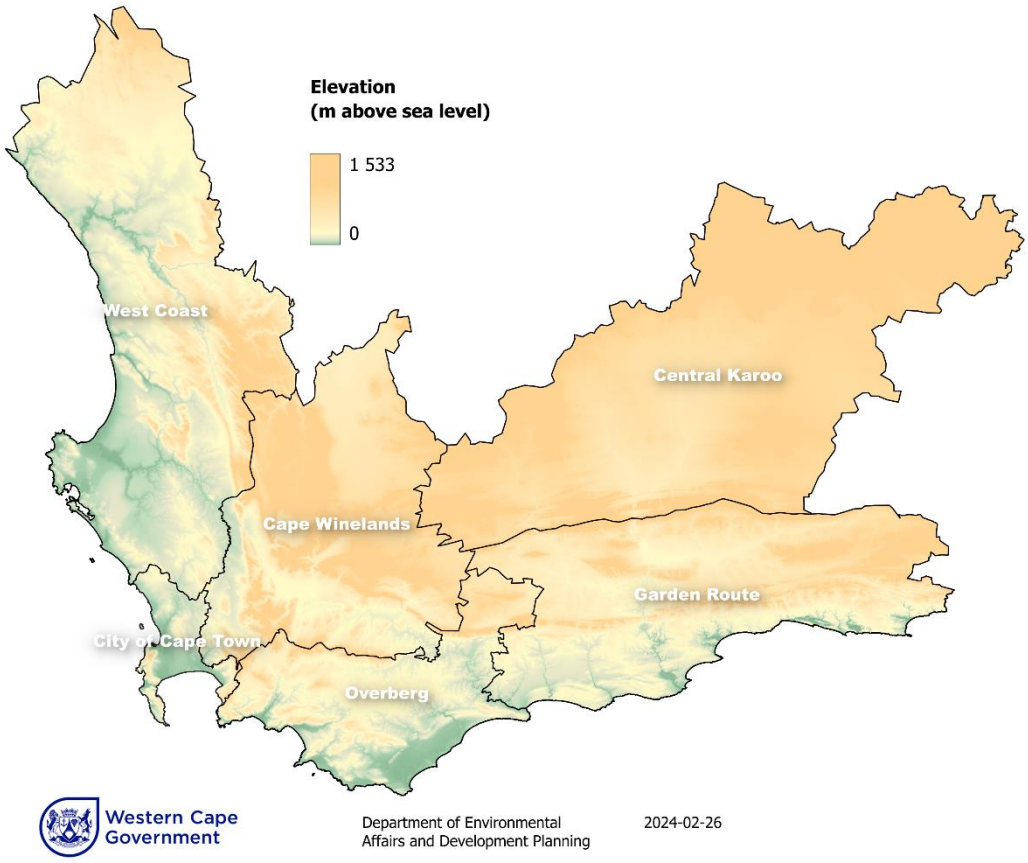


Figure 1: Elevation profile of the Western Cape Province showing the different landscape types present in the province

The land chapter in the Western Cape State of the Environment Outlook Report (SoEOR) highlights the state of land use in the Western Cape, including the need for linking land resources to spatial patterns (both anthropogenic and bio-physical), access to land as a resource as well as other interacting, dynamic systems and drivers which shape current land use and value. The function of agricultural production is strongly linked land resources and key progress points are described. Key challenges including data gaps are described. This chapter also identifies the pressures and impacts on land in the province, measured by three key indicators (land cover, land capability and land transformation) and the potential responses to address impacts.

2 DRIVERS AND PRESSURES

The following are drivers of land change in the Western Cape:

- Population increase (specifically along urban coastal areas, but also rural areas);
- Climate change with Western Cape impacts;
- Unplanned and unserviced urbanisation;
- Incompatible development in and close to environmentally sensitive areas; and
- Inappropriate land use management practices.

From these drivers, pressures of land change in the Western Cape include:

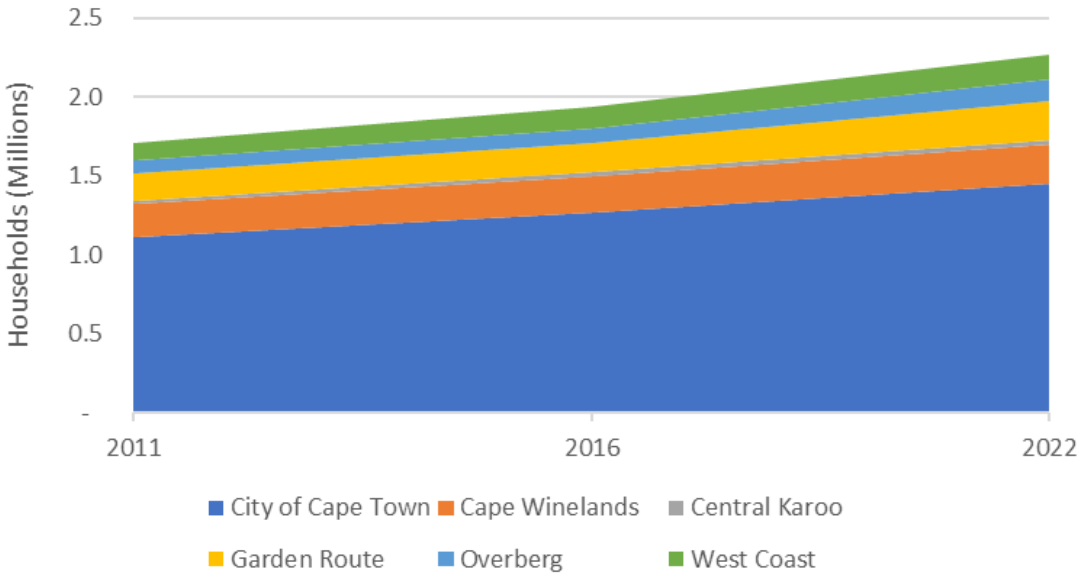
- Changes in agricultural production;
- Investment and increased demand for commodities resulting in urban, agricultural, and infrastructural expansion, and more mining;
- Mining in specific regions – i.e. West Coast.

2.1 Western Cape population

For the Western Cape population, the 2022 Census results recorded a significant increase in the province's population growth over the last decade. Currently the Western Cape population is estimated at 7.4 million people (StatsSA, 2023) which is a 27% population growth over the past decade and continues the trajectory of a projected 8-million people by 2030. Further projections from the latest PERO report (2023) suggested that the provincial population is anticipated to reach 10 million by 2040, growing by

In addition to the key drivers and pressures affecting land change, the following emerging issues may affect land change:

- *Pressure on land resources from **renewable energy infrastructure***
- *Agricultural production and place pressure on ecosystem services*
- *The potential impacts of **shale gas prospecting (and production)** – which are not yet fully understood*



an additional 2.7 million people between 2023 and 2040 - 123 000 more people per year in the Western Cape. Overall, the population growth rate in the province increased from 2.5% between 2011-2016 to 2.7% in 2016-2022 per annum (in terms of compound annual growth rate - CAGR).

Figure 2 Population growth rate in the Western Cape 2011-2022

When considering population growth of the Western Cape, it is important to consider the function of in-migration. The Western Cape has experienced a net inflow of people directly linked to the economic strength of the province and the prospects of job opportunities for people from other

provinces. For the period 2016 – 2021, the Western Cape has attracted 292 521 people, which is the province second to Gauteng to have attracted the most significant in-migration (StatsSA, 2021):

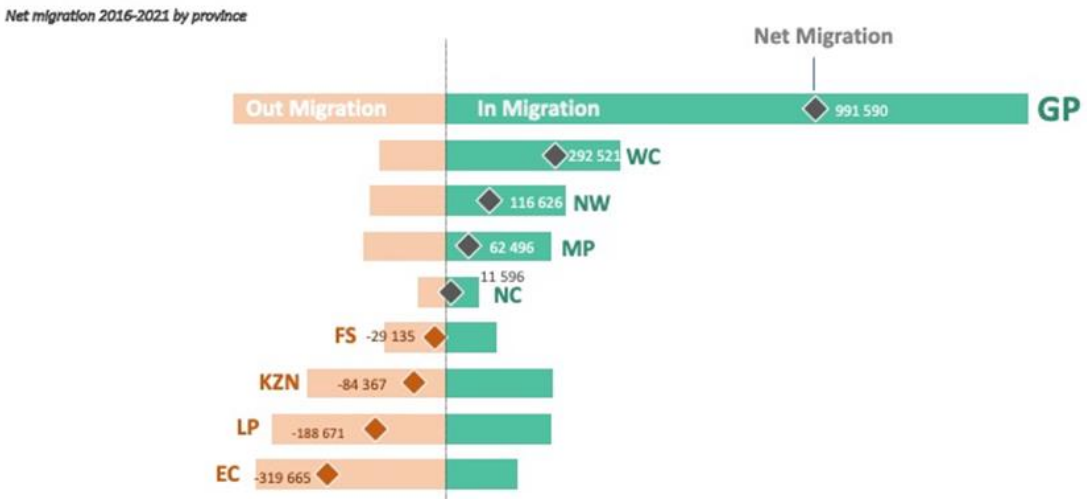


Figure 3: Net migration in South African provinces for 2016-2021 (StatsSA, 2021)

From a land perspective, it is important to note that 72% of the total population resides in the CCT (PT, 2022). This exerts intense pressure on the finite land resources in the city, specifically as regards informal settlements, since the carrying capacity of land in the CCT can only sustain a limited number of resource users. Urban expansion, encroachment by agriculture into natural habitats and increased demand for ecosystem goods and services are concerns for land resources. For the Western Cape, annual economic growth for the period 2013 to 2022 period was slightly higher than the national growth rate, at an average annual growth rate of 1.1% (PERO, 2023). Comparing the first quarter of 2020 and 2023, the provincial GDP was estimated at 0.3% higher in 2023; and for employment, it was estimated at 6.3% higher. These are positive indications of a Western Cape job market and economy. However, the economic outlook for the Western Cape remains poor which, coupled with poverty, unemployment and inequality, **it will continue to put pressure on the provincial land resource.**

Demand for (suitable) land often exceeds 'supply' and in some instances, sensitive land is jeopardised and impacted by inappropriate land use, e.g. intensive agricultural activities in the threatened Renosterveld, and human settlements perching on mountainsides (e.g. Imizamo Yethu in Hout Bay). It is in the wildland-urban interface where there exist heightened fire risks to houses; and in the coastal context - housing construction often takes place in sensitive and high risk coastal zones.

Critically, land use management is the primary means of sustaining or – in its absence - degrading land in the province. Without suitable land use management, effects on ecosystems and the economy can be significant. The pressures these drivers contribute to are detailed in the subsections below.

2.2 Urban growth

Urbanisation is a global challenge and the Western Cape is no exception, and the province's rapidly growing population and elevated urbanisation rate (second only to Gauteng) places strain on land resources (TIPS, 2022). From a land perspective, it is important to note that 72% of the total

population resides in the CCT (PT, 2022). This exerts intense pressure on the finite land resources in the city, specifically as regards informal settlements, since the carrying capacity of land in the CCT can only sustain a limited number of resource users. Urban expansion, encroachment by agriculture into natural habitats and increased demand for ecosystem goods and services all contribute, in principle, to land resource degradation in the Western Cape. This has repercussions on the scenic and aesthetic value of the province, exacerbated by increasing soil erosion in the province. Specific data analysis is needed to determine the level of land resource impacts in the Western Cape.

Migration and urbanisation are driven by real or perceived employment opportunities and better access to services. Significant increases in intra-provincial migration from interior urban centres to coastal urban nodes (particularly the City of Cape Town) are also evident, with diminished economic prospects in the interior prompting the trend. The Department of Agriculture's Mapping of Agricultural Commodities Production and Infrastructure in the Western Cape Province (Flyover Report, 2024) recorded urban creep for both the City of Cape Town and the Cape Winelands which is placing pressure on water and land resources. For the City of Cape Town, it is accompanied by an increase in peri-urban subsistence farming.

In-migration in concert with the land-intensive nature of much economic activity (manufacturing and agriculture) continuously increase the burden on land resources in the province. Intense demand has transformed land for human settlements and service provision, even though some of this land is better suited to agriculture and ecological processes (conservation). This is particularly true of coastal urban nodes in the province, such as the City of Cape Town, Saldanha Bay and Garden Route coast, where human settlements are continually expanding to cater for the growing population.

2.3 Climate change

Climate change is identified as the most significant risk to land and agriculture in the Western Cape due to its extensive influence on various other risks, posing a serious threat to the cultivation of high-value crops – this is described in detail in the Department of Agriculture's Mapping of Agricultural Commodities Production and Infrastructure in the Western Cape Province (Flyover Report) (DoA, 2024). Specific risks for Western Cape land and agriculture include alterations in microclimates and changes in the suitability of traditional growing regions. Climate change extends to pressures on water availability and the escalating need to prioritise urban water allocations. It also includes rising concerns regarding water quality. From a land cover perspective, climate change brings increased risks associated with uncontrolled fires, and from a soil perspective - increased occurrences of droughts and floods. All agricultural and other infrastructure are at risk from heightened intensity of winds and storms. Collectively, socio-economic impacts stemming from climate change pressures on Western Cape agriculture, have severe affects on both the maintenance of current job opportunities and the creation of new ones, and concurrent economic stability impacts.

2.4 Agriculture

The agricultural sector has an important economic role in the Western Cape. The Western Cape's economy is genarally in line with the national trends over the past decade and has grown more or less in line with national economic growth. Between 2021-2022, there has been a slight increase in the Western Cape's agricultural sector contribution to the economy 2.8% to 2.9%. At provincial level over the period 2013 to 2022, the agriculture sector (37.1% contribution) grew at the fastest pace followed by the Finance (27.5% contribution) and Government sectors (21.9% contribution) (PERO, 2023). The Mapping of Agricultural Commodities Production and Infrastructure in the Western Cape

Province (DoA, 2024) findings indicates that overall, during 2023 approximately 4% more jobs was created in the broader economy compared to 2013 and between 2017 and 2023 approximately 42% more jobs. The impact the 2017 drought and the massive devaluation of the Rand since 2017 can explain this result. The result indicates that potential gross production of R60 billion will result in an additional contribution of approximately R43.1 billion to the GDP of the Western Cape.

The success of the agriculture sector must be interpreted in terms of the land theme – the growth in agricultural economic value as attributed in GDP measure, does not necessarily or directly relate to pressures on the province's land resources. The growth in agricultural sector most prominently is attributed to increased access to international markets and export growth.

The Western Cape agricultural sector is export-oriented and contributes more than 50% on average to South Africa's national agricultural exports to the world. A calculation was made through research conducted by the Department of Agriculture that a 5% increase in the value of exports of certain competitive products (i.e. deciduous fruit, table grapes, wine, animal fibres, flowers and citrus) would lead to 22 951 new jobs being created especially in the non-agricultural sectors of the province (WCG, 2023).

The province's agriculture, forestry, and fishing sector accounted for 4,31% of Gross Value Added (GVA) in 2021. When the value chain is considered (packaging, processing, etc.) this percentage is even higher. At a more granular level, the Western Cape's agriculture, forestry, and fishing sector contributed 4,37% to the province's GVA over the past 5 years leading up to 2021, while 19% of South Africa's agriculture, forestry, and fishing GVA came from the Western Cape (Quantec, 2022).

The Western Cape boasts the highest employment of farm workers. This is attributed to the region's significant concentration of labor-intensive sectors, particularly in irrigated fruit orchards and vineyards (BFAP, 2022). During, the drought of 2017 overall estimated on-farm employment decreased by 1.7% compared to 2013 and increased by 5.3% in 2023 (not only because of improved rainfall but also because of structural changes on farms). Thus, it is estimated that current on-farm employment is approximately 303 861 permanent equivalent labourers. The ratio of permanent to seasonal workers is approximately 30-40% (huge variation between crops) (DoA, 2024).

The Department of Agriculture's Mapping of Agricultural Commodities Production and Infrastructure in the Western Cape Province (Flyover Report, 2024) also reported that 58% of farm workers are employed as permanent staff and the remaining 42% as temporary or casual workers. (BFAP, 2022). The agriculture sector in the Western Cape is growing and, as a resource-intensive sector, the pressure it places on land is notable and it is deemed that most of the land under cultivation in the Western Cape is typically considered not suited to agriculture[1]. In some instances, ineffective and inefficient farming practices impinge on agricultural productivity and contribute to the loss of topsoil. Many conventional farming methods and practices are unsustainable, largely due to negative impacts on the natural environment. Unsustainable and carbon-intensive practices include irresponsible use of chemical pesticides (which causes water pollution and reduces biodiversity), tillage (a leading cause of soil degradation) and burning of fossil fuels to

[1] This observation is based on the Land Capability datasets used in the northern, summer rainfall areas where soils and practices are quite different from parts of the Western Cape. One of the main issues with the datasets used to measure Land Capability is that the classification methodology demotes many of the cultivated areas in the Western Cape Province to "non-arable" classes based mainly on their shallow soil depth without acknowledging that field crops are grown during winter in the Western Cape when evapotranspiration is much lower. Conversely, the areas shown as higher classes adjacent to the west coast (e.g. Sandveld) are actually not high potential, as the soils are sandy and inherent unfertile.

power farm equipment and infrastructure (which contributes to air pollution and carbon dioxide emissions) (GreenCape, 2016).

