SMART AGRI BAROMETER

Edition 1 - 2025/2026

NEWSLETTER

CONTENTS

EDITOR'S NOTE

SMARTAGRI BAROMETER 1 - 2025/2026

It is wonderfully inspiring to see how young researchers, farmers and program managers are making their mark in the joint effort to find solutions to the climate crisis facing agriculture. In this edition, we introduce our readers to four dedicated and talented youth who are on this journey in one way or another: Mpho Mence is the new manager of the GreenCape Agri-Sector Desk; Dawn Noemdoe is thriving as a new beekeeper in addition to her work as a communicator; and both Teneille Nel and Douw Bodenstein recently graduated with PhD in Soil Science, working on soil carbon uptake potential.

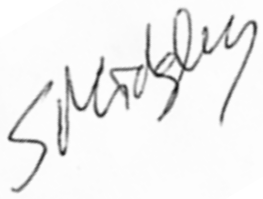
We are proud and delighted to report that the annual convening of the Mediterranean Climate Action Partnership (MCAP), hosted in Stellenbosch in early May by the Western Cape Departments of Agriculture and Environmental Affairs & Development Planning, was an unqualified success.

Dr Trautmann and Goosain Isaacs provide feedback on the event and the township tour. In the next edition of the Barometer we will take our readers on the Living Labs tour (virtually!) which showcased some of the climate adaptation approaches and projects that are building resilience in the Western Cape's Boland region.

Our partners on the SmartAgri journey have also been busy! Hortgro is building a valuable online portal and rolling out its Footprint Webinar Series, while BlueNorth Sustainability launched the new and expanded Carbon Heroes platform, and GreenCape has again published its annual assessment of the current market opportunities in the green agricultural value chain.

Enjoy the read, and please feel free to send your feedback and ideas, and to disseminate to other interested parties.

For those who have not read about the SmartAgri plan, or seen our previous editions of the SmartAgri Barometer, please visit www.greenagri.org.za and click on SmartAgri.



Prof Stephanie Midgley
Editor

NEWS SNIPPETS & MEDIA LINKS

NEW FACE OF THE GREEN-CAPE-DOA AGRI SECTOR DESK

We warmly welcome Ms Mpho Mence to the 'SmartAgri family'! Ms Mence has taken over the reins from Ms Sibusisiwe Maseko as the head of the Agri Sector Desk at GreenCape, a partnership with the Western Cape Department of Agriculture.

Since 2021, Ms Maseko made a significant contribution to the work of the Desk, and it was a pleasure to work with her. We thank her and wish her well in her future endeavours.

Mpho Mence is an Agricultural Economist with a Master's in Sustainable Agriculture, currently serving as an Analyst in the Sustainable Agriculture team at GreenCape. She has built her career at the intersection of agriculture, sustainability, and innovation—driving strategic projects in regenerative agriculture and agtech.

With hands-on experience supporting SMMEs and engaging across government, academia, and industry, she works to unlock inclusive green economy opportunities in South Africa. Her work focuses on market intelligence, value chain assessment, and catalyzing investment in climate-resilient agriculture.

The SmartAgri team at the WCDoA looks forward to working closely with Ms Mence on green and climate smart technologies and investments for the Province.

Ms Mence can be contacted at: mpho@green-cape.co.za

Remember to use the GreenAgri portal for your green-agri and agtech information needs: https://www.greenagri.org.za/

GreenAgri is an information-sharing portal for all farmers, researchers, private and non-governmental agencies interested in smart agricultural practices - supporting green farming practices, balancing farming and conservation needs, resource efficiency and waste minimisation in the Western Cape.

HORTGRO BUILDS ITS CLIMATE CHANGE PORTAL

The deciduous fruit community now has a wealth of information on climate change risks and responses available at the press of a button. Hortgro has been building up its online resource base – please take a look at https://www.hortgro.co.za/climate-change-adaptation/.

Online app: Guide to climate change and pome/stone fruit production in South Africa: https://climatechange.hortgro.science/

Climate Change Response Strategy for the Deciduous Fruit Industry of South Africa: https://www.hortgro.co.za/news/small-acts-big-impacts/

Further links to various research projects, initiatives and articles on climate change are available.

Hortgro is also rolling out its Hortgro Footprint Webinar series. "Our free Hortgro Footprint Webinar series covers essential and relevant sustainability topics for the deciduous fruit industry, such as sustainable agricultural practices for soil health and green financing opportunities.

This year, we will also incorporate topics on sustainable packaging, carbon calculations/how to become a carbon hero and water efficiency in packhouses."

For more information on the webinars and to register, please visit https://events.hortgro.co.za/webinars/. Or contact Ms Nitasha Baijnath-Pillay, Resource Management & Sustainability Manager: nitasha@hortgro.co.za.

Guide to climate change and pome/stone fruit production in South Africa

Open Climate Change App

Climate Change Response Strategy for the Deciduous Fruit Industry of South Africa

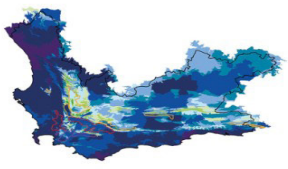
Prepared for Hortgro Pome and Hortgro Stone under Research Project no. V-20-IND-CP01, funded in the period December 2020 to September 2022. Read more

Future-proofing fruit production

The impact of climate change on agriculture can no longer be ignored and will continue over the next few decades. Read

A tool to decode climate data

We are all aware that environmental variables such as temperature are decisive for pome-fruit production and quality. Read



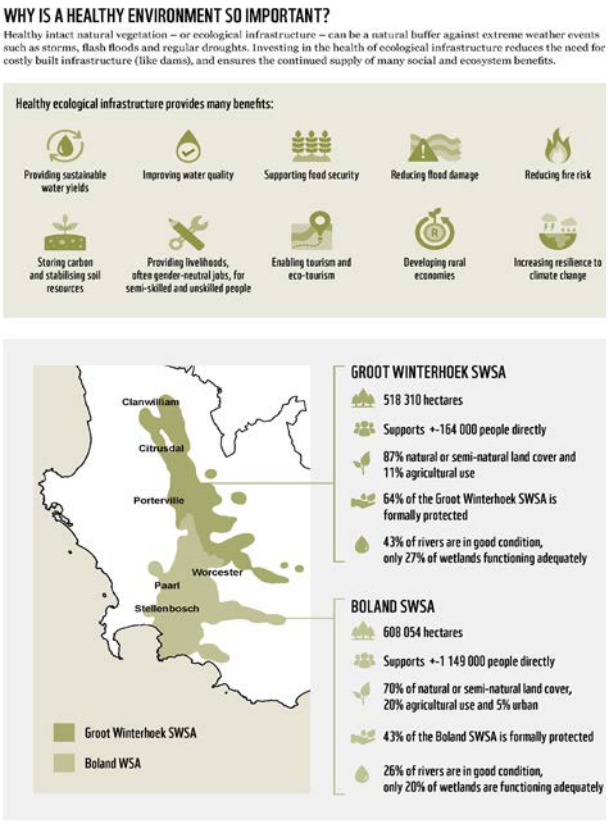
Climate-change guidelines for growers

Climate change poses a significant threat to the sustainability of the pome- and stone-fruit industries, according to Prof. Stephanie Midgley, Climate Change and Risk Scientist at the Western Cape Department of Agriculture. Read

Confronting climate change

A common perception among consumers is that so-called food miles — the distance between farm and fork — determine the contribution of a foodstuff to climate change. Read

COLLABORATIVE ACTION TO ADDRESS WATER SCARCITY



The Boland Groot Winterhoek Strategic Water Source Areas (SWSA) Collective has published a 6-page factsheet on working together for water security.

The Collective is a "platform of platforms", uniting strong actors in the Western Cape. It focuses on the Berg and Breede rivers in the Boland, and the Olifants and Doring rivers in the Groot Winterhoek. The initiative is supported by WWF-SA.

The factsheet covers threats and opportunities, the importance of a healthy environment, facts on the Groot Winterhoek SWSA and the Boland SWSA, the role and work of the Collective, membership, a case study of the 24 Rivers sub-catchment, and the importance of investment in ecological infrastructure, including the removal of invasive alien plants.

To download the full factsheet click here: https://www.wwf.org.za/?53066/boland-groot-winterhoek-SWSA-collective

AGRICARBON SUCCESS IN THE AGRICULTURAL CARBON MARKET

In March 2025, a carbon farming initiative for Africa, AgriCarbon, became the first African programme to achieve Verra certification under the VM0042 Agricultural Land Management methodology.

This initiative by the company Anthesis is focused on the opportunity for regenerative agricultural practices to contribute to climate change mitigation (absorbing CO_2 from the atmosphere into the soil), while providing financial benefits to farmers through sustainable farming.

The programme has worked with 29 farmers across 17,582 hectares in South Africa, with 39,207 tonnes of carbon credits issued. The hope is that expansion of such initiatives across Africa will now be easier, thus supporting increasing numbers of farmers and maximising the large carbon sequestration potential on the continent.

For further information see https://africasustainabilitymatters.com/agricarbon-becomes-africas-first-regenerative-farming-programme-to-receive-verra-certified-carbon-credits/

A GUIDE TO APPROPRIATE LOCAL PLANT SELECTION THROUGH CAPE FARM MAPPER

A new video has been released by Johann van Biljon, well-known ecosystem restoration expert and founder of Green Intaba (https://www.greenintaba.co.za/). Access the video here: https://youtu.be/YMggKzmlrhk?si=U8grDt6UBcAT1WiH. In this video, he explores how to harness the power of Cape Farm Mapper—an initiative of the Department of Agriculture of the Western Cape Government—to identify and compile lists of native plants specific to restoration sites.

