



ANNUAL REPORT 2024



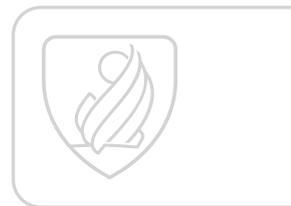
UNIVERSITY OF THE
FREE STATE
UNIVERSITEIT VAN DIE
VRYSTAAT
YUNIVESITHI YA
FREISTATA



UFS
NATURAL AND
AGRICULTURAL SCIENCES

FACULTY OF NATURAL AND AGRICULTURAL SCIENCES

ANNUAL **REPORT**
20**24**



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NATURAL AND AGRICULTURAL SCIENCES

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FROM THE DEAN'S OFFICE

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FROM THE DEAN'S OFFICE

MESSAGE FROM THE DEAN, PROF PAUL OBERHOLSTER



Prof Paul Oberholster

This year marked the beginning of my five-year term as Dean, offering me the privilege to witness the remarkable depth of talent, resilience, and innovation that define our Faculty community.

Despite persistent financial pressures across the higher education sector, our Faculty continued to thrive. Staff and students alike have shown extraordinary commitment to academic excellence and public value creation. Our departments sustained strong research momentum, enriched the quality of academic programmes, and advanced partnerships that enhance both societal relevance and institutional sustainability. Among the highlights of 2024 were the commissioning of advanced research infrastructure, including a high-definition CNC plasma cutter, next-generation sequencing equipment, and the establishment of the Algae Plant, which collectively strengthen our long-term research capacity and third-stream income potential.

Research productivity continues to be a cornerstone of the Faculty's reputation. Departments such as Plant Sciences, Genetics, Chemistry, Microbiology and Biochemistry, and Soil, Crop and Climate Sciences achieved outstanding outputs and cultivated impactful national and international collaborations. Several colleagues earned NRF-ratings, presented at prestigious conferences, and secured competitive external grants. Their work reflects a shared commitment to addressing the grand challenges of our time – food and water security, sustainable

agriculture, biodiversity conservation, and the health of ecosystems and communities.

At the heart of our mission remains student success. Our undergraduate and postgraduate students distinguished themselves through academic awards, conference presentations, and postgraduate completions. The significant number of master's and doctoral graduates, particularly in applied fields such as Disaster Management, underscores our role in shaping skilled professionals equipped to serve South Africa and the wider continent.

The Faculty also underwent several external reviews in 2024, all affirming the high quality and strategic alignment of our programmes with UFS Vision 130. These evaluations recognised our academic integrity and offered valuable direction for ongoing improvement.

We strengthened our international presence through staff exchanges, joint workshops, and participation in continental initiatives such as the African Union's Biennial Report on Disaster Risk Reduction. Collaboration with industry partners, conservation agencies, and government departments deepened the Faculty's societal impact and visibility.

I wish to express my sincere gratitude to our academic and support staff for their tireless dedication during a year of transition and consolidation. I also congratulate colleagues who received promotions, research awards, or new leadership appointments. Your contributions enrich our collective progress. My heartfelt thanks extend to the Vice-Deans, Prof Johan van Niekerk (Agriculture), Prof Liezel Herselman (Teaching and Learning), and Prof Sam Adelabu (Research and Postgraduate Studies), for their steadfast commitment, collegiality, and daily support in driving the Faculty's strategic priorities forward.

As we look to the future, the Faculty of Natural and Agricultural Sciences remains committed to advancing excellence in teaching, learning, and research, while deepening our contribution to a sustainable and inclusive society. Together, we will continue building a faculty that leads with integrity, relevance, and a shared sense of purpose.

VICE-DEANS PORTFOLIOS | 2024



Prof Liezel Herselman
Vice-Dean: Teaching and Learning



Prof Samuel Adelabu
Vice-Dean: Research and Postgraduate Studies



Prof Johan van Niekerk
Vice-Dean: Agriculture



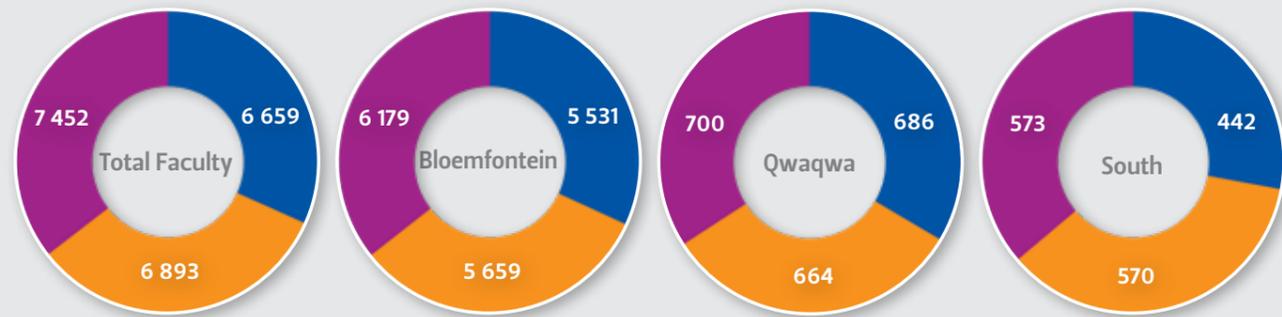
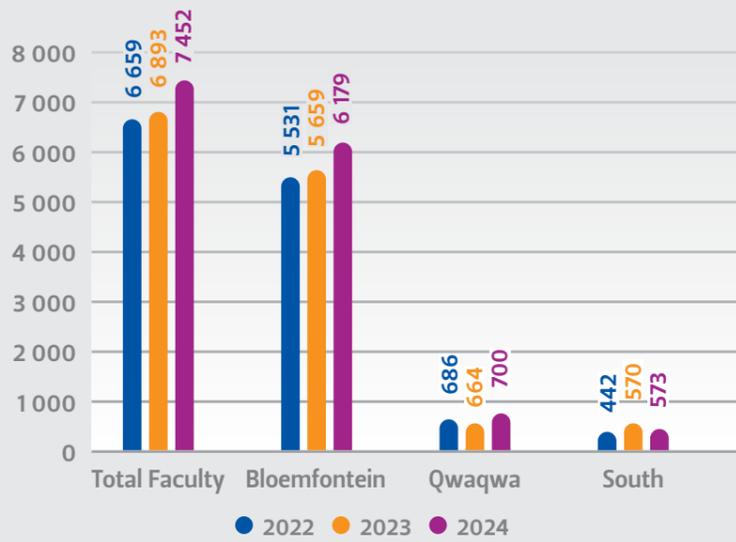
Prof Aliza le Roux
Assistant Dean: Qwaqwa Campus



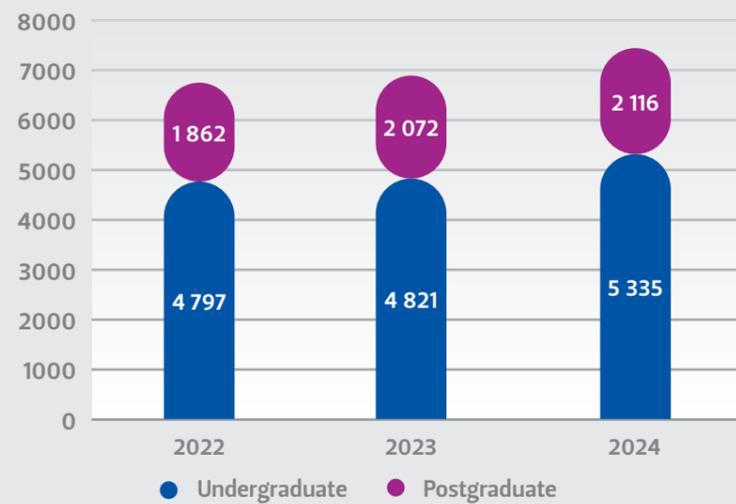
SNAPSHOT OF THE FACULTY | 2024

Student Profile

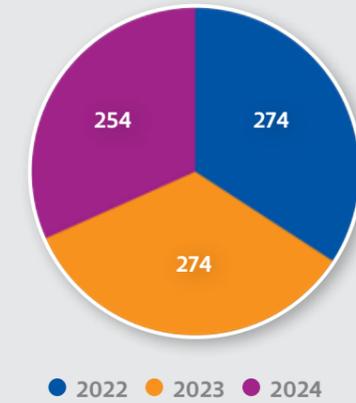
TOTAL REGISTRATIONS BY CAMPUS (2022-2024)



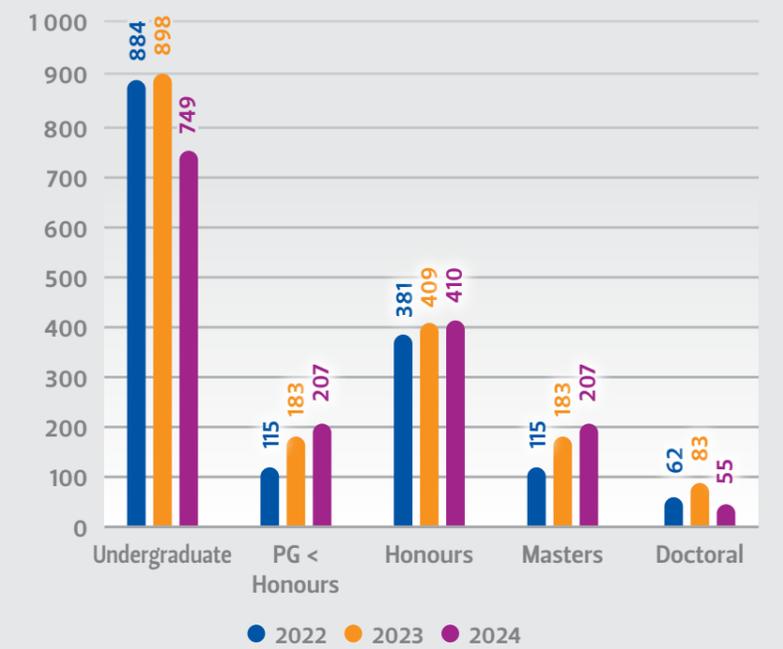
STUDENT NUMBERS (2022-2024)



INTERNATIONAL STUDENTS (2022-2024)



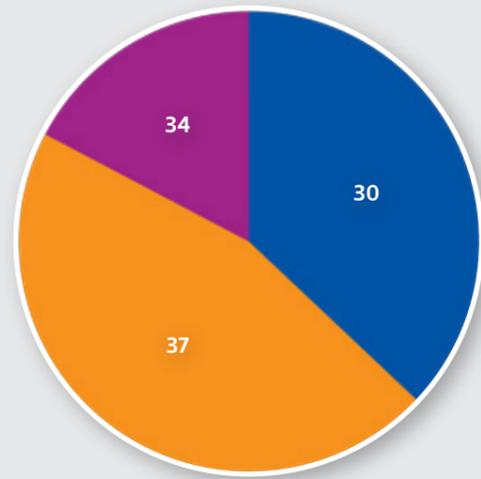
GRADUATES BY QUALIFICATION LEVEL (2022-2024)