Energy plays a crucial role as an essential input in the production, storage, and processing of agricultural products. The adverse effects of loadshedding significantly impact the socio-economic dimensions of Western Cape agricultural value chains and hinder the attainment of provincial government objectives. What is of particular concern is the heightened vulnerability of job opportunities in the horticultural sector, a critical employer in both on-farm and off-farm agricultural roles in the Western Cape. Given the complexity and magnitude of interventions required, a collective effort from all stakeholders is necessary to mitigate this electricity crisis in the Western Cape. To illustrate, running primary production and agro-processing facilities in the Western Cape uninterrupted for a full year at stage 6 loadshedding will demand spending of around R4 billion per annum on alternative energy sources (Bureau for Food and Agricultural Policy (BFAP), 2023). Despite the relatively low demand for electricity from agriculture, agriculture is the economic sector most affected by loadshedding. As emphasised by the BFAP, the unfortunate consequence of load shedding on agriculture is that it will disproportionately affect smaller businesses that lack the capital and available cash flow to invest in their own power generation. For these agricultural businesses, there will be an impact on the volume of output and the prices received in the market due to the disruptions in operations.

Loadshedding and the apple industry

The Western Cape apple industry has shown consistent growth in both area and production over the past decade (BFAP, 2023; DoA 2024). The latest 'Mapping of Agricultural Commodities Production and Infrastructure in the Western Cape Province' found apple production per hectare has increased due to new cultivars, high-density planting, and more trees being planted under shade netting, since 2013 (DoA, 2024).

However, the industry faces significant challenges due to load shedding, impacting various stages of the value chain, from inputs to distribution and marketing. The reliance on Eskom affects irrigation, packaging, processing, and transportation. Despite only exporting 46% of production, exports contribute 78% of Gross Producer Value (GPV). Load shedding, coupled with other challenges like Covid-19, global logistics issues, and geopolitical events, has led to increased production costs. A scenario simulation predicts a 3.13% increase in total production costs, a 6% reduction in yield, a 10% decrease in exports, and accelerated removal of older orchards due to limited water availability. This indicates the profound and multifaceted impact of load shedding on the apple industry, affecting its competitiveness and profitability.

According to a scenario simulation by BFAP (2023), the Western Cape apple industry could experience a substantial decrease in Gross Producer Value (GPV) due to electricity load shedding. The simulation anticipates an annual GPV reduction of approximately 10% from 2023 to 2025, with a further decline of over 6% in 2026. Beyond 2026, the impact gradually diminishes, ranging from 1.3% to 2.6% for the remainder of the simulated period. The short-term effects primarily involve direct and opportunity costs, while the long-term consequences involve structural impacts on the cultivated area, leading to a reduction in overall volume. Over the period from 2023 to 2032, the total projected impact on GPV amounts to an estimated R5.11 billion in absolute terms.

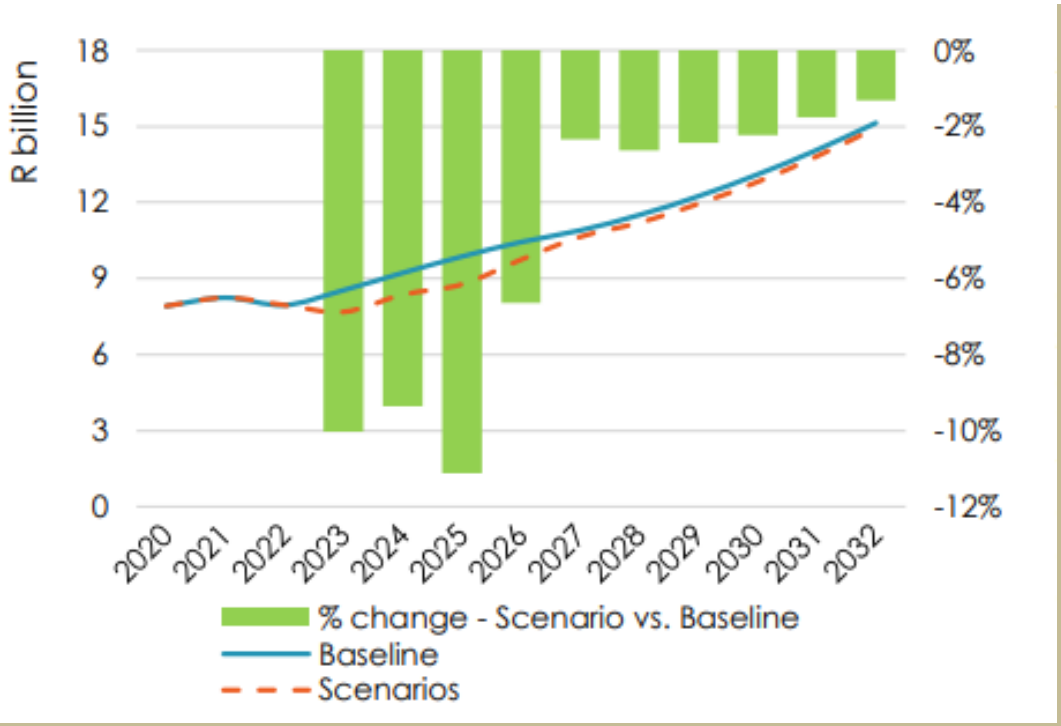


Figure 4 Western Cape scenario simulation for the apple industry under loadshedding

Given the challenges described, the baseline already reflects a contraction in production area, resulting in a projection of 23 000 hectares in 2030. This leaves questions on whether the land is converted to other agricultural uses, and whether there is a net change in land under cultivation. For the simulated scenario, an additional area contraction of 500 hectares is projected. With 30% of the industry's orchards older than 25 years and potentially marginal, especially when put under stress with additional cost to be covered, the contraction in area is conservative and likely could be higher (Hortgro, 2022).

2.5 Climate change

The Western Cape is considered highly vulnerable to the impacts of climate change, most notably (local) warming, drying and flooding. These climate-related hazards pose a substantial risk to the Western Cape's economy, population and ecosystems. A long-term reduction in water security with an increase in extreme events related to temperature rise and changing rainfall variability are projected (WCG, 2022). This suggests that the province needs to be moving towards land use practices that are resilient to these impacts. Otherwise, climate change will continue to put pressure on land resources, which will become more susceptible to erosion and other forms of land degradation.

For the Western Cape, temperatures are projected to rise by 1°C to 1.5°C by the mid-2030s, and possibly by 2°C, leading to a 5% to 20% reduction in rainfall (WCG, 2014). Already, studies suggest that the Western Cape has the most significant warming trends and variation in rainfall patterns in South Africa, *viz*. a curtailed and late start to the rainy season, with serious repercussions, particularly for agriculture (GreenCape, 2016). The timing of the first rains will affect small grain planting, while reduced moisture availability will lower the moisture content of soils, which will become less suitable for (dryland) cultivation of a number of winter crops. Reduced run-off into water storage infrastructure (mainly dams) could impact negatively on irrigated summer crops.

2.6 Mining

While mining is not a substantial economic contributor in the province, the demand for land as a commodity continues to drive environmental change. This is particularly true for the development of human settlements, supply of basic services, agriculture and agri-processing, all of which are land intensive.

However, notable mineral deposits along the West Coast ensure its role as a pressure on land. Limestone, dolomite, heavy mineral sands, sand, salt and diamonds are mined or quarried in the province (WCG, 2013a). While current mining activities remain largely restricted to the West Coast, future mining activities are likely to increase, particularly in relation to oil and gas - this includes shale gas exploration (and production) in the central Karoo and offshore oil and gas exploitation on the West and South Coasts. Since mineral resources occur throughout the province (as seen in Figure 5: Location of mineral resources in the Western Cape), future mineral extraction is likely (and supported by Department of Mineral Resources - DMR).

The extraction of construction materials in close proximity to infrastructure and in sensitive environments is considered inevitable and necessary to promote economic growth in the province (WCG, 2013a). As such, sand mines are proliferating in the West Coast, and illegal sand mining is also prevalent.

Mining, while good for economic diversification, has consequences in habitat loss, land transformation and water pollution. Mining compromises sense of place, natural landscapes and ecosystem services and it is evident that trade-offs for land resources in the province are required to support economic activity while maintaining ecosystems and sustainable social structures (CCT, 2015).

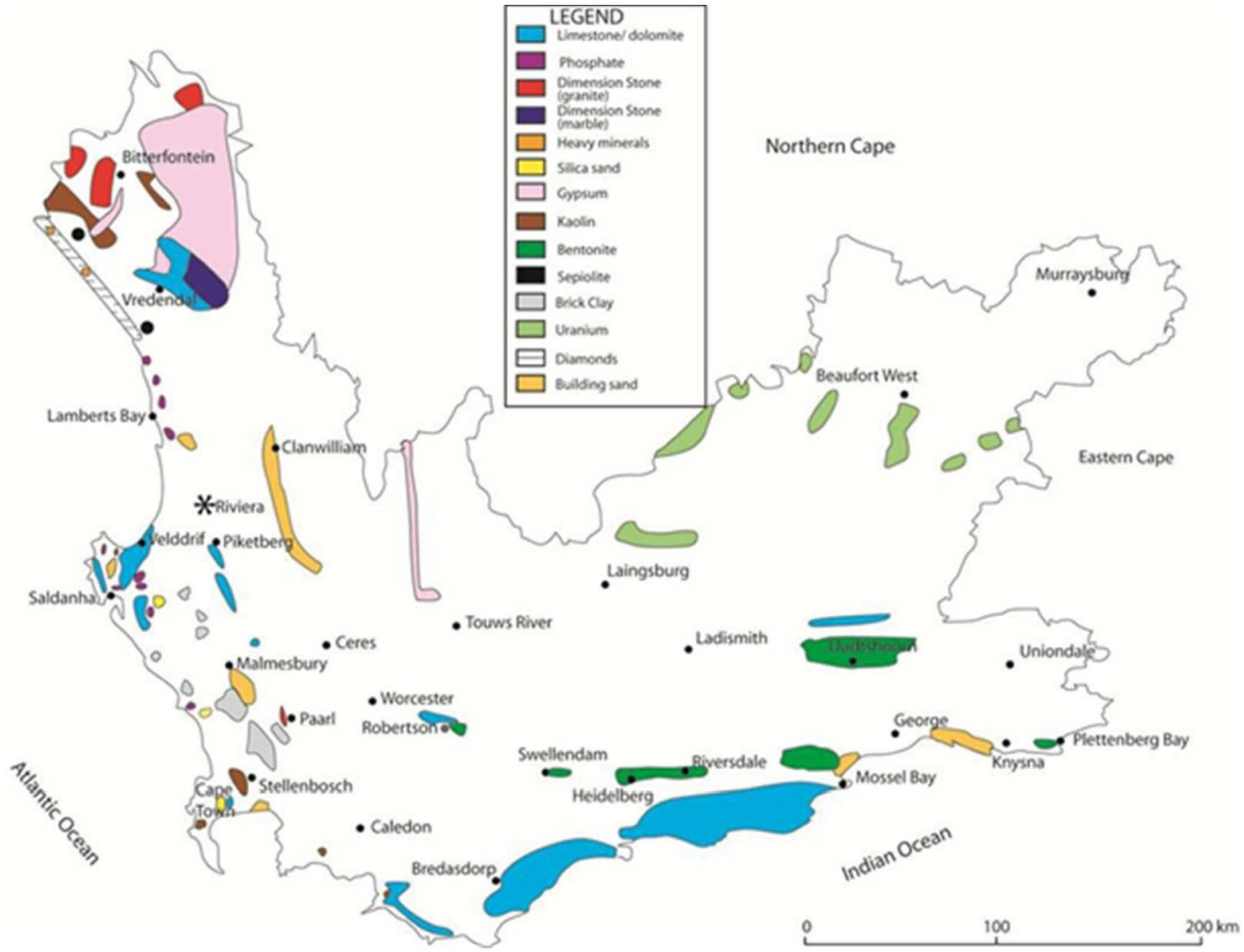


Figure 5: Location of mineral resources in the Western Cape

(Source: Council for Geoscience, 2013)

Shale gas, a natural gas found in shale formations, can be extracted for energy production. According to the South African Department of Minerals and Resources (DMR), South Africa is estimated to have 390 trillion cubic feet (tcf) of technically recoverable natural gas in the Karoo Basin. These estimates are yet to be proven. In-depth research is vital due to two significant geological uncertainties in Shale gas exploration in South Africa:

1. Determining the economically recoverable gas in the Karoo formations.
2. Addressing geo-environmental concerns related to rock nature, structure, groundwater migration, and micro-seismicity.

The Petroleum Agency of SA (PASA) is calling for the lifting of the 10-year moratorium on shale gas exploration towards the inclusion of shale gas in the country's energy mix.

PASA is further said to be considering the competitive bidding of 10 onshore Karoo blocks of shale gas exploration towards 2024/2025 – barring legislation that makes provision for such bidding (Roelf, 2023).

3 STATE

The state of land in the Western Cape is ascertained by measuring the condition of the three land indicators and determining how they have changed over time. Ultimately, how land is managed and used determines its underlying state. It can be noted at an highlevel observation that all of the province's agro-climatic zones (ACZs) are under pressure, with some zones experiencing increased threat.

*The State of **Land** in the Western Cape is tracked using the following key **indicators**:*

- Land Cover & transformation
- Agricultural land use and potential
- Urbanisation

3.1 Land cover and transformation

Changes in land use, land cover, and transformation have significant environmental impacts, which are monitored by examining alterations in the earth's surface over time, including vegetation cover, disturbances, and human activities. Historically, this information was derived from aerial photography, but the advent of satellite imagery now allows for regular monitoring from space. Land cover data for the Western Cape is sourced from national datasets, particularly the South African National Land Cover dataset. This dataset is created through automated mapping models, utilising multi-seasonal 20m resolution Sentinel 2 satellite imagery. The available datasets cover the years 1990, 2014, 2018, and 2020. Additionally, land-cover change assessments provide insights by comparing different years.

Figure 6 shows patterns of land cover derived from the Land Cover Change Assessment (2023). Land cover in the Western Cape is still mostly classified as natural[2] (69.3%), with most urbanisation and anthropogenic activities occurring along the coast (DFFE, 2023). The largest contiguous urban area is the City of Cape Town, with smaller pockets of urban development (e.g. Mossel Bay, George Knysna and Plettenberg Bay) located along the coast. Urban nodes are also located in the interior of the province – including Stellenbosch and Beaufort West.

[2] Natural land cover refers to indigenous forest, thicket/dense bush, woodland/wooded grassland, grassland, wetlands, shrubland (fynbos) and low shrubland.

