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**2024**  
REPORT

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# Climate change impacts in South Africa

*WHAT CLIMATE CHANGE MEANS FOR A  
COUNTRY AND ITS PEOPLE.*

A scientific synthesis led by the University of Cape Town

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*This report is a scientific synthesis by the University of Cape Town. It is intended to inform policymakers, media, the private sector, civil society, academics and anyone looking for country-level information on the impacts of climate change in South Africa. It has been reviewed internally before publication.*

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# Climate change impacts in South Africa

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## **Executive summary**

South Africa is one of the most diverse economies in Africa and home to 61.5 million people.<sup>1</sup> The climate is varied: the hot, arid Kalahari Desert in the north-west gives way to subtropical greenery in the east and temperate conditions in the south-west. Two oceans – the South Atlantic and the Indian – meet along a coastline stretching more than 2,500 km. From the Kruger National Park to the iSimangaliso wetlands, South Africa is home to a rich diversity of plant and animal life. It hosts three of the world's 36 biodiversity hotspots.<sup>2</sup>

**Amid chronic social and economic challenges, South Africa's vibrant agriculture and rich natural landscapes remain vital assets.**

Many South Africans lack access to basic provisions and services, with those affected concentrated disproportionately in low-income areas. More than half the population lives below the upper-bound poverty line, meaning household income cannot cover both food and basic living costs.<sup>3</sup> At least a third of South Africans between the ages of 16 and 64 are unemployed – the highest rate in any G20 country.<sup>4</sup> About 20% of the population is food insecure, with poor nutrition putting extra strain on overcrowded and under-resourced hospitals.<sup>5</sup> Blackouts are a daily experience for millions, as are poor transport links and creaking infrastructure.<sup>6</sup>

*About 20% of South Africa's population is food insecure, with poor nutrition putting extra strain on overcrowded and under-resourced hospitals.*

Amid these challenges, agriculture and biodiversity are particularly important. South Africa's produce includes livestock, sugar cane, maize, citrus, wine and grapes, while its natural landscapes are home to a world famous diversity of plant and animal life. In 2022, more than 5.7 million tourists visited South Africa,<sup>7</sup> many attracted by its striking scenery and iconic species. This represents a recovery compared with 2020 and 2021 but is just 55% of the figure pre-COVID-19.

**Crop and livestock farming provide food and livelihoods for many South Africans and, alongside nature tourism, contribute to the economy.**

Agricultural land covers about 80% of South Africa's total area.<sup>8</sup> Commercial farms account for three-quarters of agricultural land, producing fruit, wine, vegetables, cereals, wool and meat for the domestic market and international export.<sup>9</sup> Additionally, about 2–3 million smallholder farmers produce food for their own households or for limited sale.

As well as ensuring availability of food for South Africans, the agricultural sector – including fishing, forestry and hunting as well as farming – accounted for 10% of export earnings<sup>9</sup> and contributed

2.5% to the gross domestic product<sup>10</sup> in 2021/22. It is also a big employer, accounting for 21% of total employment.<sup>11</sup> Farm stays, wine-tasting and other agritourism activities generate additional income for farmers and seasonal workers,<sup>12</sup> while biodiversity tourism is a growing contributor to the economy. In 2017 alone, the Kruger National Park contributed R2.6 billion to the gross domestic product and supported more than 10,000 jobs.<sup>13</sup>

*As well as ensuring availability of food for South Africans, the agricultural sector accounted for 10% of export earnings and contributed 2.5% to the GDP in 2021/22.*



*A view of the Blyde River Canyon Nature Reserve (or Motlatse Canyon Provincial Nature Reserve) in eastern Mpumalanga, South Africa. Credit: Photo by Lina Loos on Unsplash.*

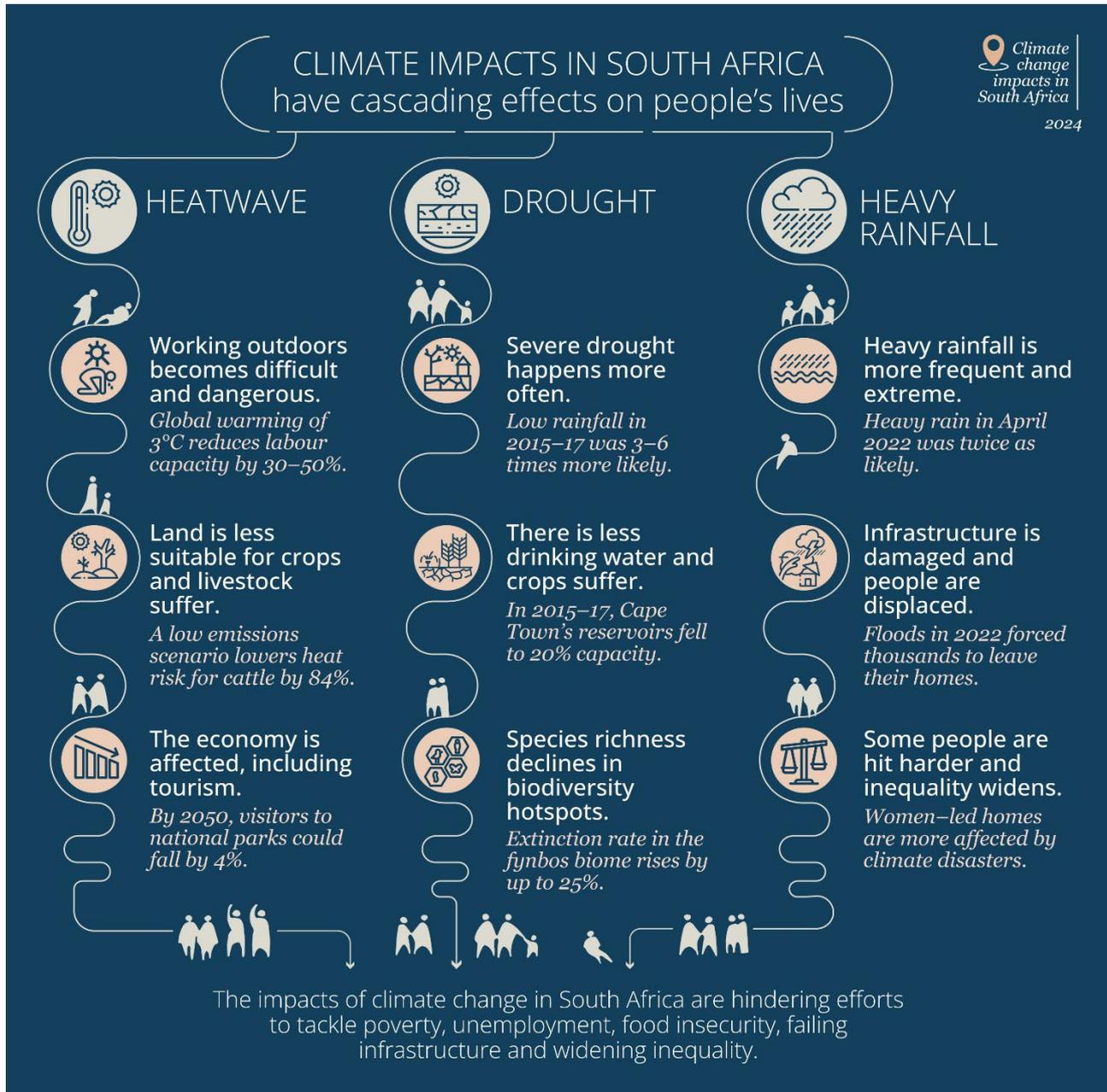
**Yet these vital assets are at risk. Climate change poses a threat to South Africans by reducing incomes, undermining food and water security and raising the cost of living.**