Research Profile

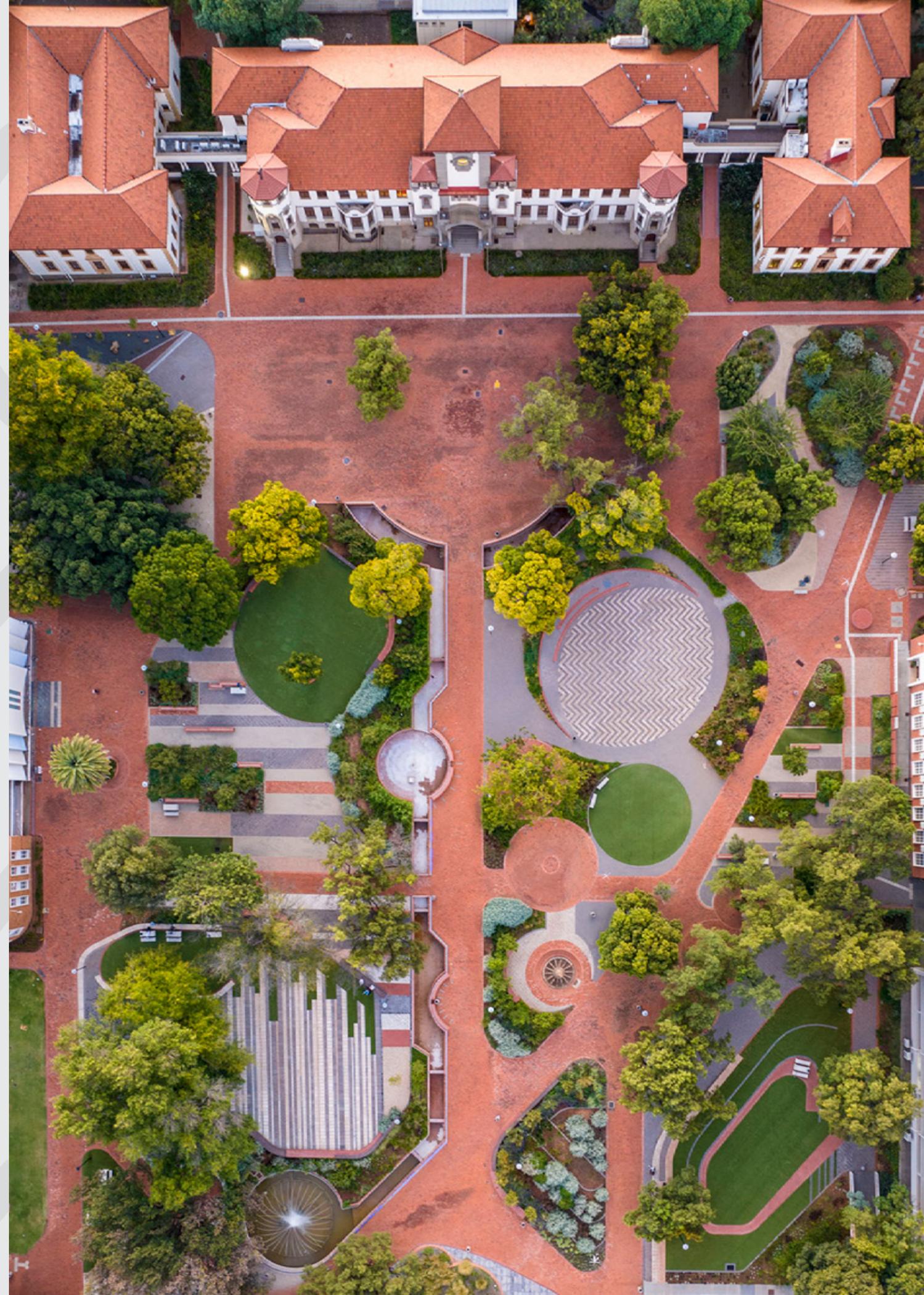
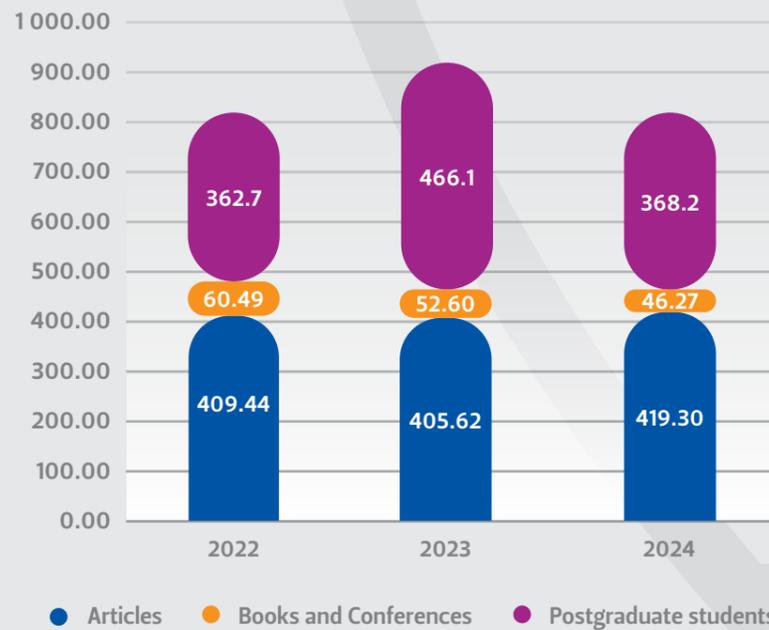


POSTDOCTORAL RESEARCH FELLOWS BY NATIONALITY (2024)



- South Africa
- Rest of Africa
- Other countries

RESEARCH OUTPUT UNITS (2022-2024)





AGRICULTURAL
SCIENCES



DEPARTMENT OF
**AGRICULTURAL
ECONOMICS**

FACULTY OF NATURAL AND AGRICULTURAL SCIENCES



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OVERVIEW OF 2024

The Department of Agricultural Economics performed well during 2024 from an academic and engagement point of view. One of our colleagues, Dr Primrose Madende, successfully completed her PhD degree. Staff and students from the Department published 23 scientific papers in peer-reviewed journals and delivered three papers at international conferences. Staff members were also actively involved in the publication of articles in the popular press, participating in farmers' days and other industry engagements, as well as interviews on radio stations. Students from the Department also contributed to our academic and industry footprint by contributing to scientific publications and conference presentations.

From a staffing point of view, 2024 saw the resignation of one of our senior colleagues and the Academic Head of Department, Prof Frikkie Maré, who was appointed as the CEO of the Red Meat Producers Organisation. Prof Henry Jordaan was appointed as the new Academic Head of Department.

Overall, 2024 was a good year for the Department.

ACHIEVEMENTS

Staff Achievements

Markus Monteiro was promoted from Junior Lecturer to Lecturer.

Dr WA Lombard received a Y1 NRF-rating, which brought the total number of NRF-rated staff in the Department to three.



Markus Monteiro



Dr WA Lombard



Prof Yonas Bahta

Prof Yonas Bahta was ranked among the top 2% of scientific researchers globally in his field by Stanford University and Elsevier in 2024!

At the UFS Exceptional Academic Achievers Awards, hosted by the Centre for Teaching and Learning, Brent Jammer received the Khotatsa Award for Exceptional Teaching, recognising lecturers who go the extra mile for their students. Petso Mokhatla and Zimbini Coka were nominated for their paper contributions at this year's Teaching and Learning Conference.

At the International Food and Agribusiness Management Association's (IFAMA) annual conference held in Almeria, Spain, from 17



Petso Mokhatla, Brent Jammer, and Zimbini Coka

to 20 June 2024, Dr Primrose Madende, who was part of the international case study team, was awarded with the second prize.

We are very proud of our staff members who received awards and prizes at our annual year-end function and prize-giving ceremony. These were:

- Best Achievement in Research: Prof Yonas Bahta
- Best Progress in Research: Dr Lindie von Maltitz
- Best Achievement in Teaching and Learning: Prof Yonas Bahta
- Best Progress in Teaching and Learning: Zimbini Coka and Markus Monteiro
- Best Achievement in Engaged Scholarship: Prof Yonas Bahta
- Best Progress in Engaged Scholarship: Dr WA Lombard
- Best Achievement in Administration and Leadership: Dr WA Lombard
- Best Progress in Administration and Leadership: Prof Yonas Bahta
- Special Award Ranked among the top 2% of scientific researchers: Prof Yonas Bahta



Dr Primrose Madende

Student Achievements

Some of our Master's students took part in a Student Case study competition at the International Food and Agribusiness Management Association's (IFAMA) annual conference. The event, held in Almeria, Spain from 17 to 20 June, brought together academics and industry professionals from the agricultural sector to explore innovations, trends, and collaborative opportunities. The vibrant atmosphere of the gala, with elegantly set tables and cheerful attendees, highlights one of the many opportunities the students had to engage with industry leaders and students on an international level.



From the left, Siphwe Tshabalala, Elené Wessels, Likhanyise Matebese, and FC Fourie

Three of our Honour's students, Levandré Theys, Hanno Jordaan, and Meyer van der Merwe, participated in the Agbiz Student Case Study Competition at the Agbiz (Agricultural Business Chamber), conference that was held at Sun City from 5 to 7 June 2024. Levandré Theys was part of the team, consisting of students from various South African universities, which was crowned as the winning team. Agbiz emphasises close collaboration with academia, providing students with a platform to demonstrate their skills to future employers and industry collaborators.



From the left, Nomthandazo Pretty-Girl Mkhize (University of KwaZulu-Natal), Diaan Venter (University of Pretoria), Levandré Theys (University of the Free State), and Marco Appel (University of Stellenbosch)

The following students received awards and prizes at our annual year-end function and prize-giving ceremony:

- Service to the Department: FC Fourie
- Student Ambassador: LG Theys

TEACHING AND LEARNING

The Department of Agricultural Economics offers three undergraduate programmes – BSc Agricultural Economics, BAgri Agricultural Economics, and BAgri Agricultural Management. At postgraduate level students can do Honours and Master's in all three programmes, and Doctoral degrees in Agricultural Economics or Agricultural Management.

At the UFS Annual Learning and Teaching Conference held on 17 September 2024, Petso Mokhatla and Zimbini Coka showcased their work in the category 'Innovating My Curriculum Through Student Engagement and Motivation'. Petso delivered their paper 'Enhancing Teaching and Learning Through Community Engagement to Bridge the Gap Between Theory and Practice'. while Zimbini presented their poster 'Integrating Work-Based Learning in Agricultural Management: Bridging Theory and Practice'.

The Department remains committed to blended learning, ensuring students gain real-world agricultural experience alongside their academic studies. This is achieved, inter alia, through visits to farms and other real-world environments, such as the following:

On 6 March 2024, our BAgri Agricultural Management Honours class, together with their lecturers Petso Mokhatla and Zimbini Coka, visited Khumo Flats Farm in Thaba 'Nchu, owned by Sebopelo Segwe, to gain first-hand knowledge of crop production management.

On 25 April 2024 the same group went on a field trip to Georgina Farm owned by Dr Dan Mosia, in Bainsvlei. The purpose of the farm visit was to provide students with practical experience in farm business



Dr Dan Mosia addressing the Agricultural Management Honours class



Agricultural Management Honours class with Petso Mokhatla and Zimbini Coka on Khumo Flats Farm, Thaba 'Nchu

management, allowing them to observe and analyse real-world operations. They also had the opportunity to engage with farm owners, enabling them to understand the challenges and strategies involved in running a successful agricultural enterprise. These experiences helped bridge a gap between theoretical knowledge and practical application, equipping students with valuable insights into the complexities of agribusiness management.

Brent Jammer rewarded the top-performing students from his Agricultural Finance class (AGEC1624) South Campus, by taking them to the annual Free State Angus Cattle Breeders Club

production auction on Friday, 11 October, at the Bloemfontein Showgrounds. This opportunity gave students hands-on experience in production auctions and animal breeding, giving them practical exposure beyond the classroom.



Brent Jammer (right) and some of the AGECE 1624 students

RESEARCH, INNOVATION AND RESEARCH COLLABORATION

Our research endeavours during 2024 continued around four broad themes:

- Water-related research, mainly funded by the Water Research Commission (WRC);

- (ii) Research on livestock economics, mainly funded by the Red Meat Research and Development South Africa (RMRD SA) and industry partners;
- (iii) Projects concerning drought and small-scale producers, mainly funded by the National Research Foundation (NRF); and
- (iv) A research project exploring the use of extended reality to enhance the learning experience of agricultural students.

The research team of Prof Yonas Bahta and Prof Henry Jordaan focuses on sustainable water use for food production. They are busy with a WRC-funded project on 'Assessing the social and economic impact of changed water use behaviour in food production in South Africa', which will continue into 2025. Currently working with them on this project are one PhD student, two Master's students, and one Honours student.

Pascalina Pilane is currently busy with her PhD research in which she is exploring the use of social sustainability assessments within the scope of water footprint methodology to inform sustainable water use in the production of table grapes and wine. This research is also based on a research project initiated and funded by the WRC.

Prof Bennie Grové's research focuses on modelling the water-energy-food nexus by combining mathematical programming, evolutionary algorithms and crop growth simulation for improved and sustainable water management. He completed a WRC project on 'Economic management of conjunctive use of irrigation water and root-accessible water tables'. At the same time, his research on the transfer of the custodianship of SAPWAT from PICWAT Consulting to the UFS is ongoing.

Dr Walter van Niekerk's primary research focus in 2024 was related to the livestock industry, especially factors influencing productivity in the livestock and related sectors on a macro-economic level. Due to his practical involvement in primary field crop production, he also has a growing interest in research related to the optimisation of production aspects. His research interests also include understanding the factors affecting lucerne hay production profitability within the industry and related sectors.

Prof Henry Jordaan, Dr WA Lombard, and PhD student Danie Naudé, are actively involved in a multidisciplinary research project with colleagues from the School of Nursing and the Department of Computer Science and Informatics in which they explore how extended reality can be used to enhance the learning experience of agricultural students. Danie is currently developing a framework, through his PhD research, that will guide the application of extended reality in agricultural education, which has the potential to transform the learning experience in this vital sector. Prof Jordaan visited Moi University in Kenya, in September 2024, along with colleagues from the School of Nursing (Prof Lizemari Hugo-van Dyk, an expert in nursing education) and the Department of Computer Science and Informatics (Dr Bennie Botha, a specialist in human-computer interaction). During the visit they forged valuable connections with faculty members from the agricultural faculty as part of an ongoing project focused on implementing extended reality technologies in an African context. This innovative, multidisciplinary research initiative embodies the spirit of collaboration across fields. While Prof Jordaan was the only member of our department present at Moi University, Dr WA Lombard and Danie Naudé are also collaborating on this project.



From the left, Dr Kipruto (HOD Agricultural Economics – Moi University), Prof Hugo-van Dyk (UFS), Prof Jordaan (UFS), Dr Saina (Dean of Agriculture – Moi University), Dr Mosol (HOD Nursing Education – Moi University), and Dr Botha (UFS), Dr Kebenei (HOD Agriculture, Animal Science & Natural Resources)

Two of our colleagues presented their research at the 24th International Farm Management Association (IFMA) Conference held in Saskatoon, Canada from 7 to 12 July 2024. Prof Bahta delivered a paper titled 'Water Resilience and Change of Water Use Behavior', and Brent Jammer delivered a paper on 'Economic Value of Sex-Sorted Semen in South Africa: A Beef Cattle Example'. The conference, with its theme 'Resilience Through Innovation', brought together experts and researchers from around the world to discuss and exchange ideas on enhancing agricultural practices through innovative solutions. We are thrilled to have our department represented on this prestigious international platform, contributing to the global conversation on agricultural resilience and innovation.