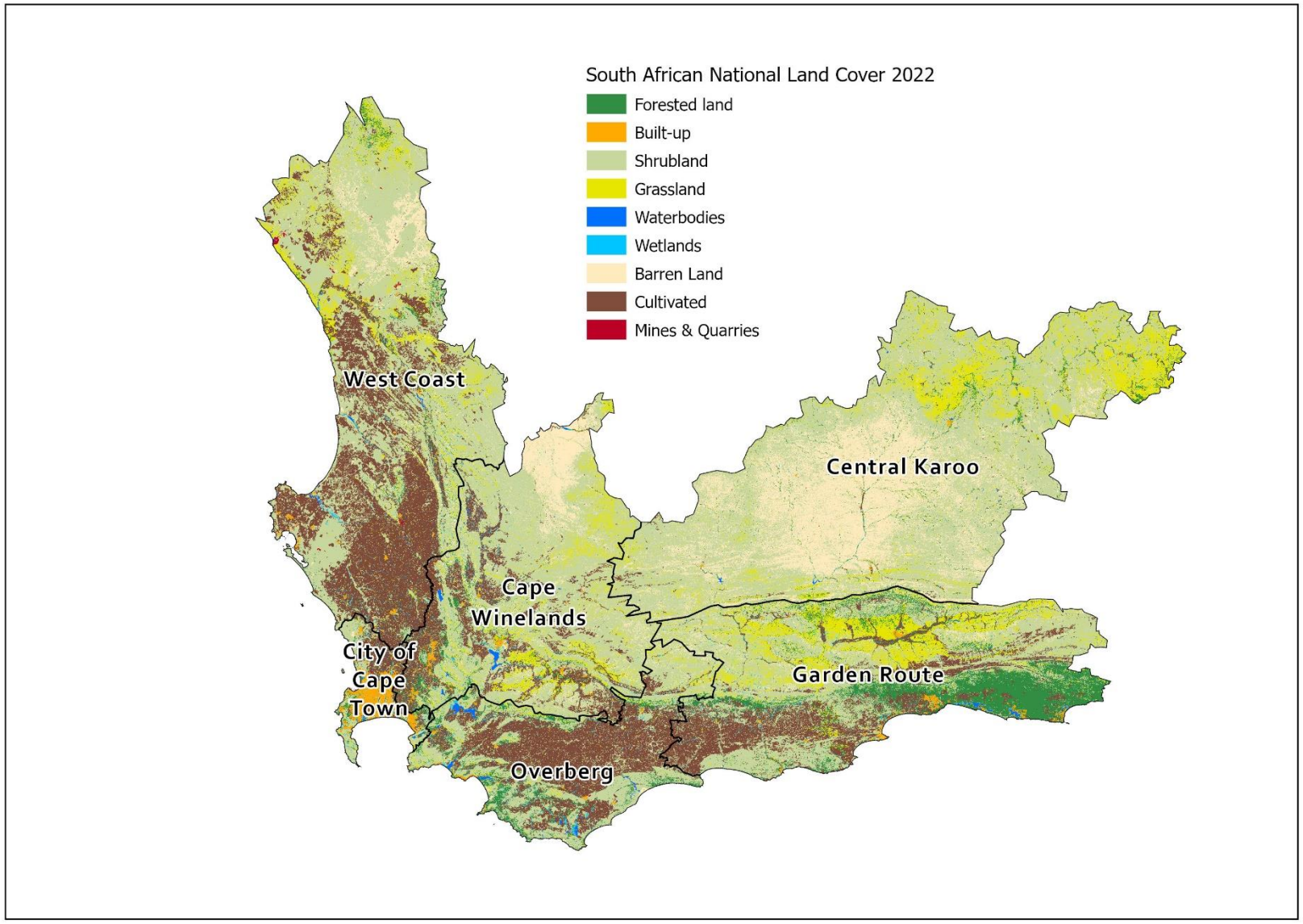

South African National Land Cover 2022
Forested land
Built-up
Shrubland
Grassland
Waterbodies
Wetlands
Barren Land
Cultivated
Mines & Quarries
West Coast
Central Karoo
Cape Winelands
City of Cape Town
Garden Route
Overberg

Figure 6 Summarised land cover for the Western Cape

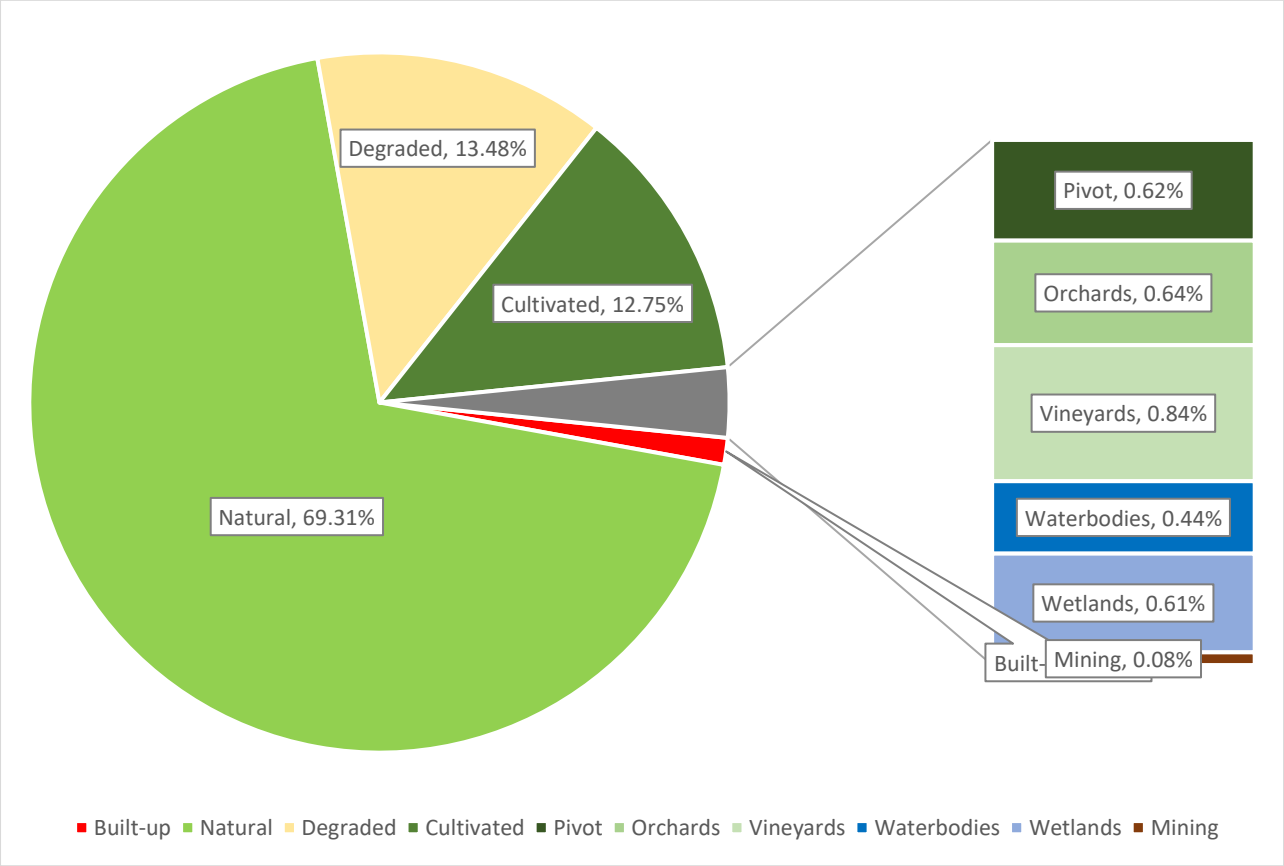


Figure 7: Western Cape Land Cover in 2023 (Source: DFFE, 2023)

Land cover data further indicates 13.48% as degraded and 12.75% under cultivation (Figure 77). Figure 8 indicates the change in land cover that took place between 1990 and 2020 . What can be highlighted is that land under cultivation has remained relatively stable since 1990, and that relatively little land is, in fact, taken up by urban uses.

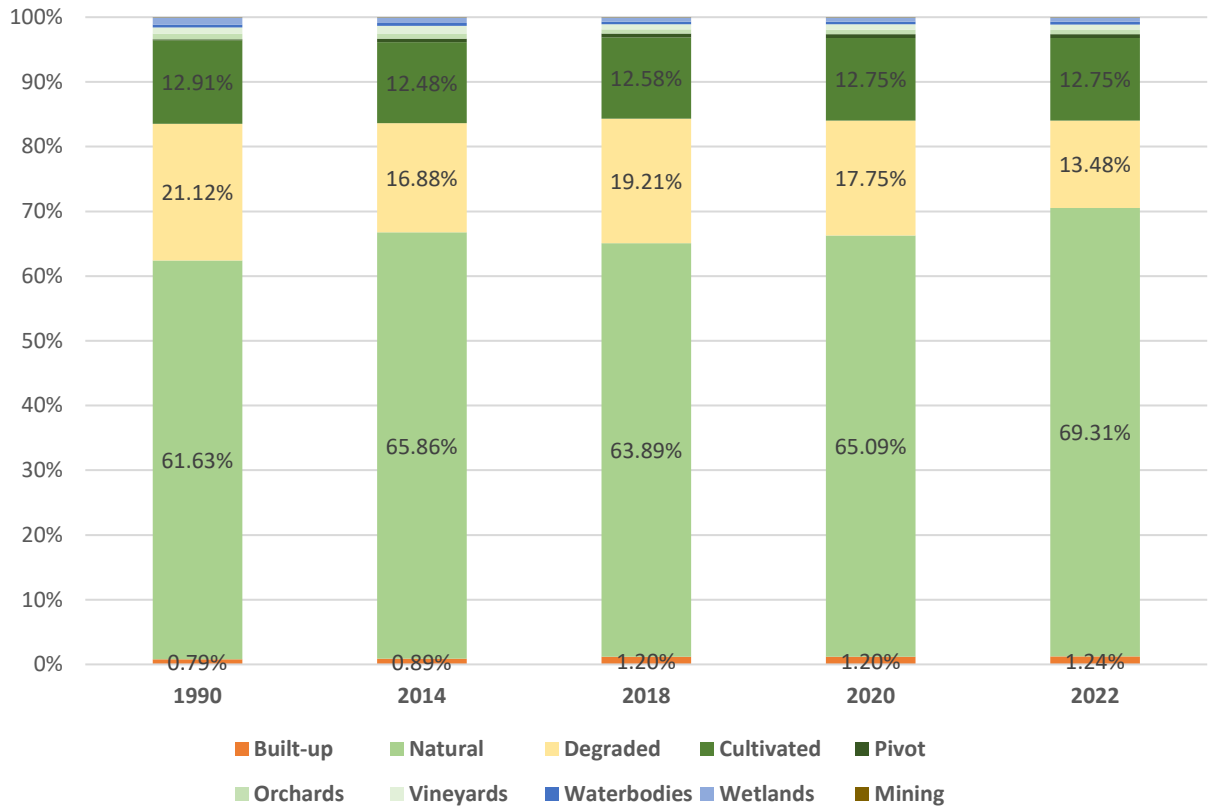


Figure 8 Land cover change shown as percentage data comparison between consecutive survey years (1990-2020) (Source: DFFE, 2023)

Care should be taken when interpreting the National Land Cover change assessment information and drawing conclusions. Some apparent changes could be due to changes in classification methods, data quality or data processing techniques. Nevertheless, an overview of the apparent changes from 1990 to 2020 is provided below.

The Western Cape is still largely natural and untransformed (National Land Cover data suggests 69.31% remains in a natural state), with the greatest instances of transformation focused on the coastal plains (agriculture). Transformation is a result of agricultural activities, urban expansion and degradation and is largely driven by land use. Figure 8 presents the distribution of transformed land based on the latest Land Cover Change Assessment (DFFE, 2023). Between 1990 and 2014, 2% (172 676 ha) of natural area was converted into agricultural uses, and then a similar area between 2014 and 2018 (175 667 ha). However, between 2018 and 2020, only 0.4% (29 972 ha) of the 2018 natural area was transformed by agriculture.

Change	2014	Change Per year	2018	Change Per year	2020	Change Per year	2022	Change Per year
Built-up	13%	0.5%	35%	8.7%	0%	-0.2%	4%	1.8%
Natural	7%	0.3%	-3%	-0.7%	2%	0.9%	6%	3.2%
Degraded	-20%	-0.8%	14%	3.4%	-8%	-3.8%	-24%	-12.0%
Cultivated	-3%	-0.1%	1%	0.2%	1%	0.6%	0%	0.0%
Pivot	291%	12.1%	4%	1.1%	4%	2.0%	1%	0.7%
Orchards	-2%	-0.1%	-20%	-5.0%	3%	1.4%	-2%	-0.9%
Vineyards	18%	0.7%	-32%	-7.9%	3%	1.4%	0%	-0.2%
Waterbodies	2%	0.1%	-12%	-2.9%	10%	4.8%	3%	1.6%
Wetlands	-25%	-1.0%	-26%	-6.5%	-1%	-0.6%	0%	0.1%
Mining	58%	2.4%	10%	2.5%	4%	1.9%	7%	3.6%

Table 1 Land cover change in the Western Cape (2014-2023)

(Source: DFFE, 2023)

Of the significant changes, one notes the rapid urban expansion in the mid-2010's, fluctuations in the amount of land denoted as 'degraded' (presumably due to difficulties in consistently defining what constitutes degraded or eroded land), and consistent expansion of overall agricultural activities. An interesting fluctuation in orchard and vineyard hectarage appears through the years, which might be linked to the extended drought period 2015-2018, given how it matches a similar decrease in the area designated as 'waterbodies'. The emerging trends could be verified through incorporation of more recent data, as available on an annual basis from Hortgro, SATI, CRI, SAWIS and Grain SA.

It is important that 'degradation' be defined. Understanding the landscape is part of describing degradation. For example, the sparse vegetation of the Karoo and its naturally fluctuating vegetation cover linked to normal rainfall variability should not be necessarily be interpreted as degraded land. Other elements such as invasive alien species, gullies and overgrazing may be seasonal changes and not subject to a permanent description of 'degradation'.

Spatial analysis also points out that transformation of natural areas for urban and agricultural uses is no longer a problem of absolute area, but rather the constant eroding of small pockets of natural vegetation. The image below shows a myriad small transformations took place around Klapmuts in the Cape Winelands District Municipality between 2018 and 2020.

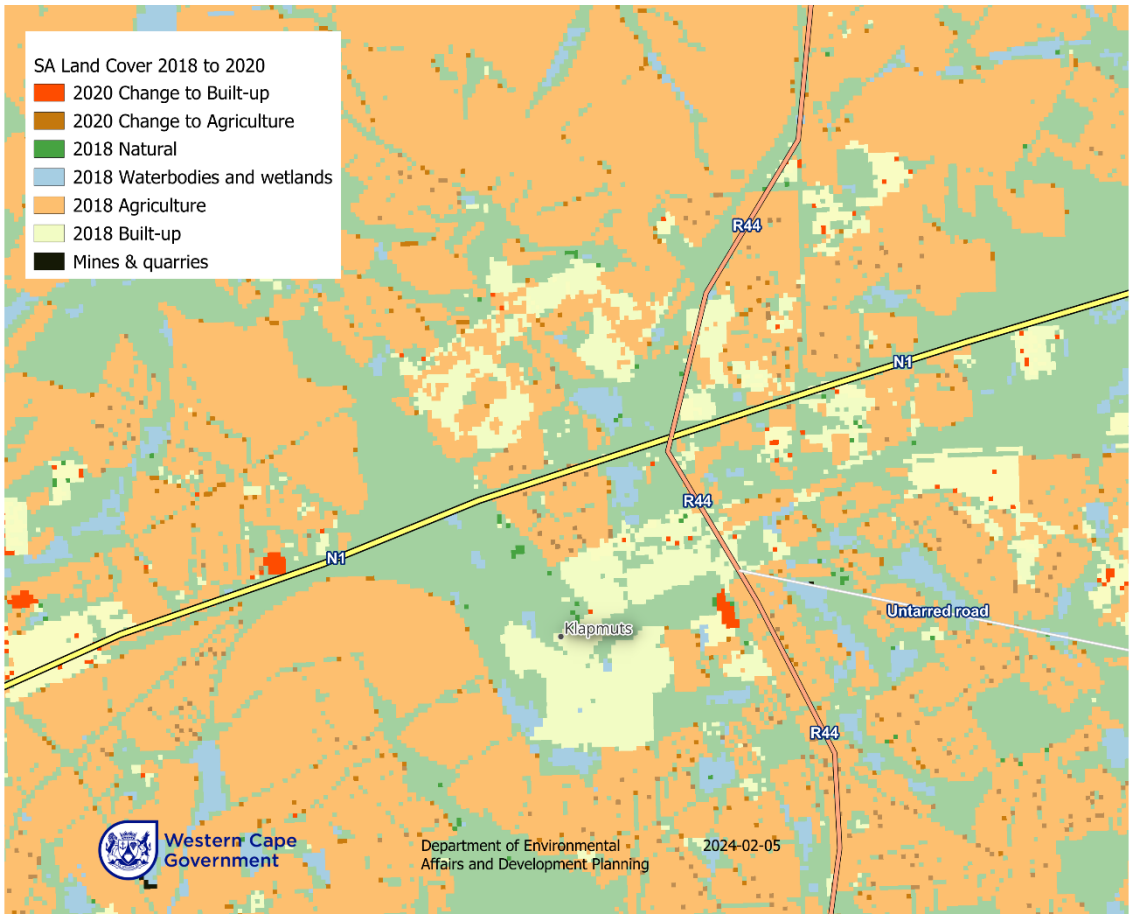


Figure 9 Land transformation Cape Winelands District Municipality (Klapmuts region, 2018-2020) (Source: DFFE, 2023)