Climate impacts are already clear in South Africa and will worsen as the global temperature rises, though the extent of the impacts depends greatly on future emissions. Even in scenarios where global warming is limited to 2°C, heatwaves are projected to become hotter and more frequent, raising the risk of deadly heat stress.<sup>14</sup>

Similarly, severe droughts will happen more frequently. Between 2015 and 2017, a lack of rainfall led to a severe drought and a drinking water crisis in the Cape Town area – an event that human-caused climate change made three to six times more likely.<sup>15</sup> Despite an overall drying trend across the country, in eastern South Africa heavy rainfall is projected to increase, making the region more

prone to flooding. Tropical cyclones, although not necessarily more frequent, may become more intense.<sup>14</sup>

*Between 2015 and 2017, a lack of rainfall led to a severe drought and a drinking water crisis in the Cape Town area – an event that human-caused climate change made three to six times more likely.*



**Signature figure.** Climate impacts in South Africa have cascading effects on people's lives. Credit: InfoDesignLab.

As well as adding to the existing pressures on public services and infrastructure, climate change threatens the lives and livelihoods of South Africans through its effect on agriculture, nature and nature tourism (see Signature figure). Extreme heat is making land less suitable for crops and posing a major threat to livestock.<sup>16</sup> With crop-growing concentrated in just 12% of the country's land area, lower production in these vital areas threatens food security and export earnings. For

families and farming households, any extreme event that reduces production – such as a flood or a drought – is likely to reduce job security and income.<sup>17</sup>

Extreme weather threatens the plants and animals that attract tourism as well and directly damages infrastructure at nature reserves, adventure destinations and parks. Temperature rise by 2050 is projected to decrease visitors to South Africa’s national parks by 4%, with the Kruger National Park most affected.<sup>18</sup>

### **Limiting greenhouse gas emissions and building resilience can improve the everyday lives and experiences of South Africans.**

Small-scale farmers have long been aware of the threat that climate change poses to their lives and livelihoods, just as commercial farmers are tuned in to the impacts of changing weather patterns on their farms’ productivity. As such, adaptation strategies include enhancing soil carbon, planting new crop varieties and using Indigenous practices to harvest rainwater. Although adaptation has, so far, been sufficient to stave off the worst impacts, limits to adaptation may be soon reached under projected climate change scenarios.

Structural barriers, such as access to finance, insurance and infrastructure, mean that small-scale farmers are more vulnerable to climate impacts than commercial outfits. Alongside slow-moving state-led land and agrarian reform programmes, initiatives to enhance ecological infrastructure and adapt to climate change in nature-smart ways offer a means to address climate change, inequality, poverty and infrastructure failures simultaneously.

*Initiatives to enhance ecological infrastructure and adapt to climate change in nature-smart ways offer a means to address climate change, inequality, poverty and infrastructure failures simultaneously.*

The severity of future climate change ultimately depends on the level to which global emissions are reduced. Much of South Africa’s economic future hinges on the speed with which investments in its solar and wind resources can replace coal and provide affordable and reliable electricity.

Meanwhile, South Africa has led calls in international climate negotiations for a “just transition” to elevate concerns about social justice and commit high-income countries to financing decarbonization and loss and damage in middle- and low-income countries. In this context, South Africa’s national targets are to limit its annual greenhouse gas emissions to 398–510 MtCO<sub>2</sub>e by 2025 and to 350–420 MtCO<sub>2</sub>e by 2030.<sup>19</sup> Contingent on climate finance, South Africa has adopted a net zero by 2050 target in its low-emission development strategy.<sup>20</sup>

#### ***IN THIS REPORT:***

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***CHAPTER 2*** Lives and livelihoods

***CHAPTER 3*** Climate impacts

***CHAPTER 4*** Act and adapt

# Climate change impacts in South Africa

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## Chapter 1 | Farming and nature in context

*Amid chronic social and economic challenges, South Africa's vibrant agriculture and rich natural landscapes remain vital assets.*

For decades, South Africa has grappled with deep-rooted social and economic challenges. Widening inequalities, crumbling infrastructure and lack of access to basic services are prevalent across the country and show little sign of relief. Amid these systemic problems, a vibrant agricultural sector and rich natural biodiversity support millions of South Africans by providing food, jobs and livelihoods. Yet these crucial assets are at risk from climate change.

### 1.1 National snapshot

South Africa, officially the Republic of South Africa, covers more than 1.2 million square kilometres and is home to 61.5 million people. Its climate is varied: the hot, dry Kalahari Desert in the north-west transitions to subtropical greenery in the east and a temperate climate in the south-west. Two oceans – the South Atlantic and the Indian – meet along a coastline stretching more than 2,500 km.

*South Africa's climate is varied: the hot, dry Kalahari Desert in the north-west transitions to subtropical greenery in the east and a temperate climate in the south-west.*

South Africa is an upper-middle-income country<sup>21</sup> and has one of the most industrialized economies in Africa. The gross domestic product (GDP) per capita is \$6,766<sup>22</sup> with the biggest contributors to the economy being services (63% in 2022, including tourism), followed by industry (24%) and agriculture (2.6%).<sup>10</sup> South Africa attracts visitors from all over the world, generating income and jobs (though the number of tourists dropped significantly during the height of the COVID-19 pandemic).<sup>23</sup> Before 2020, tourism contributed between 7% and 8% of the GDP.<sup>24</sup>

About three-quarters of South Africa's population works in the service sector, including in transport, communication, finance and government services.<sup>25</sup> Unemployment continues to put pressure on livelihoods, particularly in lower-income areas. Unemployment among South Africans aged 16 to 64 and actively seeking work reached 32.8% in 2023 – the highest rate in any G20 country.<sup>4</sup>

Still bearing the legacy of apartheid, South African society is highly divided. South Africa's population is predominantly urban, with more than two-thirds living in its large cities and smaller towns.<sup>26</sup> Smaller communities are found throughout the country's rural areas. Decades of systemic

underinvestment and mismanagement have taken their toll on daily life, from infrastructure and transport to food security and healthcare. Services such as electricity, water, sanitation, transport, security and education are buckling under the strain of high demand and insufficient supply, with consequences for all sectors of the economy.

Food is generally affordable, though prices are linked directly to the inflation rate (5.7% in 2023<sup>27</sup>). The number of people living in poverty reduced after 1994, but progress halted in 2010–2011. According to the latest available survey data (2014/15), 30 million people were living below the upper-bound poverty line – meaning about 55% of the population was unable to pay for both food and basic non-food needs.<sup>3</sup> One in three citizens receives a government social grant, designed to support the most vulnerable households.<sup>28</sup>

*One in four children in South Africa experience stunted growth because of undernutrition. Food insecurity and consumption of foods with low nutritional value are primary reasons for ill health.*

Over 20% of South Africans are food insecure,<sup>29</sup> with one in four children experiencing stunted growth because of undernutrition.<sup>30</sup> Food insecurity and consumption of foods with low nutritional value are primary reasons for ill health, including diabetes and hypertension.<sup>5</sup> Free medical care is available to all South Africans, though facilities are often overcrowded and under-resourced.<sup>31</sup> Given these issues, maintaining the stability and resilience of South Africa's farming sector is crucial.