Brent Jammer (left) and Prof Yonas Bahta at the IFMA Conference

Prof Yonas Bahta and Dr WA Lombard represented the Department at the 32nd International Conference of Agricultural Economists held in New Delhi, India, from 2 to 7 August 2024. Prof Bahta delivered a research paper on 'The Impact of COVID-19 on the Value Chain, Food Security, and Factors Affecting Food Insecurity in Namibia', while Dr Lombard's paper was on 'Livestock Producers' Preferences for Oxytetracycline Antibiotics: An Eye-Tracking Approach in South Africa'.



Prof Yonas Batha and Dr WA Lombard

Dr Primrose Madende represented the Department at the 11th International Conference on Agriculture (AGRICO24) from 23 to 25 September in Bangkok, Thailand. She presented her research on empowering youth to actively participate in agricultural activities. Some of the most striking themes that emerged from the conference included climate change, food security, and resource management.



Dr Madende presenting at the AGRICO24 conference in Bangkok, Thailand

The presentation on the power of collaboration to address key challenges facing agriculture was particularly inspiring. The ideas and collaborations that can emerge from such engagements will undoubtedly drive positive change in the agricultural industry.

Dr Madende also participated in Intercontinental Conference on Sustainable Agriculture and Climate Resilience: A Management Perspective in Istanbul, Turkey, on 17 and 18 November 2024. Dr Madende shared her work on empowering youth for climate change adaptation and resilience. The conference provided a dynamic platform to connect with experts, scholars, and industry leaders to deliberate on the profound implications of climate change on agriculture and foster discussions that go beyond identifying challenges and focus on actionable strategies for building climate-resilient agricultural systems.



Dr Primrose Madende

With support from the UFS Centre for Graduate Support, the Department held a writing retreat from 12 to 14 November 2024 at Letsatsi Game Lodge, Smithfield, which was attended by postgraduate students and staff from the Department attended the retreat. Dr Willem de Lange from Stellenbosch University, an associate editor of the *Journal of Environmental Management*, provided valuable feedback as the guest reader.



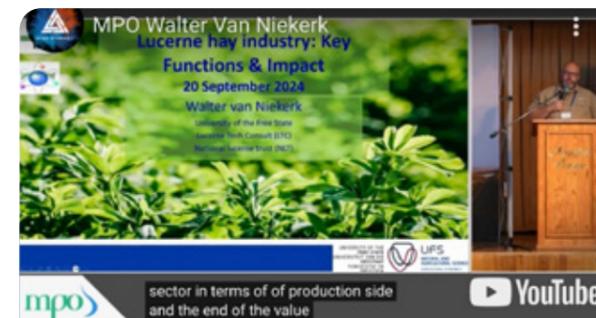
From the left, Prof Nicky Matthews, Prof Bennie Grové, Pascalina Pilane, Dr Willem de Lange, Dr Lindie von Maltitz, Zimbine Coka, and Stephen Nyaki

ACADEMIC CITIZENSHIP AND COMMUNITY ENGAGEMENT

As the Department of Agricultural Economics operates within a very diverse and dynamic agricultural sector, we are actively involved in a wide range of engagements within the sector to give back to the farming community at large. During 2024, this was done through participation in farmer's days, farmer-arranged conferences, and also through publications in popular media, such as *Farmer's Weekly*, *Veeplaas*, *Landbou Weekblad*, *Stock Farm* and *Farmbiz*. Our staff were also regular guests on radio programmes on OFM and RSG.

As part of our ongoing engagement with the agricultural community, Dr Walter van Niekerk delivered a presentation titled 'Lucerne Hay Industry: Key Functions & Impact' at the Milk Producers' Organisation (MPO) Annual General Meeting on 20 September 2024. Dr van Niekerk remained actively involved with the National Lucerne Trust (NLT), which provides training days for lucerne producers and role players. In his role as a technical adviser to the NLT he ensures that the grading processes are

maintained to the highest standard, contributing to the industry's continued success.



Dr Walter van Niekerk presenting at the MPO Annual General Meeting

Markus Monteiro delivered a paper at the 3rd Annual Meeting of the National Grain Research Programme, hosted on the Bloemfontein Campus. The presentation on 'Maize Production Economics in South Africa: Examining Profitability Trends Over Time' shed light on the importance of considering inflation in profitability assessments.

Dr Lindie von Maltitz was one of the presenters at the 2nd SABI Technical Forum, held on 13 and 14 August, at the Indaba Hotel, Spa & Conference Centre in Sandton, which brought together industry experts to share valuable knowledge and ideas Dr Von Maltitz's presentation on 'Management Strategies for Agribusinesses in Times of Uncertainty' addressed



From the left, David van der Merwe (Chair – Raisins SA), Prof Bennie Grové (UFS), Ferdie Botha (CEO – Raisins SA), and Dr Walter van Niekerk (UFS)

essential strategies for navigating the challenges facing the agricultural sector today. Her participation highlights the expertise within the Department and underscores our commitment to advancing industry knowledge.

Prof Bennie Grové and Dr Walter van Niekerk, visited Raisins SA, where they assisted with calculating input costs and benchmarking raisin producers. They also had the opportunity to attend the 3rd Annual Raisins SA/Nedbank Symposium in Kakamas, that was held in September 2024.

Dr Lindie von Maltitz, Dr Walter van Niekerk, and Brent Jammer attended the launch of Standard Bank's 7th edition of the *Finance and Farm Management* textbook on 1 October 2024 in Sandton, Johannesburg. This updated edition includes essential topics like smart farming, HR management, and South African legislation, preparing the next generation of farmers to tackle modern agricultural challenges.



Prof Lizel Massyn (UFS Business School), Dr Cobus Oberholster (BKB), Dr Lindie von Maltitz, Brent Jammer, Dr Walter van Niekerk, Kholofelo Thobejane (VKB), and Prof Johan van Niekerk, Vice Dean of the Faculty of Agriculture (UFS)

Dr Walter van Niekerk and Markus Monteiro, visited Hoër Landbouskool Jacobsdal in May, and presented a guest lecture on marketing basics and SAFEX.



Markus Monteiro addressing some of the learners at Jacobsdal Landbouskool

Brent Jammer, alumnus of Vaal River High School, and an Honours student, Levandr  Theys, alumnus of Delportshoop High School, both in the Barkly West district, visited the Delportshoop High School in August 2024 to talk to the students about studying agriculture and the different careers in agriculture.



Levand  Theys (left) and Brent Jammer (right) with some of the learners at Delportshoop High School

POSTGRADUATE STUDENTS

In 2024, a total of 75 students were registered for the three Honours programmes offered by the Department, 20 students for a Master's degree

and 11 for the PhD degree. Seventy-one students graduated with an Honours degree, eight with a Master's degree and one with a PhD degree.

Primrose Madende graduated with her PhD. The title of her thesis was 'Tailor-made development pathways to enhance youth participation in agriculture'. Her supervisors were Dr JIF Henning and Prof H Jordaan.



From the left, Prof Henry Jordaan, Dr Primrose Madende, and Dr Janus Henning

POSTDOCTORAL RESEARCH FELLOWS

Dr Stephen Nyaki, from Tanzania, joined the Department in March 2024. His research focuses on climate change, water use behaviour, and development. He is supervised by Prof Yonas Bahta.

STAFF MATTERS

After 16 years with the Department of Agricultural Economics, Prof Frikkie Mar  left at the end of

January 2024, and joined the RPO (Red Meat Producers Organisation) as CEO (Chief Executive Officer).

In January 2024, Dr Christo Joubert sadly passed away. He was a senior lecturer in the Department for one year.

RESEARCH OUTPUTS

Research Articles

Bahta, Y.T. & Nyaki, S.A. 2024. Livelihood vulnerability from drought among smallholder livestock farmers in South Africa. *Hydrology* 11: 137. DOI: 10.3390/hydrology11090137.

Conradie B., Matthews, N. & Bahta, Y. 2024. Benefits of herding on communal rangeland in Free State Province, South Africa. *South African Journal of Agricultural Extension* 52(5): 36-52. DOI: 10.17159/2413-3221/2022/v52n5a14651.

Kotze, H.C., Qotoyi, M.S.M.A., Bahta, Y.T., Jordaan, H. & Monteiro, M.A. 2024. A systematic review and meta-analysis of factors influencing water use behaviour and the efficiency of agricultural production in South Africa. *Resources* 13: 94. DOI: 10.3390/resources13070094.

Hadebe, R., Grov , B., Matthews, N. & Barnard, J.B. 2024. Bio-economic analysis of irrigation schedules considering shallow groundwater: lessons from South Africa. *Applied Water Science* 14: 190. DOI: 10.1007/s13201-024-02241-z.

Marais, M., Jordaan, H., Lombard, W.A. & Bahta, Y.T. 2024. Assessing the potential of a niche market for wool products in South Africa. *AIMS Agriculture and Food* 9(1): 108-128. DOI: 10.3934/agrfood.2024007

Mokati J.T.W., Ncube, A. & Bahta, Y.T. 2024. Is it really feminization of Agriculture? The issue of household food security in Lesotho's Southern Lowland District. *Journal of Asian and African Studies* 59 (2): 411-424.

Monteiro, M.A., Bahta, Y.T. & Jordaan, H. 2024. A systematic review on drivers of water-use behaviour among agricultural water users. *Water* 16: 1899. DOI: 10.3390/w16131899.

Monteiro, M.A. & Jammer, B.D. 2024. Price dynamics in South African agriculture: A study of cross-commodity spillovers between grain and livestock Markets. *Sustainability* 16(8): 3136. DOI: 10.3390/su16083136.

Muhame, C., Ncube, A. & Bahta, Y.T. 2024. Dissemination and participation in early warnings and disaster risk reduction in South Africa. *Jamba: Journal of Disaster Risk Studies* 16(1): a1566. DOI: 10.4102/jamba.v16i1.1566.

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STAFF (2024)

Head of Department:
Prof H Jordaan

| | |
|------------------------|--|
| Professor: | Prof YT Bahta |
| Associate Professors: | Prof B Grové, Prof H Jordaan, and Prof N Matthews |
| Senior Lecturers: | Dr JIF Henning, Dr WA Lombard, and Dr HN van Niekerk |
| Lecturers: | B Jammer, P Mokhatla, MA Monteiro, P Pilane, and Dr L von Maltitz |
| Junior Lecturer: | Z Coka |
| Programme Director: | Dr WA Lombard |
| Researcher: | Dr P Madende |
| Research Assistants: | FC Fourie, D Grové, H Kotzé, HC Jordaan, H Kotzé, L Matabese, R Msila, D Naudé, LG Theys, S Tshabalala, M van der Merwe, H Venter, and E Wessels |
| Research Fellows: | Dr E Owusu-Sekyere, Dr B Riddout, Dr DB Strydom, and Prof FA Maré |
| Affiliated Associates: | PL Oosthuizen |
| Officers: | I Combrinck and C van der Merwe |



DEPARTMENT OF
ANIMAL SCIENCE

FACULTY OF NATURAL AND AGRICULTURAL SCIENCES



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OVERVIEW OF 2024

In the latter part of 2024, the El Niño weather pattern was replaced with the more favourable La Niña pattern. The prospect of a better rainy season in the southern Free State and Northern Cape was, however, soon dashed when the rains stayed away. This had a severe impact on veldt quality and quantity which led to high feed costs. Unfortunately, both feeder lamb and weaner prices remained at a similar level as in 2018 while input costs were soaring. This

placed livestock farmers in an extremely difficult position. In some areas the situation is so bad that urgent intervention is needed.

The Department of Animal Science had an excellent year with several achievements and highlights. A standout achievement in the Meat Science Section was the completion of the state-of-the-art meat processing laboratory. This new facility has already proven to be an invaluable resource, supporting a wide range of activities. It has been utilised for undergraduate student practicals, offering hands-on learning opportunities and enhancing the educational experience. Additionally, the laboratory has played a critical role in meat quality analysis as part of the Beef Genomics 2 (BGP2) programme. Furthermore, the lab has facilitated several research projects. This milestone not only elevates the quality of academic and research outputs but also strengthens the Animal Science Department's capacity to contribute to industry development,

Another notable highlight for the Department was the acquisition of the CASA (Computer-Assisted-Semen Analysis) equipment. Prof Van der Host conducted comprehensive training on this equipment with Dr O'Neill and Dr Maqhashu.

On the academic front the development of a structured Masters for MAgric students is nearing completion. Once finalised, this programme will serve as a cornerstone for cultivating future agricultural leaders.

Dr Beanelri Janecke recently assumed leadership of the Predation Management Centre (PMC), bringing fresh energy and new ideas to the role. Under her guidance, the PMC has already seen noticeable developments. One key milestone was the completion of the new laboratory and office facilities in August / September.

ACHIEVEMENTS

Staff Achievements

At the Annual General Meeting of the South African Society for Animal Science (SASAS) Free State Branch the following staff members were elected on the committee: Dr OB Einkamerer – Chairperson; Dr A Maqhasu – Vice Chairperson, and Dr HA O'Neill – Secretary



Mienke Botha

Student Achievements

Mienke Botha from the Department of Animal Science received the South African Society for Animal Science (SASAS) prize and the Dean's medal.