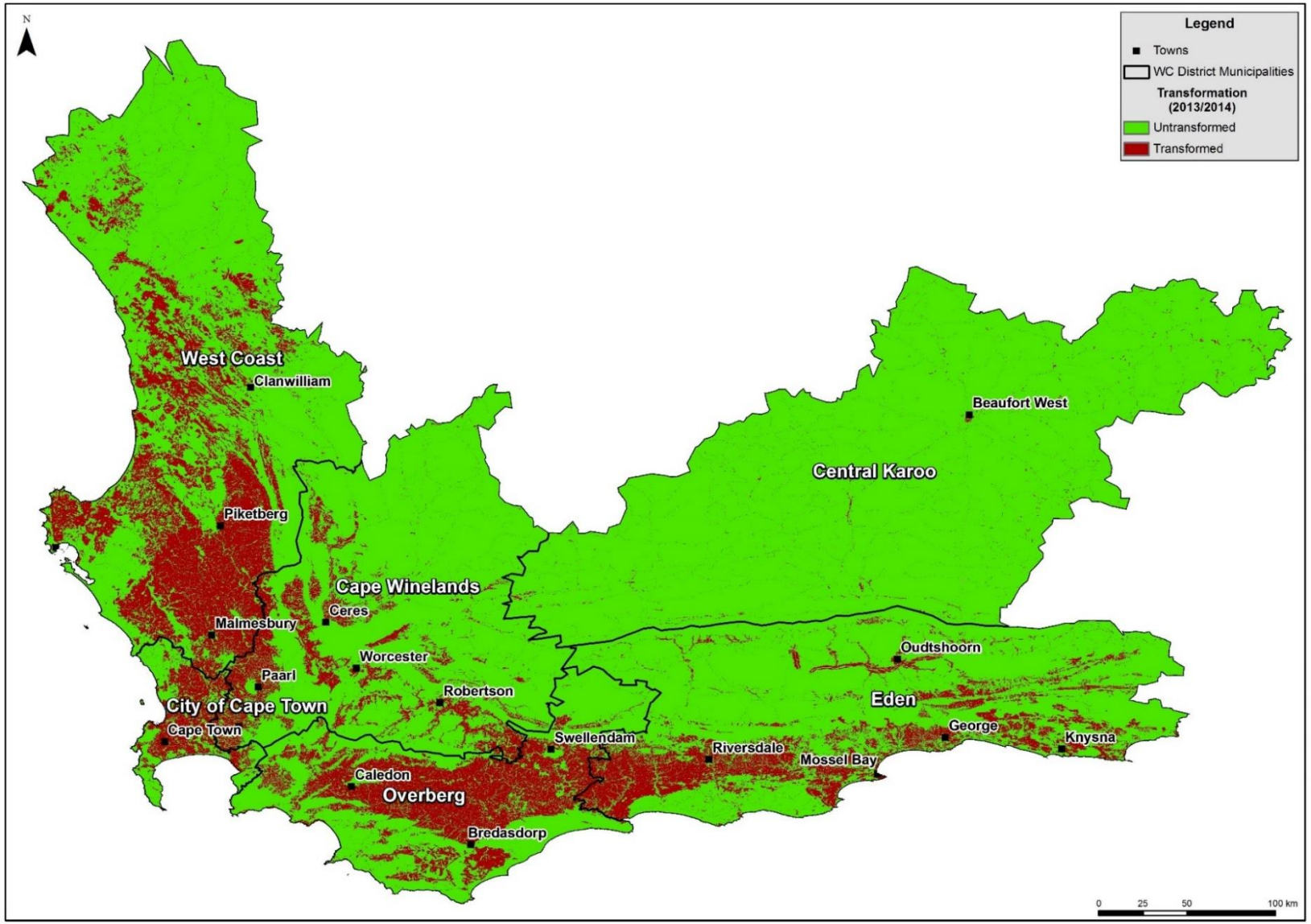


Figure 10: Land transformation within the Western Cape (DFFE 2023)

3.2 Agricultural and Land Use Potential

3.2.1 Land capability

For the purpose of this Western Cape State of Environment Outlook Report, the land capability is applied as a course guide to understand the Western Cape land, and is is not applied to determine optimal land use.

Land capability is defined as the ability of soil resource to effectively carry its respective land use (Schoeman et al, 2002). In a generic sense, land capability as a spatial determinant influences spatial planning, development decisions, and environmental management by defining the inherent potential and limitations of land for various uses based on its physical, biological, and hydrological characteristics.

Land capability does not directly dictate land suitability or agricultural potential. It is distinct from **agricultural soil capability** which is determined as a function of the potential of the soil to hold and supply moisture to the plant; the sensitivity of the soil affecting productivity and the inherent potential of the soil to be fertile (DALRRD, 2021).

Land capability for South Africa is described in terms of land capability values ranging from 1, being the lowest value, to 15, being the highest possible value. These values are informed by a combination of climate, soil and terrain capability evaluation values in a 40:30:30 relationship respectively (DALRRD, 2021). Using these evaluation ranges, the below map (Figure 11) illustrates the land capability evaluation classes present within the Western Cape, clearly indicating lower average values. The Western Cape's majority of land capability falls in the evaluation range of 4 to 6, compromising about 60% of the province, followed by evaluation range 1 to 3 (20%) and evaluation range 7 to 9 (20%).

Land capability evaluation values 11 – 15, which are regarded as areas having an above-average production capability (very high land capability), only takes up 0.51% of the total country's surface – none of which is located in the Western Cape (DALRRD, 2021).

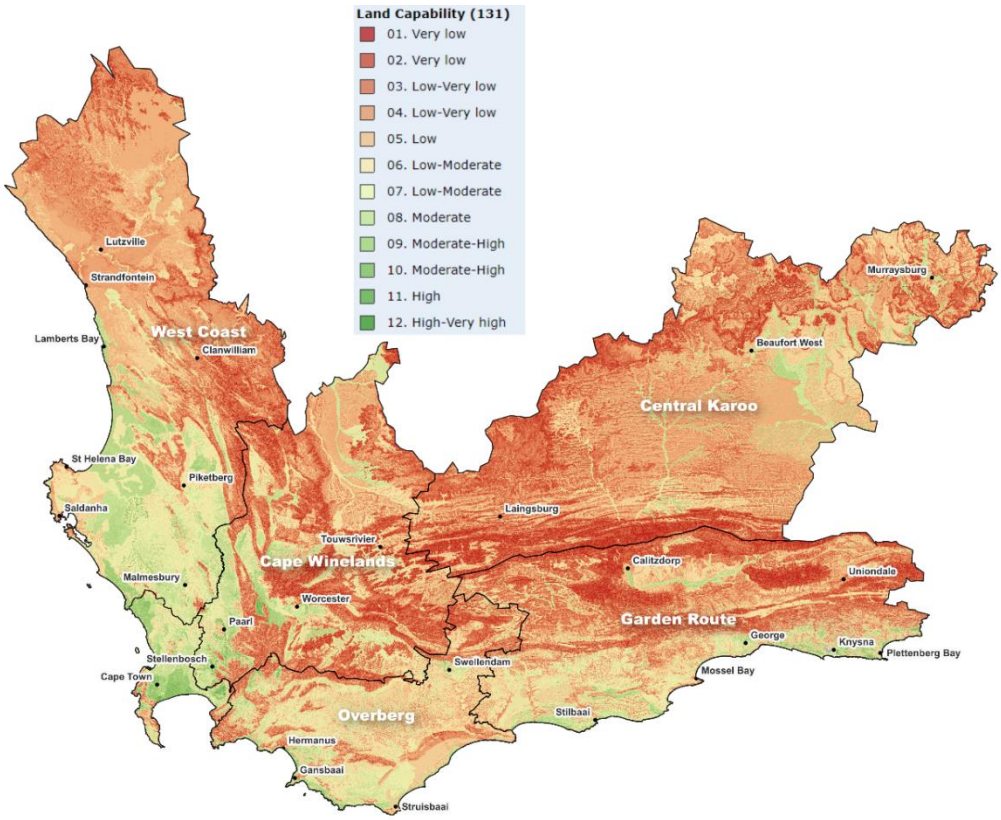


Figure 11 Land capability of the Western Cape province

Source: DALRDD, 2021

The table (Table 2) below shows land capability classes across the Western Cape with data pointing out that high competing non-agricultural land uses as well as the abuse, particularly of soil resources, constantly put this land under pressure. This has a serious impact on possible food production. When interpreting the below table, it is important to note that for the Western Cape, **there is limited direct relation between land capability and agricultural potential[3].** The province has high percentages sandy soils and mountainous regions, yet the agricultural production and potential of the province remains high.

Table 2 Classes of Land Capability typical to the Western Cape

	Class	Characteristics	Western Cape locality
Land suited to cultivation	I	Land has few limitations that restrict its use. It may be used safely and profitably for cultivated crops.	No land present in this class
	II	Land has some limitations that reduce the choice of plants or require moderate conservation practices.	No land present in this class
	III	Land has severe limitations that reduce the choice of plants or require special conservation practices or both.	Mostly limited to the West Coast District and City of Cape Town areas
	IV	Land has very severe limitations that restrict the choice of plants, require very careful management or both.	Mostly limited to the West Coast, Overberg, Cape Winelands and City of Cape Town areas with some land in the Garden Route District. Restricted to fertile valleys
Land with limited use – generally not suited to cultivation	V	Land has little or no erosion hazard but has other limitations that are impractical to remove, that limit its use largely to pasture, range, woodland or wildlife food and cover. The limitations restrict the kind of plants that can be grown and prevent the normal tillage of crops.	Mostly present in the inland areas
	VI	Land has severe limitations that make it generally unsuited to cultivation and limits its use mainly to pasture and range, woodland or wildlife food or cover	
	VII	Land has very severe limitations that make it unsuited to cultivation and restrict its use mainly to grazing, woodland and wildlife.	Dominates in the Karoo and interior areas of the province
	VIII	Land has limitations that preclude its use for commercial plant production and	

[3] Under consideration is the amending of this indicator as an appropriate determinant of the state of Western Cape land, as it does not directly contribute to understanding of agricultural potential in the Western Cape. The decision to amend the indicator for the purpose of describing state of Western Cape land and outlook, will be subjected to stakeholder review and consideration.

		restrict its use to recreation, wildlife, water supply or aesthetic purposes.	

3.2.2 Soils

Care should be taken to ensure crops are planted in the appropriate soil (type) to ensure sustainable production. Here, the land capability indicator can be used to determine the optimal land use in the province, without compromising or further reducing the capability of the land resource. Table 2 illustrates that, apart from the West Coast, land capability in the Western Cape mostly falls between classes VI and VIII (i.e. land that has severe to very severe limitations and is generally unsuitable for cultivation). Land capability classifications have been updated recently; however, the updated information was not available, and some of the data is considered problematic.

Soils are in part a product of the underlying geology and rate of weathering, and vary across the Western Cape. Western Cape soil profiles, which determine land capability, are summarised below:

- Chemically weathered, deeper soil profiles are found in the wetter coastal areas of the province, while the dry interior soils have shallow, poorly formed soil profiles;
- The West Coast is dominated by soils that are created through wind erosion (i.e. windblown sands). These soils are incredibly susceptible to wind erosion, which is exacerbated by vegetation loss due to anthropogenic activities and desertification;
- Inland from this, soils are typically clay-based and derived from the weathering of Malmesbury shale substrates, as such making them suitable for winter wheat farming;
- The sandstone substrates of the Cape Fold Belt Complex, along with adjacent sand plans are nutrient poor and highly leached;
- High lying soils (600m and above) experience high winter rainfall, which results in acidic sands with high organic value;
- Colluvial slopes, which are deeper and underlain by shale or granite, are less acidic and nutrient rich;
- "Young" sands on the coastal margin are highly alkaline and best described as highly alkaline; and
- The soils typical of the Karoo landscape (mostly located in the Central Karoo) receive little rain and are incredibly thin, making them very unsuitable for agriculture aside from stock farming.

3.2.3 Agricultural Land Use and Production[4]

The Western Cape is second in South Africa in terms of percentage of provincial land used for agriculture with cognisance of the capability, suitability, potential and state of the natural agricultural resource. The Western Cape accounts for 12% of South Africa's total agricultural area, and provides 20% of the nation's total agricultural production outputs (DFFE, 2013). Of importance,

[4] Western Cape State of Environment Outlook Report 2024, the amendment has been made to expand on this land indicator to include an overview of agricultural land use and production, and land capability. This amendment has been made specifically to expand the focus on what has previously only been described as land capability. The context is Western Cape specific – Western Cape land capability may be relatively poor, yet this is not a matter of concern and little change is expected over time. Agricultural production, land use and potential are more appropriate indicators of Western Cape state of land.

however, is that the production practice needs to take cognisance of the capability, suitability, potential and state of the natural agricultural resource.

Cultivated land is most prevalent on the coastal plains unlike the arid interior of the province. The total area of land under cultivation is approximately thirteen (13) million hectares of which two (2) million hectares are cultivated and 320 000 hectares are under irrigation.

In the 2023/2024 season, the DoA commissioned an update of the aerial survey that includes all area where crops and livestock are produced and seeks to identify all rural agricultural infrastructures (DoA, 2024).

The main findings of the 2023/2024 aerial survey can be summarised as follows:

Table x provides an overview of the current trends and challenges across various fruit and nut crops in the Western Cape, highlighting both growth opportunities and areas of concern within the agricultural sector. Overall, while strawberries and pomegranates show growth and potential in the Western Cape due to consumer demand and suitable growing conditions, persimmons face challenges leading to a decline in plantings, primarily due to aging plantations and suitability issues. An emerging trend is the considerable increase in area under protective agriculture which most certainly impact on increasing yields and quality. The area increased from just under 2500 ha in 2013 to more than 12 000 ha in 2023.

Table 3 Fruit and nut crops in the Western Cape

Crop Type	Changes observed (2017-2023)
Deciduous Fruit (Apples/Pears)	Production per hectare has increased due to new cultivars, high-density planting, and shade netting. More apples are being planted in certain areas, while pear plantings have remained relatively stable since 2013.
Stone Fruit (Apricots, Nectarines, Peaches, Plums, Cherries)	Area planted with apricots has decreased due to issues in the canning industry, financial pressures, and cultivar sensitivity to weather changes. Currently a decrease in production expected for peaches due to lower market demand and preference for nectarines. Plums occupy the largest area planted among stone fruits, but is considered under pressure with some wine producers considering switching back to grapes. A niche stone fruit market that is growing is cherries, with growing market demand and new plantings, mainly for export.
Grapes (Wine Grapes, Table Grapes)	Wine grapes: Industry has contracted due to low profitability, leading farmers to diversify into other crops like fruit trees. Table grapes: Area planted decreased slightly nationally but increased in the Western Cape, with new cultivars replacing older ones.
Citrus	Significant increase in planting, especially soft citrus, driven by export demand. Rising freight costs and logistical challenges have impacted profitability.

Sub-Tropical Fruit (Avocados, Mangos, Litchis, Kiwis, Guavas)	Avocados: Rapid increase in planting, especially in specific regions. Access to international markets like China and Japan. Mangos: Limited planting due to climate limitations; stagnant market. Litchis: Trials underway, but not widely planted. Kiwis: Emerging crop with increased planting, especially in the George area; experimental due to market risks. Guavas: Stable area planted, mainly for local consumption.
Nuts (Almonds, Pecan Nuts, Macadamia Nuts)	Almonds: Significant increase in planting in the Western Cape, favored for low labor intensity and mechanical harvesting. Pecan Nuts: Growing area planted, particularly mapped through new technologies. Macadamia Nuts: Considerable increase in planting, attractive due to ease of cultivation and profitability.
Berries	Blueberries: Production down due to profitability issues, with some farmers transitioning back to other crops like apples and pears. Overall area planted has increased significantly since 2013, reflecting fluctuating market dynamics. Strawberries: Farming strawberries is costly but lucrative due to high market value and consumer popularity. Significant increase in planting area from 176 hectares in 2017 to nearly 400 hectares estimated in 2023.
Persimmons	Overall decrease in plantings, partly due to incorrect placement in unsuitable areas. Existing plantations are aging (20-30 years old), affecting production and packing efficiency. Replaced by apples in apple-growing regions and by plums and soft citrus in warmer areas.
Pomegranate	Western Cape dominates national pomegranate farming, producing approximately 80% of the total output. Significant increase in planting area from 715 hectares in 2017 to 945 hectares in 2023. Bergrivier area shows particular growth in cultivation.

Source: DoA (2024) -

Where vegetables are concerned, many vegetable farmers are leaving the industry due to high transportation costs, market accessibility issues, and overall profitability concerns. Some farmers are transitioning to seed production, especially those located far from markets. Exporting internationally, particularly to the Middle East, has become a viable option for improving cash flow (DoA, 2024).

Persistent drought in the Western Cape has severely impacted the potato sector by limiting water availability for agriculture. This reduced water availability has forced producers to decrease the area planted with potatoes. Input costs such as fertilizer, labor, diesel, and electricity have significantly increased, making production unaffordable and unprofitable for smaller farmers. In regions like Bergrivier-Sandveld, larger scale farmers are renting fields from smaller farmers who have had to cease operations due to high costs and low profit margins. There has been a shift from potato farming to onion farming in areas like Ceres and Koue Bokkeveld due to economic pressures. Electricity costs and access to electricity are limiting factors particularly for tomato production; a new tomato variety, Tabitha (BR 5911) F1 hybrid, shows promise in harsh climatic conditions.

Overall, vegetable production in the Western Cape has not recovered to pre-drought levels. The area planted was significantly reduced in 2017 due to drought, and though it has increased from that low point, it remains below 2013 levels. Other critical issues include water availability, rising input costs, and shifts in crop choices among farmers.

The 2017 DoA flyovers survey reflected the impacts of the 2015-2019 drought; the 2023 survey follows on some normal to high rainfall with, with strong signs of agricultural sector growth for the Western Cape.