Learn step-by-step how to use Cape Farm Mapper to:

- Discover native plant species in your area
- Gather reliable data from community observations
- Generate targeted plant lists for planting and restoration planning
- Ensure your projects support local biodiversity and ecosystem health
- Whether you're working on a small-scale revegetation or a large habitat restoration, sourcing local plants is crucial for success. Using CFM makes this process accessible, accurate, and community-driven.
- Join us as we demonstrate practical tips to streamline your plant sourcing process and contribute to more sustainable, resilient ecosystems.

To access Cape Farm Mapper go to: https://gis.elsenburg.com/apps/cfm/

MEET DAWN NOEMDOE: DAWN OF THE BEES

Dawn Noemdoe of Wellington is on a journey as beekeeper, agricultural journalist and blogger, and advocate for women in agriculture. In 2024-2025 she was a beneficiary of the small-scale farmers / agro-processing programme of the Cape Winelands District Municipality.

Dawn established her business, HoneyatDawn, as a leap into the unknown. It has since become one of the most rewarding experiences of her life.

Her CGTN Africa documentary, "Faces of Africa – Dawn of the Bees", captures not only her growth as a beekeeper and business owner, but also her deep commitment to environmental sustainability.

"Her work is bringing fresh energy to South Africa's beekeeping community. Determined to create new opportunities in towns affected by poverty, Dawn is focused on ethical beekeeping, producing premium honey and natural bee products, while also educating locals, especially the youth on the crucial role bees play in our ecosystem. Dawn's work aims to empower others & provide an alternative source of income."

Click this link to watch the video on Youtube:
https://youtu.be/9164ko248mg

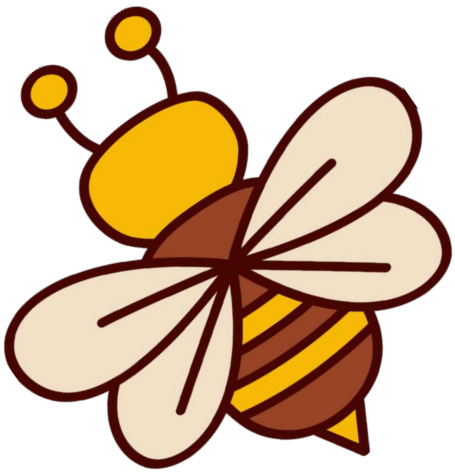
Dawn Noemdoe email address:
dawnlisa1@gmail.com
buzz@honeyatdawn.co.za

Dawn Noemdoe - Instagram:
(@dawnnoemdoe)

Instagram photos and videos instagram.com

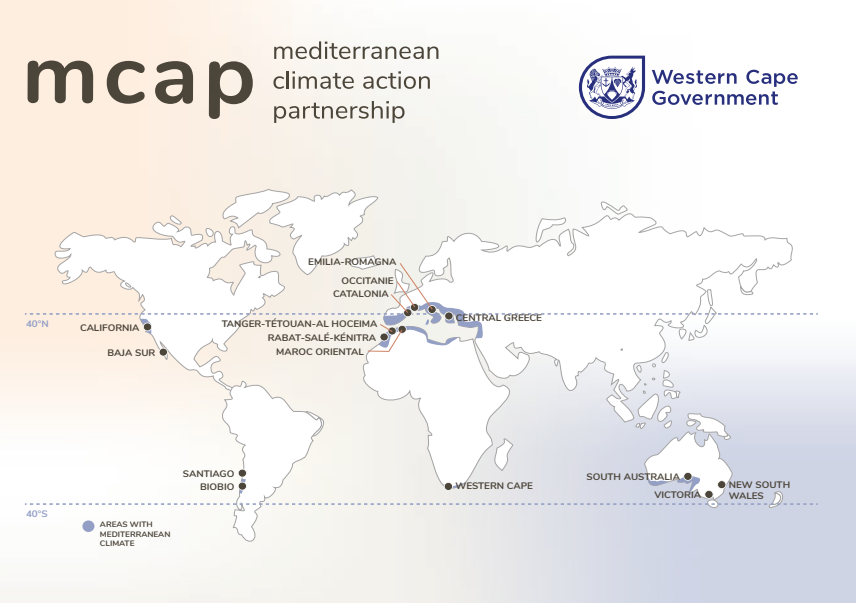
HoneyatDawn Pty Ltd - Instagram:
(@honeyatdawnsa)

Dawn Noemdo - linkedin.com



SMARTAGRI IMPLEMENTATION

WESTERN CAPE HOSTS THE 2025 MEDITERRANEAN CLIMATE ACTION PARTNERSHIP (MCAP) ANNUAL CONVENING



By Dr Ilse Trautmann (WCDoA) and Goosain Isaacs (DEA&DP)

As mentioned in the SmartAgri Barometer Edition 3 (2024/2025), the Western Cape Government, represented by the Department of Agriculture and Department of Environmental Affairs & Development Planning, proudly hosted the 2025 Mediterranean Climate Action Partnership (MCAP) Annual Convening from 6–9 May 2025. This highlighted the province's growing reputation as a focal point for climate action, innovation and partnership in climate change response measures.

The MCAP Convening brought together 11 of the 16 founding Mediterranean subnational governments from across five continents to accelerate regional responses to climate risks in three focus areas, being drought, wildfire and extreme heat. These climate driven impacts continue to threaten ecosystems, communities and livelihoods in these regions. The recent event was the second MCAP convening since its official launch at COP28, Dubai, in 2023, with the first convening being held in Barcelona in 2023.

The 2025 Convening also set the tone for delivering on MCAP's ambitious three-year action agenda, structured around objectives aimed at:

1. Elevating Mediterranean Regions Through a Unified Global Voice
2. Positioning MCAP as a Global Model for Scalable Climate Solutions
3. Amplifying the Leadership of MCAP Regions
4. Mobilizing Resources to Sustain and Scale Action; and
5. Leveraging Crisis as a Catalyst for Action and Policy Change

These goals are supported by dedicated workstreams focusing on MCAP's three thematic Working Groups that focus on drought, wildfire, and extreme heat.

In welcoming MCAP delegates to the province, Premier Alan Winde indicated that "…the Western Cape and its Mediterranean partners are proving that subnational governments are not merely backstops to national action — they are leaders on the frontlines. Their local knowledge, community relationships, and legislative powers uniquely position them to pilot innovation, champion bold policies, and build resilience from the ground up."

This year's annual convening served as a key event in transforming regional momentum into measurable milestones. It provided a platform to set shared objectives, prioritise strategic actions, exchange best practices and expand regional partnerships to access critical climate data and research. The gathering was also a key moment for the MCAP Leadership Council to review and approve priority actions for the coming year and engage in vital governance discussions.

The Local Organising Committee left no stone unturned to compile a 4-day programme to showcase not only the Western Cape as preferred tourism destination, but also as a climate change champion and partner of choice. After the official opening at Leeuwenhof, a township tour followed where delegates were introduced to township life as well as some projects designed to mitigate the effect of climate change on these livelihoods. And in true South African spirit, the day was concluded with a rooibos tea and 'Old Vine' wine tasting.

On the second day, a guided tour showcased climate change response measures through visits to a series of 'Living Lab' sites across the Cape Winelands where they witnessed real-world examples of climate resilience and innovation. The next edition of the Barometer will feature a more detailed account of this tour.

A highlight of the week was the presentation of results from the Mini-Sprint Project Acceleration effort, which focused on identifying tangible, fast-tracked initiatives that can be executed by member regions in the months ahead. Funding for projects to be implemented collectively by the partner regions in the respective work streams are from philanthropic organisations and a process of project calls and adjudication was put in place. The first round of calls was concluded at the recent event in Stellenbosch.

The Western Cape emerged as a key contributor and partner amongst the three selected MCAP mini-sprint project proposals listed below.

1. **Designing a Wildfire Risk Information Service and Spatial Planning for Wildfire Prevention and Biodiversity Conservation** - with Catalonia, California, New South Wales and Western Cape
2. **Regional Heat Island Monitoring and Prediction Tool Development** - with Santiago, California and Western Cape
3. **Coastal Wetlands Resilience: Protecting Biodiversity & Sustainable Water Management** - with Catalonia, Central Greece and Western Cape

The annual convening facilitated progress in the design of these cross-regional projects, emphasizing the urgency of implementation and the ambition to showcase outcomes at the United Nations Framework Convention on Climate Change's 'COP 30' in Brazil later this year. Through the Western Cape Government's strong partnerships with local academic institutions, public entities and the private sector, international delegates were able to engage directly with community members, conservation agencies, and farmers—gaining first-hand insights into how the province is piloting and implementing climate change adaptation measures in response to shared Mediterranean climate challenges.

The 2025 MCAP Convening affirmed that tackling Mediterranean climate risks requires more than policy – it demands partnership, agility, and global-local collaboration. As a proud host of this vibrant and fast-moving alliance, the Western Cape will continue to contribute meaningfully to shaping a future where Mediterranean communities across the globe can thrive despite climate adversity.

MCAP Co-Chair Mr Wade Crowfoot, Secretary of the California Natural Resources Agency, stated at the opening event "We all face similar threats driven by climate change - drought, wildfires, extreme heat and

flooding. We know we will do a better job protecting our people if we work together across continents. This week is all about learning about what is working in the Western Cape and sharing with each other how we are making investments, deploying resources to protect our regions from these climate change impacts. We are ultimately stronger together."

MCAP Co-Chair Ms Sonsoles Letang, Director General for Climate Change and Environmental Quality for the Government of Catalonia, said, "It is very important for us to share all the tools and strategies that each region utilises to fight climate change. To have a common tool among all MCAP regions makes us stronger."'

And at the end of the convening Secretary Crowfoot commented: "An eye-opening week in South Africa! So grateful we formed the Mediterranean Climate Action Partnership (MCAP) to help protect our people from climate change threats and build a healthy and prosperous future. No time to waste so we can't reinvent the wheel in each place. We're stronger together!"