TEACHING AND LEARNING

The fourth-year Animal Breeding students successfully attended and completed two prestigious courses – the Simbra Inspectors Course and the Dohne Merino Breeders Course. These programmes provided students with valuable, hands-on experience and in-depth knowledge about breed standards etc.

The ANIN4864 students engaged in numerous practical sessions designed to enhance their hands-on learning experience. Some of these sessions were facilitated by industry experts, including Nicole van Niekerk (Adlibio) and Lubbe Jacobs (Lubern Feeds), who shared their expertise and insights with the students. In addition to the in-class practicals, students participated in several educational excursions. These included a Braunvieh technical session at Be Human, as well as two contrasting dairy farming systems – a pasture-based dairy farm and a Total Mixed Ration-(TMR-) based dairy farm (Homesek Farms).



ANIN4864 final year students at Homesek Farm (TMR-based dairy farm)

ANIN4864 students also participated in technical sessions featuring lectures delivered by prominent members of the feed industry. Experts from Vitam International provided an in-depth lecture on mycotoxins and silage. Representatives from Trouw Nutrition presented a session on the mineral nutrition of livestock.



ANIN4864 final year students attending a session delivered by Vitam International

The new third-year course in Animal Product Processing and the fourth-year course in Meat Science and Technology, as well as Dairy Science and Technology were offered for the second time in 2024. The students found the hands-on approach in the manufacturing of Meat and Dairy Products very satisfactory.

RESEARCH, INNOVATION AND RESEARCH COLLABORATION

Animal Breeding

Genotyping of Drakensberger cattle is currently underway. The aim of the research is to conduct genome wide association studies to identify a marker for the dermatosporax condition present in the breed. The research is led by Prof Cason in collaboration with several other institutes across the country.

Several members of Animal Breeding attended and presented at the European Federation of Animal Science (EAAP) 2024 Conference held in Florence, Italy, from 1 to 5 September 2024. Prof Errol Cason presented on his research with a presentation titled 'A genome-wide association study to identify the genetic origin of dermatosporax in South African Drakensberger cattle'. This focused on genetic signatures indicative of a connective tissue disorder in the South African Drakensberger population.



From the left, Prof Danie Vermeulen, Prof Frikkie Nesor, and Prof Errol Cason at the EAAP 2024 conference in Florence, Italy

Dr Michiel van Niekerk presented on 'Genomic evaluation of SA Holsteins incorporating local and foreign genetic markers under two production systems', showing that the addition of genomic information to existing pedigree information results in more accurate genetic relationships amongst animals and enhances prediction accuracy.

Participation in the conference allowed for strengthening of past collaborations and building future ones. With relation to future projects, discussions were held with Prof Vincent Ducrocq (Université Paris-Saclay, France), Prof Donagh Berry (Teagasc, Ireland), and Prof Mogens Sandø (Aarhus University, Denmark). While in Italy, we met with Dr Paul Boettcher at the Food and Agriculture Organisation (FAO) in Rome, and Prof Albino Maggio in Bellizzi at the agricultural and zootechnical farm 'Torre Lama' of the Università Dglo Studi Di Napoli Federic II.

Kovsie Fermentation Institute

The installation of the Kovsie Fermentation Institute was completed at the end of 2024. A canning and kegging plant as well as an additional fermenter were also installed.

Predation Management Centre contributions

On 1 March 2024, Dr Beanelri Janecke assumed the leadership of the Predation Management Centre (PMC) that falls under the Department of Animal Science. The PMC represents the tertiary institutions of South Africa at the Predation Management organisation of South Africa (PMSA). The annual general meeting was hosted by the Department and the PMC on the Bloemfontein Campus on 22 August 2024.

The Predation Management Forum met with Dr Janecke and Prof Frikkie Nesor in August. The goal was to discuss a coordinated approach to research projects and the professional and effective communication of the programme's objectives to various stakeholders. The forum consisted of representatives of the PMSA, National Wool Growers Association (NWGA), Red Meat Producers' Organisation (RPO), Wildlife Ranching South Africa (WRSAs), and Mohair SA.

Construction of the new laboratory and office for the PMC was finalised during August/September, and it looks great!

Dr Janecke presented a paper at the UFS Centre for Environmental Management's (CEM) 30th Anniversary Conference, held on 11 and 12 October on the Bloemfontein Campus. The title of her talk was 'Modern technological approaches to predator management for improved livestock protection and environmental monitoring'.

Centre of Meat and Dairy Science

Researchers from the Centre of Meat and Dairy Science published six articles and had three congress contributions during 2024. Lecturers from the Centre are currently supervising or co-supervising 13 MSc and three PhD students.

Three MSc students graduated from the Centre during 2024. Prof Arno Hugo and Prof Celia Hugo supervised MSc Agric student, Melissa Hatting with a dissertation titled 'The evaluation of rejected wet carcass syndrome lamb meat for human or animal consumption'. She graduated with distinction.



Example of wet carcass

Prof Celia Hugo and Prof Arno Hugo also supervised A Burger, for his MSc Agric on 'The evaluation of plant extracts as natural preservatives on the chemical, microbial and sensory quality of boerewors'.



Naturally preserved sausage

In the Dairy Section, S Cloete and JM Behrens, final year Dairy Science students in 2023, were awarded the Merit Award by the South African Society of Dairy Technology with a final average of 90% over their 2022 and 2023 study years.

A guest speaker, Mike Mouton, delivered a presentation on 10 October 2024 on milking parlours in South Africa to the Dairy Science Students.

A highlight in the Meat Science section was the completion of the new Meat Processing Laboratory. The facility is used for undergraduate student practicals, meat quality analyses for the Beef Genomics 2 (BGP2) Programme, as well as several research projects.



Students manufacturing polony in the new Meat Processing Laboratory

The Meat Science section started with a very interesting new research project undertaken by MSc student Rinus Behrens, titled 'To Shock or to Shoot –



Crocodile carcasses

The Effect on Crocodile Meat Quality'.

The Centre of Meat and Dairy Science continued their research collaborations with researchers from North-West University, University of KwaZulu Natal, Stellenbosch University, University of Pretoria, and Central University of Technology.

Rangeland and Wildlife Science

Wildlife Science hosted nine international students and collaborating partners from five continents, including Master's and Doctoral students from Peru, Canada, UK, Japan, Austria, USA, and the Netherlands.

Prof Miho Saito from Koyoto University in Japan is conducting her sabbatical research in South Africa with Prof Deacon as collaborator and host.

During August 2024, over 50 scientists, students, and team members assisted with the giraffe reproduction project at Amanzi.



ACADEMIC CITIZENSHIP AND COMMUNITY ENGAGEMENT

The Animal Physiology team (Dr O'Neill and Dr Maqhashu) actively engaged with the community by presenting Artificial Insemination (AI) courses to farmers and interested students. As part of their community outreach efforts, they extended this training to 6 inmates from Grootvlei Correctional Services. Additionally, the team offered the course to students from the Peritum Agricultural College.



Students from Peritum Agricultural College attending an AI course

Dr Janecke, Director of PMC, assisted in drawing up a Strategic Management / Business Plan for the PMSA organisation and compiled a report on all the research undertaken over a ten-year period on predators and predation management. The plan aims to align the organisation with the Red Meat Industry Strategy of 2030.

The PMC featured in the *Veeplaas* and *Landbouweekblad* magazines during August and September 2024 to introduce the new leadership of the centre. Dr Janecke also writes a monthly article for the *PMSA newsletter* on any relevant topic.

Prof Nesor delivered an invited talk at the 2024 Aldam Stockman School as well as at the 70-year celebrations of the Brahman breed in southern Africa in Windhoek. He was also invited to talk at the National Wagyu Congress held at Maselspoort



near Bloemfontein. Prof Arno Hugo also delivered an invited talk at the 2024 Aldam Stockman School as well as the National Wagyu Congress held at Maselspoort near Bloemfontein.

Prof Cason presented a workshop in microbiome analysis as part of the UFS/NGS Intermediate to Advanced Bioinformatics International Workshop.

POSTGRADUATE STUDENTS

The total number of postgraduate students enrolled in 2024 in the Department of Animal Science was 87, in the following levels:

- **Honours (Total: 31 students)**
- **MSc (Total: 40 students)**
 - Animal Breeding: 2
 - Animal Nutrition: 12
 - Wildlife: 6
 - Grassland Science: 2
 - Animal Physiology: 5
 - Animal Production: 5
 - Animal Science: 8
- **PhD (Total: 16 students)**
 - Animal Breeding: 9
 - Animal Nutrition: 2
 - Animal Science Physiology: 2
 - Wildlife Thesis: 2
 - Grassland Science: 1

Nine candidates graduated with a Master's degree in 2024: M Naude and KP Rasebapatja (majoring in Animal Nutrition); LD Barnard and T Mohlamme (majoring in Animal Production); J Scholtz (majoring in Animal Physiology); M Hatting (Majoring in Food Science); W Madikizela and C Visser (majoring in Grassland Science); and A Janse van Rensburg (majoring in Wildlife).

Doctoral degrees were conferred on the following four candidates in 2024:

Januarie, DA (Animal Breeding)

Thesis: Genetic and phenotypic characterization of the indigenous sanga cattle of Namibia

Supervisor: Prof FWC Nesor

Co-supervisors: Prof ED Cason and Prof JP Grobler

Pyoos, GM (Animal Breeding)

Thesis: Breed genetic and heterosis effects on variability of growth and efficiency traits in beef cattle

Supervisor: Prof FWC Nesor

Co-supervisor: Prof MM Scholtz

External supervisor: Dr MD MacNeil

Smit, ZM (Wildlife Science)

Thesis: The Impact of Severe Drought on The Vegetation of The Southern Kalahari

Supervisor: Dr PJ Malan

Co-supervisor: Prof F Deacon

Van der Walt, MS (Wildlife Science)

Thesis: The Long-Necked Animals, Searching for A Million Years of Similaritie

Supervisors: Prof F Deacon and Prof J Goedhals

Co-supervisor: Dr W Daffue



RESEARCH OUTPUTS

Research Articles

Aboshady, H., Gavriilidou, A., Ghanem, N., Radwan, M., Elnahas, A., Agamy, R., Fahim, N., Elsayy, M., Shaarawy, A., Abdel-Hafeez, A., Kantanen, J., Ginja, C., Makgahlela, M.L., Kugonza, D., Gonzalez-Prendes, R. & Crooijmans, R. 2024. Gut Microbiota Diversity of Local Egyptian Cattle Managed in Different Ecosystems. *Animals* 2752-1-2752-14.

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Einkamerer, O.B., Ferreira, A., Fair, M.D. & Hugo, A. 2024. The effect of dietary non-protein nitrogen content on the meat quality of finishing lambs. *South African Journal of Animal Science* 54: 340-357.

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Erasmus, M., Idris, O.A., Adetunji, A.I. & Cason, E.D. 2024. Biogenic synthesis and characterization of gold nanoparticles using transformed mesophilic *Escherichia coli* BL21 and thermophilic *Thermus thermophilus* HB27. *Biologia* 79: 2605-2619.

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Mhlongo, L.C., Mseleku, C., Tenza, T., Fomum, S., McGaw, J., Hassen, A. & Nsahlai, I. 2024. A Review of Ethnomedicinal Plants as Potential Anthelmintic Agents to Alternatively Control Gastrointestinal Nematodes of Ruminants in South Africa. *Journal of Parasitology Research* 2024: 7955692-1 - 7955692-11.

Mhlongo, L.C., Mseleku, C., Tenza, T. & Nsahlai, I. 2024. Factors Influencing Dietary Tannin Inclusion in Dairy Diets: A review. *Journal of Applied Veterinary Sciences* 9(1): 73-84.

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& Abbai, N. 2024. Comparison of the urinary microbiome in men who have sex with men with and without *Chlamydia trachomatis* infection. *European Journal of Clinical Microbiology & Infectious Diseases* 43: 2159-2170.

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Tenza, T., Mhlongo, L.C., Ncobela, C. & Rani, Z. 2024. Contribution of the informal market of village chickens to sustainable livelihoods in KwaZulu-Natal, South Africa. *East African Journal of Biophysical and Computational Sciences* 5: 13-24.

Tenza, T., Mhlongo, L.C., Ncobela, C. & Rani, Z. 2024. Village Chickens for Achieving Sustainable Development Goals 1 and 2 in Resource-Poor Communities: A Literature Review. *Agriculture-Basel* 14: 1264-1 - 1264-16.

Zenda, M. & Malan, P.J. 2024. Investigation of Challenges Faced by Small-Scale Sheep Farmers in the Northern Cape (Hantam Karoo), South Africa. *South African Journal of Agricultural Extension* 52(1): 189-209.

Zenda, M., Malan, P.J. & Geyer, A.C. 2024. An analysis of the wool characteristics that determine wool price for Merino wool in South Africa. *Scientific African* 23: e02005:1-e02005: 8.

Zenda, M., Malan, P.J. & Geyer, A.C. 2024. An Analysis of the Wool Characteristics That Determine the Wool Price for White Wool in South Africa. *South African Journal of Agricultural Extension* 52(1): 210-230.