3.3 Urbanisation

The urbanisation context is covered in the Human Settlements & Infrastructure chapter of the Western Cape SoEOR 2024. However, it is important to note here the latest findings and trends as per Census 2022, which has pertinent implications for land resources of the Western Cape (StatsSA, 2023).

> As reflection of an increasing demand for land to meet the City of Cape Towns growing population needs, the Phillipi Horticultural Area (PHA) has been under tremendous pressure for proposed housing development, sand mining and water extraction for almost a decade. The scale at which the PHA is to be transformed, and the potential socio- economic and socio-ecological impacts are well documented. However, from a climate change, food security and development strategy perspectives combined, clear direction should be provided as to whether the existing zoning of the PHA will remain unchanged or not.

The Census 2022 reveals significant shifts in urban demographic patterns across South Africa. Johannesburg's population growth rate has notably slowed to 0.7% per year, making Cape Town nearly equal in size at the time of the Census. With Cape Town's population growing at 3% annually, projections suggest it will surpass Johannesburg in size by 2024, becoming the country's largest municipality. The Western Cape as a whole has seen rapid growth, with a compound annual growth rate (CAGR) of 2.8% from 2016 to 2022, surpassing the Eastern Cape to become the third largest province by population. This demographic shift is driven largely by significant in-migration from the Eastern Cape to the Western Cape. This trend underscores a long-term pattern where the Western Cape, once the fifth largest province in 1996, has steadily risen in population ranking, paralleling only Gauteng in proportional growth rates, albeit with lower absolute population increases.

As population increases on limited land, the pressure on soil and water resources intensifies, driven mainly by urbanisation. The demands of this urban population are anticipated to rely heavily on natural environments in the foreseeable future (Du Preez & Van Huyssteen, 2020).

In the urban context, the decline in livestock and crop farming from the urban fringe of the CCT to make way for mixed development has affected a number of households (PLAAS, 2017). One such area is the Philippi Horticultural Area on the Cape Flats, part of which was identified as a potential site for low cost housing (see insert). As more land is rezoned for urban development, alternative livelihood options need to be presented to those displaced who, in most instances, lack the skills required for non-agricultural work. Urban agriculture, for example has been proposed by many as a livelihood strategy to improve food security and decrease urban poverty, particularly in informal settlements (Haysom, 2008).

Urbanisation also exert wildland urban interface (WUI) pressures; which for the context of the Western Cape remains a fire-dependent ecosystem. It is a global phenomenon that housing expansion in WUIs lack planning for the management of surrounding vegetation, which in fire-prone areas directly relate to increasing frequency of wildfires (Chas-Amil et al., 2013; Radeloff et al.,

2018). These pressures are particularly evident in the WUI along the southwerstern coast of the Western Cape. South African research confirms that in the case of the '2017 Knysna fires' the intensity of the fires was heightened by extremely high fire danger conditions, preceded by an unprecedented drought. The situation was compounded by the conversion of natural fynbos vegetation to plantations and the encroachment of invasive alien species into native habitats. Decades of fire suppression efforts also led to an accumulation of combustible materials, exacerbating fire control challenges. Additionally, residential expansion within and near fire-prone zones increased the vulnerability of local residents. For the WUI this underscores the importance of controlling invasive alien plant species, limiting the commercial planting of invasive trees, implementing strict regulations on development in high-risk fire areas, and promoting awareness and adoption of fire-safe practices (Kraaij et al., 2018).

4 IMPACTS

Taking into consideration the state of- and pressure on- land, this section discusses the impacts of land use changes on the Western Cape environment.

4.1 Reduced natural ecosystems, species and ecological processes

Anthropogenic drivers adversely affect land and its ability to support natural ecosystems, species and ecological processes. Drivers include the transformation of natural areas for grazing and pastures, plantations, field crops and horticulture as well as expanded human settlements, infrastructure and services. Rapid development has occurred in coastal areas, regions with unique natural landscapes, flora and fauna, and biodiversity which underpin the tourism sector. However, even growth and hospitality developments within the tourism sector, have gradually degraded habitats and biodiversity in the province (WCG, 2013). As population and human settlements continue to grow, negative impacts on biodiversity will continue with significant consequences for those reliant on subsistence activities and ecosystem services.

4.2 Urban heat island effect

In South African urban areas, the Urban Heat Island (UHI) effect has become a pressing concern, exacerbated by rapid urbanisation and climate change. Cities such as Johannesburg, Cape Town, and Durban experience elevated temperatures compared to their surrounding rural areas due to various factors like impervious surfaces, reduced vegetation, and increased energy consumption. This is emphasising the need for strategic urban planning to mitigate rising temperatures (Musakwa et al., 2017 and Kabanda et al., 2017). With the intensification of the UHI effect in Cape Town between 2003 and 2020 demonstrated in Figure 12, the importance for Western Cape urban regions such as the City of Cape to implement measures such as green infrastructure, sustainable building designs, and urban planning strategies is clear - to alleviate the UHI effect and enhance the resilience of urban areas to climate-related challenges.

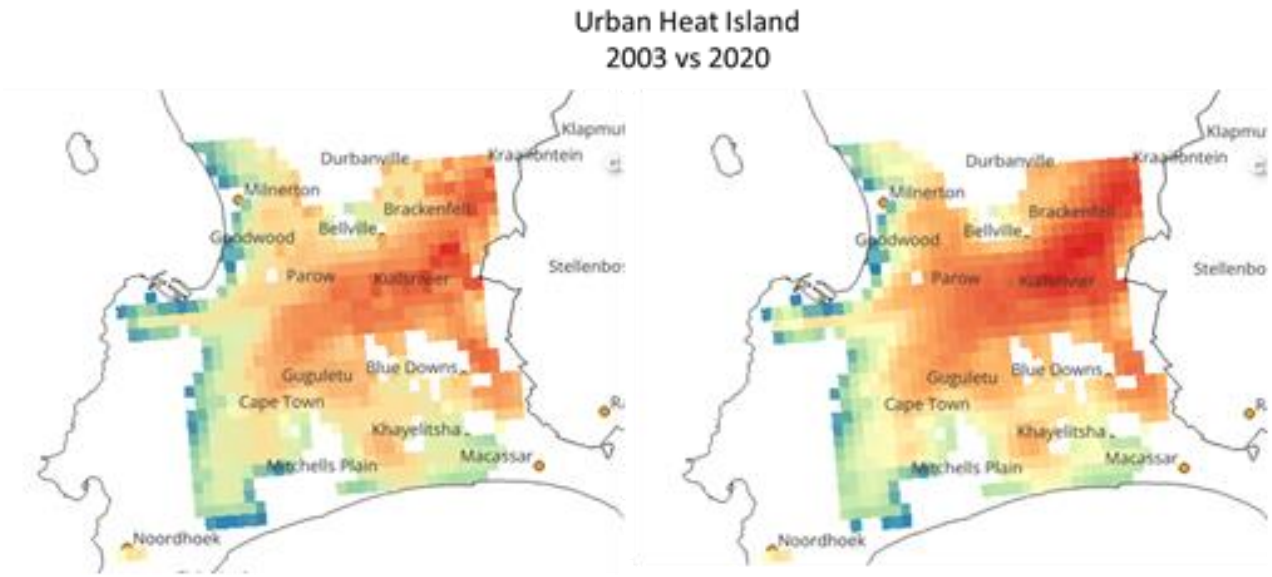


Figure 12 Urban heat island effect for City of Cape Town (2003-2020)

(Source: Chakraborty & Lee. 2019)

4.3 Urban edge effects

Increased siltation of dams has raised maintenance costs and reduced reservoir capacity, also threatening agricultural productivity (GreenCape, 2016). Furthermore, informal settlements inappropriately sited in sensitive and/or rural areas is increasing desertification, occasioned by poor services and infrastructure which fosters poor agricultural practices and unsustainable utilisation of ecosystem services. The risks of fire to settlements and surrounding areas particularly in the wildlands-urban interface are critical. Informal settlements also facilitate the spread of alien invasive species in the Western Cape (particularly in the CCT) with repercussions for runoff and encroachment on sensitive land.

4.4 Soil resources

Understanding soil resources, its formation and impact are critical to understanding the Western Cape state of land. There are various factors influencing soil formation – including the parent material (passive soil forming factor), the impact of climate and climate change, together with topography, biotic activity and time. According to DALRRD, productive arable land with suitable physical and chemical characteristics is limited. Although limited, it is thus of the utmost importance that such areas be identified and preserved, particularly under the understanding that soil cannot be renewed in a human lifetime, if lost. Another important reason is to allow agriculture to shift as it tracks climate changes across the landscape. We must keep land available for food production in areas where future climate is projected to remain, or become suitable (milder warming, sufficient rainfall). DALRRD justifies this further: factors responsible for soil formation may no longer be present. Even repairs to damaged or degraded soils cannot be done within several human life spans (2021).

As the largest user of Western Cape soil resources, agriculture and forestry have a serious impact on soil quality. A decline in soil quality is induced by a variety of degradation processes which can be grouped as physical, chemical and biological (Du Preez & Van Huyssteen, 2020). The aforementioned researchers emphasised that soil degradation processes do not develop independently of one another. For example, salinisation causes structure degradation with the

result that the surface tends to seal. This causes poor water infiltration and high water runoff which ultimately manifest in water erosion. Known soil quality issues relevant to the Western Cape include erosion, fertility decline, elemental imbalance and organic matter decline.

Soil erosion is a major environmental problem confronting land and water resources not only in the Western Cape but for the whole of South Africa. Although soil erosion is a natural process – and all landscapes are vulnerable to soil erosion - it is often accelerated by human activities, for example by the clearing of vegetation, soil tillage or overgrazing (GrainSA, 2014). Erosion problems occur when the rate of erosion is increased above natural levels (DALRRD, 2021).

For South Africa, approximately 30% of the country's soils are characterised as very sandy, containing less than 10% clay, making them susceptible to wind erosion. Under specific cropping conditions, these soils can experience an annual soil loss of up to 60 tons per hectare. Studies, such as the one conducted by Schoeman, Koch, Kaempffer, and Scotney in 1992, have determined that soils with a higher sand fraction are more vulnerable to wind erosion. The conclusion drawn from this research is that any soils with less than 20% clay content are considered potentially prone to wind erosion. Non-natural causes of soil erosion include poor farming practices as well as the trend toward agricultural intensification. Soil formation is a relatively slow process and therefore soil is essentially a non-renewable and a limited resource (GrainSA, 2014). For the Western Cape, wind erosion is a particular concern:

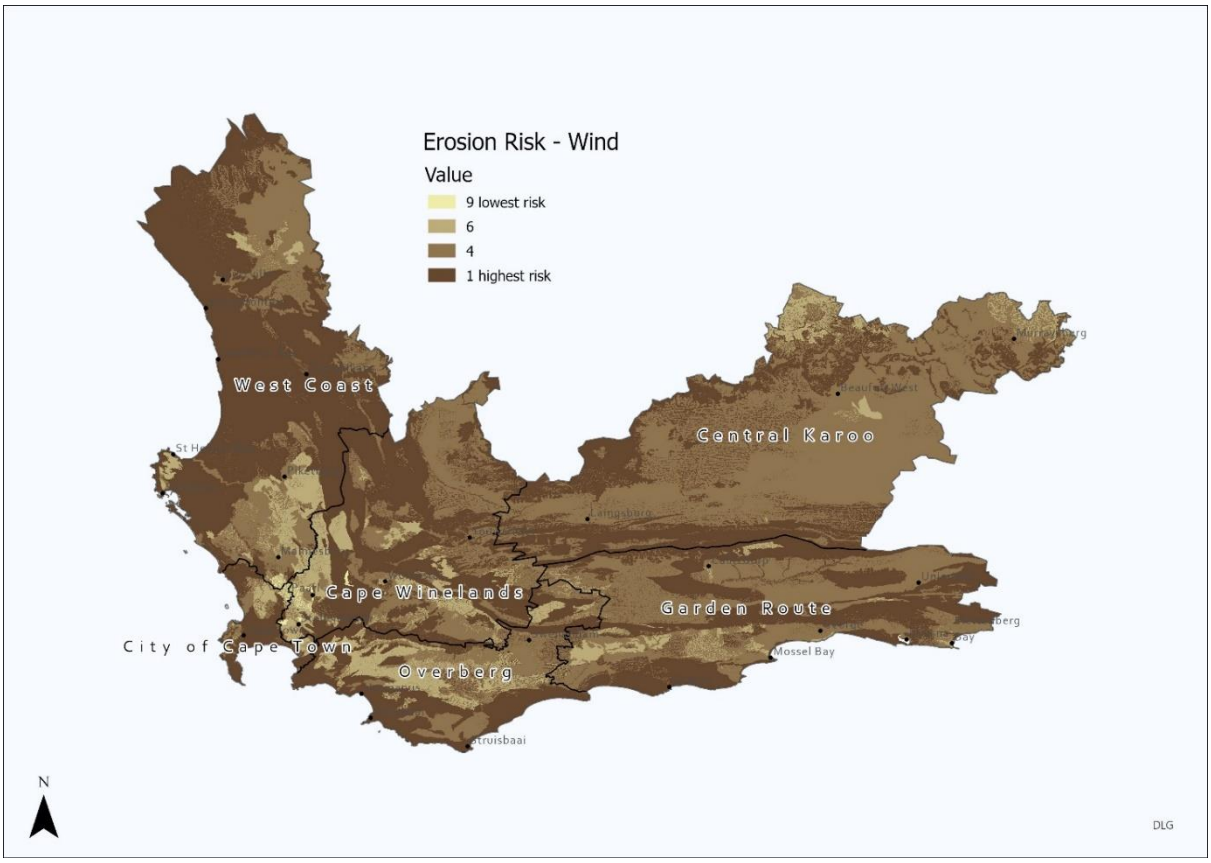


Figure 13 Wind erosion susceptibility for South Africa (moderate to very high susceptibility for the Western Cape, DALRRD, 2021)

Natural causes of soil erosion include water and wind erosion are also responsible for the degradation of vast tracts of land – and this is likely to increase based on climate change predictions for the Western Cape. The province's soils are mainly affected by natural and anthropogenic acidification and salinisation. Organic matter decline, with the associated impact on other soil properties is of

general concern to South African soils, especially since the soils in South Africa have naturally low organic matter content (Du Preez & Van Huyssteen, 2020). The low and declining organic matter content further contributes to organism decline and pathogen increase, a situation that is exacerbated by conventional tillage and mono-cropping. These are important motivating factors for conservation agriculture, describe in more detail in this chapter. There is however good indication that the Western Cape's adoption of conservation agriculture to date, contributes to the maintaining of soil organic carbon (Du Preez & Van Huyssteen, 2020). Restoration of soil organic carbon, especially at a site-specific level, requires more research (Du Preez & Van Huyssteen, 2020).

Prolonged erosion contributes to irreversible soil loss over time, diminishing the ecological functions, such as biomass production, and hydrological functions, including filtering, infiltration, and water holding capacity. It follows that erosion and nutrient loss are driving an increase in the cost of food production globally. Soil erosion not only results in the loss of fertile topsoil and reduced soil productivity but also leads to significant off-site impacts, including increased sediment mobilisation and delivery to rivers, causing siltation and pollution of South Africa's water resources.

In addition to climate change predictions, the Western Cape faces challenges related to the fire-erosion cycle, which remains inadequately understood and managed (Fernquist & Floraberger, 2003). Soil degradation initiates a cycle that leads to extensive soil erosion in the Western Cape, contributing to vegetation degradation and loss, followed by wind and water erosion.

Erosion is a key threat soil resources in the province, and is a result of numerous pressures, including climate change and poor land use practices. Soil type, land use and condition and weather patterns all contribute to the rate and extent of erosion (WWF, 2016). Soil erosion reduces agricultural potential with implications for food security and livelihoods.

A soil and irrigation matter that effects multiple regions of South African, including western and southern regions is salinisation – particularly where intensive commercial irrigation is prevalent. Salinisation poses significant social and economic challenges.

In general, agriculture significantly influences salinity levels, especially in regions characterised by intensive irrigation and natural saline geological formations (Van Rensburg et al., 2008 & 2011). Conversely, dryland cropping on shallow soils, such as those found in the Western Cape, may significantly contribute to nitrate leaching. The application of fertilisers has resulted in more phosphorus being added than what is removed by the crops, likely aimed at boosting and sustaining soil phosphorus levels to optimal ranges (Du Preez & Van Huyssteen, 2020). Conservation agriculture is once again a positive response to these soil resource degradation challenges.

Correctly applied synthetic and organic fertilizers enhance soil fertility and - because they can increase agricultural potential - can protect the natural environment from poorly conceived agricultural expansion (ARC, 2014). However, fertilizers are often overused and nutrient rich run off to rivers and groundwater, and nitrous oxide emissions, may damage the environment. No new soil loss or degradation data has been reported for the Western Cape since 2005, however it needs to be explored what the impact on quality of topsoil reserves in the province is.