This event was a roaring success and the delegates were stunned by the climate change work WCG and our partners are doing. The Mediterranean Climate Action Partnership (MCAP), a regional approach to building climate change resilience is one to follow – we expect great outcomes from this partnership and will keep our readers posted.

To view the MCAP website, please click here.

For more information, contact Dr Ilse Trautmann at 021-8085012 or ilse.trautmann@westerncape.gov.za

Premier Alan Winde welcoming delegates at Leeuwenhof, Cape Town Official residence of Premier

The rest of the programme of the convening was focused on the work and vision of MCAP and its members.

MCAP CONVENING MEETING PARTICIPANTS GETTING A FEEL FOR TOWNSHIP LIVING

Mr Goosain Isaacs

The technical township tour on Tuesday 6th May 2025 was an unforgettable cultural experience as delegates explored the heart of Cape Town's oldest township Langa, established in 1927.

The journey began with a guided walking tour of Langa, offering a closer look at everyday life in the township. Delegates strolled through its streets, met friendly locals, and heard stories that bring to life the struggles and triumphs of the people who call Langa home. From informal settlements to vibrant community hubs, the experience was both eye-opening and inspiring.

This followed with a visit to the Guga S'thebe Arts and Cultural Centre, located in a stunning building decorated with colourful mosaics and traditional African designs. Guga S'thebe is the cultural heartbeat of Langa where delegates witnessed and experienced drumming, explored exhibitions of local art and engaged with artisans at the on-site marketplace.

Delegates purchased handmade crafts and souvenirs supporting the local economy while taking a piece of Langa's spirit home with them.

The local organising team was commended by participants for sharing with delegates the juxtaposition of Cape Town suburban affluence with vulnerable township living.

A CHALLENGING 2024 FOR CONSERVATION AGRICULTURE

Prof Johann Strauss

The 2024 season was a rollercoaster ride, marked by several highs and lows. Conditions varied throughout the province, having a profound impact on yield, quality, fertilisation and weed control.

With record canola yields in the southern Cape and dismal canola crops in the Swartland, our producers faced significant challenges. The very wet conditions in June contributed to excellent yields in the southern Cape, as the planting season starts earlier there than in the Swartland, allowing the crops to be more advanced and cope with the conditions.

The wheat crop struggled with grading in both production areas. The soils were too wet to control weeds and apply topdressing at the appropriate times, resulting in significant weed competition and a subsequent decline in wheat yield.

Although the southern Cape struggled with good grading, wheat yields were above average, whereas those in the Swartland were down by 20%. Accompanied by low commodity prices for wheat, the impact on the Swartland was profound. Since most of the harvest was either of low B3 grading or utility grade, farmers' incomes were severely affected.

Although the season was in turmoil, the conservation agriculture trials yielded some positive results. The building of the soil structure through the basic principles resulted in better handling of wet conditions, through improved intake and distribution of excess water, allowing us to access the soil earlier than was the case in soils where CA principles are not followed.

With the wet conditions, fertilisation was a nightmare, and some of the crop-only systems required more applications than usual.

Even though that was the case, the medic pasture systems did not receive more funding than we had applied for in previous years. These systems still outperformed those with higher application rates and also resulted in higher-quality grading.

The challenges of the 2024 season were still evident in the early part of 2025; more producers were burning residue to cope with the increased weed pressure resulting from the poor weed control in 2024.

Many also felt the need to loosen the soil that they believed was compacted by the heavy rains, or to repair wheel ruts. Although these efforts are not part of a conservation agriculture approach, sometimes we must be flexible enough to take strategic actions. The actions, however, should be rather a one-time action than a continued practice.

For more information on Conservation Agriculture, contact Prof Johann Strauss at Johann.strauss@westerncape.gov.za

RENEWABLE ENERGY DEVELOPMENT AND AGRICULTURE IN THE WESTERN CAPE

Dr Michael Wallace

INTRODUCTION

The Western Cape of South Africa is rapidly emerging as a leader in renewable energy, driven by favorable environmental conditions, strategic government initiatives, and increasing private sector investment.

Amid ongoing energy insecurity and the growing threat of climate change, the province has embraced wind and solar energy as central pillars of its sustainable development strategy. This transition not only addresses pressing energy needs but also presents both opportunities and challenges for the region's agricultural sector.

A RENEWABLE ENERGY HUB

With strong coastal winds and high solar irradiance, the Western Cape is ideally suited for renewable energy development. The province has become a focal point for large-scale wind and solar projects, many of which are supported by the national Renewable Energy Independent Power Producer Procurement Programme (REIPPPP).

Launched in 2011, this initiative has attracted billions in private investment and facilitated the construction of numerous renewable energy facilities.

According to a factsheet by the Western Cape Government and Wesgro, the province manufactures approximately 70% of South Africa's locally produced renewable energy components, including photovoltaic (PV) panels and wind turbine parts. The provincial government estimates that the renewable energy market could reach a value of R468 billion by 2030.

MAJOR WIND AND SOLAR FACILITIES

Several significant wind and solar energy facilities are either operational or under development in the Western Cape. The Department of Forestry, Fisheries and the Environment (DFFE) provides an official map of Renewable Energy Environmental Impact Assessment (EIA) applications through its SA_REEA MapServer platform (DFFE, 2024).

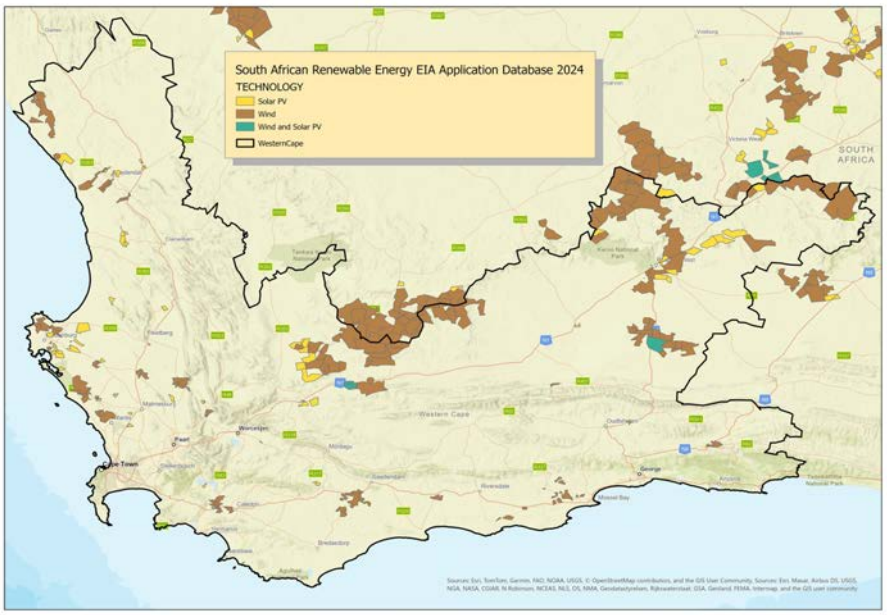


Figure 1. Wind and solar energy applications by farm portion—operational and planned as of the third quarter 2024 data release (DFFE, 2024).

Although currently offline, the MapServer offers valuable insights into existing and planned renewable energy installations. The most recently available data from the platform is illustrated in Figure 1. Updated releases should be imminently available. While most of these sites are located on natural veld, the expansion of renewable energy infrastructure into cultivated agricultural areas is drawing increased attention.

NOTABLE OPERATIONAL OR PLANNED FACILITIES IN THE PROVINCE INCLUDE:

Gouda Wind Farm (near Tulbagh): 138 MW, supplying electricity to over 200,000 households.

Roggeveld Wind Power Station (near Matjiesfontein): 147 MW.

Perdekraal East Wind Farm (Ceres Karoo): 110 MW.

Sere Wind Farm (near Vredendal): 100 MW.

Klipheuwel/Dassiesklip Wind Energy Facility (near Caledon): 27 MW.
Aurora-Rietvlei Solar PV Plant (Aurora): 9.65 MW.

Paleisheuwel Solar Facility (near Clanwilliam): 75 MW.

Excelsior Wind Farm (outside Swellendam): 33 MW.

Umoya Wind Farm (near Hopefield): 67 MW.

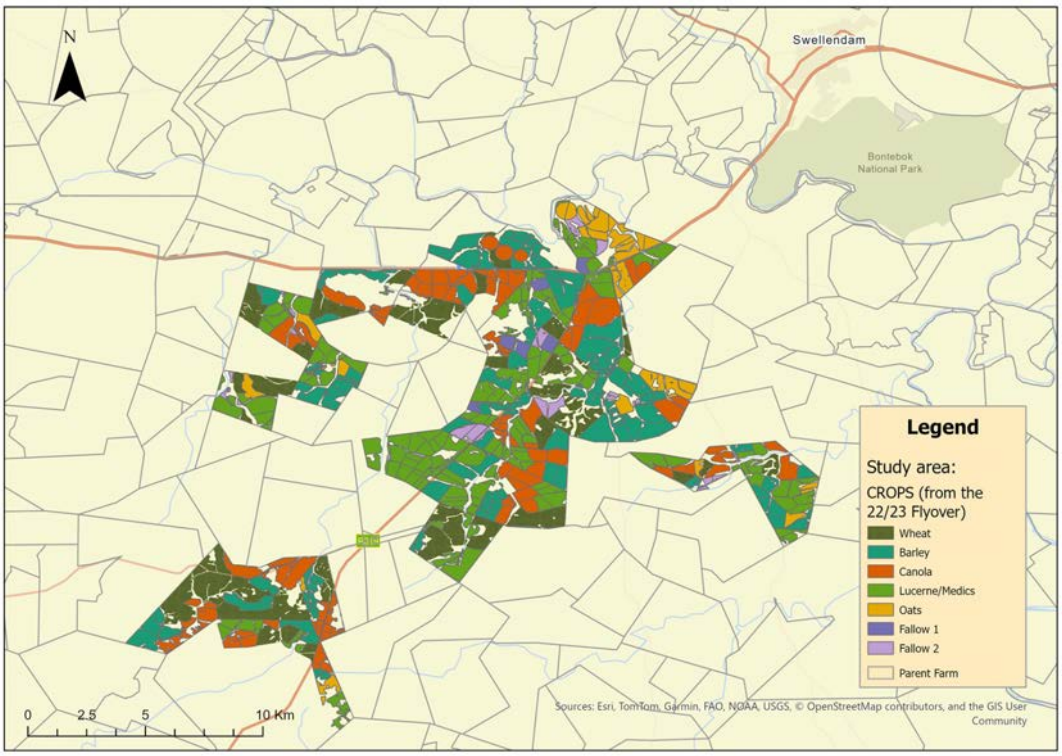


Figure 2. Wind energy sites southwest of Swellendam showing typical commodity production.