## 1.2 Special assets

South Africa has large expanses of land that hold great economic and environmental value, as well as cultural and spiritual significance for particular groups.

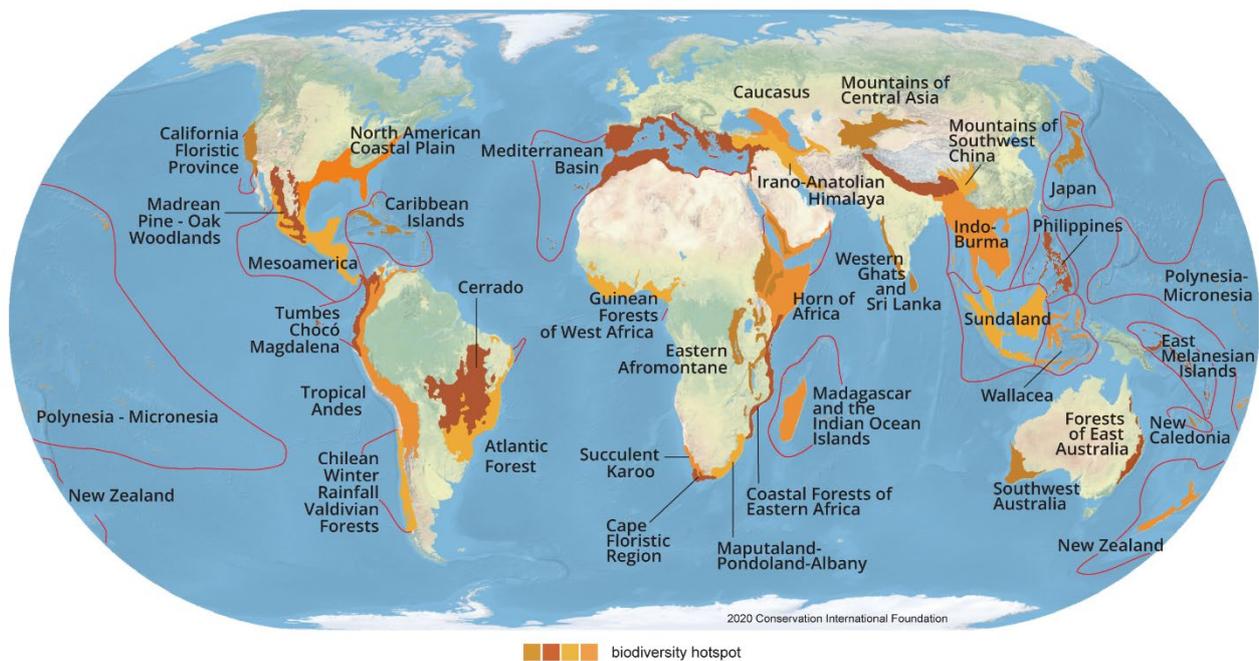
Agricultural land covers about 80% of South Africa's total land area.<sup>8</sup> Of that agricultural land, 12% is classed as arable, with major crops including sugar cane, maize, wheat, soya beans, apples, grapes, apricots, avocados and citrus. Additionally, large tracts are used as permanent pastureland for livestock farming, including chickens, sheep, cattle, goats and pigs. Crops and livestock are crucial to feeding the domestic population and are exported internationally (see Section 2.1).

*Agricultural land covers about 80% of South Africa's total land area, with major crops including sugar cane, maize, wheat, soya beans, apples, grapes, apricots, avocados and citrus.*

From the Kruger National Park in the north-east to the iSimangaliso wetlands and coral reefs in the east and the floral splendour of the Bokkeveld escarpment in the west, South Africa's natural landscapes are home to a rich diversity of plant and animal life. About 9% of mainland South Africa is under the formal legal protection of the Protected Areas Act. This includes national parks, nature reserves, mountain catchment areas, forest wilderness areas, World Heritage Sites and marine protected areas.<sup>32</sup> More than 5.7 million international tourists visited South Africa in 2022 (55% of pre-COVID-19 levels),<sup>7</sup> with many attracted to the rich natural beauty and unique landscapes.

*The Cape Floristic Region on the country's south-western tip, Maputaland-Pondoland-Albany in the east and Succulent Karoo on the Atlantic coast are home to endemic species not found elsewhere.*

Three of the world's 36 biodiversity hotspots are in South Africa. These are Earth's most biologically rich – yet threatened – terrestrial regions, as designated by Conservation International.<sup>2</sup> The Cape Floristic Region on the south-western tip, Maputaland-Pondoland-Albany in the east and Succulent Karoo on the Atlantic coast are home to endemic species not found elsewhere (see Figure 1).



**Figure 1.** South Africa is home to three of the world's 36 biodiversity hotspots, with a rich variety of plant and animal species that are not found anywhere else. Source: Conservation International.

South Africa's iconic landscapes are home to many distinct biomes, including the smallest and only biome to be completely enclosed in a single country: the fynbos biome. The diversity of plant life in the fynbos biome is world famous. Hundreds of unique endemic species have evolved over millions of years, exposed to hot, dry and windy summer conditions, and are well adapted to periodic fires. These regions are continually threatened, however, by human expansion, increased frequency of fires, and climate change.

*CHAPTER 2 examines the ways that farming and the abundance of species and natural habitats directly support the lives and livelihood of millions of South Africans as well as contribute to the economy.*

# Climate change impacts in South Africa

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## Chapter 2 | Lives and livelihoods

*Crop and livestock farming provide food and livelihoods for many South Africans and, alongside nature tourism, contribute to the economy.*

South Africa has a productive and diverse farming sector. Growing crops and raising livestock feeds the families of millions of small-scale farmers. Across the country, commercial farms also produce fruit, vegetables, cereals, wool and meat, primarily for export but also for the domestic market, providing jobs and contributing to South Africa's economy. Tourism of all kinds is a growing contributor to South Africa's economy, with many visitors attracted by the country's national parks and striking scenery.

### 2.1 Supporting citizens

There are two types of farming in South Africa. Commercial farms, of which there are around 40,000, produce for the export market and for local consumption. In addition, 2–3 million smallholder (or subsistence) farms produce enough for farmers and their families, sometimes with a small surplus for trade. Approximately 78% of agricultural land is farmed commercially.<sup>9</sup> A small proportion of commercial farms (5,000–7,000) produce most of the food grown in the country.