5 RESPONSES

In the instance of land, a complex and dynamic element of the natural and anthropogenic system in the Western Cape, responses need to be multi-sectoral. This is largely because of the wide multitude of land uses in the province, but also because land use is intrinsically linked with the social and economic dynamics of the province.

Critically, the capacitating and upskilling of those who work in land use planning, spatial planning, land policy, legislation and regulation, must be rolled out, as should awareness-raising and up-skilling of land users, to ensure effective responses to land challenges and impacts. This will require collaboration by a range of stakeholders in the private and public sectors.

Education and awareness of the fundamental role that ecosystems play in both the natural system and within communities is not well understood by land users in the Western Cape (ARC, 2014), and capacity building would promote sustainable usage of finite ecosystem services by communities that rely on them.

As such, ecosystem services and other unmonetised benefits of land in the Western Cape need to be managed in a way that ensures sustainability for future generations. Aesthetics, heritage and culture are all intrinsically linked to land in the Western Cape and should be considered in land use management policy. Other important pressures such as alien invasives, climate change and urban encroachment all jeopardise ecosystems and need to be mitigated.

5.1 Mining

A particular concern, which has escalated in recent years, is the concentration of prospecting and mining activity in the coastal zone, within the West Coast of the Western Cape. This concern is particularly prevalent along the coastline of the Matsikama municipal region due to the concentration of mining interest within its coastal zone.

The concern arises not only from the destructive nature of these activities and the impact of these activities on the receiving environment, but also the lack of strategic co-ordination which seems to be applied in rolling out or coordinating mining activities in the sensitive coastal environment, in a manner which would ensure that environmental sustainability is adequately considered from a cumulative perspective, beyond just a project level perspective.

To ensure that these concerns is addressed and that the Western Cape Government (WCG) develops an environmental sector response to this increasing development pressure on its coastline, a National Mining Task Team has been established under the auspices of the National Working Group 7, in order to address and resolve some of the concerns. Concurrently, the WCG will also be undertaking specific initiatives that enable a sector response to these concerns pertaining to mining activity with the coastal zone.

5.2 Agricultural adaptation

Although agriculture has a significant and not always positive effect on the natural environment, farming practices *per se* mainly determine the impact agriculture has on the natural environment (Vink, 2003). As population increases so does the imperative to produce food and it is difficult to weigh land transformation against the human need for fibre and food. In addition, much of South Africa's agricultural export production is dominated by the province in the form of high-value products such as wine grapes and fruit[5], that are critical for food security, but requires land. The land requirements must be weighed against the significant foreign revenue generated by these

[5] Fruits significantly contribute to food security by providing nutrient-rich options that support overall health and well-being. They offer a diverse range of vitamins, minerals, fiber, and antioxidants, promoting balanced diets and helping to prevent diet-related diseases. Fruits are accessible, affordable, and culturally significant, enhancing culinary traditions and dietary diversity worldwide. Their high water content aids in hydration and satiety, making them a practical choice for healthy snacking and meals. Sustainable fruit production practices also support environmental health and biodiversity, contributing to long-term food security (Graham, 2015).

industries, which has a strong positive impact on employment and household income in the Western Cape, and therefore indirectly also supports food security.

Export markets are a key driver of sustainable agricultural practices, as international regulations and protocols require more environmentally friendly practices and reduced carbon emissions (SmartAgri Status Quo Report, 2017; Jack, 2022). Consumers are also starting to exert similar pressure. In response, a number of Biodiversity Initiatives have emerged in the Western Cape. The initiatives aim to put production on a more sustainable footing by conserving agricultural resources such as soil, energy and water in recognition that production landscapes are dependent on biodiversity for the ecosystem services they provide (SANBI, 2017). Such initiatives include the actions of Greencape, the SmartAgri plan of DoA, the GreenAgri portal (co-hosted by DoA and GreenCape), the Biodiversity in Wine Initiative (BWI), SIZA (The Sustainability Initiative of South Africa) and CCC (Confronting Climate Change) Initiative, as well as programmes initiated by inudstry commodity organisations.

A range of influences has encouraged a transition to sustainable agriculture in both South Africa and the Western Cape. In the Western Cape, these include water scarcity and climate change, decreasing soil condition, the high cost of energy and an ever-increasing food demand (GreenCape, 2023). This, coupled with novel consumer awareness on consumption and sustainability, pesticide residues, ecosystem degradation and pollution are supporting positive land management responses in the Western Cape.

The impact of the Western Cape's agricultural sector must be read with the province's agricultural land in view.

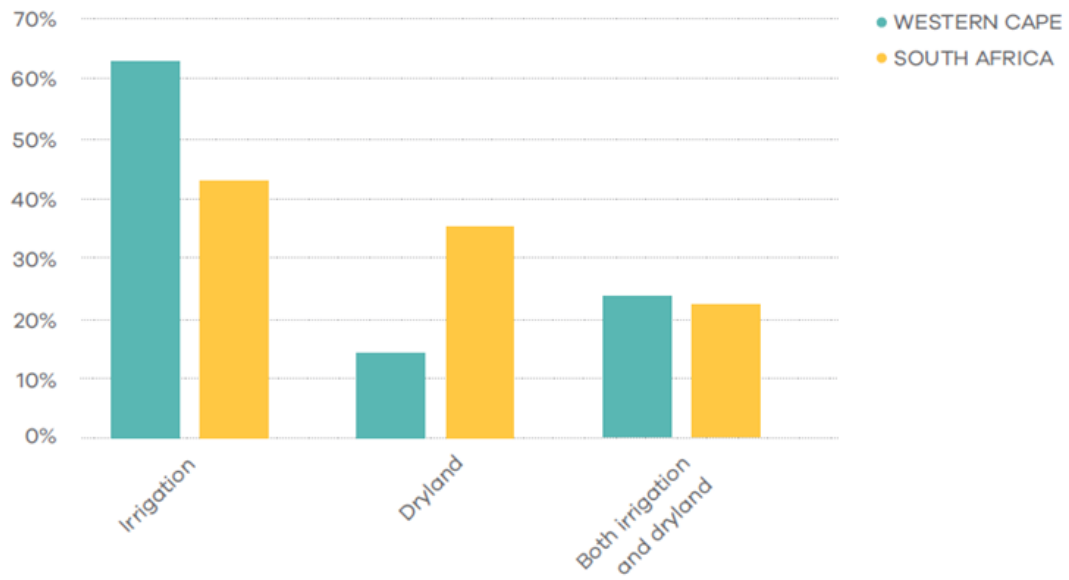


Figure 14 Western Cape agricultural land

(Source: GreenCape, 2023)

Compared to the rest of South Africa, the portion of agricultural land under irrigation is far higher than that at national level (GreenCape, 2023)I. In light of climate change effects and particularly water vulnerability, there is considerable pressure to move to sustainable farming methods.

5.2.1 Climate change response plan

The Western Cape is a major global exporter of agricultural products and responsible for a large proportion of South Africa's exports of prepared foodstuffs, fruit and vegetables. The agriculture sector is particularly vulnerable to anticipated alterations to weather patterns, with severe consequences predicted for the productivity of the sector, rural communities and the population and economy as a whole. The SmartAgri Plan was developed in response to this threat, and with the objective of providing a roadmap to ensure a low-carbon, climate-resilient agricultural sector in the Western Cape (Western Cape Government 2016a). The vision of SmartAgri is: *"Leading the way to a climate resilient agricultural future for the Western Cape while the goal of the plan is: "To equip agriculture to respond to climate change risks and opportunities through innovation, leadership and united strategic action"*. Without adaptation or mitigation, this pressure will have significant consequences, such as increased poverty and food insecurity, and the emergence of climate refugees which will all affect land use and trigger land use change in the province.

Agricultural sector adaptation

Farmers are adjusting their choice of crops and the timing of their field operations as part of their strategy to adapt to the anticipated impacts of climate change. This adaptation is crucial for maintaining agricultural productivity and sustaining rural livelihoods. However, the correlation between farmers' perceptions and their specific actions in response to future climate change is not yet fully comprehended. The complex relationship between farmers' awareness of climate change and the practical steps they take to adapt remains an area that requires further investigation and understanding (Talanow et al., 2020; Theron et al., 2022).

As part of the Western Cape Climate Change Response Framework and Implementation Plan for the Agricultural Sector (SmartAgri Plan, 2016), 23 agro-climatic zones (ACZs) have been identified in the province through the aggregation of more than 80 relatively homogenous farming areas (RHFAs) based on climatic, vegetative and productive attributes. These agro-ecological zones provide a spatial unit for representing the specific agricultural character, current enterprises, and climatic potential of a locality.

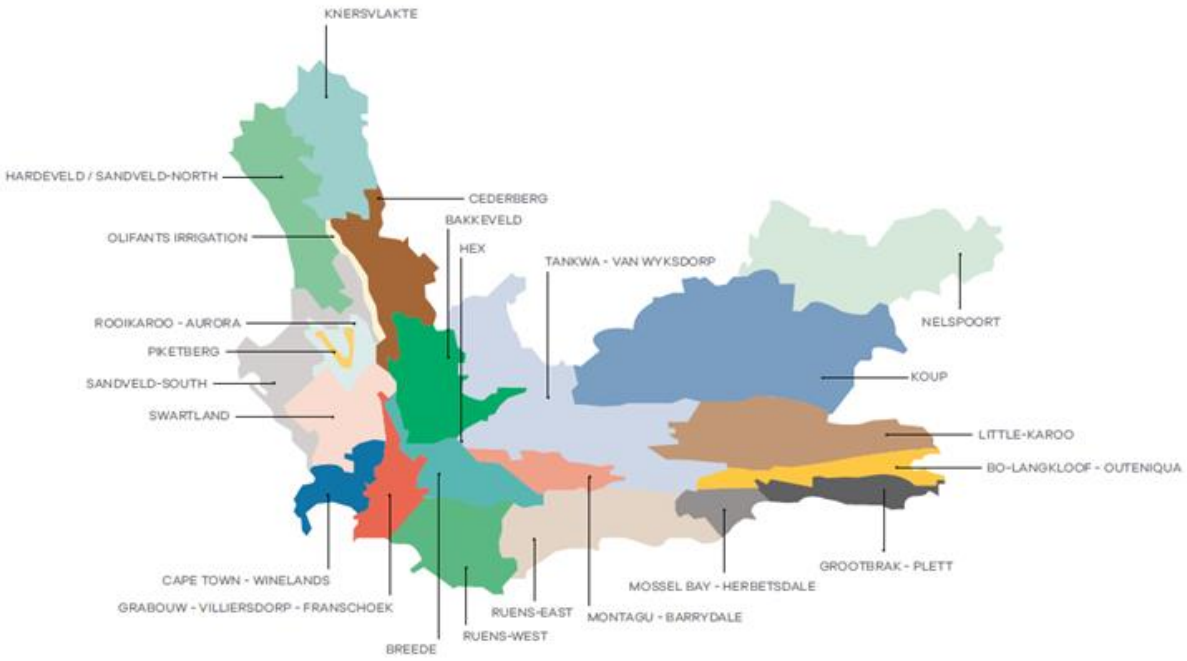


Figure 15 Western Cape Province 23 SmartAgri Zones

Source: GreenCape (2023)and source documents: *SmartAgri Status Quo Review (2016)*; *Jack et al., (2022): SmartAgri Updated Climate Change Trends and Projections for the Western Cape*

Thirteen out of the identified 23 Agro-climatic Zones are **facing a decline in productivity** due to changing rainfall patterns and increasing temperatures, making the climate less conducive for the traditional commodities grown in those regions. Furthermore, persistently low dam levels pose a threat to continuous production even in areas where output remains relatively stable.

The consensus amongst farmers is that while the sector contributes a relatively small amount to greenhouse gas emissions (GHGs), it is the sector most directly affected by climate change impacts. Decreased rainfall and warming is evident, e.g. in the Swartland region, one of the largest grain producing regions in the country (GreenCape, 2016).

Future agricultural potential for the Swartland regional remains high for small grains, but there is an increasing variability in predictable yield (GreenCape, 2023). The Western Cape DoA is responding to this with through its drive towards promoting 'climate smart' intensification of winter grain production while improving soil health in the Western Cape. The Western Cape DoA has initiated and implemented various agricultural research and implementation programmes towards this goal. For the Swartland region, project focus is placed on conservation agriculture towards improving cash crop farming in the Swartland region, particularly in areas dominated by sandy soil. It aims to compare standard production practices with conservation agriculture principles, emphasising minimal soil disturbance and crop diversity. Through research and implementation, the DoA addresses issues such as residue management, soil erosion, and the introduction of alternative crops and cover crops for enhanced biodiversity and weed control. Key objectives include improving soil health, increasing yields, reducing mechanical input costs, and exploring sustainable farming practices in sandy soils.

Droughts and extended dry periods often cause severe crop damage or complete failures, necessitating urgent and sustainable measures to enhance productivity. Initiatives like Conservation Agriculture in the Western Cape, detailed in Section 5.1.4, focus on such measures, including strategies to increase resilience against drought-induced moisture stress.

In response to the unsustainability of traditional commercial farming methods with far-reaching impacts on health and the environment, the Western Cape is transitioning towards sustainable practices. This shift involves moving away from agrochemicals, tillage, and fossil fuels. Initiatives also focus on eradicating invasive plants, restoring natural areas, and incorporating various technologies like water management, remote sensing, smart farming, precision farming, and sensors. Market pressures, driven by rising costs, population growth, limited arable land, and power outages, are further motivating farmers to adopt innovative and competitive farming methods to meet the region's food requirements (GreenCape, 2016; GreenCape 2023).

There is growing recognition of the need for '*climate smart agriculture*', which focusses on climate change adaptation by building farmers' climate resilience and improving livelihoods through poverty reduction and climate change mitigation. Programmes such as FruitLook aim to improve water use efficiency without compromising production while the Landcare programme strives to rebuild, maintain and improve the natural resources in the Western Cape (DEA&DP, Western Cape Climate Change Response Strategy, 2014).

The Western Cape Green Economy Strategy Framework highlights smart agri-production as one of five drivers of the green economy in the province, and identifies the following priorities:

- Sustainable labour intensive farming;
- Farming practices that are in harmony with nature; and
- Water technologies that reduce consumption and increase efficiency.

Current priorities to respond to climate change induced food insecurity and nurture economically sustainable agricultural sector in the Western Cape include (DEA&DP, Western Cape Climate Change Response Strategy Biennial Monitoring & Evaluation Report 2015/16, 2016):

- Farming practices that are in harmony with nature, i.e. 'conservation agriculture';
- Climate smart agriculture;
- Agricultural water technologies that reduce consumption and increase efficiency;
- Research on climate resilient and alternative crops and livestock appropriate to the Western Cape;
- Addressing climate vulnerability through the Municipal Support Programme; and
- Assessing food security in the context of the resource nexus.

SmartAgri consists of four Strategic Focus Areas (SFAs), each of which consists of a set of objectives which have affiliated projects and activities at the lowest level of the programme logic. A narrative summary of progress is presented in the full evaluation report which provides a nuanced assessment of implementation progress and challenges, and thus informs the next steps of SmartAgri. The presentation below provides a summative assessment of implementation progress.

In a collaborative effort, the Western Cape Departments of Agriculture (DoA) and DEA&DP launched the Smart Agriculture for Climate Resilience (SmartAgri) project in August 2014, which was completed in 2016 after a 20-month project and intensive stakeholder engagements (DoA, Status Quo Review of Climate Change and Agriculture in the Western Cape Province, 2016a). Under the University of Cape Town's African Climate and Development Initiative (ACDI), a consortium developed a provincial climate change response framework and implementation plan for the agricultural sector. Known as the SmartAgri Plan, it builds upon the Western Cape Climate Change Response Strategy (WCCCRS) and its Implementation Framework, particularly focusing on

"Food Security." The plan closely aligns with the current five-year Provincial Strategic Plan and introduces four Strategic Focus Areas.

- Promote a climate-resilient low-carbon production system that is productive, competitive, equitable and ecologically sustainable across the value chain;
- Strengthen effective climate disaster risk reduction and management for agriculture;
- Strengthen monitoring, data and knowledge management and sharing, and lead strategic research for climate change and agriculture; and
- Ensure good co-operative governance and institutional planning for effective climate change response implementation for agriculture.

The SmartAgri Plan provides a "roadmap" towards a more productive and sustainable future for the agricultural sector, to ensure the continued growth and competitiveness of the entire agricultural value chain.

The SmartAgri Implementation Plan is reinforced by six "Priority Projects". These projects were developed both to deliver climate resilience to agriculture over the short- to medium-term, and to begin the transformative process required for long-term resilience and sustainability at a time when the climate will have changed significantly. They are:

- Conservation Agriculture for all commodities and farming systems;
- Restored ecological infrastructure for increased landscape productivity, socioecological resilience and soil carbon sequestration;
- Collaborative integrated catchment management for improved water security (quality and quantity) and job creation;
- Energy efficiency and renewable energy case studies to inspire the transition to low-carbon agriculture;
- Climate-proofing the growth of agri-processing in the Western Cape; and
- Integrated knowledge system for climate smart agricultural extension.