Planned Overberg Wind Farm (near Swellendam): Expected capacity of 380 MW, poised to become South Africa's largest privately developed single wind farm, with significant conservation considerations due to its proximity to sensitive habitats.

City of Cape Town PV Plant (Atlantis): A 7 MW city-owned facility, scheduled for completion by year-end.

According to GreenCape's 2025 Renewable Energy Market Intelligence Report, the Western Cape currently hosts 465 MW of large-scale PV and 958 MW of wind power, with nearly equivalent capacity in the development pipeline for the next six years (GreenCape, 2025).

IMPACT ON AGRICULTURE

The integration of renewable energy with agriculture in the Western Cape has yielded promising outcomes. Rather than displacing agricultural activity, many wind, and even some solar projects are designed to coexist with farming operations.

Wind turbines occupy a relatively small footprint—typically around 2% of the land they are sited on—allowing continued agricultural use for grazing or crop cultivation.

In areas such as Caledon and Swellendam, annual crop production continues around the turbines, with farmers benefiting from lease payments and improved infrastructure. Figure 2 illustrates wind farm sites near Swellendam alongside commodity production data from 2022/23.

The Excelsior Wind Farm, for instance, operates on agricultural land and employs a 'shut-down on demand' system to protect endangered bird species such as the Black Harrier and Cape Vulture. This involves real-time monitoring and rapid turbine shutdowns when birds are detected nearby, minimizing ecological disruption (Overberg Renosterveld Trust, 2024). Similar measures are anticipated for the upcoming Overberg Wind Energy Facility.

Solar farms, while more land-intensive, are increasingly being adapted for dual land use. Recent research has shown that certain crops—such as leafy greens and berries—can thrive under solar panels, which provide shade and reduce water evaporation (Randle-Boggis et al., 2025).

CHALLENGES AND CONSIDERATIONS

Despite the benefits, integrating renewable energy into agricultural landscapes presents several challenges:

Land Use Conflicts: The diversion of prime agricultural land for energy production can raise concerns about long-term food security. The availability of open spatial data such as the Flyover iterations and the DFFE SA_REEA MapServer platform facilitate spatial monitoring of trends that may begin to impact on agriculture.

Ecological Sensitivity: Projects like the Excelsior and Overberg wind farms underscore the importance of environmental impact assessment and subsequent careful planning to avoid adverse impacts on endangered species and sensitive ecosystems.

Grid Connectivity: Remote energy facilities often face delays in connecting to the national grid, limiting their full potential.

CONCLUSION

The Western Cape's renewable energy expansion reflects a strong commitment to sustainability, innovation, and economic resilience. By leveraging its natural resources and aligning energy development with agricultural practices, the province is creating a model for integrated rural development. As South Africa advances its energy transition, the Western Cape stands as a compelling example of how clean energy and agriculture can coexist.

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For further information please contact Dr Michael Wallace: mike.wallace@westerncape.gov.za

Wind turbine - Caledon by Piet Lombard

Wind turbine - Gouda by Dr Mike Wallace

NATURE-BASED SOLUTIONS TO THE IMPACTS OF CLIMATE CHANGE AND WEEDS ON AGRICULTURAL PRODUCTION

DR MIKE FERREIRA

The demand for agricultural products and the drive for greater profits require an increase in agricultural production from the same unit area. This necessitates an improvement in efficiency that can be resolved by an intensification of production processes. Currently, this intensification relies heavily on the use of agrochemicals for crop protection and fertilisation, but many of these products are being phased out either due to pest or weed resistance or new laws and regulations. This requires alternative approaches to ensure crop protection and to counteract pests, diseases and weeds. Compounding matters are the less manageable effects of climate change.

ADVERSE SECONDARY EFFECTS OF PRODUCTION INTENSIFICATION

Recent studies indicate that the intensification of agricultural production has contributed to an increased spread of weedy and alien plant species, underlining the interconnected nature of agricultural practices and biological invasions. Also, alien plants and weed species are spreading in regions worldwide as one of the consequences of the global expansion of trade and transport, which facilitates their spread and establishment in new environments.

This is especially the case in highly human-dominated agricultural landscapes, which have undergone massive changes in land use structure and intensity over the last three-quarters of a century. The constant disturbances over large swaths of land have enabled the spread of weeds beyond routes of transport. This trend is contributing to the emergence of biological invasions as a primary cause of biodiversity loss across the globe with substantial and growing impacts on human well-being and the global economy.

However, in agroecosystems, biological diversity contributes to several ecosystem services coupled with definite positive influences on crop yield. These include crop pollination and biological pest control by insect predators. In addition, beneficial microbes are involved in numerous processes in the rhizosphere of crops. These belowground organisms' shapes soil formation, creates labile plant nutrient pools, facilitates colonisation by vascular plants, and influences development of complex communities of different life forms.

Also, studies have shown that soil microbial community composition can significantly impact plant health and resistance against attacks by pests, diseases and the competitive effects of weeds.

In addition, production intensification is compounded by climate change that drives a range of shifts of species and biomes, as organisms track suitable climates and habitats. Recent reports indicate that globally, climate change threaten the long-term sustainability of agricultural production systems in various ways. Findings also show that some agricultural crops exhibit reduced biomass, below and aboveground, that is evident in reduced yields under warmer conditions. Pre-emptively addressing this constraint requires a wider farmland concept that will improve the sustainability of intensive production systems.

WEED INVASIONS AND CLIMATE CHANGE

Weeds can pose significant threats to agricultural productivity, biodiversity and ecosystem functioning. Data suggest that increased temperatures bolster weed competitiveness, but that the impacts of warming vary depending on the weed species in question. Additionally, competition from weeds generally increased under higher temperatures, raising concerns about global warming and associated impacts on crop production and related management challenges.

Recent data imply that under warmer conditions, weeds will gain a competitive edge over many crop plants, as invasive species often demonstrate superior fitness and adaptability, enabling them to thrive in changing agroecosystems. This is especially true for C4 plants which are known to be more tolerant of warming conditions. Plants with the C4 photosynthesis mechanism facilitate greater water use and nutrient use efficiency compared to C3 plants and this factor further enhances its invasive potential.

As climate change progresses, warming conditions may exacerbate weed pressures, threatening crop production and food security. Effective weed management strategies and adaptive agricultural practices will be essential to mitigate these impacts and sustain agricultural productivity.

NATURE-BASED SOLUTIONS IN THE AGRICULTURAL LANDSCAPE TO CLIMATE CHANGE

Recent findings provide insights into a possible nature-based solution to both ecological and socio-ecological impacts of climate change. Ecosystems across the globe are vulnerable to the effects of climate change, as are the communities of people that depend on them. For ecosystems to provide services to people, they must themselves be able to resist, recover and/or adapt to change. In an undisturbed environment of ecological equilibrium, diversity allows for sustained productivity through extremes of fires, floods and droughts, pests, diseases and weed invasions via the buffering effects of multiple species, which differ independently in their responses to similar environmental conditions.

The concept of nature-based principles includes habitat conservation and the introduction of ecological high density semi-natural habitats that will enable the dispersion of complementary life forms to the surrounding areas to benefit agricultural production. Clearly, the presence of native species with a comparatively intricate and balanced variety of plants in a sheltered environment in the agricultural landscape, are essential for the settlement of many life forms, particularly in the face of intensive production and climate change. This is supported by data that show ecosystems provide effective adaptation and contribute to the mitigation of climate change impacts. Conservation of farmland biodiversity that focus on supporting semi-natural habitats and the diversity of species traits present in the communi¬ties of these habitats, will also provide an insurance against future changes by hosting organisms and genes that may become of fundamental importance to guarantee ecosystem processes vital to production stability and food safety under changing environmental conditions. Implementation of these practices will ensure sustainable food production in the face of climate change, whilst simultaneously meeting yield demands and human consumption.

Enhancing the assortment of life forms in agricultural surroundings through plants, not only sets up safe havens in the landscape, but also improves the dispersion of complementary life forms to farmlands. Consequently, semi-natural habitats will ensure that ecosystem services vital to agricultural yields persist during fluctuating climatic and environmental conditions. The connectivity, density and structural diversity of semi-natural habitats are positive factors that are strongly associated with the provision of ecosystem services.

Lastly, the variety of species traits and genes found in diverse habitats has ensured its survival and guaranteed the continuation of ecosystem processes over millennia under changing environmental conditions and unquestionably will do likewise during future alterations in climatic conditions.

For further information please contact Dr Mike Ferreira:
Email: Mike.Ferreira@westerncape.gov.za

Effective suppression of Paterson's curse (*Echium plantagineum*) with a biomass mulch of wood chips implies that it can be applied for controlling this weed and its seed bank in fields margins, roadsides and along fences in the agricultural landscape.

Effective suppression of intra-row weeds in rooibos plantations with a biomass mulch of wood chips reduces the area subjected to herbicide applications, improves the soil micro-climate and the crops' vegetative growth.