The country's farms produce three main categories of produce:

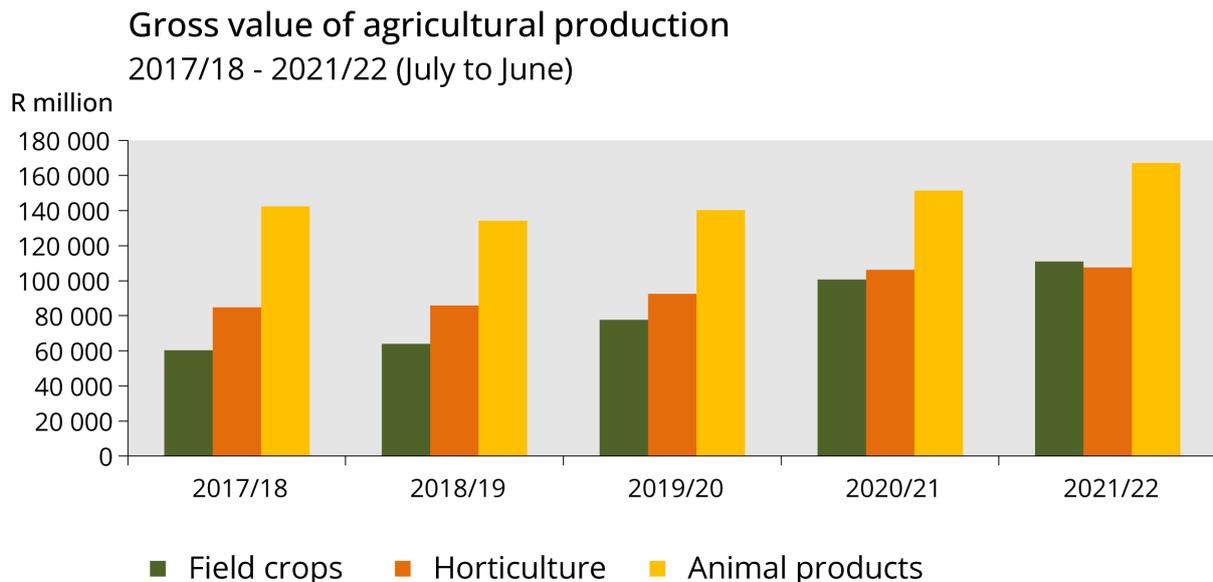
*Field crops (cereals and grains)* – comprising summer crops (mostly maize and sorghum), winter crops (wheat, barley, canola and oats), sugar cane, and oilseed crops (soya beans and groundnuts).

*Horticulture* – mainly deciduous fruit (including apples, grapes [including wine], pears and apricots), subtropical fruit (bananas, avocados, pineapples and mangoes) and citrus fruit (oranges, lemons and grapefruit), and a wide range of vegetables, including potatoes, brassicas, root crops, and pumpkins and squashes.

*Livestock/animal products* – cattle (dairy and beef), pigs, sheep, goats and poultry. Ostrich is also gaining popularity, with an increase in demand for skins, wool and meat.

Crop and livestock farming are largely capable of supporting domestic food security, in principle. Palm oil, wheat and rice are among the main imports, with environmental conditions meaning that only small quantities can be grown in the country.<sup>33</sup>

The agricultural sector as a whole – including fishing, forestry and hunting as well as farming – generated a gross value of R385,724 million in 2021/22 – a 7.7% increase on the previous year. Figure 2 shows how this increase is attributed to a rise in the value of animal products and field crops. The value of exports also increased by 29.3% in 2021/22 compared with 2020/21.<sup>33</sup> Maize, grapes, oranges, apples and wine were the most important exports by value, while the Netherlands, the UK, Botswana, Namibia and China were the largest destinations for agricultural products. Overall, the agricultural sector accounted for 10% of total export earnings<sup>9</sup> and 2.6% of GDP in 2021/22.<sup>10</sup>



**Figure 2.** In 2021/22, the total gross value of agricultural production rose 7.7% compared with the previous year, attributable to an increase in the value of livestock (animal products) and field crops. Source: Department of Agriculture, Land Reform and Rural Development, 2022.<sup>33</sup>

As well as providing food security for millions of rural farmers and their families, agriculture is a major employer. The agricultural sector as a whole accounts for 21% of total employment,<sup>11</sup> with commercial farms employing about 750,000 people.<sup>34</sup> Skilled and semi-skilled labour is required, including for the design and deployment of technology, consultancy, management, maintenance, harvesting and transportation. It is common for migrant or seasonal workers to create informal settlements around agricultural towns, supplying seasonal labour to farms during harvest periods. Agriculture is thus directly and indirectly responsible for the livelihoods and wellbeing of entire communities.

*As well as providing food security for millions of rural farmers and their families, the agricultural sector accounts for 21% of total employment.*

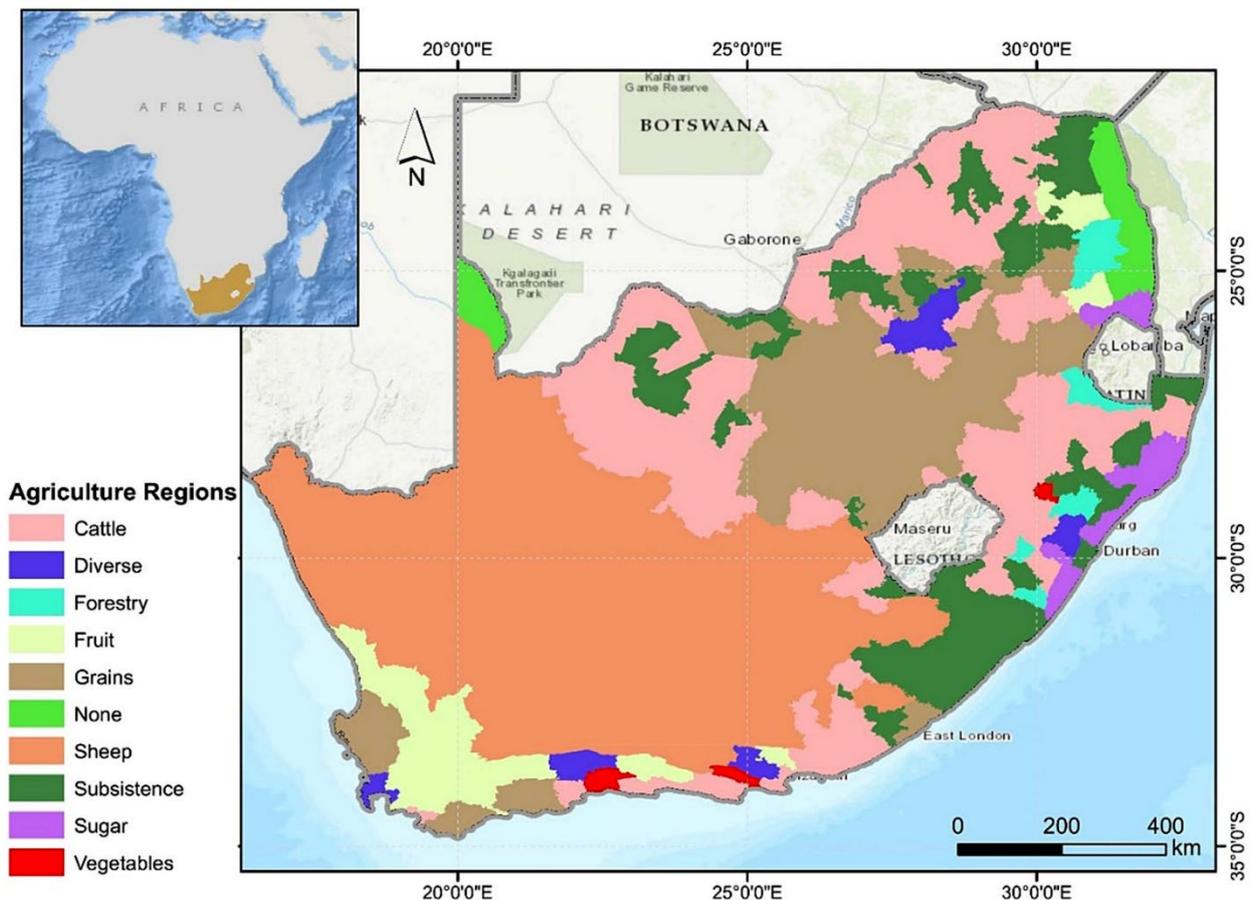
To supplement income, agricultural enterprises are increasingly incorporating agritourism into their offerings.<sup>12</sup> This can include farm stays, restaurants, social functions and conference facilities, as well as recreational activities such as wine-tasting, hunting, nature experiences, cycling tracks, hiking routes, 4 × 4 trails and photography.<sup>35</sup> Alongside increased revenue, agritourism can provide additional permanent employment for local skilled and semi-skilled workers and relief from the stresses of life for urban dwellers.<sup>36</sup> With visitors from all over the world attracted by South Africa's