Conference Contributions

Conference Papers / Posters

Balcha, E., Wilkes, A., Marquardt, S., Ndu'n'gu, P., Onyango, A., Merbold, L., Korir, D., Delprado, A., Pardo, G., Dominik, W., Lydia, L., Scholtz, M.M., Katongole, C., Vibeke, L., Assouma, M., Dossa, L., Du Toit, L., Todd, R., Peter, S., Kagai, J., Tadese, M., Gibbons, J., Odubote, I., Bateki, C. & Arndt, C. 2024. *Revised Protocol for Region-Specific Tier 2 Enteric Methane Emission Factors in African Cattle*. Poster presented at the International Research Symposium on Agricultural Greenhouse Gas Mitigation: from Research to Implementation, Berlin, Germany. 21-23 October 2024.

Barnard, L.D., Naser, F.W.C., Cason, E.D., Hugo, A. & O'Neill, H.A. 2024. *The effect of gender, days on feed and Zilpaterol hydrochloride treatment on the growth performance of feedlot cattle*. Poster presented at the 54th Annual SASAS Congress, East London, South Africa. 3-5 July 2024.

Bhika Kooverjee, B., Soma, P., Naser, F.W.C. & Scholtz, M.M. 2024. *Estimating the Breed Composition of Wet Carcass Syndrome-Affected Sheep in South Africa*. Poster presented at the 54th Annual SASAS Congress, East London, South Africa. 3-5 July 2024.

Chabalala, N., Chadyiwa, M., Mapholi, N. & Scholtz, M.M. 2024. *The effect of changes in the component traits of efficiency in beef cows on the farm-gate carbon footprint*. Poster presented at the 54th Annual SASAS Congress, East London, South Africa. 3-5 July 2024.

Deacon, F. & Daffue, W. 2024. *Collaring Himalayan brown bears: Insights and implications for conservation*. Poster presented at the Southern African Wildlife Management Association, Windhoek, Namibia. 6-11 October 2024.

Deacon, F., Maqhashu, A., Luther-Binoir, I., Daffue, W., Storbeck, K., Stander, M. & Bercovitch, F. 2024. *The relationship between age, ossicone volume, and testosterone concentration for prediction of sexual maturity in wild South African giraffes*. Poster presented at the Annual Conference of the International Embryo Technology Society, Denver, CO, USA. 9-12 January 2024.

Dedieu, B., Bankuti, F., Mokolobate, M.C., Chien, D., Damasceno, J., Maiwashe, A., Khanh, P., Rueda Garcia, A. & Scholtz, M.M. 2024. *Resilience and livestock production systems: long term dynamics*. Poster presented at the United Nations Science Summit - side event: Resilient and sustainable ruminant production in a changing climate, Virtual. 17 September 2024.

Diamond, S., Grobler, S., Scholtz, M.M. & Fourie, P. 2024. *Factors affecting longevity of the Koopmansfontein Bonsmara herd*. Poster presented at the 54th Annual SASAS Congress, East London, South Africa. 3-5 July 2024.

Granweiler, J. & Deacon, F. 2024. *Implications of topography on giraffe habitat use, suitability and population movement*. Poster presented at the Annual British Ecological Society, Liverpool, UK. 10-13 December 2024.

Grobler, S., Van der Westhuizen, H., Snyman, H.A., Scholtz, M.M., Naser, F.W.C., Greyling, J.P.C., Morey, L. & Trytsman, M. 2024. *The effect of two different grazing strategies on extensive beef production and rangeland basal cover in the Marikana*

Thornveld. Poster presented at the 54th Annual SASAS Congress, East London, South Africa. 3-5 July 2024.

Hugo, A., Roodt, E. & Van Wyngaard, B.E. 2024. *Factors affecting meat quality: What makes Wagyu unique?* Poster presented at the Wagyu Conference 2024, Bloemfontein, South Africa. 21-23 August 2024.

Hugo, A., Roodt, E. & Van Wyngaard, B.E. 2024. *Meat quality: Farm to Fork.* 16th LRF Stockman School: Theme: Being a resilient, Aldam, South Africa. 9-11 October 2024.

Janecke, B.B. 2024. *Modern technological approaches to predator management for improved livestock protection and environmental monitoring.* Poster presented at the Sustainable horizons – Navigating the future with environmental innovation. UFS Centre for Environmental Management (CEM) 30th Anniversary Conference, Bloemfontein, South Africa. 11-12 October 2024.

Jordaan, F., Scholtz, M.M., MacNeil, M.D. & Neser, F.W.C. 2024. *The effect of climate on the weaning weight of Bonsmara beef calves in hot and arid areas.* Poster presented at the 54th Annual SASAS Congress, East London, South Africa. 3-5 July 2024.

Kgari, R., Dzama, K. & Makgahlela, M.L. 2024. *Genomic evaluation of breeding values and their validation accuracies in South African Brahman cattle.* Poster presented at the 54th Annual SASAS Congress, East London, South Africa. 3-5 July 2024.

Korir, D., Wilkes, A., Marquardt, S., Ndun'gu, P., Onyango, A., Merbold, .L, Balcha, E., Delprado, A., Pardo, G., Dominik, W., Lydia, L., Scholtz, M.M., Katongole, C., Vibeke, L., Assouma, M., Dossa, L., Du Toit, L., Todd, R., Peter, S., Kaga,i J., Tadese, M., Gibbons, J, Odubote, I., Bateki, C. & Arndt, C. 2024. *Protocol for Developing Region-Specific Tier 2 Enteric Methane Emission Factors in African small ruminants.* Poster presented at the International Research Symposium on Agricultural Greenhouse Gas Mitigation: from Research to Implementation, Berlin, Germany. 21-23 October 2024.

Ledwaba, M.R., Mphaphathi, M., Sebopela, M., Mashilo, T.L., Thema, M., Negota, N., Chokoe, T. & O'Neill, H.A. 2024. *Comparative study on the effect of slicing and aspiration techniques on the quality and quantity of cattle oocytes.* Poster presented at the 54th Annual SASAS Congress, East London, South Africa. 3-5 July 2024.

Madilindi, M., Zishiri, O., Dube, B., Scholtz, M.M. & Banga, C. 2024. *Non-genetic influences on predicted feed efficiency traits in multiparous South African Holstein cows.* Poster presented at the 54th Annual SASAS Congress, East London, South Africa. 3-5 July 2024.

Makgahlela, M.L., Mabunda, R., Bhika Koooverjee, B. & Soma, P. 2024. *Behavioural aspects of aggression in the American Pit Bull Terrier dog breed in South Africa.* Poster presented at the 54th Annual SASAS Congress, East London, South Africa. 3-5 July 2024.

Mashilo, T.L., Mphaphathi, M., Ledwaba, M.R. & Maqhashu, A. 2024. *Comparative evaluation of the effects of retrieval technique and equilibration time on bull cauda epididymal sperm characteristics with the aid of computer-assisted sperm analyzer.* Poster presented at the 54th Annual SASAS Congress, East London, South Africa. 3-5 July 2024.

Mashilo, T.L., Mphaphathi, M., Maqhashu, A., Ledwaba, M., Thema, M., Sebopela, M. & Chokoe, T. 2024. *Evaluation of sexed semen on conception and pregnancy loss rates in synchronized Bos indicus, Bos taurus-indicus, and Bos taurus cows following timed artificial insemination.* Poster presented at the Annual Conference of the International Embryo Technology Society, Denver, CO, USA. 9-12 January 2024.

Mhlongo, L.C., Kenyon, P. & Nsahlai, I. 2024. *Effect of dietary inclusions of different types of Acacia mearnsii on milk performance and nutrient intake of dairy cows.* Poster presented at the 54th Annual SASAS Congress, East London, South Africa. 3-5 July 2024.

Mseleku, C., Chimonyo, M., Slotow, R., Mhlongo, L.C. & Ngidi, M. 2024. *Relationship between village chicken availability and dietary diversity along a rural-urban gradient.* Poster presented at the 54th Annual SASAS Congress, East London, South Africa. 3-5 July 2024.

Nkadimeng, M., Van Marle-Koster, E., Ramukhithi, F.V., Mphaphathi & Makgahlela, M.L. 2024. *Assessing reproductive performance of beef cattle heifers in smallholder farming systems of South Africa.* Poster presented at the 54th Annual SASAS Congress, East London, South Africa. 3-5 July 2024.

Pardave, S. & Deacon, F. 2024. *Feeding practices of zoo-housed giraffes in Latin America: preliminary results.* Poster presented at the Chilean Congress of Zoology, Chile. 11-15 November 2024.

Pyoos, G.M., MacNeil, M.D., Scholtz, M.M., Seshoka, M. & Neser, F.W.C. 2024. *Feeding behaviour of young growing beef bulls differing in breed composition.* Poster presented at the 54th Annual SASAS Congress, East London, South Africa. 3-5 July 2024.

Pyoos, G.M., Scholtz, M.M., Seshoka, M.M., Neser, F.W.C. & MacNeil, M.D. 2024. *The effect of breed composition on methane efficiency in beef bulls.* Poster presented at the International Research Symposium on Agricultural Greenhouse Gas Mitigation: from Research to Implementation, Berlin, Germany. 21-23 October 2024.

Ramoroka, M.P., MacNeil, M.D., Neser, F.W.C. & Makgahlela, M.L. 2024. *Identifying genes associated with adaptive mechanisms for cattle surviving in harsh smallholding systems of South Africa.* Poster presented at the 54th Annual SASAS Congress, East London, South Africa. 3-5 July 2024.

Rasebapatja, K.P., Einkamerer, O.B., De Witt, F. & Josling, G.C. 2024. *The effect of substituting maize with popcorn screenings on the nutrient digestibility and performance of broilers fed mash diets.* Poster presented at the World Poultry Science Association South Africa, Pretoria, South Africa. 5-6 May 2024.

Scholtz, M.M., Arndt, C., Mrode, R., Mulat, D., Assouma, M., Dossa, L. & Elbeltagy, A. 2024. *Overview on the status-quo and challenges to reduce methane emissions from livestock systems in Africa.* Poster presented at the ICAR & Interbull Conference, Bled, Slovenia. 19-24 May 2024.

Scholtz, M.M., Chabalala, N. & Chadyiwa, M. 2024. *Farmgate methane intensity of beef can be reduced by changes in cow-calf efficiency traits.* Poster presented at the International Research Symposium on Agricultural Greenhouse Gas Mitigation: from Research to Implementation, Berlin, Germany. 21-23 October 2024.

Scholtz, M.M., Pyoos, G.M., Makgahlela, M.L. & Seshoka, M.M. 2024. *Robustness of indigenous animals to climate variability.* Poster presented at the United Nations Science Summit – side event: Resilient and sustainable ruminant production in a changing climate, Virtual, 1 September 2024.

Seshoka, M.M., Grobler, S., Scholtz, M.M., Morey, L., Buchanan, G. & Neser, F.W.C. 2024. *The effect of weather patterns on fertility in different cow genotypes in the Eastern Kalahari Bushveld.* Poster presented at the 54th Annual SASAS Congress, East London, South Africa. 3-5 July 2024.

Shingange, R., Ramukhithi, F.V. & Maqhashu, A. 2024. *Novel insights into pubertal South African indigenous Ovis aries males.* Poster presented at the Annual Conference of the International Embryo Technology Society, Denver, CO, USA. 9-12 January 2024.

Shingange, R., Ramukhithi, F.V. & Maqhashu, A. 2024. *The impact of environmental robustness on indigenous ram-lambs' physiological age and secondary sex characteristics.* Poster presented at the 54th Annual SASAS Congress, East London, South Africa. 3-5 July 2024.

Smit, Z.M., Deacon, F., Malan, P.J. & Smit, G.N. 2024. *Drought impact on the vegetation of southern Kalahari: implications and mitigation of future impacts in the face of climatic changes.* Poster presented at the Sustainable Horizons – Navigating the Future with Environmental Innovation. UFS Center for Environmental Management (CEM) 30th Anniversary Conference, Bloemfontein, South Africa. 11-12 October 2024.

Soma, P., Bhika Koooverjee, B. & Scholtz, M.M. 2024. *Runs of Homozygosity in Wet Carcass Syndrome-affected South African Sheep.* Poster presented at the 54th Annual SASAS Congress, East London, South Africa. 3-5 July 2024.

Wepener, M., Scholtz, M.M., Weepener, H. & Neves, L. 2024. *The effect of climate change on the distribution of heartwater in South Africa.* Poster presented at the 54th Annual SASAS Congress, East London, South Africa. 3-5 July 2024.

Other Outputs

Popular/Magazine Articles

Deacon, F. 2024. Keeping track of the Himalayan brown bear. *Nature Africa* online pp. 1-5.

Deacon, F. 2024. I designed headgear to track giraffes. *Nature Africa* online March 2024 pp. 1-3.

Scholtz, M.M. & Jordaan, F. 2024. How to interpret a sales catalogue. *Landbouweekblad* 8 August 2024.

Scholtz, M.M. & Jordaan, F.J. 2024. Interpreteer 'n veiling se katalogus korrek. *Landbouweekblad* 8 August 2024

Scholtz, M.M. & MacNeil, M.D. 2024. Inbreeding versus line breeding. What is the difference? *Ankole* 18 November 2024.