A cultivated hedge row (white mustard and vetch) that encloses the crop serves as a safe haven for insects predators that prey on pests of wheat, thereby reducing the amount of agrochemicals applied in the agricultural landscape.

NEWS FROM OUR PROVINCE

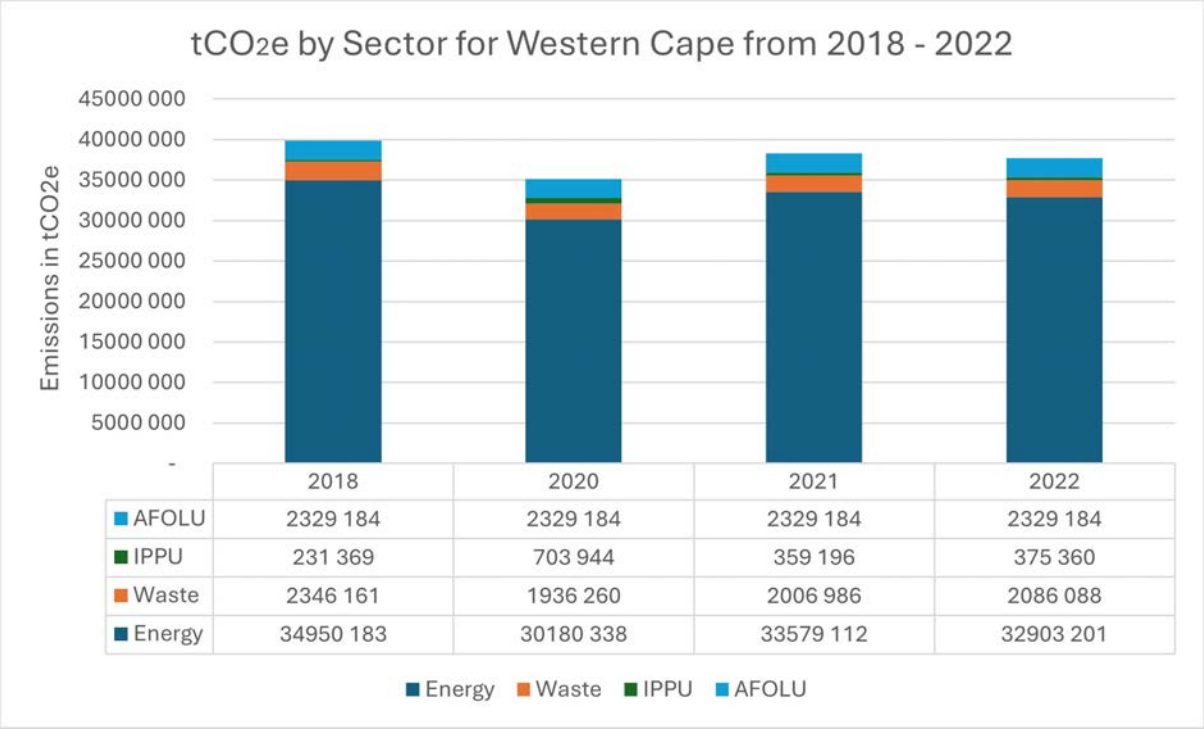
THE 2ND GHG INVENTORY FOR THE WESTERN CAPE (2009 – 2022)

Ms Lize Jennings-Boom

The 2nd iteration of the Western Cape Greenhouse Gas (GHG) Emissions Inventory was completed in March 2025. The analysis is undertaken every 2-3 years by the Climate Change Directorate in the Western Cape Department of Environmental Affairs and Development Planning (DEA&DP). It covers the following sectors:

- Energy, which includes electricity, liquid fuels for transport, coal for industrial purpose (outside of power station use) and gas for other purposes
- Industrial Process and Product Use (IPPU) which are GHG emissions resulting from various industrial activities that product emissions not directly the result of energy consumed during the process as well as the use of man-made GHGs in products. These include refrigerants, aerosols, solvents and lubricants.
- Waste related emissions, include landfilling, wastewater treatment works and incinerations of waste. Organic waste is one of the biggest contributors of GHG emissions from this sector.
- Agriculture, Forestry and Other Land Use (AFOLU) includes land use change, forestry agricultural activities including livestock management, manure management, fertilizers, enteric fermentation, burning biomass, cropland and grassland soil carbon. This sector sees relatively slow change over the short-term and due to the technical expertise needed to update the data, which is outside the scope of the inhouse team, this sector has not been updated in the 2nd iteration.

The Western Cape has been collecting GHG emissions data in the energy sector for almost 15 years, where more recently they have expanded work toward collecting information for the other sectors. The image (Figure 1) shows the emissions per sector for 2018 (the date of the first iteration of the GHG inventory) with updates for 2020, 2021 and 2022. The reason for the multiple year update was linked to trying to understand the impacts that the COVID-19 lockdown in 2020 as well as ongoing loadshedding had on the emissions picture.



	2018	2020	2021	2022
AFOLU	2329 184	2329 184	2329 184	2329 184
IPPU	231 369	703 944	359 196	375 360
Waste	2346 161	1936 260	2006 986	2086 088
Energy	34950 183	30180 338	33579 112	32903 201

Figure 1. Estimated emissions per sector for 2018 (the date of the first iteration of the Western Cape GHG inventory) with updates for 2020, 2021 and 2022.

The energy sector has remained the dominant contributor over the years. The decrease in 2020 can be primarily attributed to the impact of the COVID-19 lockdown, and the decreases in 2022 from 2021 figures can be partially linked to the 250+ days of loadshedding experienced in 2022. The continued shift towards renewables, efficiencies and other mitigation measures is also contributing to emissions reductions.

Although the GHG inventory formally reports emissions from 2018 onward, it draws on energy data collected by DEA&DP since 2009, allowing for a broader historical perspective. Figure 2 illustrates trends and shifts in energy-related emissions between 2009 and 2022. Notably, increased adoption of energy efficiency measures and small-scale renewable energy systems across the residential, commercial, and industrial sectors have contributed to gradual emission reductions over time. Additionally, improvements in the quality and accuracy of coal-related data have influenced the variability observed in the coal emission figures.

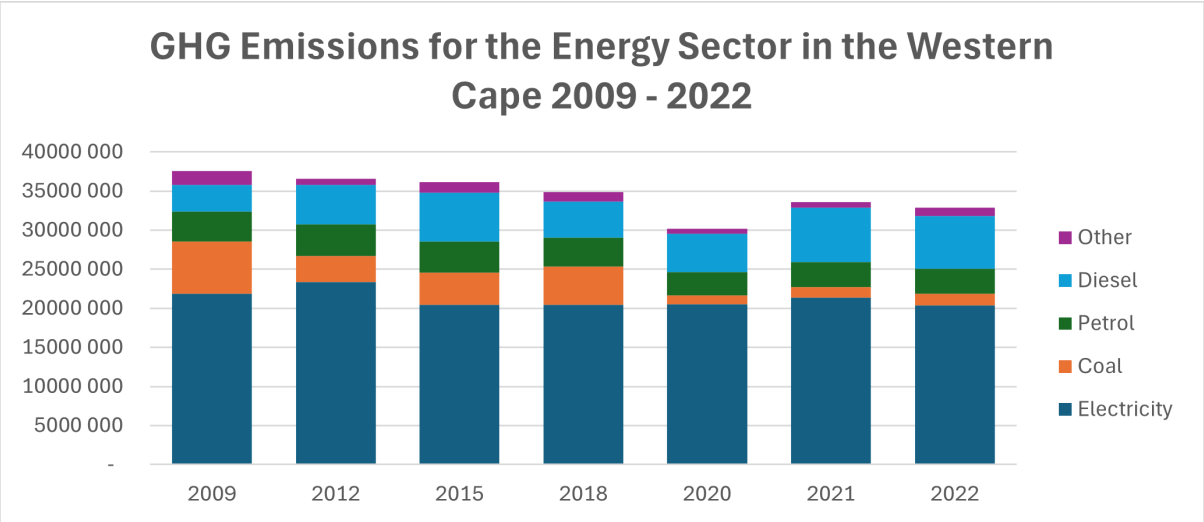


Figure 1. Trends and shifts in energy-related GHG emissions between 2009 and 2022.

While this GHG Inventory provides a high-level overview of the GHG emissions in a number of sectors and sub-sectors, it is not able to provide facility-level information or data down to a very disaggregated level. Due to challenges with access and quality of data, a number of assumptions also need to be made to fill in data gaps. Work is now underway to finalise the updated GHG emissions reports for each sector, supported by the development of a consolidated summary report and district-level reports focused on energy and waste-related emissions.

These outputs will not only enhance the understanding of emission trends across the Western Cape, but also support evidence-based planning and targeted climate action at both provincial and local levels. The continued collaboration of sector departments and partners remains key to ensuring the credibility, relevance, and impact of these reporting efforts.

For more information, please contact Ms Lize Jennings-Boom at DEA&DP: lize.jennings@westerncape.gov.za

NATIONAL NEWS

NATIONAL HEAT HEALTH ACTION GUIDELINES

Guide to extreme heat planning in South Africa for the human health sector
The Power of Togetherness

South Africa's National Department of Health published the National Heat Health Action Guidelines in 2021. These will assist Provincial Departments of Health, District Health Services and Municipalities to reduce the burden of disease from heat exposure.