national parks and biodiversity hotspots, tourism generates income and provides hundreds of thousands of jobs every year. In 2017, the Kruger National Park alone contributed R2.6 billion to the GDP and supported more than 10,000 jobs.<sup>13</sup>

*In 2017, the Kruger National Park alone contributed R2.6 billion to the GDP and supported more than 10,000 jobs.*

## 2.2 Vulnerabilities

Agricultural production in South Africa depends on either seasonal rainfall for rain-fed systems or accumulated water for irrigated crops.<sup>37</sup> Where there are major river systems, irrigation schemes provide water to crops during the dry season. Due to the costs associated with irrigation, these schemes are mainly used for high-value crops, such as fruit and vegetables (where the financial return can be maximized), whether on small-scale or commercial farms. In some cases, dams and water supply schemes have the dual purpose of serving urban communities as well as agricultural areas. In these instances, strict allocations are issued to maintain a sustainable supply of water, with household use receiving a higher priority than agricultural use in times of shortage.



**Figure 3.** A map of major agricultural regions in South Africa. Deciduous fruit (pale green) is grown in the south-western Cape region and in the Langkloof region of the Eastern Cape, and most wheat (grains; brown) is grown in the Western Cape, where rain is limited mostly to winter. Source: Mpakairi et al., 2023.<sup>37</sup>

Deciduous fruit is grown in the south-western Cape region and in the Langkloof region of the Eastern Cape, for example, and most wheat is grown in the Western Cape, where rain is limited mostly to winter (see Figure 3). Vegetables are produced in most parts of the country. However, in certain areas, where conditions are most suitable or markets are closer, farmers tend to concentrate on specific vegetable crops. For example, green beans are grown mainly in Kaapmuiden, Marble Hall and Tzaneen; green peas mainly in George and Vaalharts; onions mainly in Caledon, Pretoria and Brits; and asparagus mainly in Krugersdorp and Ficksburg.

*With arable land suitable for growing crops concentrated in just 12% of South Africa's land area, domestic food security and exports are vulnerable to climate change in these critical production areas.*

But with arable land suitable for growing crops concentrated in just 12% of South Africa's land area, domestic food security and exports are vulnerable to climate change in these critical production areas. For commercial farming, highly specialized crops increase vulnerability to climate change due to their capital-intensive and climate-sensitive nature. Given the country's high reliance on commercial food production, this presents a threat to South Africa's economy and food security. Diversifying their income streams is one strategy that farmers are using to spread their exposure to climate risk.<sup>12</sup>

Similarly, tourism activities are affected by seasonal climate and are highly vulnerable to extreme weather events affecting infrastructure, visitor numbers and profitability (see Chapter 3).

*The millions who derive their livelihoods from small-scale farming are more vulnerable to climate impacts and extreme weather due to lack of access to potable water, sanitation services, electricity and roads.*

Small-scale farming is a productive and diverse subsector of agriculture, but disparities across South Africa's dual farming sector are deep rooted. While many commercial farms are in remote but well-serviced rural places that were designated as "white areas" during the apartheid years, primarily Black small-scale farmers run smallholdings in regions that were designated "Bantustans" under apartheid. These are often in areas with less fertile soils or limited infrastructure. Therefore, the millions who derive their livelihoods from small-scale crop or livestock farming are more vulnerable to climate impacts and extreme weather due to lack of access to potable water, sanitation services, electricity and roads.

*CHAPTER 3 looks at how climate change poses an immediate threat to the lives and livelihoods of millions of South Africans through its negative impact on food security, employment, exports and health.*

# Climate change impacts in South Africa

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## Chapter 3 | Climate impacts

*Climate change poses a threat to South Africans by reducing incomes, undermining food and water security, and raising the cost of living.*

Through rising temperatures and more extreme weather, the impact of climate change on South Africa has direct consequences for millions of citizens by threatening food and water security, raising the cost of living, contributing to poor health and reducing incomes. But these risks are not distributed equally; they stand to widen existing inequalities.

### 3.1 Evidence of climate change

South Africa is warming by approximately 0.2°C per decade,<sup>38</sup> contributing to climate impacts ranging from extreme heat and drought to sea level rise and flooding (see Figure 4). In recent decades, human-caused climate change has contributed to an increase in the frequency and intensity of hot extremes,<sup>39</sup> and average rainfall across South Africa has decreased in all areas except the north-west. Human-induced climate change made the rainfall deficit that drove the severe 2015–2017 drought three to six times more likely.<sup>15</sup>

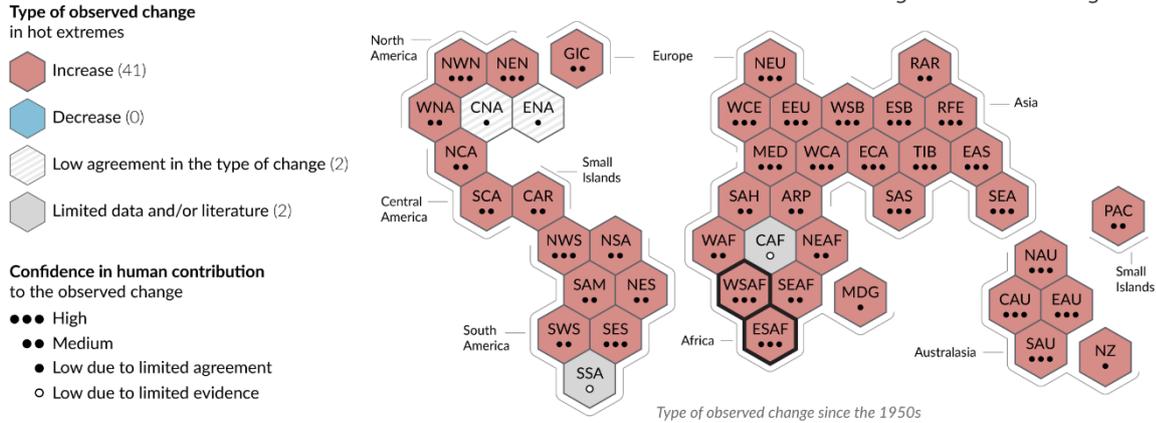
Despite an overall drying trend, the intensity and frequency of heavy rainfall events has also increased. Climate change doubled the likelihood of the intense rain that hit parts of South Africa in April 2022, which led to 400 people being killed and many thousands being forced to flee their homes.<sup>40</sup> In the oceans around South Africa, marine heatwaves have become more intense and the sea level is rising. Between 1900 and 2018, the sea level rose in the South Atlantic Ocean by 2.07 mm per year and in the Indian Ocean by 1.33 mm per year.