A key action taken to facilitate implementation and prioritise roll-out of the SmartAgri Plan was the appointment by the WC-DOA of an implementation expert/specialist advisor. The two–year appointment of an expert (2016-2018) is considered to have fast tracked implementation and helped the WC-DOA raise awareness of climate change and its potential impacts and to 'land' the SmartAgri plan in the sector with stakeholder-focused interventions.

The six priority projects were selected on the basis that they could catalyse or accelerate implementation of the overall plan. The assessment finds that a catalytic effect, related to the SmartAgri priority project and not the ongoing departmental programme, can be observed at an institutional level for all six projects within the Department of Agriculture. Four projects were assessed to have had a sectoral effect. The conservation agriculture and integrated knowledge systems priority projects have made the strongest progress in terms of being catalytic beyond the pre-existing departmental programmes associated with each.

5.2.2 LandCare Programme

The LandCare Programme is a community-based initiative with government support aimed at promoting sustainable management and use of agricultural resources (WCG, 2014). The program focuses on community-led, ecologically sustainable land management practices, ensuring that

cultivation, grazing, and harvesting of natural goods and services are conducted in a manner that preserves and does not degrade the land resource. Supported by both the National government and WCG, these community initiatives generate green jobs, alleviate poverty, enhance food security, improve livelihoods, and contribute to the reversal of soil and land degradation. LandCare services are delivered to clients in the Western Cape through:

- Resource conservation projects;
- LandCare projects; and
- Area wide planning.

Resource conservation projects in the Western Cape are governed by regulations outlined in the Conservation of Agricultural Resources Act 43 of 1983. These projects encompass planning, surveying, designing, and controlling works, including disaster relief works, to prevent the degradation of agricultural resources and propose sustainable resource utilization. Commercial farmers are also targeted by these projects to encourage them in conserving natural resources, ultimately enhancing the quality and quantity of fruit and grapes for the export market.

LandCare projects aim to serve all land users in the Western Cape, with a particular emphasis on smallholder farmers and communities. In 2018, twenty LandCare projects were proposed, focusing on water conservation, water quality improvement, and capacity building – some of which are highlighted below.

5.2.3 Crop Protection Programme

The Crop Protection Programme in the Western Cape under the LandCare projects, adopts a multidisciplinary approach, focusing on nematology, entomology, and plant pathology. The program is dedicated to effectively managing various phytosanitary pests and diseases, with a strong emphasis on finding biological alternatives for control. This is especially crucial due to increasing market resistance to chemical use and the decreasing availability of acceptable chemical control options. The program also highlights the growing importance of soil health and regenerative agriculture.

In the 2022-2023 period, there has been a notable increase in projects related to phytosanitary measures and market access. A noteworthy project completed during this period revealed the significant risk posed by the polyphagous shot hole borer (PSHB) to the South African deciduous fruit industry. A comprehensive strategy to address the PSHB threat is currently in development (Hortgro, 2022).

5.2.4 Conservation agriculture

The latest Sustainable Agriculture Market Intelligence Report (MIR, 2022) described the notable investment opportunities in sustainable agriculture for the Western Cape in terms of energy efficiency, renewable energy, regenerative agriculture, smart farming and electric equipment. Several of these fall under the category of climate smart agriculture (CSA) – "*a framework for an integrated approach to managing landscapes (cropland, livestock, forests and fisheries) that address the interlinked challenges of food security and climate change*" (World Bank, 2021).

While conservation agriculture (CA) primarily focuses on soil conservation and improvement, sustainable agriculture (which includes CA) addresses broader goals such as conserving natural resources, promoting biodiversity, ensuring food security, and enhancing rural livelihoods.

One such example is 'solar drying technology' which presents opportunities for Western Cape sustainable agriculture, not only as an opportunity for greater beneficiation on farms but also as an

environmentally sustainable method of reducing post-harvest losses in low- and middle-income countries. According to the Sustainable Agriculture MIR (2022), farms in the Western Cape that produce fruits such as tomatoes and apricots, as well as nuts, would be well-positioned to invest in solar dryers as there are existing markets for goods such as dried fruits and nuts. The relatively higher value of these commodities would also suggest that those farmers are better placed to make the required capital investment, provided that a clear business case for the technology has been made.

As discussed earlier, the greening of the agricultural sector (sustainable agriculture) is growing in the Western Cape, and while it has benefits for land health and sustainability, it has implications for the livelihoods of those working in agriculture. Green agriculture embraces innovative methods and technology, unlike conventional farming methods, which tend to be labour intensive. Though conventional jobs may be lost, technologists will be required to operate equipment, creating opportunities to upskill farmers and farm workers, increasing income for these beneficiaries.

Conservation agriculture aims to enhance farmers' livelihoods through sustainable and profitable farming practices. The core principles involve minimizing soil disturbance, maintaining permanent soil cover, and practicing crop rotation. In the Western Cape, there is growing interest at both national and provincial levels in implementing conservation agriculture to conserve water, optimize natural resources, and protect soils.

Wheat farming in the Western Cape has seen notable success with conservation agriculture, leading to increased production and profits, reduced soil erosion, and improved soil health and water quality. Collaborating with the Western Cape Department of Agriculture and Agricultural Research Council (ARC), wheat farmers transitioned from conventional cropping systems to conservation agriculture principles. ARC research demonstrated the cost-effectiveness of conservation agriculture, despite initial expenses for specialized equipment. By 2013, 166 000 hectares of wheat in the Western Cape were cultivated using conservation agriculture, with an average cost of R2 387 per hectare to produce a three-ton yield, significantly less than the R4 444 per hectare using conventional methods (ARC, 2014).

The success of conservation agriculture in improving soil health, increasing moisture retention, reducing compaction and temperature, and fostering beneficial microorganisms has been crucial for Western Cape farmers. The positive outcomes have led to the continued adoption of conservation agriculture by various farmers, including smallholders aiming to compete and contribute to the development of an inclusive rural economy in the province (ARC, 2014).

Under the auspices of conservation / sustainable agriculture, the Western Cape DoA are placing emphasis on nutrient and water efficiency through implementation such as hydroponic production systems vegetables in greenhouses. With active projects between 2023 – 2031, the DoA is emphasising the importance of optimal crop nutrition in ensuring economic sustainability through progressive agricultural methods. Although fertilizer inputs significantly contribute to crop yields, its excessive application poses economic and environmental concerns, especially when nutrients are leached into the environment.

Balancing yield and quality with efficient resource use is a challenge, and not only so for the Western Cape. It extends to hydroponically grown crops - if not managed properly, it can lead to nutrient losses and environmental pollution. Soilless production in closed systems offers a sustainable approach with improved water and nutrient use efficiency. The DoA research and implementation on **hydroponic production systems** aim towards on-going development of this alternative method for managing nutrient concentrations in re-circulating systems, with the overall objective of quantifying nutrient uptake and changes in recycled nutrient solutions.

5.2.5 Agricultural research

The Western Cape Department of Agriculture maintains a number of on-going research priorities through long-term projects. With respect to land and soil management, the 2018 – 2030 project – ***Effect of tillage frequency on soil quality and plant productivity under current and biological agricultural management systems*** is one example of the DoA research and implementation that prioritises evaluating the impact of tillage practices on soil fertility, nutrient distribution, and crop productivity specifically in the province's dryland farming system. Through extended experiments, the DoA enables the continuous monitoring of changes in both crop yield and quality, as well as soil fertility over time.

Additionally, to support the sustainability of the Western Cape's wheat-based systems under different tillage and soil nutrient management scenarios, it is crucial to conduct these assessments through prolonged experiments. The project's objectives encompass several aspects:

- assessing the effects of infrequent tillage on the stratification of specific soil chemical parameters at a depth of 450 mm within a dryland crop rotation system,
- evaluating the impact of infrequent tillage on lime movement and soil pH up to 450 mm deep one, two, and three years after liming, scrutinizing the effects of tillage on selected soil physical characteristics such as soil texture and aggregate stability, and
- determining how tillage practices influence the yield and quality of wheat and canola in a dryland crop rotation system.

With the provincial importance in terms of land, economy and agricultural productivity, DoA research and implementation such as the *Management and facilitation of the "SKOG"(Swartland and Kleingraan Ontwikkelingsgroep) initiative at Langgewens Research Farm* is an ongoing effort between 2023 and 2033 continues on the SKOG model. Established in 1998, the SKOG project has adapted to evolving producer needs and research expertise. It remains crucial for developing production guidelines, technology transfer, and knowledge dissemination to the farming community. In its 25th year, SKOG is the sole research hub and technology transfer event of this scale in the Swartland. The project primarily targets small grain producers in the Western Cape, particularly those in the Swartland area. Key outputs for the target group encompass production guideline development, technology and knowledge transfer, access to research trials, and demonstrations presented during the annual SKOG Information Day. The project's objectives include revising the SKOG model to enable departmental officials to fulfill their roles, ensuring compliance with departmental policies and legislation, streamlining SKOG management to alleviate administrative burdens on the SKOG Manager, fostering continued collaboration among existing principals through a new agreement drafted by Western Cape Government Legal Services, conducting practical research and extension actions for small grain production practices in the Swartland, and maintaining SKOG as a showcase for departmental research at Langgewens, along with research from SKOG collaborators in the private sector and other research institutions.

5.3 Policy, tools and legislation

The Spatial Planning and Land Use Management Act of 2013 (SPLUMA) and the Western Cape Provincial Spatial Development Framework of 2014 (PSDF) are the primary tools used to address spatial inefficiencies relating to land in the Western Cape. However, other legislation, policies and tools also address land issues and their impact on the receiving environment.

5.3.1 Spatial Planning and Land Use Management Act

SPLUMA was promulgated in mid-2015. It is an enabling Act to accommodate spatial planning and land use management legislation in South Africa, and encourages consistency across all procedures and decisions in spatial planning and land use management. In terms of SPLUMA, the mandate for spatial planning and land use management is devolved to local municipalities. All municipalities must therefore establish Municipal Planning Tribunals to enact SPLUMA effectively. The hope is that SPLUMA will ultimately facilitate optimal spatial transformation. Enabling components driven by the Act include Spatial Development Frameworks (SDF's), land use schemes and land development applications.

5.3.2 Urban Edge Policies

Rapid urbanisation and urban growth have elevated concerns regarding effects on the receiving environment and the sustainability of urban development. The urban edge is a demarcated line to manage and control the outer limits of development in urban areas (WCG, 2009). Urban edges are a land use management measure prescribed by the PSDF growth management policies, to determine where urban development should stop (spatially) and to promote sustainable environmental/urban interactions. As such, defined urban edges in the Western Cape prevent undesirable urban growth, particularly encroachment into arable farmland, fireprone sensitive areas and other sensitive areas.

5.3.3 Western Cape Biodiversity Framework, Biodiversity Sector and Bioregional Plans

Municipal biodiversity plans and land-use guidelines have been compiled for Saldanha Bay, Cederberg, Bergrivier, Matzikama, Hessequa, Mosselbay, Breede River/Winelands, Breede Valley and Witzenberg Local Municipalities. The CCT Biodiversity Network and a Western Cape Biodiversity Framework has been developed to inform bioregional development-planning decisions in the city.

Spatial biodiversity information is increasingly being integrated into government spatial and development planning. GIS Maps and guidelines indicating the location of Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs) are used to inform land-use planning and environmental management. This enables efficient and environmentally sustainable development, including the appropriate placement of human settlements, agriculture and industry, away from threatened ecosystems. An important focus area of Western Cape policy is the Cape Floristic Region, which is highly vulnerable to climate change and anthropogenic pressures such as agriculture and housing developments.

The WCG is actively promoting the use of Biodiversity Sector Plans and Bioregional Plans, and building the capacity of officials to improve compliance with the conditions that safeguard biodiversity and ecosystem services. Importantly, the WCG has moved to mainstream biodiversity into their integrated planning tools, including Environmental Management Frameworks and the PSDF.

5.3.4 The South Africa Land Reform Programme

Launched in 1994, the South African Land Reform Programme is a threefold approach to addressing previous racial discrimination in the distribution and ownership of land: Redistribution seeks to grant the previously disadvantaged and the poor access to land. Land restitution addresses cases of forced removals that took place between 1913 and 1994. The Land Claims Court and Commission, was established under the Restitution of Land Rights Act 22 of 1994 to manage and oversee the process.

The reform of land tenure in both South Africa and the Western Cape is addressed through land policy, administration and legislation to ensure that improved tenure security is realised, acknowledging that a diversity of land tenure types need to be accommodated, including communal tenure.

5.3.5 Summary of policy, tools and legislation

Other responses are listed in the summary below:

Table 4 Summary of policy, tools and legislation

Year	Description	Purpose
International Responses		
1990	Environmental certification of particular agricultural products	Voluntary, usually third party-assessed, norms and standards relating to environmental, social, ethical and food safety issues, adopted by companies to demonstrate the performance of their organizations or products in specific areas.
1994	United Nations Convention to Combat Desertification	Convention to combat desertification and mitigate the effects of drought through national action programs that incorporate long-term strategies.
2004	Stockholm Convention on Persistent Organic Pollutants	International environmental treaty, signed in 2001 and effective from May 2004, that aims to eliminate or restrict the production and use of persistent organic pollutants (POPs).
2015	United Nations Sustainable Development Goals (SDGs)	SDG 15 specifically targets the protection, restoration, and sustainable management of terrestrial ecosystems, including efforts to combat desertification, restore degraded land, and halt biodiversity loss.
2015	Paris Agreement - UNFCCC	The Paris Agreement is a landmark international treaty under the United Nations Framework Convention on Climate Change (UNFCCC) that aims to address climate change and its impacts.
2016	United Nations Framework Convention on Climate Change (UNFCCC).	At the UN Climate Change Conference (COP 21) in Paris, on 12 December 2015, Parties to the UNFCCC reached a landmark agreement to combat climate change and to accelerate and intensify the actions and investments needed for a sustainable low carbon future. The Paris Agreement builds upon the Convention and – for the first time – brings all nations into a common cause to undertake ambitious efforts to combat climate change and adapt to its effects, with enhanced support to assist developing countries to do so. As such, it

		charts a new course in the global climate effort.
2021	African Continental Free Trade Area (AfCFTA)	Since the beginning of 2021, intra-Africa trade has been conducted under the AfCFTA as a drive to boost intra-continental trade. The intended outcome of this initiative is to develop frameworks whereby the AfCFTA can be used as a catalyst for African nations to address infrastructure gaps and improve manufacturing capacity so that local production and regional trade can thrive. Main intra-Africa agricultural exports are palm oil, sugar, maize, rice and cigarettes, where South Africa contributed 15% of sugar exports and 54% of maize exports (Trade Law Centre, 2019).
2022	EU Green Deal and Farm-to-Fork Strategy	The Farm-to-Fork (F2F) Strategy looks at how the EU's food chain can be revolutionised to contribute to the EU's target of carbon neutrality by 2050. SA producers continue to organise engagements, both with local producers and international experts, to gain a sense of what shifts in production will be needed to maintain access to the EU market once the F2F Strategy is active.
National Responses		
1970	Subdivision of Agricultural Land Act 70 of 1970/ Subdivision of Agricultural Land Act Repeal Act 64 of 1998	Regulates the subdivision of agricultural land in South Africa.
1983	Conservation of Agricultural Resources Act 1983	To provide for the conservation of the natural agricultural resources of the Republic by the maintenance of the production potential of land, by the combating and prevention of erosion and weakening or destruction of the water sources, and by the protection of the vegetation and the combating of weeds and invader plants.
1989	Environmental Conservation Act 73 of 1989	To provide for the effective protection and controlled utilization of the environment and for matters incidental thereto.
1995	White Paper on Agriculture	The Interim Constitution of the Republic of South Africa requires that a new policy be established for Agriculture. In terms of the Constitution agricultural functions fall within the competence of provincial

		governments. However, not all such functions are allocated *in toto* to the provinces because of the overriding provisions of section 126(3) of the Constitution. A national agricultural policy is necessary and a distinction should therefore be made between national and provincial responsibilities towards agriculture and its different role-players.
1995	Working for Water Programme	This programme works in partnership with local communities, to whom it provides jobs, and also with Government departments including the Departments of Environmental Affairs and Tourism, Agriculture, and Trade and Industry, provincial departments of agriculture, conservation and environment, research foundations and private companies to remove invasive alien plants.
1997	White Paper on South African Land Policy	The White Paper on South African Land Policy, published in April 1997, outlines the vision and implementation strategy for land policy in South Africa. It aims to address the complex legacy of land ownership, which has been a source of conflict due to historical conquest, dispossession, and racially-skewed distribution of land resources. The policy focuses on three key elements: 1. **Restitution**: A person or community dispossessed of property after **19 June 1913** due to past racially discriminatory laws or practices is entitled to restitution or equitable redress. 2. **Redistribution**: The state must take reasonable legislative and other measures to foster conditions enabling citizens to access land on an equitable basis. 3. **Tenure reform**: A person or community with legally insecure land tenure due to past racially discriminatory laws or practices is entitled to secure tenure or comparable redress[1].
1998	The National Water Act 36 of 1998	The National Water Act 36 of 1998 is a significant piece of legislation in South Africa. It aims to reform water resources management by achieving sustainable use and equitable allocation of water, safeguarding water quality, and promoting social and economic development