STAFF (2024)

Head of Department:

Prof FWC Neser

| | |
|------------------------|--|
| Professors: | Prof A Hugo and Prof FWC Neser |
| Associate Professors: | Prof ED Cason and Prof F Deacon |
| Affiliated Professors: | Prof VP Ducrocq, Prof JPC Greyling, Prof ML Makgahlela, and Prof MM Scholtz |
| Senior Lecturers: | Dr OB Einkamerer, Dr MD Fair, Dr A Maqhashu, Dr J Myburgh, and Dr HA O'Neill |
| Lecturers: | Dr A Hattingh, Dr BB Janecke, GC Josling, Dr L Krüger, and Dr PJ Malan |
| Junior Lecturers: | G Janse van Rensburg and J Pause-Ross |
| Research Fellows: | Prof HO de Waal, Dr W Olivier, Prof HA Snyman, and Prof JB van Wyk |
| Programme Director: | Dr HA O'Neill |
| Technicians: | E Roodt and JAM van der Merwe |
| Officers: | NAK Green and KR Moopelwa |
| Secretary: | I Auld |
| Technical Assistants: | NK Long and SA Rowles |
| Service Workers: | N de Bruin, TA Dumisi, and VJ Lamie |

DEPARTMENT OF SOIL, CROP AND CLIMATE SCIENCES

FACULTY OF NATURAL AND AGRICULTURAL SCIENCES



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OVERVIEW OF 2024

Commercial summer grain production in South Africa is predominantly rainfed and occurs mainly in semi-arid regions. In these areas, drought is the primary factor contributing to reduced grain yields, which can lead to food insecurity and rising grain prices. The

2023/24 summer growing season was particularly challenging, with a severe drought lasting two-and-a-half months. The timing and intensity of the drought had a significant adverse effect on agricultural productivity. In response to these challenges, the Department is pleased to announce the establishment of the Research Chair in Climate Change and Agriculture, a new initiative aimed at addressing the complex impacts of climate change on agricultural systems.

In March 2024, the Department underwent an external review, conducted by four reviewers from three local universities. This review, part of a process held every five years, provided valuable insights into the Department's performance. Overall, the review was positive, with feedback highlighting that the Department of Soil, Crop and Climate Sciences is a respected and reputable entity at national level. It was noted that the Department successfully addresses the dual agricultural system – both smallholder and commercial farming – in support of broader societal development. Additionally, the Department's strategy is well-aligned with the University of the Free State's new Vision 130 strategy. The transition from an undergraduate teaching-focused model to a more research-oriented institution, with a goal of achieving a 70:30 balance between undergraduate and postgraduate students, was also acknowledged. The Department's efforts toward demographic and gender transformation among both staff and students were commended. Along with this positive feedback, the Department received a set of key recommendations for improvement over the next five years.

In 2024, the Department made notable progress by expanding its portfolio of externally funded projects compared to 2023. This included securing

funding from the private sector, the Water Research Commission (WRC), the Research Chair in Climate Change in Agriculture (co-funded by the Agricultural Research Council), and two European Union-funded grants.

The year 2024 also marked a period of change within the Department. One staff member retired, while others transitioned to new positions. However, the Department also welcomed a new staff member and celebrated promotions for those who have demonstrated continued dedication and excellence in their respective fields.

ACHIEVEMENTS

Staff Achievements

In recognition of significant achievements, Dr James Allemann, one of our esteemed retired personnel, was honoured with an Honorary Award from the South African Society for Crop Production (SASCP) for his outstanding contributions to the Society, its objectives, and the field of science.



Dr James Allemann (middle) received an Honorary award at the Combined Congress 2024

Stefaans Erasmus was elected as Chairperson of the South African Irrigation Institute (SABI) Orange Branch and re-elected as Chairperson of the South African Institute for Agricultural Engineers (SAIAE), Free State Branch.

On 10 June 2024, Dr Neo Mathinya successfully defended her PhD thesis at Wageningen University & Research in the Netherlands.



Dr Neo Mathinya with her promoters. From the left, Professor Ken Giller and Dr Gerrie van de Ven from the Plant Production Systems Group in Wageningen University & Research, Dr Mathinya, and Prof Linus Franké from the UFS Department Soil, Crop and Climate Sciences

Cowan McLean received second place in the Natural and Agricultural Science (NAS) Flash Fact competition for his presentation on 'Developing a soil quality framework for Mokala National Park'.

Prof Johan van Tol was promoted to Full Professor, a testament to his academic contributions and leadership in his field, while Dr Weldemichael Tesfahuney earned a NRF C2 rating, recognising his outstanding research and scholarly impact.

Student Achievements

Jaco Kotzé was awarded the prize for the best student presentation at the South African Hydrological Society's bi-annual conference in Cape Town in October 2024, while Muwanwa Tshikovhi received the prize for the best presentation by an MSc student at the 2024 SCCS Postgraduate Student Symposium.

In recognition of his academic achievements



Franco Botha (Left) receiving both the SASCP Student Gold Merit Award and the Omnia Award

in the Department, Franco Botha received the SASCP Student Gold Merit Award for the best academic performance in Agronomy, with a score of over 75%, as well as the Omnia Award for the best final-year student in Crop Production.

Anfal Fatima (76.6%) and Nontobeko Buthelezi were the first recipients of the award for the best student in Crop Production with specialisation in Horticulture. Sonia Manzini was honoured with the prize for the best final-year student in Agrometeorology.



Anfal Fatima (above, left) and Nontobeko Buthelezi (below, left) receiving their awards for best students in Crop Production with a specialisation in Horticulture



TEACHING AND LEARNING

The Department is committed to being student-centred, acknowledging the diverse backgrounds of our students, and enhancing their learning experience. As an applied science department, we make a concerted effort to familiarise



Members of the fourth-year class of CROP4814 (Crop Physiology) and 4834 (Plant Water Relationships) at the facilities of Agraforum SA

undergraduate students with the practical aspects of various fields of study. The first- and second-year classes are large, with over 450 and 250 students, respectively, posing a significant challenge for practical sessions. However, as students progress to their third- and fourth-years, the numbers in these modules decline significantly, with 50 to 80 students in the third-year and around 15 in the fourth-year. These smaller groups participate in excursions, industry exposure, and on-farm visits. For instance, the final-year Role of Nutrition on Crop Development (CROP4824) students attended a soil fertility and crop nutrition workshop at VKB in Bethlehem, and the Crop Physiology and Plant Water Relationships fourth-year classes visited Agraforum SA in May 2024 as part of their practical sessions.

The third-year Irrigation Systems and Irrigation Survey (AGEG3724) class went on an excursion to Paradys Experimental Farm to observe and discuss the irrigation systems on the farm.



Irrigation systems at Paradys Experimental Farm

In July 2024, the third-year Horticultural students went on an excursion to Hartswater where they were introduced to a pruning demonstration, harvesting, handling, and grading of pecans in July 2024.



Hardus du Toit from the South African Pecan Nut Producers Association (SAPPA) giving a pruning demonstration to the students

The final-year BSc Agric and Honours students presented their research projects at the end of the year as part of the Research Project in Soil, Crop and Climate Sciences (SCCS4808 and 6808) modules. A small function was held to celebrate the achievements of both the students and Department.



Final-year students of SCCS4808 and 6808

RESEARCH, INNOVATION AND RESEARCH COLLABORATION

Prof Linus Franké initiated a Research Chair in Climate Change and Agriculture, jointly funded by the Agricultural Research Council (ARC), the Department of Agriculture, Land Reform and Rural Development (DALRRD), and the UFS. The Research Chair focuses on holistic and interdisciplinary research unpacking the multi-layered relationships between climate change and the agricultural sector, thereby contributing to climate change adaptation and mitigation in the agricultural sector, supporting policy development and implementation in this field, and steering the societal discourse on climate change and sustainable agriculture. The Research Chair started in July 2024, and Prof Franké used the first months to define the major research themes of the Chair and recruit PhD students and a postdoctoral researcher falling under the Chair. By the end of 2024, the Chair supported three PhD students and one MSc student, with two PhD students and one postdoc expected to join in early 2025.

Prof Franké acts as the principal coordinator of a European Union-funded intra-Africa mobility grant – ‘Capacity Building for Climate-Resilient Food Systems in Africa (CaReFoAfrica)’. This project aims to facilitate academic mobility of staff and students between African universities. While the UFS is leading the consortium, other partners include Maseno University (Kenya), the University of Eldoret (Kenya), Makerere University (Uganda), and Université Evangelique en Afrique (Democratic Republic of Congo), Université d’Abomey-Calavi (Benin), with the Hochschule Weihenstephan-Triesdorf (Germany) as a technical partner. Two PhD students and one MSc student were awarded bursaries for studies in the Department in early 2025. Prof Linus Franké and Dr Stephan Steyn attended the CaReFoAfrica Consortium meeting in Brussels, Belgium, from 19 to 22 March 2024. A follow-up meeting was held at the Bloemfontein Campus from 16 to 19 July, during which consortium members discussed procedures and regulations, provided an overview of current research activities, and selected candidates for degree-seeking bursaries.



Prof Linus Franké

Socio-Ecological Systems’, which began in September 2024. This collaborative project, involving five universities (Central University of Technology, University of the Free State, University of Pretoria, University of Johannesburg, and Tshwane University of Technology), has secured ZAR 900,000 funding from the BRICS initiative through the NRF, supporting the project for the next three years. Dr Mengistu is leading one of the four primary sub-projects.



Dr Weldemichael Tesfuhoney and his team are investigating pigeon pea as a potential legume crop for semi-arid regions of the Free State, in collaboration with the ARC-Grain Crop Institute in Potchefstroom. This project includes two Agrometeorology MSc students who are studying water and radiation use to improve crop productivity. To promote the adaptability of this drought-tolerant crop in semi-arid areas as a climate change mitigation strategy, engagements with farmers and agricultural extension officers were held, including a demonstration day. Additionally, the experimental trials served as practical learning sessions for Agrometeorology students, who were taught how to set up micrometeorological instruments.

As part of the BRICS Multilateral Joint Science and Technology Research Collaboration ‘Climate Change Adaptation and Mitigation’ call, Dr Tesfuhoney and postdoctoral fellow Dr Achamyeleh Mengistu have been involved in proposing an interdisciplinary project titled ‘An Interdisciplinary Approach for Assessment of the Impacts of Climate Change on

Prof Elmarie Kotzé and Prof Gert Ceronio are collaborating with the University of Bonn, Germany, on the effect of sub-soil melioration on water-use efficiency in maize under semi-arid conditions. This partnership, which is built on a 14-year research relationship, involves visiting researchers from Germany utilising the Kenilworth Research Farm’s facilities for valuable measurements.

Prof Kotzé also collaborated with researchers from the University of Dijon, France, on a joint project investigating soil carbon dynamics in temperate grasslands in the Drakensberg. As part of this work, PhD student Lindokuhle Dlamini obtained his degree through a cotutelle arrangement between the two institutions.

Dr Johan Barnard remained actively involved in two WRC-funded projects during the year. Both projects are interdisciplinary in nature, collaborating with Agricultural Economics. The first project focused on developing a bioeconomic model to enhance the



economic management of conjunctive irrigation water use and root-accessible water tables, culminated in the submission and acceptance of the final report in 2024. Dr Johan Barnard specifically focused on applying a differential evolution algorithm to calibrate the AquCrop and SWAP soil-crop-water simulation models. The second project, titled ‘SAPWAT Change of Custodianship and Climate Database Upgrade’, involved the transition of custodianship for SAPWAT, a decision-support tool for estimating crop water requirements. During this initial phase, the project team participated in multiple training workshops led by Dr PS van Heerden, the current custodian. Additionally, discussions were held regarding the source code and database, which were subsequently transferred to the team. As part of this project, Dr Stephan Steyn developed an updated climate database for southern Africa (1979–2024) based on AgERA5 reanalysis data, which will be integrated into SAPWAT for agrometeorological analysis and modelling. This climate database has a spatial resolution of 0.1° × 0.1° (about 9 km) and comprises all the major climatic elements required for agrometeorological analysis and modelling.

Prof Johan van Tol and his team are leading a WRC-funded research project aimed at predicting landslide occurrences in KwaZulu-Natal and the Eastern Cape. The study integrates remote sensing with mechanistic hydrological modelling to enhance predictive accuracy. Additionally, Prof Van Tol, is collaborating with the Freshwater Consulting Group

and WetRest, and has launched another WRC-funded project focused on improving South Africa’s wetland delineation guidelines.

Prof Van Tol and Prof Elmarie Kotzé are collaborating on a project funded by the German Department of Agriculture, in partnership with the Technical University of Munich (TUM) and the University of Pretoria (UP). This project aims to assess belowground carbon storage in various forest systems in the Vhembe District, Limpopo, while also comparing forest management practices between Germany and South Africa. In July, Prof van Tol, Prof Kotzé, and PhD student Arno Buys visited TUM and several forest sites in Germany to further their research.



UFS and University of Pretoria researchers visited several forests in Germany

Prof Tesfay Weldelessie has been awarded a €308,020 research project grant for 2024–2028 from the European Union through the CREATE-GreenAfrica initiative. This project addresses climate change, a global challenge that disproportionately affects Africa, one of the world’s most vulnerable continents. The CREATE-GreenAfrica consortium, which includes six partner universities and one technical partner from EU member states, aims to build climate-oriented capacity and research activities that contribute to sustainable and green development. The Intra-Africa Academic Mobility Scheme will support the initiative by advancing the knowledge and skills of students, trainees, and staff on climate change adaptation and mitigation, helping Africa move toward a resilient, green, and carbon-neutral economy.