*Climate change doubled the likelihood of the intense rain that hit parts of South Africa in April 2022, which led to 400 people being killed and many thousands being forced to flee their homes.*

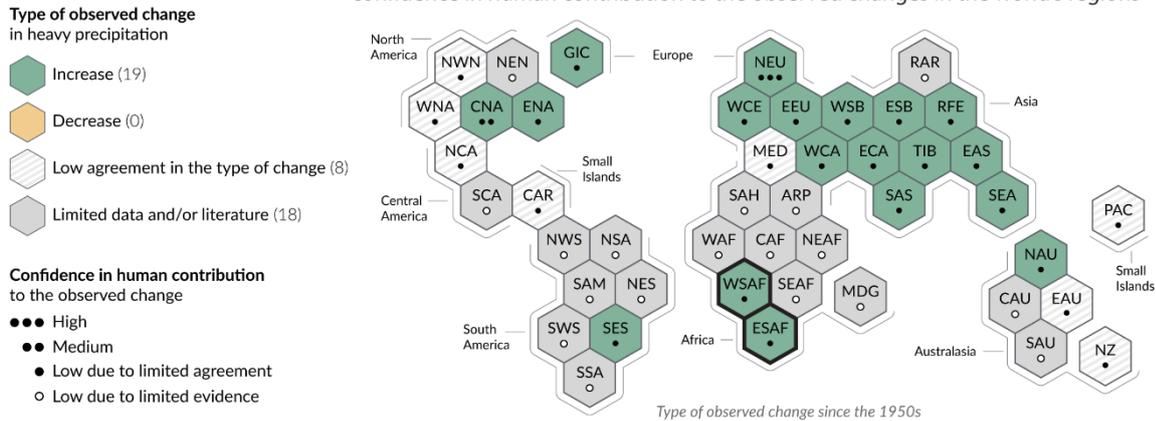
It is very likely that climate impacts will increase further in South Africa, though the extent depends greatly on the level to which global emissions are reduced. Under a very low emissions scenario (RCP2.6 or SSP1-2.6; see box later in this section) it is very likely that temperatures across Africa can be limited to 2°C above pre-industrial levels or lower, though this would still have severe consequences for people and livelihoods (see Section 3.2). However, warming across Africa is very likely to be greater than 3°C in the highest emissions scenario (RCP8.5 or SSP5-8.5), but this level of emissions is higher than the world is currently tracking.<sup>14</sup>

## Climate change impacts are already affecting every inhabited region across the globe, with increases in hot extremes, heavy rainfall and drought in South Africa

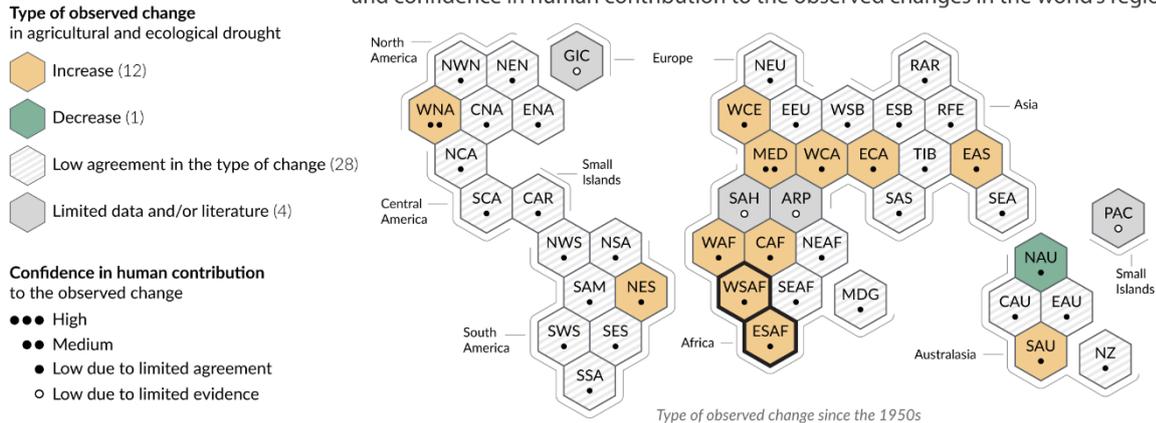
a) Synthesis of assessment of observed change in **hot extremes** and confidence in human contribution to the observed changes in the world's regions



b) Synthesis of assessment of observed change in **heavy precipitation** and confidence in human contribution to the observed changes in the world's regions



c) Synthesis of assessment of observed change in **agricultural and ecological drought** and confidence in human contribution to the observed changes in the world's regions



Each hexagon corresponds to one of the IPCC AR6 WGI reference regions

 North-Western North America

IPCC AR6 WGI reference regions: **North America:** NWN (North-Western North America), NEN (North-Eastern North America), WNA (Western North America), CNA (Central North America), ENA (Eastern North America), **Central America:** NCA (Northern Central America), SCA (Southern Central America), CAR (Caribbean), **South America:** NWS (North-Western South America), NSA (Northern South America), NES (North-Eastern South America), SAM (South American Monsoon), SWS (South-Western South America), SES (South-Eastern South America), SSA (Southern South America), **Europe:** GIC (Greenland/Iceland), NEU (Northern Europe), WCE (Western and Central Europe), EEU (Eastern Europe), MED (Mediterranean), **Africa:** MED (Mediterranean), SAH (Sahara), WAF (Western Africa), CAF (Central Africa), NEAF (North Eastern Africa), SEAF (South Eastern Africa), WSAF (West Southern Africa), ESAF (East Southern Africa), MDG (Madagascar), **Asia:** RAR (Russian Arctic), WSB (West Siberia), ESB (East Siberia), RFE (Russian Far East), WCA (West Central Asia), ECA (East Central Asia), TIB (Tibetan Plateau), EAS (East Asia), ARP (Arabian Peninsula), SAS (South Asia), SEA (South East Asia), **Australasia:** NAU (Northern Australia), CAU (Central Australia), EAU (Eastern Australia), SAU (Southern Australia), NZ (New Zealand), **Small Islands:** CAR (Caribbean), PAC (Pacific Small Islands)

**Figure 4.** In West Southern Africa (WSAF) and East Southern Africa (ESAF), human influence has contributed to an increase in hot extremes (top). Heavy rainfall (middle) and drought (bottom) have increased, though the available evidence shows limited agreement in the human contribution to the observed change since the 1950s. Source: IPCC,<sup>41</sup> adapted to emphasize South Africa.

Heatwaves and droughts will become more frequent and last longer in South Africa, even in the most ambitious scenarios that limit global temperature rise to 2°C. Heavy rainfall over eastern parts of the country is projected to rise, making the region more prone to flooding. While the number of tropical cyclones is projected to decrease, those that do occur may be more intense.