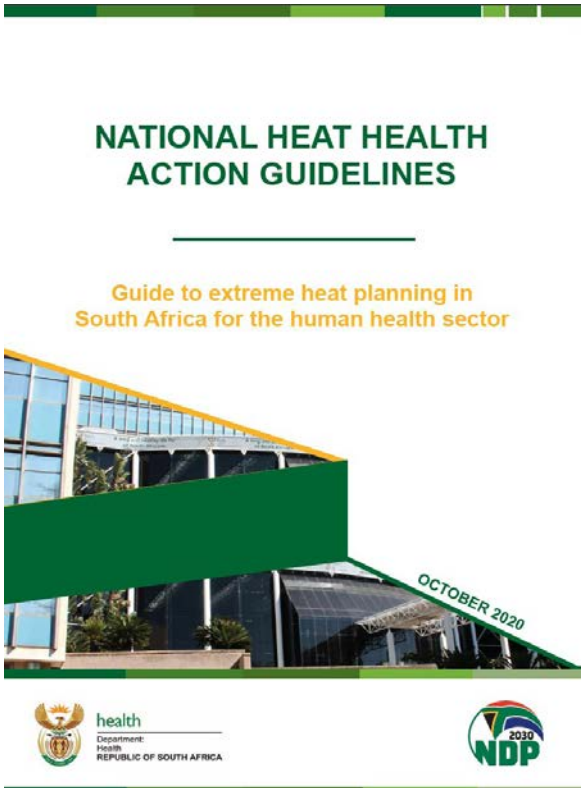
Human health is impacted by climate change driven increases in extreme heat (maximum temperature >35°C) in multiple ways, sometimes causing increases in mortality and morbidity: cardiac and respiratory problems; dehydration, heat cramps, heat exhaustion and heat stroke which manifests as damage to the brain, kidneys and other organs; exacerbation of chronic medical conditions including HIV/Aids and diabetes; mental health problems including anxiety, irritability, interpersonal violence and gender-based violence; outbreak of food- and water-borne infections; and malaria- and other vector-borne infections.

Some population groups have higher exposures to heat, such as people who work outdoors (e.g. on farms) or in hot indoor areas (e.g. poorly ventilated packhouses). Workers in outdoor settings such as agriculture and construction, commonly experience sunburn, sleeplessness, irritability and exhaustion.

Heat Health Action Plans are a package of practical, feasible, and low-cost interventions at the individual and community level that can assist people to adapt to high temperatures.

The agricultural sector can contribute by building greater awareness around heat extremes and effective responses during such events. It is especially important to train foremen and managers on prevention (e.g. responding to heat-health warning systems based on weather forecasts) and the recognition of heat stress symptoms in agri-workers.

Click here to access the South Africa National Heat Health Action Guidelines report: https://www.health.gov.za/wp-content/uploads/2022/06/National-Heat-Health-Action-Guidelines.pdf



INTERNATIONAL NEWS

1. CLIMATE-RELATED STUDIES BY WORLD ECONOMIC FORUM

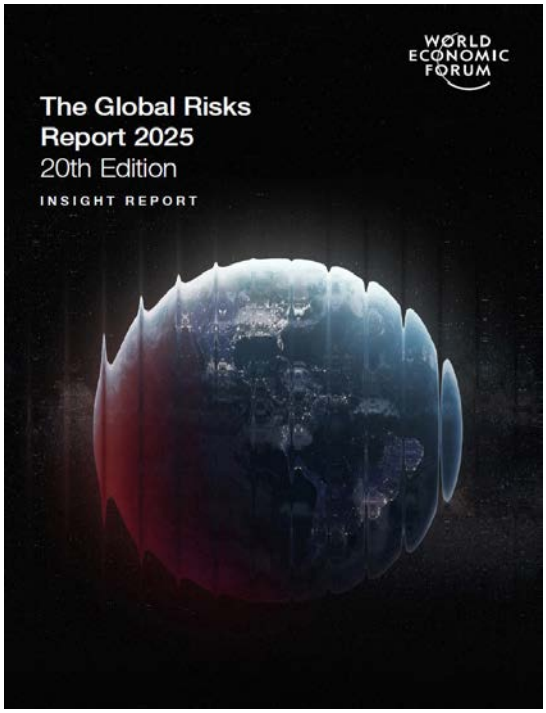
The following three publications by the World Economic Forum make for very interesting reading for anyone interested in the future.

1. The Global Risks Report 2025 20th edition – Insight Report

"The Global Risks Report 2025 presents the findings of the Global Risks Perception Survey 2024-2025 (GRPS), which captures insights from over 900 experts worldwide. The report analyses global risks through three timeframes to support decisionmakers in balancing current crises and longer-term priorities: current or immediate-term (in 2025), short- to medium-term (to 2027), and long term (to 2035).

The report considers not only the survey findings and the range of implications, but also provides six in-depth analyses of selected risk themes."

LINK: https://reports.weforum.org/docs/WEF_Global_Risks_Report_2025.pdf



2. FUTURE OF JOBS REPORT 2025 – INSIGHT REPORT

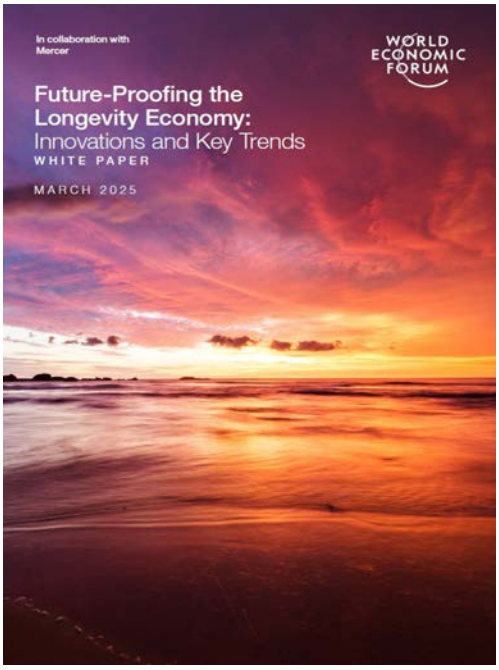
"Technological change, geoeconomic fragmentation, economic uncertainty, demographic shifts and the green transition – individually and in combination – are among the major drivers expected to shape and transform the global labour market by 2030. The Future of Jobs Report 2025 brings together the perspective of over 1,000 leading global employers ... to examine how these macrotrends impact jobs and skills, and the workforce transformation strategies employers plan to embark on in response, across the 2025 to 2030 timeframe."

"Climate-change mitigation is the third-most transformative trend overall – and the top trend related to the green transition – while climate change adaptation ranks sixth with 47% and 41% of employers, respectively, expecting these trends to transform their business in the next five years. This is driving demand for roles such as renewable energy engineers, environmental engineers and electric and autonomous vehicle specialists, all among the 15 fastest-growing jobs.

Climate trends are also expected to drive an increased focus on environmental stewardship, which has entered the Future of Jobs Report's list of top 10 fastest growing skills for the first time."

LINK: https://reports.weforum.org/docs/WEF_Future_of_Jobs_Report_2025.pdf

3. FUTURE-PROOFING THE LONGEVITY ECONOMY: INNOVATIONS AND KEY TRENDS. WHITE PAPER (2025)



"More than one in four people worldwide now reside in a country where the population has already peaked in size, signalling a profound shift in labour markets and economic systems. Meanwhile, global life expectancy has increased significantly over the past century; however, this progress masks stark disparities – life expectancy can exceed 80 years in high-income countries yet remain below 60 in some low-income nations. As birth rates decline, some of the world's most advanced economies would need to at least double their productivity growth rates to sustain historical improvements in living standards.

These demographic shifts intersect with two other defining transitions of our time: the rapid acceleration of technological advances and artificial intelligence, as well as **the escalating impact of climate change and extreme heat. Taken together, these forces create both an urgent challenge and an unprecedented opportunity to rethink** financial resilience and economic participation across all life stages. **Governments, businesses and civil society must act now to build systems that enable people of all generations to thrive."**

LINK: https://reports.weforum.org/docs/WEF_Future_Proofing_the_Longevity_Economy_2025.pdf


FEATURE:
Extreme heat, climate change and the longevity economy

Climate change is reshaping economies, communities and public health systems worldwide, presenting significant challenges and considerations for the longevity economy. As extreme weather events become more frequent and environmental changes disrupt financial security, career stability and public health, individuals and institutions must navigate new uncertainties that affect their long-term well-being. A longevity economy that accounts for climate risks will require a deeper understanding of how these disruptions affect financial resilience, workforce participation and intergenerational stability.

Financial resilience in a changing climate

Rising global temperatures, natural disasters and resource scarcity are altering economic conditions, retirement security and individual financial stability. People face increasing risks related to housing markets, insurance costs and disruptions to employment and earnings. Climate-driven economic shocks may have long-term implications for pensions, social protections and access to financial resources, affecting both individuals and broader economic systems.

Research from the World Economic Forum projects that by 2050, climate change could cause $12.5 trillion in global economic losses,[67] compounding financial uncertainty for households and businesses.

Health and well-being in extreme heat

Extreme heat and environmental changes are increasingly recognized as significant public health concerns. The World Health Organization projects that between 2030 and 2050, climate change will cause approximately 489,000 additional deaths per year from heat-related illnesses, occupational hazards and extreme weather events.[68]

As individuals live longer and remain engaged in their communities and careers, climate-related health risks may shape labour conditions and access to care. Prolonged exposure to extreme heat can particularly affect older adults, outdoor workers and those with pre-existing conditions, raising questions about how urban planning, public health systems and employer policies will adapt to changing environmental conditions.[69]

The changing nature of work and careers

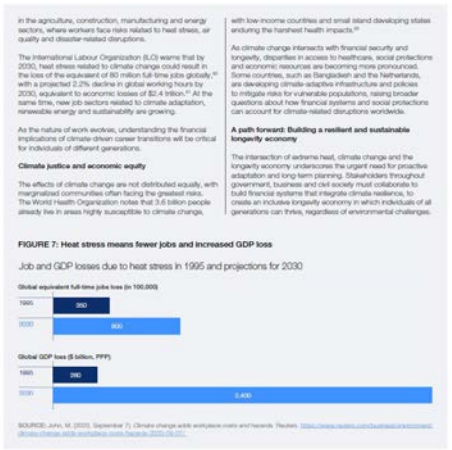
Climate change is influencing labour markets, with some industries experiencing new challenges and emerging opportunities. Extreme weather events, shifting ecosystems and environmental regulations are reshaping employment

Future-Proofing the Longevity Economy: Innovations and Key Trends 29

Feature on extreme heat, climate change and the longevity economy:

"Climate change is reshaping economies, communities and public health systems worldwide, presenting significant challenges and considerations for the longevity economy. As extreme weather events become more frequent and environmental changes disrupt financial security, career stability and public health, individuals and institutions must navigate new uncertainties that affect their long-term well-being.