In addition, Prof Weldelessie is a key partner in a

collaboration between the University of Free State (UFS) and Eduardo Mondlane University (UEM) in Mozambique. This partnership, formalised through a Memorandum of Understanding (MoU) between UEM's Centre of Excellence in Agri-Food Systems and Nutrition (CE-AFSN) and UFS, focuses on advancing research and training in agri-food systems and nutrition. The collaboration includes joint research, publications, student exchanges, and shared supervision, with a project budget of USD 60,000.

Prof Weldeclassie also initiated a research collaboration between the School of Life Sciences at Nantong University, China, and UFS, focusing on climate resilience and crop breeding. Although the proposal for funding was not successful, this collaboration has laid the foundation for future research endeavours. Additionally, Prof Weldeclassie formed a consortium with international partners from the Netherlands, Kenya, Ethiopia, and South Africa, as well as national collaborators from Walter Sisulu University and the Agricultural Research Council, under the B-SEEN project. This project focuses on enhancing socio-ecological resilience in vulnerable communities across Ethiopia, Kenya, and South Africa, by developing sustainable, locally driven resilience strategies. The project has been submitted for funding under the Long-Term Europe-Africa Water-Energy-Food Nexus Research Programme.

Prof Linus Franké and Dr Elmarie van der Watt continued research on agronomic practices for growing hybrid potatoes from seed. Greenhouse and field trials with biostimulants and different agronomic practices were conducted. The work is supported by a grant from DST-NRF and Solynta BV, a company in the Netherlands involved in hybrid potato breeding. Dr Van der Watt visited Agraforum in Germany as part of an initiative to strengthen research collaboration between UFS and Agraforum. During this visit, potato trials were conducted at one of the largest potato producers in Germany.

Dr Van der Watt and Adri Moffat conducted research on the effect of different biostimulants from different companies on various crops under glasshouse conditions, including products from Agraforum SA, Transformus, Kelpak, Bioco Crops, and Nitroguard.

The South African Pecan Producers Association



Dr Elmarie van der Watt and collaborator taking samples on a potato farm in Germany near Walsrode

(SAPPA) extended Dr Gesine Coetzer's post-harvest research project on pecan nuts for an additional year, following the promising results obtained in the first two years of the study. This extension underscores the value of the research in enhancing the understanding of post-harvest practices for pecan nuts. Additionally, SAPPA has committed to supporting a bursary for a MSc in Agriculture study, further investing in the development of new knowledge and expertise within the industry. This collaboration highlights SAPPA's ongoing commitment to advancing the pecan farming sector through research and education.

Several lecturers and students participated in the Combined Congress, held in Wilderness in January 2024. The event attracted horticulturists, agronomists, weed scientists, and soil scientists from both academic and industrial sectors.

ACADEMIC CITIZENSHIP AND COMMUNITY ENGAGEMENT

Prof Tesfay Weldeclassie serves as an Associate Editor for the *South African Journal of Plant and Soil*. He has also collaborated with biofertilizer companies

on Arbuscular Mycorrhiza Fungi (AMF), worked with the tobacco industry on *Striga gesnerioides* weed management, and engaged with the Weed Science Society of South Africa board.

Dr Elmarie van der Watt completed her second year as Vice-President of the South African Society for Crop Production (SASCP). She also served on the Council of the South African Academy of Science and Art, where she evaluated MSc dissertations for the Junior Kaptein Scott 'Gedenkmedalje' and helped identify top MSc students from various universities. This prestigious medal is awarded annually for the best MSc dissertation submitted to a South African university, alternating between Zoological and Botanical Sciences.

Dr Van der Watt was invited to present a webinar for SQM on March 1, 2024, focusing on 'Plant Physiology with Emphasis on Heat and Drought Stress'. She was invited to speak at a farmers' day hosted by SSK Cooperation in Riversdal on August 21, 2024. She delivered a talk on 'Strategieën en Vooruitzichte vir Biostimulante om Stress te Verlig' (Strategies and Prospects for Biostimulants to Relieve Stress). Part of her presentation was also published in *Landbouweekblad* under the title 'Biostimulants: Boosting Crop Resilience and Sustainability for Farmers'.

Stefaans Erasmus attended and chaired a session at the SABI Technical Forum in August 2024. Additionally, he presented a tutorial on Artificial Intelligence (AI) in Agriculture at the Southern African Conference for Artificial Intelligence Research (SACAIR) Unconference in December 2024.

Prof Elmarie Kotzé and Dr Johan Barnard continued their annual training sessions for the Agribusiness Transformation Programme, sponsored by Standard Bank. These sessions, held in Bloemfontein, Kroonstad, and Bethlehem, were attended by emerging farmers. The topics covered included soil water storage, water management in rain-fed and irrigated crop production systems,

irrigation water quality, soil quality/health, soil degradation hazards, and visual soil assessment.

Dr Johan Barnard was invited as a guest speaker at the South African Irrigation Institute (SABI) Oranje Branch Meeting in November near Jacobsdal. He presented an article that he authored in the October issue of *SA Grain* magazine, titled 'Wat is die dorste? Watergebruik by akkerbougewasse' (What is the thirstiest? Water usage in crop production).

Prof Johan van Tol disseminated the hydrogeological assessment guidelines developed through a WRC project by training approximately 80 officials from the Department of Water and Sanitation (DWS). The training focused on identifying when a hydrogeological assessment is required and establishing the minimum standards for such assessments.

Dr Gesine Coetzer and Shane van Niekerk attended the SAPPA Annual General Meeting and Information Day on 1 November 2024, in Douglas. During the event they presented key insights on the effect of temperature and humidity on the on-farm storage of pecan nuts (*Carya illinoensis*). Their presentation provided an in-depth analysis of how environmental factors impact the quality and longevity of stored pecans, contributing to the understanding of best practices in post-harvest management for the pecan industry.

Prof Gert Ceronio delivered a presentation titled 'Do We Live Up to the Challenge?' at the 3rd Annual Meeting of the National Grain Research Programme, held on the UFS Bloemfontein Campus. Following this presentation, he was invited to deliver the keynote address at the Combined Congress in Polokwane in 2025.

Dr Stephan Steyn contributed to the UFS Career Podcast on 'Agrometeorology, Meteorology, and Climate Science', which is available for listening on the UFS Career Podcast website.



Prof Johan van Tol



Prof Gert Ceronio



Students and stakeholders at the University of the Free State SCCS Research Symposium

POSTGRADUATE STUDENTS

In 2024, a total of 52 postgraduate students were enrolled in the Department of Soil, Crop and Climate Sciences – 7 at Honours level, 6 structured MSc, 24 for MSc and MSc Agric, and 15 for PhD. During 2024, five students graduated with their Honours Degree and one in the structured MSc.

Nine students completed the MSc Agric degree – JA Buys, W Dickerson, V Makuya, MA Salagae, AM Sethoibela, A Sibalekile, B Simelane, Z Somi, and W Visser.

Five candidates completed their doctoral studies and graduated with the PhD:

Ingrid Allemann

Thesis: Allelopathic properties of *Amaranthus cruentus*

Supervisors: Dr E van der Watt and Dr GM Coetzer

Lindokuhle X Dlamini

Thesis: Soil carbon dynamics in Afromontane grasslands, Cathedral Peak, South Africa

Supervisors: Prof E Kotzé, Prof J Lévêque, Dr M Thevenot, Dr GT Feig, and Dr O Mathieu

Njabulo EM Dlamini

Thesis: Variety and environmental effects on ratoon yields of irrigated sugarcane

Supervisors: Prof AC Franké and Prof M Zhau

Isadore E Smit

Thesis: Soil information in hydrological modelling: Mapping, modelling and applications in the macro-scale Sabie-Sand catchment

Supervisors: Prof JJ van Tol, Prof GM van Zijl, and Dr ES Riddell

Tercia Strydom

Thesis: Short- and long-term impacts of experimental fires on selected soil properties in the Kruger National Park

Supervisors: Prof JJ van Tol and Dr IPJ Smit

The Department hosted its annual Postgraduate Students Symposium, which highlighted the dedication, hard work, and innovation of our students, faculty, and partners, including Omnia Holdings, Starke Ayres (Pty) Ltd, and the Department of Labour. Ayabonga Sibalekile and Muwanwa Kaylne Tshikovhi received awards for their outstanding presentations.

POSTDOCTORAL RESEARCH FELLOWS

Dr Melku Dagnachew Alemu, from Ethiopia, joined the department in early 2024 under the supervision of Prof Johan van Tol. His research focuses on soil information and the impact of land cover changes on hydrological regimes across various regions. These changes are analysed through hydrological modelling using SWAT and other hydrological models.

STAFF MATTERS

Dr Gesine Coetzer and Prof Gert Ceronio received their UFS long service awards for 35 and 30 years, respectively.

The Agrometeorology division bid farewell to two valued staff members. Linda de Wet retired after more than 25 years of dedicated service. Over the course of her career, Linda contributed significantly to several undergraduate modules and served as programme director. Dr Phumudzo Tharaga accepted a research position at the ARC, though he will continue to co-supervise some postgraduate students.

The Agronomy division also said goodbye to Dr Jerry Dlamini, who accepted an academic position at North-West University (NWU). In September 2024,

Dr Tendai Mucheri was appointed as a lecturer in Agronomy. Dr Mucheri, who obtained her PhD at Stellenbosch University, focuses her current research on crop production, weed science, and precision agriculture.

RESEARCH OUTPUTS

Research Articles

Araya, T., Ochsner, T.E., Mkeni, P.N., Hounkpatin, K.O.L. & Amelung, W. 2024. Challenges and constraints of conservation agriculture adoption in smallholder farms in sub-Saharan Africa: A review. *International Soil and Water Conservation Research* 12(4): 828-843. DOI: 10.1016/j.iswcr.2024.03.001

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carbon fractions in Afromontane grasslands, Cathedral Peak, South Africa. *European Journal of Soil Science* 75(4): e13528. DOI: 10.1111/ejss.13528.

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Makuya, V., Tesfuhoney, W.A., Moeletsi, M.E. & Bello, Z. 2024. Assessing the Impact of Agricultural Drought on Yield over Maize Growing Areas, Free State Province, South Africa, Using the SPI and SPEI. *Atmosphere* 15: 1438. DOI: 10.3390/atmos15121438.

Maleka, M.F., Modise, T.J., Du Plessis, M.G. & Coetzer, G.M. 2024. Characterization and identification of sequence variants from a *de novo*-assembled partial pan-genome of cactus pear (*Opuntia* L.). *South African Journal of Botany* 175: 241-252. DOI: 10.1016/j.sajb.2024.10.023.

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Maritz, J., Gorjão, L.R., Bester, A., Esterhuysen, N., Erasmus, S., Riekert, S., Immelman, R., Geldenhuys, T., Viljoen, A. & Bodenstein, L. 2024. Data-Driven Modeling of Frequency Dynamics Observed in Operating Microgrids: A South African University Campus Case Study. *IEEE Access* 12: 14466-14473. DOI: 10.1109/ACCESS.2024.3357945.

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Moyo, K., Khetsha, Z.P., Masowa, M.M., Van Der Watt, E., Moloantoa, K.M. & Unuofin, J.O. 2024. Eco-organic system and silicon-based biostimulant as a strategy for vegetable production under multistress conditions in South Africa: A review. *Journal of Applied Horticulture* 26(1): 83–89. DOI: 10.37855/jah.2024.v26i01.16.

Praeg, N., Steinwandter, M., Payne, D., Sneathlidge, M.A., Alves, R.P., Apple, M., Britton, A.J., Bruni, E.P., Chen, T., Dumack, K., Fernandez-Mendoza, F., Freppaz, M., Frey, B., Fromin, N., Geisen, S., Grube, M., Guariento, E., Guisan, A., Ji, Q., Jimenez, J.J., Maier, S., Malard, L., Minor, M.A., McLean, C.C., Mitchell, E.D., Peham, T., Pizzolotto, R., Taylor, A.F.S., Vernon, P., Van Tol, J.J., Wu, Y., Wu, D., Xie, Z., Weber, B., Illmer, P. & Seeber, J. 2024. Biodiversity in mountain soils above the treeline. Preprint - Biological Reviews. DOI: 10.1101/2023.12.22.569885.

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Steenekamp, D., Van Rensburg, L.D., Barnard, J.H. & Du Preez, C.C. 2024. Are inorganic nitrogen concentrations in potassium chloride and saturated paste extracts of irrigated soils comparable? *South African Journal of Plant and Soil* 41(4–5): 1–9. DOI: 10.1080/02571862.2023.2294448.

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Conference Contributions

Conference Papers

Kotzé, E. & Dlamini, L.X. 2025. *Evaluating Fire Exclusion and Grassland Degradation Effects on Soil Aggregates and Carbon in Afromontane Grasslands: Lessons from Cathedral Peak, South Africa.* Paper delivered at the 9th International Symposium on the interactions of soil minerals with organic matter and microbes (ISMOM 2024), Tsukuba, Ibaraki, Japan. 15–18 October 2024.

Lusizi, Z., Elephant, D., Tesfay Araya, & Nyambo P. 2024. *Impact of wattle tree species on soil physicochemical properties at Matatiele in Eastern Cape, South Africa.* Paper delivered at the Combined Congress 2024, George, South Africa. 22–25 January 2024.

Sibalekile, A., Tesfay Araya, Kotzé, E. & Castillo, J. 2024. *Impacts of glyphosate on soil microbial communities in soybean systems.* Paper delivered at the Combined Congress 2024, George, South Africa. 22–25 January 2024.