Relative sea level is virtually certain to keep rising in the oceans around Africa – by up to 90 cm in a very high emissions scenario (SSP5-8.5, comparing 2081–2100 levels with 1995–2014 levels) or by up to 50 cm in a very low emissions scenario (SSP1-2.6, over the same period).<sup>14</sup>

### Climate models and future scenarios

Climate models are mathematical representations of the physical and biogeochemical processes that occur in the atmosphere, land and oceans. They are one of the main tools that scientists have to examine how certain changes will affect Earth's future climate.

The Sixth Assessment Report from the IPCC featured a set of climate models from the Sixth Coupled Model Intercomparison Project (CMIP6). To allow comparison across the different models, the project developed a standard set of scenarios that each modelling group from around the world uses.

This set of scenarios, called Shared Socio-economic Pathways (SSPs), differ in their assumptions about future socioeconomic factors, such as population, economic growth and urbanization. They describe five very different "baseline" worlds. The IPCC's Sixth Assessment Report combined the SSPs with a separate set of scenarios that describe how concentrations of greenhouse gases and other factors that affect the climate could evolve. There are four of these Representative Concentration Pathways (RCPs) – RCP2.6, RCP4.5, RCP6.0 and RCP8.5 – with the names representing the total heating effect (or radiative forcing) by 2100.

Below is a summary of the combined SSP-RCP pathways referenced in the literature cited in this report (temperatures are relative to pre-industrial levels):

**SSP1-2.6** An optimistic, sustainability-focused scenario in which global temperature rise is limited to 2°C by the end of the century.

**SSP3-7.0** Regional rivalry means that efforts to reduce emissions are fragmented and temperature rise reaches 3.6°C by the end of the century.

**SSP5-8.5** A worst case, no-mitigation scenario in which fossil fuels dominate economic growth and global temperature rises by 4.4°C by the end of the century.

Before the SSPs were available, model studies used the RCPs to describe possible future worlds in terms of greenhouse gases and warming. This report refers to RCP2.6 as an ambitious, very low emissions scenario, RCP4.5 as a middle-of-the-road scenario and RCP8.5 as a very high emissions scenario (higher than the world is currently tracking).

## 3.2 Cascading impacts on people

Climate change is adding to the existing pressures on basic public services and infrastructure in South Africa. Drought and floods damage transport links, public buildings, and water and energy infrastructure, and challenge the provision of basic services.

During the water crisis that followed the 2015–2017 drought, for example, reservoirs serving 3.7 million people around Cape Town dropped to 20% of capacity, leading the government to impose water restrictions. In recent years, extreme weather has compounded South Africa's electricity crisis, with a ripple effect across the whole economy. Intense rainfall has made coal reserves too wet to use and damaged electricity distribution infrastructure. Extreme heat poses a risk to human health, adding extra pressure on the health system and reducing labour productivity.

*During the water crisis that followed the 2015–2017 drought, reservoirs serving 3.7 million people around Cape Town dropped to 20% of capacity, leading the government to impose water restrictions.*



*The government imposed water restrictions after a severe drought in 2015–2017 triggered a water crisis in Cape Town, South Africa. Credit: Photo by Tobias Reich on Unsplash.*

In addition to aggravating existing problems, climate change threatens the lives and livelihoods of South Africans – directly and indirectly – through its effect on agriculture, nature and tourism. The more severe rainfall and drought expected with further warming (see Section 3.1) will make water availability more uncertain, with consequences for food production in key growing areas. Farming

at smallholder and commercial scales is mostly rain-fed. Where water is available, commercial farms may irrigate to grow fruit and vegetables during the dry season or to supplement rain-fed production of grains in the rainy season. Farmers grow crops and raise livestock in climatologically suitable areas, which are also threatened by climate change (see Section 2.2) but yields and quality vary from year to year due to variation in seasonal rainfall and temperature.

Further compounding this, extreme heat and more intense heatwaves are making arable land less suitable for cultivating crops and are posing a major threat to livestock, with extremely hot days causing distress and death among animals and birds.<sup>16</sup> Encroachment of woody trees and shrubs on grazing areas due to increased atmospheric carbon dioxide is also reducing the number of animals that can be supported. Over the last 60 years, encroachment has increased by 10% on subsistence grazing lands and 20% on commercial grazing lands.<sup>39</sup>

*Global temperature rise of 3°C is projected to reduce labour capacity in agriculture by 30–50% in sub-Saharan Africa, relative to 1986–2005.*

Climate impacts on people working in agriculture stand to further reduce output from the agricultural sector. Global temperature rise of 3°C is projected to reduce labour capacity in agriculture by 30–50% in sub-Saharan Africa, for example, relative to 1986–2005.<sup>42</sup> Hiring of farm workers depends on having thriving crops and livestock. Therefore, any extreme event that reduces production – such as drought – can be expected to reduce job security and income for farming households.<sup>17</sup> With respect to livestock, heat risk for cattle can be reduced by 84% under a very low emissions scenario with high environmental protection (SSP1-2.6) compared with a medium emissions scenario with low environmental protection (SSP3-7.0).<sup>16</sup>

The impacts of extreme climate and weather events are experienced differently by different people. The nature of the risk they pose is different for urban and rural communities, and the magnitude of the risk differs with levels of household income. During the Cape Town drought in 2015–17, for example, informal settlements were hit harder, with fewer adaptation initiatives (such as water tanks and groundwater extraction) in these areas than in formal suburbs. Since community taps are used in informal settlements, and controlled flow-meters had been installed on those taps, it was beyond an individual's control to be able to safely access water as needed.

*During the Cape Town drought in 2015–17, informal settlements were hit harder, with fewer adaptation initiatives than in formal suburbs.*

Similarly, climate impacts are experienced differently by people of different genders, leading to a widening of existing inequalities in South Africa.<sup>43</sup> These gender inequalities include high incidence of gender-based violence; a higher likelihood of poverty among women, who are more likely to hold low-skilled and low-paid jobs and experience gender-based occupational exclusion; and a greater burden of unpaid care work among women, who are often the ones who look after children, older adults and those who are ill in households and communities.<sup>44</sup>

Exacerbating these existing inequalities, households headed by women in agricultural districts are more vulnerable to climate impacts than households headed by men.<sup>45</sup> And research in other parts of the world has linked rising temperatures with an increase in gender-based violence.<sup>46</sup> As well as

causing physical trauma, gender-based violence is recognized as a mental health stressor in South Africa<sup>17</sup> – where levels of mental illness are already among the highest in the world.<sup>47</sup>

In terms of biodiversity and nature tourism, a warmer and drier climate is expected to reduce the geographical ranges of endemic species as well as species richness in the Cape Floristic Region, notably in the Western Cape.<sup>48</sup> Depending on the level of future warming, the rate of species extinction could increase by up to about 25% in the fynbos biomes across South Africa. Even under low emissions scenarios, woody encroachment is projected to significantly affect species in most biomes but particularly grasslands. The Nama-Karoo biome, the Indian Ocean coastal belt, the fynbos biome and the forest biome have all been assessed as “significantly threatened” by climate change.<sup>49</sup>

*Depending on future warming, the rate of species extinction could increase by up to about 25% in the fynbos biomes across South Africa.*

Extreme weather events threaten the habitat and sustainability of the plants and animals that attract tourism as well as directly damage infrastructure at nature reserves, adventure destinations and parks. Temperature rise by 2050 is projected to decrease visitors to South Africa’s national parks by 4%, with the Kruger National Park most affected.<sup>18</sup>



*A group of zebras in the Kruger National Park. Climate change is projected to threaten the habitat of iconic species and decrease visitors to South Africa’s national parks. Credit: Photo by David Tomaseti on Unsplash.*

*CHAPTER 4* looks at how building resilience and limiting the emissions that cause climate change can reduce the impacts of climate change on prosperity, lives and livelihoods in South Africa.