A longevity economy that accounts for climate risks will require a deeper understanding of how these disruptions affect financial resilience, workforce participation and intergenerational stability."


in the agriculture, construction, manufacturing and energy sectors, where workers face risks related to heat stress, air quality and disaster-related disruptions.

The International Labour Organization (ILO) warns that by 2030, heat stress related to climate change could result in the loss of the equivalent of 80 million full-time jobs globally,[70] with a projected 2.2% decline in global working hours by 2030, equivalent to economic losses of $2.4 trillion.[71] At the same time, new job sectors related to climate adaptation, renewable energy and sustainability are growing.

As the nature of work evolves, understanding the financial implications of climate-driven career transitions will be critical for individuals of different generations.

Climate justice and economic equity

The effects of climate change are not distributed equally, with marginalized communities often facing the greatest risks. The World Health Organization notes that 3.6 billion people already live in areas highly susceptible to climate change, with low-income countries and small island developing states enduring the harshest health impacts.[72]

As climate change intersects with financial security and longevity, disparities in access to healthcare, social protections and economic resources are becoming more pronounced. Some countries, such as Bangladesh and the Netherlands, are developing climate-adaptive infrastructure and policies to mitigate risks for vulnerable populations, raising broader questions about how financial systems and social protections can account for climate-related disruptions worldwide.

A path forward: Building a resilient and sustainable longevity economy

The intersection of extreme heat, climate change and the longevity economy underscores the urgent need for proactive adaptation and long-term planning. Stakeholders throughout government, business and civil society must collaborate to build financial systems that integrate climate resilience, to create an inclusive longevity economy in which individuals of all generations can thrive, regardless of environmental challenges.

FIGURE 7: Heat stress means fewer jobs and increased GDP loss

Job and GDP losses due to heat stress in 1995 and projections for 2030

Global equivalent full-time jobs loss (in 100,000)

1995 350

2030 800

Global GDP loss ($ billion, PPP)

1995 280

2030 2,400

SOURCE: John, M. (2023, September 7). Climate change adds workplace risks and hazards. Reuters. https://www.reuters.com/business/environment/climate-change-adds-workplace-risks-hazards-2023-09-07/

Future-Proofing the Longevity Economy: Innovations and Key Trends 30


NEWS FROM OUR PARTNERS
Organic Coffee
CAFE CULTURE
TAKE LIFE ONE SIP AT A TIME
KEEP YOURSELF OCCUPIED
WHAT WE SAVE, SAVES US
COMMUNICATION
Connect and stay in touch with everyone everywhere
DO MORE OF WHAT MAKES YOU HAPPY
EXPLORATION
FOLLOW YOUR DREAM AND MAKE IT HAPPEN
MARKETING
STAY POSITIVE, WORK HARD, MAKE IT HAPPEN
ALWAYS BE GRATEFUL
RECREATION
DREAM IT, WISH IT, DO IT
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NEW AND EXPANDED CARBON HEROES PLATFORM LAUNCHES TO CELEBRATE CREDIBLE SUSTAINABILITY PROGRESS IN AGRICULTURE

Ms Anél Blignaut

On 15 May 2025, Blue North Sustainability officially launched the enhanced **Carbon Heroes platform**—a digital recognition system designed to spotlight genuine and measurable sustainability progress across food and agricultural sectors. The launch event was held at the atmospheric Die Boekklub venue just outside Stellenbosch, bringing together a diverse group of industry stakeholders for an evening of connection, conversation, and celebration. Among the attendees were distinguished guests Dr Ilse Trautmann and Prof Stephanie Midgley from the Western Cape Department of Agriculture, along with representatives from Woolworths, Hortgro, WWF-South Africa, and leading farms and agribusinesses.

Since 2011, Blue North has worked closely with businesses at every level of the agricultural supply chain—from farm to retailer—supporting their efforts to meet increasingly demanding sustainability goals. Over the years, it became clear that while numerous environmental and social standards and audits are essential to ensure compliance, they often fall short of capturing the full depth and commitment to sustainability demonstrated by many businesses. These processes sometimes feel more like obligatory procedures than opportunities to showcase meaningful work happening across the supply chain.

Throughout this journey, Blue North witnessed countless inspiring sustainability initiatives and success stories that often went unrecognised. The challenge was clear: how to highlight these positive contributions in a credible, transparent, and impactful way—without adding yet another rigid standard that might increase compliance burdens? In response, Carbon Heroes was launched in 2021 as a pioneering pilot initiative focused on celebrating fruit and wine growers who used the Confronting Climate Change (CCC) carbon footprinting tool.

This pilot proved highly successful, generating positive sentiment and encouraging deeper engagement with sustainability practices by shining a light on genuine carbon management efforts. Building on this strong foundation, Blue North saw the opportunity to broaden Carbon Heroes beyond carbon alone, evolving it into a comprehensive, inclusive platform that recognises a wider spectrum of sustainability efforts. The updated Carbon Heroes platform now embraces six key areas: Foundational Compliance, Commitment, Carbon, Water, Biodiversity, and Transparency—reflecting the interconnected realities of sustainability challenges and progress within the agricultural sector.

Carbon Heroes operates as a recognition framework designed to make sustainability efforts visible and to reward authentic progress with integrity. Participating businesses—from primary producers to exporters and other value chain actors—are invited to measure their sustainability performance using trusted tools such as SHERPA and CCC, set meaningful targets, and demonstrate ongoing improvement.

Recognition is awarded at Bronze, Silver, and Gold levels across the six pillars, with each organisation receiving a public profile and a unique QR code to showcase their achievements.David Farrell, CEO of Blue North Sustainability, emphasised the platform's role in shifting the sustainability narrative. "There is so much great work happening on farms and within businesses that often goes unnoticed — Carbon Heroes seeks to change that by celebrating credible, bottom-up progress," he said. "Our aim is to foster greater transparency and trust across agricultural value chains by encouraging self-disclosure and publicly sharing progress."

The launch party featured an interactive exploration area where guests could browse the new Carbon Heroes platform firsthand. Attendees shared enthusiastic feedback on its user-friendly design and clear purpose. "Credibility is key," Farrell noted. "We've developed a robust methodology and a strict set of rules to ensure the integrity of the recognition process."

The enhanced Carbon Heroes platform is now live and accessible at http://www.carbonheroes.co.za, offering practical guidance for businesses eager to apply, earn recognition, and learn from others committed to sustainability. For further details, contact Blue North Sustainability at support@bluenorth.co.za.

Ms Louise Brodie (Lucentlands) and Prof Stephanie Midgley (WCDoA)

David Farrell (Blue North) and Dr Ilse Trautmann (WCDoA)

Top left to right: David Farrell (Blue North), Chantelle Smit (Blue North), Malissa Murphy (Blue North), Nitasha Baijnath-Pillay (Hortgro), Keenan Naicker (Blue North), Anél Blignaut (Blue North), Tania Coetsee (Blue North), Amber Paulse (Blue North). Front left to right: Alexis Oosthuizen (Blue North), Joné Carter (Blue North), Solène Reed (Blue North), Dr Ilse Trautmann (WCDoA), Prof Stephanie Midgley (WCDoA), Wilmie Cronjé (Blue North), Eddie Vienings (Blue North)

GREENCAPE PUBLISHES 2025 SUSTAINABLE AGRICULTURE MARKET INTELLIGENCE REPORT (MIR)

The 2025 Sustainable Agriculture Market Intelligence Report (MIR) is compiled for investors and suppliers to the sustainable agriculture sector in the Western Cape. It highlights smart farming and undercover farming as areas that offer opportunities for investors, agricultural and green technology manufacturers, service providers, distributors and others in the value chain.

This report provides updates on smart farming, and has a particular focus on precision-spraying using drones. It also provides an update on undercover farming, last featured in the 2021 Sustainable Agriculture MIR, as this market is particularly active due to strong market drivers.

Please click here to download the 2025 MIR Report for Sustainable Agriculture: https://greencape.co.za/wp-content/uploads/2025/04/WEB-2025-Sustainable-Agriculture-MIR.pdf

SHOWCASING RESEARCH AND YOUNG SCIENTISTS

DR TENEILLE NEL

Doctor of Philosophy in the Department of Soil Science in the Faculty of AgriSciences at Stellenbosch University, 2024

TITLE: TERMITE-AFFECTED SOILS IN THE WESTERN CAPE – A TOOLKIT FOR THE ASSESSMENT OF OXALOTROPHY AND CARBON STORAGE POTENTIAL

Supervisor: Prof Catherine E. Clarke
Co-supervisor: Dr Michele L. Francis

Dr Teneille Nel at her graduation in December 2024

THESIS ABSTRACT

Soil carbon (C) sequestration is a nature-based strategy to reduce atmospheric CO_2 levels. Soil inorganic carbon (SIC) represents a store of durable C in (semi-)arid soils. Earthen mounds (*heuweltjies*) occupied by *Microhodotermes viator* termites are ubiquitous in the Greater Cape Floristic Region of South Africa and may be active sites for the biogenic formation of calcium carbonate ($CaCO_3$) via the oxalate-carbonate pathway (OCP).