		through effective water management. This act was enacted in 1998 and has been amended twice. It also repealed certain previous water laws, making it a pivotal framework for water governance in the country.
1998	The National Environmental Management Act 107 of 1998	To provide for co–operative environmental governance by establishing principles for decision—making on matters affecting the environment, institutions that will promote co-operative governance and procedures for co-ordinating environmental functions exercised by organs of state; to provide for certain aspects of the administration and enforcement of other environmental management laws; and to provide for matters connected therewith.
1999	Land Care Programme	The overall goal of the LandCare Programme is to optimise productivity and sustainability of resources so as to result in greater productivity, food security, job creation and a better quality of life for all.
2000	The Integrated Sustainable Rural Development Strategy	To attain socially cohesive and stable rural communities with viable institutions, sustainable economies and universal access to social amenities, able to attract and retain skilled and knowledgeable people, who equipped to contribute to growth and development.
2001	National Department of Agriculture: Environmental Implementation Plan	The Environmental Implementation Plan describes policies, plans and programmes of a department that performs functions that may impact on the environment and how this department's plans will comply with the NEMA principles and national environmental norms and standards.
2005	A National Action Programme (NAP) on Combating Land Degradation	NAPs are a key tool for the implementation of the UNCCD at the country level. They are strengthened by Action Programs at sub-regional and regional levels
2011	Green Paper on Land Reform	The Green Paper on Land Reform is underpinned by the following principles: de-racialising the rural economy, democratic and equitable land allocation and use across race, gender and class a sustainable production discipline for food security.
2011	South Africa National Climate Change Response Policy (White Paper)	The National Climate Change Response Policy is a comprehensive plan to address both mitigation and adaptation in the short, medium and long term (up to 2050). GHG emissions are set to stop increasing at the

		latest by 2020-2025, to stabilise for up to 10 years and then to decline in absolute terms.
2012	Spatial Planning and Land Use Management Act 16 of 2013 (SPLUMA)	The law gives the Department of Rural Development and Land Reform (DRDLR) the power to pass Regulations in terms of SPLUMA to provide additional detail on how the law should be implemented.
2015	Draft Preservation And Development Of Agricultural Land Bill	The purpose of the Draft Preservation and Development of Agricultural Land Bill is to promote the preservation and sustainable development of agricultural land in South Africa. The Draft Bill also aims to provide for the demarcation of protected agricultural areas and to introduce measures to discourage land use changes from agriculture to other forms of development.
2016/17	Strategic Plan for South African Agriculture	To facilitate the generation of equitable access and participation in a globally competitive, profitable and sustainable agricultural sector contributing to a better life for all.
2017	DRDLR: Revised Environmental Policy	Revision of existing environmental policy to better align with country needs and changes in legislation
2019	Carbon Tax Act	The first phase of the South African Carbon Tax Act (No 15 of 2019) came into effect in June 2019, running until December 2022 with the second phase coming into effect from 2023 until 2030.
2000	The Policy for Farm Towns	Policy to guide the sustainability of agriculturally dependent towns in the broader economy.
2018	Climate Smart Agriculture Framework	This framework outlines the role that Climate Smart Agriculture (CSA) can play in addressing vulnerabilities facing the agriculture sector. Various stakeholders, and farmers, have a role to play in promoting resource efficiency, increased productivity and social equity through mitigation and adaptation efforts.
2021	Climate Change Bill	In October 2021, the Draft Climate Change Bill was tabled in Parliament to "enable the development of an effective climate change response and a long-term, just transition to a climate-resilient and low-carbon economy and society for South Africa in the contextof sustainable development" South Africa has officially passed the Climate Change Bill. Both arms of Parliament - the National Assembly and the National Council of Provinces, unanimously approved this critical

		legislation on 25 April 2024, sending it to the President's desk for final signature, before it can be Gazetted into law.
2022	Agriculture and Agro Processing Master Plan (AAMP) 2022	The AAMP is one of the seven priority plans identified by President Ramaphosa in the State of Nation Address (SONA) of 2019 as part of key economic sectors essential for the economic reconstruction and recovery during and post the Covid-19 pandemic. Other priority sectors include mining, automobile, green energy, ICT, defence, tourism and creative industries and each sector must have its Master Plan. A Master Plan is considered to be a planning and implementation framework that promotes public-private partnerships to leverage on resources, skills and experiences to advance economic growth and inclusion as well as the creation of sustainable jobs in the country. In addition to developing the AAMP, the Minister of DALRRD also tasked the NAMC to monitor and evaluate the implementation of AAMP by the different social partners. Furthermore, the NAMC was considered a strategic State-Owned Entity to rebuild state capacity (i.e., DALRRD) through collecting and processing market and industry data to improve the credibility of agricultural statistics, rebuild capacity in economic decision tools and policy analysis.
2022	Cannabis for Private Purposes Bill	Following amendments made to the schedules of the Medicines and Related Substances Act, No. 101 of 1965 (Medicines Act), the Minister of Justice and Correctional Services introduced the Cannabis for Private Purposes Bill that sought to "respect the right to privacy of an adult person to possess cannabis plant cultivation material; regulate the possession of cannabis plant cultivation material and protect adults and children against the harms of cannabis."
2022	Land Reform – Draft 18th Amendment Bill	The Joint Constitutional Review Committee (JCRC) advised that Section 25 of the Constitution of South Africa should be amended to allow for expropriation of land without compensation. Following that, a draft amendment bill, Draft Constitution 18th Amendment Bill (Section 25 Amendment) was published where it described the circumstances upon which "It may be just and equitable for nil compensation to be paid where land is expropriated in the public interest."

Provincial Responses		
2002	A Settlement Framework for the Western Cape	Framework to inform the sustainable use of land in the development of human settlements in the Western Cape.
2005/6-ongoing	The Department of Agriculture's Land Care and Area-wide Planning	LandCare is a national movement aimed at restoring sustainability to land and water management in both rural and urban areas. It encompasses integrated sustainable natural resource management where the primary causes of natural resource decline are recognised and addressed. LandCare is community based and community led and seeks to achieve sustainable livelihoods through capacity building and related strategies. LandCare policies will be developed and achieved through the formation of partnerships with a wide range of groups from within and outside Government through a process that blends together appropriate upper level policy processes with bottom-up feedback mechanisms.
2010	Western Cape Biodiversity Framework	Aimed at integrating all biodiversity-planning products for the Western Cape into a common, user-friendly framework to give guidance in the land-use decision-making process.
2014	Western Cape Land Use Planning Act 3 of 2014 (LUPA)	To consolidate legislation in the province pertaining to provincial planning, regional planning and development, urban and rural development, regulation, support and monitoring of municipal planning
2014	Western Cape Provincial Spatial Development Framework	Coordinates, integrates and aligns Provincial plans and development strategies with policies of National Government; the plans, policies and development strategies of Provincial Departments; and the plans, policies and development strategies of municipalities. Due for review and updating for 2024 to 2026.
2016	Western Cape Biodiversity Sector Plan	Is intended to help guide land-use planning, environmental assessments and authorisations; and natural resource management in order to promote sustainable development.
2016	SmartAgri Plan	The SmartAgri Plan 2016 is a strategic initiative developed by the Western Cape Department of Agriculture in South Africa. Its primary aim is to enhance agricultural resilience and sustainability in response to various challenges, including climate change, water scarcity, and

		socioeconomic factors impacting the agricultural sector.
2017	Informal Settlement Support Plan (ISSP)	The Informal Settlement Support Programme (ISSP) is a people-centered and partnership-based approach aimed at improving living conditions for informal settlement residents across the Western Cape in South Africa. Guided by the Western Cape Government's Provincial Strategic Goal, the program focuses on enabling resilient, sustainable, quality, and inclusive living environments. The ISSP includes strategic documents, rapid appraisal profiles, and a close-out report from 2016. Its overarching goal is to transform precarious settlements into dignified neighborhood.
2019	Western Cape Ecological Infrastructure Framework	The Western Cape Ecological Infrastructure Framework (EIF) is a strategic initiative developed to guide the sustainable management and conservation of ecological infrastructure across the Western Cape
2019	Living Cape: A Human Settlements Framework	The Living Cape Framework, developed by the Western Cape Government, aims to improve urban living by clearly defining necessary changes and how to achieve them. It focuses on enhancing the quality of human settlements, emphasizing holistic spaces that integrate housing, services, infrastructure, and social fabric. Unlike traditional housing delivery models, Living Cape inspires creative and adaptive practices in sustainable human settlement development[1].
2022	Western Cape Climate Change Response Strategy	A comprehensive framework developed by the Western Cape Provincial Government to address the challenges posed by climate change. The strategy outlines a set of goals, objectives, and actions aimed at mitigating greenhouse gas emissions, adapting to climate impacts, and promoting resilience across various sectors within the province.
2022	LandCare Programme	The Western Cape continues to focus on sustainable land management practices to address issues such as erosion, land degradation, and soil conservation. The program is part of a national initiative in South Africa aimed at promoting responsible land use and enhancing agricultural productivity while safeguarding natural resources.

2024	Western Cape Provincial Spatial Development Framework	Currently under review and udpating
Local Authority Responses		
Various dates as per government entity	Integrated Development Plans (IDPs), Spatial Development Frameworks (SDFs) and Environmental Management Frameworks (EMFs)	IDP: an overall framework for development. It aims to co-ordinate the work of local and other spheres of government in a coherent plan to improve the quality of life for all the people living in an area. SDF: serves to give spatial direction to the IDP, and provide a common spatial agenda for diverse sector plans. EMFs: Studies biophysical and socio-cultural systems of a geographically defined area to reveal. where specific land-uses may best be practiced and to offer performance standards for maintaining appropriate use of such land.

6 CONCLUSION

OUTLOOK: STABLE

Land is a non-renewable and irreplaceable resource, the management of which needs to be prioritised in the Western Cape. The increasing population, economic development, and global market demands are placing significant pressure on land resources. As a result, there is an ongoing need for interventions to avoid and mitigate land degradation, soil loss, and the loss of crucial biodiversity areas.

The Western Cape maintains its prominent role in the horticultural sector, contributing 37% of South Africa's horticultural farm income despite having less than 10% of productive agricultural land (including arable and grazing land) (MIR, 2023). It is estimated that the 2023 total potential on-farm value of crop production was approximately R60 billion, 68% higher compared to 2017 (mainly because of the devaluation of the Rand and higher commodity prices). The contribution of orchards (including vineyards) was 79% in 2017 but decreased to 66% in 2023 explained by the gain in vegetables, grain & oilseeds, and lupins value of production (DoA, 2024).

Most horticultural farms in the Western Cape are irrigated, with a higher proportion compared to the national level. Hence, ensuring a reliable water supply and an efficient network from bulk water storage to farming communities is crucial for the sustained success of the irrigated horticultural sector in the Western Cape. Climate change models for the province anticipate lower rainfall and higher temperatures in the coming years, posing a risk of reduced water availability. This could have adverse effects on all agricultural production, both irrigated and rainfed.

Mapping data from the Department of Agriculture's Mapping of Agricultural Commodities Production and Infrastructure in the Western Cape Province (Flyover Report, 2024) provided extremely accururate agricultural land use (cultivated) data from the iterations undertaken in 2013, 2017/2018 and 2023. From this flyover mapping data, it is concluded that at current there is an exponential rise in citrus production across the Western Cape, underscoring the region's evolving agricultural prowess. Equally noteworthy was the expansive growth of the almond industry, spanning the Cape Winelands, West Coast, Overberg, and Garden Route districts, marking a strategic diversification in agricultural output. In contrast, the Blueberry industry witnessed a notable contraction, reflecting dynamic market forces at play. The Southern Cape emerged as a hub for alternative high-value crops like kiwi, pecan nuts, avocados, and macadamia, signaling a shift towards more lucrative agricultural ventures. Concurrently, the deciduous fruit sector continued its robust expansion, geared towards increasing export volumes. However, in a stark contrast, the canned fruit industry experienced a downturn, suggesting challenges in its traditional market dynamics. These changes underscore the region's resilience and adaptability in navigating the complexities of global agricultural markets.

The sustainable use of the land resource requires critical action by the WCG, and multiple such actions have been reported on in this chapter. As part of the Western Cape Climate Change Response Framework and Implementation Plan for Agriculture (SmartAgri Plan), agro-climatic zones (ACZs) have been identified. It can be noted at an highlevel observation that all of the province's agro-climatic zones (ACZs) are under pressure, with some zones experiencing increased threat. These zones result from aggregating over 80 relatively homogenous farming areas based on shared climatic, vegetative, and productive attributes. They aim to represent specific agricultural characteristics, existing enterprises, and climatic potential, contributing to the sector's adaptability and resilience to climate change. Any loss of or reduction in cultivated land and increase in the

extent of degraded land, affect not only the sustainability of the province, food security, livelihoods and land use options if affected by climate change. Although this reporting cycle did not establish any significant land degradation, it must remain a priority for climate resilience and land resource sustainability.

There exists a fine balance between land transformation and loss or potential loss of agricultural land resources, relating primarily to growth of settlements. The land indicators reported on in this chapter indicate a stable outlook, but with specific areas of action and pressure points, again highlighted below:

Table 5 presents an overview of the key pressures, impacts, challenges, progress and recommended critical areas for action.

Table 6 Summary of the land outlook in the Western Cape presents the anticipated changes or outlook for the future of land, based on the findings in this chapter.

Table 5 Overview of key aspects

Aspect	Summary of key points
Pressures	• Electricity / loadshedding • Urban growth • Food security • Transport and infrastructure networks • Agricultural expansion • Mining expansion • Climate Change • Water resources • Access to land • Changes in crops and farming methods • Erosion
Impacts	• Loss of productive land • Loss of future socio-economic opportunities and livelihoods • Exacerbated impacts of climate change • Standard of living and livelihoods, particularly in rural areas • Reduction of natural ecosystems, species and ecological processes
Challenges	• Ability to ensure long term, sustainable land use in the Western Cape • Adapting to a climate-changed future and shifting land suitability • Water and food security
Progress	• Increased application and success of conservation agriculture • Implementation of climate responsive agricultural management • Implementation of sustainable intensification of agricultural production in some sub-sectors

	• Development of key legislation and land use management tools and legislation • Control of invasive alien vegetation across the province
Critical areas for action	• Create capacity to support regenerative agriculture and climate smart agricultural practices • Secure appropriate, regularly updated data and information with regard to land cover and change • Continue to drive sustainable and conservation agriculture methodologies and production increases not dependent on additional farmland • Continue to drive efforts towards climate change and mitigation practices to enhance resilience, as these challenges will persist over an extended period • Explore alternative means of ensuring the protection of natural areas and the prevention of land degradation specific to land use management • Assess methods and legislation to protect and preserve productive agricultural land, with consideration of climate change projections • Control of invasive alien vegetation encroachment near human settlements and in catchments • Development of new irrigation water bulk infrastructure for risk mitigation on high value export crops

Table 6 Summary of the land outlook in the Western Cape

Indicator	Quantification	Target/Desired State	Trend
Land cover & land transformation	• 69.3% natural • 30.7 transformed – agriculture/urban/degraded/other: 12.75% agriculture 1.24% urban 13.4% degraded	• Protect/maintain current natural land cover • As far as possible prevent further land transformation – minimal if any change in land transformation over past five years • Maintain/ manage degraded land to prevent	Stable[6] 

[6] Care should be taken when interpreting the National Land Cover change assessment information and drawing conclusions. Some apparent changes could be due to changes in classification methods, data quality or data processing techniques – a stable outlook however seems plausible.

		increase in degradation	
Agricultural Land Use and Potential including Land capability[7]	The agricultural footprint is stable to decreasing however agricultural production is increasing for the Western Cape. • No high value agricultural soils - vulnerable agriculture requiring high inputs • Concern is soil-climate-terrain and the impacts of agriculture, and the implications for agricultural production and resilience.	• Sustainable agricultural practices that enhance /protect/ make use of existing agricultural soils. Importantly, land capability does not equate to agri-potential, which means agricultural potential can be on an improving scale.	Stable to improving 

[7] There is increasing need to understand the sustainability of the Western Cape province and the State of Environment Outlook Report should take a critical function in leading this understanding. Therefore, future iterations of the State of Environment Outlook Report could potential exploring moving away from 'land capability' as an indicator towards other indicators that could offer greater sustainability insights, i.e. linking agricultural footprint with water footprint, etc.

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