# Climate change impacts in South Africa

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## Chapter 4 | Act and adapt

*Limiting greenhouse gas emissions and building resilience can improve the everyday lives and experiences of South Africans.*

While there are examples where adaptation of farming practices has, so far, been sufficient to stave off the worst impacts of climate change, limits to adaptation may be soon reached for some farmers under projected climate change scenarios. Limiting the scale of the damage will require government coordination and international commitment to reduce greenhouse gas emissions.

### 4.1 Building resilience at home

Small-scale farmers have long been aware of the threat that climate change poses to their lives and livelihoods, just as commercial farmers are tuned in to the impacts of changing weather patterns on their farms' productivity. As such, farmers have already begun accessing climate change adaptation options. Conservation agriculture, aimed at retaining soil carbon to enhance drought resilience, is now widespread in dryland farming areas. Irrigation efficiency has improved, crop and cultivar selection are used as a response to variable seasonal climates, and dependence on chemicals has reduced. Enhanced access to medium- and short-term weather forecasts has enabled farmers to prepare for extreme weather.

*Farmers across South Africa are tapping into the experience of their predecessors to improve decision making. This includes Indigenous and local knowledge of weather forecasting and managing water resources.*

Many smallholder and commercial farmers across South Africa are also tapping into the experience and knowledge of their predecessors to improve decision making. This includes, for example, Indigenous and local knowledge of weather and climate forecasting and managing water resources. For example, some farmers harvest rainwater for use during dry months, thereby extending the growing season. Many South Africans also consume indigenous foods, some of which have been commercialized (e.g. rooibos tea).

To date, farmers have generally been able to adapt to variation in seasonal rainfall and temperatures. The economic sustainability of the sector has therefore remained generally secure – so far. However, rising temperatures and increasingly extreme weather threaten the ability of farmers to adapt.

In addition, there are a number of barriers to adaptation, particularly for small-scale farmers and informal settlements. While most commercial farmers in South Africa have adopted the advantages of new technology, adoption among small-scale farmers has been impeded by lack of capital as well as lack of access to finance, insurance and land. Another barrier is lack of access to reliable infrastructure and markets. The networks of road and rail that used to effectively service South Africa's agricultural areas have deteriorated, while electricity supply challenges inhibit productivity and profits. Recovering from climate shocks is, therefore, a difficult and lengthy process for small-scale farmers and low-income households. Commercial farmers tend to have better access to finance and greater adaptive capacity. However, they also have significant sunk capital, which may decrease their resilience relative to smaller operations.

*Barriers to adaptation, particularly for small-scale farmers and informal settlements, include lack of capital as well as lack of access to finance, insurance, land, reliable infrastructure and markets.*

At a national level, government assistance to smaller-scale farmers includes consultancy, provision of seeds, access to veterinary services and, in many cases, facilitation of access to loans and insurance. Additionally, there is a concerted effort from the government and the private sector to enhance the transfer of skills, knowledge and techniques from commercial farmers to "emergent" or "development" small-scale farmers who may be attempting to move towards a more commercial status. But while the network of extension and support officers is extensive in theory, a lack of funding at the provincial level to train these officers and get them into the field leads to large gaps in their knowledge of the breadth of issues that farmers now face.

A growing body of international laws and regulations governing the export of farm produce is making farming more complex. Apart from allowing farmers to move away from the obvious risks of monoculture – soil degradation, pest infestations, biodiversity loss, and more – agritourism can help broaden revenue streams and improve financial stability.

*Initiatives to enhance ecological infrastructure and adapt to climate change offer a way for South Africa to address climate change and, simultaneously, inequality, poverty and infrastructure failures.*

Emerging from a history of highly regulated agriculture during apartheid, South Africa has underexplored potential to unlock the compatibility between the agricultural, biodiversity and conservation sectors, which are, in turn, linked to tourism. Public sector programmes designed to restore wetlands and riparian zones, remove invasive alien species, reduce flooding risks and enhance the flow of water into dams have begun to be supported by farmers as a means of protecting their farms and their operations. The same approaches create employment for people living in rural areas and contribute to more connected and resilient rural communities.

While state-led land and agrarian reform programmes move ahead slowly, initiatives to enhance ecological infrastructure and adapt to climate change in nature-smart ways, driven by people who live and depend on the land, offer a way for South Africa to address climate change and, simultaneously, underlying inequality, poverty and infrastructure failures – all of which would otherwise increase vulnerability to climate change.

## 4.2 Reducing emissions

Alongside the actions of individual farmers and various government support mechanisms, the severity of future climate change impacts – relative to those already experienced today – ultimately depends on the level to which global emissions are reduced.

*Much of South Africa’s economic future hinges on the speed with which investments in renewable energy can replace coal and provide affordable and reliable electricity.*

South Africa faces the difficult task of radically reducing its economic dependence on emission-intensive sectors while also lifting people out of poverty and unemployment, reducing unsustainable inequality and managing the impact of increasingly damaging weather events. South Africa has excellent wind and solar resources, and much of the country’s economic future hinges on the speed with which investments in renewable energy can replace coal and provide affordable and reliable electricity.



*Cooling towers at the decommissioned coal-powered Orlando power station are now used as a bungee jumping centre and have become an iconic sight in Soweto, South Africa. Credit: Photo by Michael Schofield on Unsplash.*

Critically, South Africa has led calls for a “just transition” in international climate negotiations, drawing on the country’s history of transition to “elevate concerns about social justice in the global transition to sustainable economies and societies” and ensure that high-income countries help finance decarbonization and a loss and damage fund in middle- and low-income countries.<sup>50</sup>

Within the context of a just transition, South Africa's updated mitigation targets commit the country to annual greenhouse gas emission levels of 398–510 MtCO<sub>2</sub>e by 2025 and 350–420 MtCO<sub>2</sub>e by 2030, compared with 398 and 614 MtCO<sub>2</sub>e between 2025 and 2030, as communicated in the country's first nationally determined contribution.<sup>19</sup> Contingent on climate finance, South Africa has adopted a net zero by 2050 target in its low-emission development strategy.<sup>20</sup>

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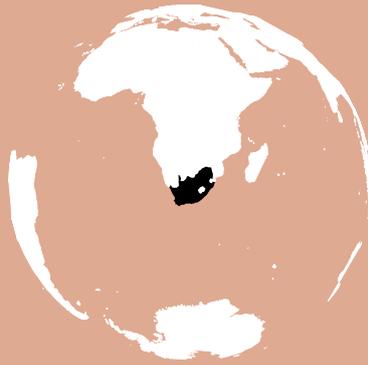
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*WHAT CLIMATE CHANGE  
MEANS FOR A COUNTRY AND  
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