However, a lack of techniques to monitor the OCP has hindered its investigation. The impact of land use change on C storage capacity of *heuweltjies* demands research efforts to inform land-use decisions. No studies have confirmed whether OCP is active in heuweltjie soils or assessed the quantity and distribution of soil organic C (SOC) and SIC in *heuweltjies* of mesic climatic regions.

The aims of this study were to develop an analytical toolkit to identify and monitor the OCP and apply these techniques to evaluate biotic and abiotic drivers of C dynamics in termite-affected soils. This toolkit included novel methods of quantifying oxalate concentrations in environmental samples by mid-infrared (MIR) spectroscopy and monitoring soil pore gas composition in incubation experiments. Soils, vegetation and termite frass (excrement) from semi-arid and mesic regions (Koringberg and Stellenbosch) and from cultivated and uncultivated *heuweltjies* were compared to evaluate climatic controls as well as the impact of land-use change on C dynamics in the mounds.

The heuweltjie in Stellenbosch contributed to 51% of landscape SOC stocks (predominantly in the topsoil) and subsoil alkalinization suggested that bicarbonates may be produced in these *heuweltjies* and leached to aquifers for long-term C storage. In Koringberg, heuweltjie subsoils were enriched in SOC and SIC relative to off-mound soils. The SOC enrichment factor of uncultivated heuweltjie topsoils relative to off-mound soils was up to 5.6 times greater than that of cultivated mounds due to higher organic C content of frass derived from renosterveld vegetation compared to crops. The deeper, cultivated mound (up to 140 cm depth) stored more C than the shallower mounds in undisturbed soil (mean maximum depth of 85 cm) and contributed 53% toward total landscape C stocks. MIR spectroscopic models accurately quantified CaOx in compound clay mineral mixtures, frass samples and vegetation extracts (normalized root mean squared error of prediction ≤ 0.07).

Higher soluble oxalate content in vegetation from drier climatic zones may reflect drought stress-induced oxalate synthesis in plant tissues of these regions. CaOx in frass samples may have degraded more rapidly in soils with greater moisture content. Increases in pH, calcite saturation index and apparent respiratory quotient values provided evidence of oxalotrophy in heuweltjie soils treated with CaOx or frass. Soils treated with frass sequestered more C (18.5% increase) than CaOx treatments, which may be attributed to CO_2-fixation. Decreased apparent respiratory quotient (ARQ) values in frass treatments (ca. 0.5 units lower than the control) suggested preferential metabolism of lignin. This study provides an analytical toolkit that enables more comprehensive assessment of C dynamics in oxalate-rich ecosystems to inform land use decisions based on evaluation of climate-regulating ecosystem services.

PUBLISHED FIRST-AUTHOR ARTICLES FROM THE THESIS:

- Nel, T. et al. 2025. Impacts of land use change on carbon storage in termite mounds of South Africa. Catena. https://doi.org/10.1016/j.catena.2025.109141
- Nel, T. et al. 2025. Oxalate content of vegetation and termite frass in western South Africa. Ecosphere. https://doi.org/10.1002/ecs2.70265
- Nel, T. et al. 2025. Carbon dynamics in termite mounds: The effect of land use on microbial oxalotrophy. Catena. https://doi.org/10.1016/j.catena.2025.108947
- Nel, T. et al. 2024. Efficient quantification of soluble and insoluble oxalates in clay mineral mixtures. Communications in Soil Science and Plant Analysis. https://doi.org/10.1080/00103624.2024.2336574

DR DOUW BODENSTEIN

Doctor of Philosophy in the Department of Soil Science in the Faculty of AgriSciences at Stellenbosch University, 2025.

TITLE: EVALUATION OF SELECTED GLOBAL AND REGIONAL SOIL MAPS FOR SOIL CARBON CONTENT MODELLING OF AREAS OF SOUTH AFRICA

Supervisor: Prof Catherine E. Clarke
Co-supervisors: Dr Stephan van der Westhuizen and Dr Andrew Watson

Dr Douw Bodenstein

THESIS ABSTRACT

Southern Africa faces climate variability, compromised food and water security, as well as the loss of ecosystem functions due to high greenhouse gas levels, like carbon dioxide. Environmental models, such as hydrological models, Earth Systems Models and Land Surface Models, as well as carbon turnover models, are often used to investigate the systems in which these problems occur. Soil maps serve an important purpose for many of these environmental models by providing spatially distributed information about soil types and properties.

The most intensively researched soil property of these maps is soil organic carbon (SOC). Soil organic carbon is an important component in soil systems, which impact local ecosystems and global carbon circulation systems. Global and regional soil maps like the Harmonized World Soil Database v1.2 (HWSD), SOTER (Soil and Terrain Digital Database) maps, and SoilGrids are often used in environmental models. Numerous soil maps therefore exist for the use in environmental models. However, few modelling studies critically evaluate the soil map used and likely depend on the implied accuracies of the maps.

This study assessed the accuracy of global and regional soil maps for a portion of southern Africa by comparing the mapped soil properties to those from two soil profile databases. The investigated soil maps were the HWSD, AfSoilGrids250m , and SOTER for southern Africa, while the profile databases were the African Soil Profile Database (AfSIS) and the South African Soil Profile Database. The analyses revealed that, for most cases, the modelled and observed data correlated poorly but that the AfSoilGrids250m map was the most representative of field conditions.

This research study further developed a 3D Random Forest machine learning model to predict SOC concentrations at six standard depths for South Africa. A similar modelling approach to SoilGrids2.0 was implemented, in which depth was used as a covariate, thereby allowing for the prediction of soil properties in three dimensions. The SOC maps obtained from the model were compared to SoilGrids2.0 as well as with data from the South African Soil Profile Database.

The results showed that the new SOC maps for South Africa were able to predict carbon concentrations in texturally contrasting soils more accurately than SoilGrids2.0. The final component of this research used the existing global soil maps (HWSD and SoilGrids2.0), together with the newly developed SOC map of South Africa, to estimate the carbon sequestration potential of a semi-arid, Mediterranean rainfall region in South Africa.

The results showed that the RothC-26.3 carbon turnover model could be calibrated for the study region and that the model could be used to predict carbon sequestration potential. The results further indicated that the choice of soil basemap is important, as the basemap impact the predicted rate of carbon sequestration.

PUBLISHED FIRST-AUTHOR ARTICLE FROM THE THESIS:

- Bodenstein, D., Clarke, C., Watson, A., Miller, J., van der Westhuizen, S., Rozanov, A., 2022. Evaluation of global and continental scale soil maps for southern Africa using selected soil properties. Catena (Amst) 216. https://doi.org/10.1016/j.catena.2022.106381

UPCOMING CONFERENCES

1

GARDEN ROUTE ENVIRONMENTAL FORUM (GREF): CLIMATE CHANGE AND ENVIRONMENTAL MANAGEMENT INDABA

June 27, 2025
Main Auditorium, Nelson Mandela University

Theme: A global re-look at Climate Change and securing sustainable funding mechanisms for resilient landscapes in the Southern Cape

To register contact Louise Mare: louisamare@gmail.com

2

ADAPTATION FUTURES 2025 (AF2025)

13-16 October 2025
Te Pae Christchurch Convention Centre
Ōtautahi Christchurch
NEW ZEALAND

Hybrid (in-person and virtual)
Adaptation Futures Conference 2025

AF2025 is a unique opportunity to share new ideas, network with 1500 people from around the world and online and inspire action to accelerate climate adaptation!

AF2025 will recognise the vital role of Indigenous and local knowledges and insights from Oceania. AF2025 aims to support Global South, Indigenous and youth leadership at this global event.AF2025 will offer innovative, inclusive and interactive discussion formats, face to face and online. Alongside welcoming traditional papers/panels and posters to ignite action and share new insights we encourage 'co-creation' sessions including workshops/talanoa-wānanga opportunities for rich discussion, feedback and new knowledge creation. AF2025 will intentionally stimulate inclusive, disruptive and challenging conversations to accelerate adaptation.

3

Technical Field Days presented by the Western Cape Department of Agriculture in partnership with farmers and industry bodies

Registration details for these events will be made available later in the year. Please SAVE-THE-DATES!

- Conservation Agriculture Western Cape (CAWC) Jack Human Week: 6-7 August 2025, Percheron Hall, Elsenburg, and Tygerhoek Research Farm, Riviersonderend.

Book tickets here: https://www.quicket.co.za/events/300102-blwk-se-jack-human-bewaringslandbouweek/?ref=invite&?utm_source=invite&utm_medium=email&utm_campaign=invite_system#/

- SSK Winter Cereal Information Day: 27 August 2025, Uitkyk, Riversdale
- SKOG Information Day: 28 August 2025, Langgewens Research Farm
- Outeniqua Information Day: 17 September 2025, Outeniqua Research Farm
- Hopefield Information Day: 19 September 2025, Waterboerskraal, Hopefield

4

Western Cape Agricultural Research Forum (WCARF)

18 September 2025
Elsenburg

For more information contact Dr Ilse Trautmann:
ilse.trautmann@westerncape.gov.za

5

30TH UNITED NATIONS CLIMATE CHANGE CONFERENCE 2025 (UNFCCC COP30)

10-21 November 2025
Belém, Brasil
https://cop30.br/en

BECOME PART OF THE SMARTAGRI DRIVE

Interested persons who would like to get more information on SmartAgri and its related actions, are invited to contact Prof Stephanie Midgley: stephanie.midgley@westerncape.gov.za. Please subscribe to the SmartAgri Barometer if you would like to be updated on a regular basis.

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Newsletter compiled by:

Prof Stephanie Midgley
Specialist Scientist: Climate Change
stephanie.midgley@westerncape.gov.za

Lee-Ann Bell
Information Developer
lee-ann.bell@westerncape.gov.za

SMARTAGRI Newsletter
stephanie.midgley@westerncape.gov.za

Web: www.elsenburg.com
www.greenagri.org.za

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