Tesfay Araya & Van Tol, J.J. 2024. *Improving crop productivity, resilience, and sustainability through conservation agriculture*

systems in Eastern Cape, South Africa. Paper delivered at the 9th World Congress on Conservation Agriculture, Cape Town, South Africa. 22–25 July 2024.

Van der Watt, E. 2024. *Effect of selected biostimulants of the physiology and growth of onions.* Paper delivered at the Combined Congress 2024, George, South Africa. 22–25 January 2024.

Van Tol, J., Kotze, J.J., Niedrist, G., Schneiderbauer, S., Delves, J. & Clark, V. 2024. *Alpine wetland degradation in the northern Maloti-Drakensberg: On the need for baseline research.* Paper delivered at the Centennial Celebrations and Congress for the International Union of Soil Science, Florence, Italy. 19–21 May 2024.

Van Tol, J.J., Bieger, K. & Arnold, J. 2024. *Enhancing Hydrogeological Models with Hydrogeological Approaches for Improved Catchment Process Representation.* Keynote Address delivered at the International Conference on Water and Environmental Sustainability, Richards Bay, South Africa. 12–13 August 2024.

Conference Posters

Mengistu, A.G., Van Rensburg, L.D., Sabelo, S.W. & Mavimbela, S.W. 2024. *Shallow groundwater effects on bare soil evaporation and soil temperature in two windblown sands (Eutric Cambisol and Chromic Luvisol) in South Africa.* Poster presented at the 2024 IAH World Groundwater Congress, Davos, Switzerland.. 8–13 September 2024.

Moyo K., Van der Watt E., Masowa M.M. & Khetsha Z.P. 2024. *Eco-organic system and silicon-based biostimulant as a strategy for vegetable production under multistress conditions in South Africa: A review.* Poster presented at the 8th Edition of Global Congress on Plant Biology and Biotechnology, Singapore. (25–27 March 2024).

Conference Proceedings

Legodi, L., Van der Watt, E., Masowa M.M. & Khetsha, Z.P. 2024. Potential use of seaweed- and silicon-based biostimulants to alleviate the multistresses on tomato (*Solanum lycopersicum* L.) in South Africa: A short review. In: *Proceedings of the International Symposium on Sustainable Vegetable Production from Seed to Health Booster Sources, 12–16 May 2024, Bucharest, Romania.* Acta Horticulturae 1416_25. pp. 193–200.

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Research Reports

Grové, B., Barnard, J.H., Erasmus, J.C. & Hadebe, M.R.M. 2024. *Economic management of conjunctive use of irrigation water and root-accessible water tables.* Water Research Commission Report 3118/1/23, Pretoria, South Africa.

Van Tol, J.J., Job, N., Bouwer, D., Murugan, S. & Le Roux, P.A.L. 2024. *Hydrogeological Assessment Guidelines: Theory and application in a South African wetland management context. Integrating hydrogeology in wetland delineation and management guidelines.* WRC Report No. TT 925/23. Water Research Commission, Pretoria, South Africa.

Van Zijl, G.M., Van Tol, J.J. & Smit, I.E. 2024. *Towards a hydrogeological soil map for South Africa.* Water Research Commission. WRC Report No. 3145/1/24, Pretoria, South Africa.

STAFF (2024)

Head of Department:

Prof Linus Franké

| | |
|----------------------------|---|
| Professors: | Prof AC Franké and Prof JJ van Tol |
| Associate Professors: | Prof GM Ceronio, Prof E Kotzé, and Prof TA Weldeslassie |
| Senior Lecturers: | Dr JH Barnard, Dr GM Coetzer, Dr WA Tesfahuney, and Dr E van der Watt |
| Lecturers: | Dr L Banda, L de Wet, SJ Erasmus, Dr P Loke, Dr VN Mathinya, CC Mc Lean, Dr T Mucheri, Dr AS Steyn, and Dr PC Tharaga |
| Research Fellows: | Prof CC du Preez, Dr I Gura, and Prof CW van Huyssteen |
| Programme Director: | L de Wet |
| Senior Officers: | L Henning, N Radebe, and BE Tshabang |
| Senior Assistant Officers: | A Moffat and M Mokgethi |
| Technical Assistants: | TA Madito, DE Makara, T Mlobeli, TG Mokoena, ME Nthoba, and ZE Yokwane |

DEPARTMENT OF

SUSTAINABLE FOOD SYSTEMS AND DEVELOPMENT

FACULTY OF NATURAL AND AGRICULTURAL SCIENCES



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OVERVIEW OF 2024

The Department of Sustainable Food Systems and Development (SFSD) entered 2024 with a renewed focus on expanding its footprint in education, research, and engaged scholarship. The launch of new qualifications enhanced postgraduate supervision, and a growing number of national and international research partnerships underscore the Department's commitment to food system transformation. From innovations in agro-processing to climate-smart crop breeding, the SFSD is establishing itself as a knowledge hub driving sustainability, inclusion, and economic resilience.

ACHIEVEMENTS

Staff Achievements

Prof Johan van Niekerk continued to serve as Vice-Dean: Agriculture and strengthened international collaboration through his leadership on the Transforming African Agricultural Universities to Meaningfully Contribute to Africa's Growth and Development (TAGDev 2.0) and Agricultural Research Commission (ARC) projects.

Prof Wilna Oldewage-Theron achieved an NRF C2-rating and contributed to national nutrition policy. She was the recipient of the 2023-2024 Texas Tech University (TTU) College of Health and Human Sciences (CHHS) Wolfe International Scholars Award, as well as the 2023-2024 Apple Polishing Award from Texas Tech Mortar Board, honouring faculty and staff who have had an impact on careers of undergraduate students. Her appointment as critical reader by UNISA and awards from TTU highlighted her influence in academic development.



Dr Nokuthula Tinta

Dr Nokuthula Tinta and Dr Alba du Toit completed high-level training through the Women Influencing Scholarship and Education (WISE), programme. Dr Tinta coordinated inclusive research projects such as the Lebitso App and Good Money Habits initiative.

Student Achievements

Bridget Mangwandi, a Food Biochemistry student, represented UFS on MasterChef South Africa Season 5. Her creative sustainability-oriented dishes and entrepreneurial drive showcased the potential of food system education in popular culture.

Several PhD and Master's students presented at national expos and participated in international exchange programmes. Notably, students under

the Crop Breeding (RC5) component of the ARC-UFS Research Chair Programme contributed to critical research in cereal and legume breeding.

TEACHING AND LEARNING

2024 saw the successful roll-out of the undergraduate degree in Food Systems. The programme attracted a new cohort of students passionate about sustainability, nutrition, and food entrepreneurship. Guest lectures and collaborative sessions with the UFS Business School helped students bridge the gap between academic content and real-world innovation.

RESEARCH, INNOVATION AND RESEARCH COLLABORATION

ARC-DALRRD-UFS Research Chairs

The ARC-DALRRD-UFS Research Chairs initiative, a powerful collaboration between the Agricultural Research Council (ARC), the Department of Agriculture, Land Reform and Rural Development (DALRRD), and the UFS, are designed to address some of the most pressing challenges in agriculture, food security, and climate resilience in South Africa. Seven thematic research chairs have been established under two overarching Centres of Excellence: Climate Smart (Resilient) Agriculture and Broadening the Food Base for Diversification of the Food Basket. These chairs are each led by renowned researchers and supported by interdisciplinary teams, drawing on expertise from across the UFS, the ARC, and national and international partners.

Research Chair 1, led by Prof Linus Franké from the UFS Department of Soil, Crop and Climate Sciences, focuses on Climate Change and Agriculture. It adopts a systems-based, interdisciplinary approach

to understand the impact of climate change on agriculture and to develop viable adaptation and mitigation strategies. The Chair aims to quantify and reduce the carbon footprint of agricultural activities, enhance carbon sequestration through improved land use practices, and contribute to policy development by generating empirical data and realistic models. A significant component of this chair is capacity building, with a strong cohort of PhD and MSc students engaged in projects ranging from carbon credit systems to rangeland soil carbon dynamics, many of whom are supported through international mobility programmes like CaReFoAfrica. Projects such as MASSTER and NatuRA further broaden the scope of the chair by integrating economic diversification and sustainable land management in mountain regions.



Prof Paul Oberholster, Dean: NAS, Dr Glen Taylor, Senior Director for Research Development (DRD), Prof Vasu Reddy, Deputy Vice-Chancellor, Research and Internationalisation, and Prof Johan van Niekerk, Vice-Dean for Agriculture (NAS), at the announcement of the Research Chairs

Under the leadership of Dr Alba du Toit from the Department of Sustainable Food Systems and Development, Research Chair 2 focuses on Innovative Agro-processing for Climate-Smart Food Systems. This Chair reimagines local food systems through the application of consumer-led and culturally sensitive agro-processing technologies, particularly nixtamalisation, to improve the nutritional value and marketability of staple and underutilised crops such as maize, sorghum, cowpea, and spekboom. The Chair supports product

development, recipe design, and community-based trials to assess the adoption of new technologies, with a strong emphasis on empowering rural women and smallholder farmers. Several postgraduate students and postdoctoral fellows are involved in research projects, ranging from maize and sorghum processing to the valorisation of indigenous crops such as Bambara groundnuts and cowpeas.



Dr Alba du Toit

Research Chair 3, dedicated to Agricultural Risk Financing, is a newer initiative which will be launched early in 2025. This Chair aims to build a knowledge base around climate finance, green investment, and agricultural risk management, with research themes spanning banking sustainability, climate fintech, and multi-stakeholder engagement. The Chair will also develop executive education content to enhance financial inclusion and regenerative agriculture practices.

Prof Arno Hugo from the Department of Animal Science, leads Research Chair 4, which addresses Sustainable Livestock Production. This Chair tackles the environmental footprint of the livestock sector while improving productivity, animal welfare, and food safety. By integrating genetics, feed management, and water-use efficiency across the value chain, the Chair seeks to make livestock production more sustainable and economically viable. Numerous research projects are underway, exploring topics such as the impact of different diets on meat quality, the use of natural preservatives, and the conservation of wildlife species such as giraffes. The Chair has produced multiple scientific publications and is deeply engaged with industry stakeholders, including the Red Meat Producers Organisation and the South African Poultry Association.

Research Chair 5 is spearheaded by Prof Maryke Labuschagne from the Department of Plant Sciences and focuses on Breeding Climate-Resilient, Nutritious, and Disease-Resistant Crop Varieties. The Chair aims to strengthen the genetic base of both staple and neglected crops, such as maize, sorghum, cowpea, pigeon pea, cassava, and indigenous vegetables like amaranth. Through extensive collaboration with ARC scientists and plant breeders, the Chair supports a broad portfolio of postgraduate research, covering genome-wide association studies, disease resistance screening, and nutritional profiling. The diversity of projects under this Chair reflects a strong commitment to crop diversification, biofortification, and food system resilience in the face of climate change.



Chairs 6 and 7, which focus respectively on Communication for Innovation and the Impact Assessment of Climate-Smart Interventions, are in the early stages of development. Chair 6 aims to explore how knowledge generated through research can be effectively communicated to different stakeholders to drive innovation, while Chair 7 is dedicated to evaluating the effectiveness and scalability of climate-smart agricultural practices. The latter will play a critical role in generating evidence-based policy recommendations and training stakeholders in impact assessment techniques.

Together, the ARC-UFS Research Chairs are building a future-facing, sustainable agricultural research ecosystem. Through their collaborative research outputs, policy engagement, and robust

postgraduate training programmes, these chairs not only generate new knowledge but also empower a new generation of scientists, practitioners, and rural entrepreneurs. They reflect a national commitment to transforming food systems through climate resilience, innovation, and inclusive development.

Soy Innovation Laboratory

Led by Dr Brandon van Rooyen, the Soy Innovation Lab became a flagship initiative in 2024. Outreach campaigns, funded in part by the Oil and Protein Seeds Development Trust (OPDT), engaged school learners, dietitians, and public audiences. New soy-based product prototypes were tested in collaboration with private sector partners. The lab provided experiential learning for students and strengthened the Department's third-stream income potential.



(From the left) Khezwo Nematshema, Dr Brandon van Rooyen, Vuyelwa Nkoi, and Dr Dolapo Adelabu at the launch of the newest line of affordable, protein-rich, soy-based dairy alternatives

TAGDev 2.0 and RUFORUM

The Transforming African Agricultural Universities to Meaningfully Contribute to Africa's Growth and Development (TAGDev2.0) initiative represents a bold, visionary leap toward reshaping agricultural higher education across the continent. Spearheaded by the Regional Universities Forum for Capacity Building in Agriculture (RUFORUM), in partnership with the Mastercard Foundation and the Global Confederation of Higher Education Associations for Agricultural and Life Sciences (GCHERA), TAGDev2.0,

coordinated by Prof Jan Swanepoel from the Department of Sustainable Food Systems and Development, builds on the successes of TAGDev 1.0. The programme aims to empower Africa's young population – especially young women, refugees, displaced persons, and individuals with disabilities – by equipping them with entrepreneurial and technical skills that address systemic challenges in agriculture and education. Launched in 2023, the initiative will run for a decade, reaching its conclusion in 2033, and is backed by a significant investment of \$100 million. The UFS is a key implementation partner in South Africa, alongside other institutions across the continent.

A key innovation of TAGDev2.0 lies in its three-pronged approach to learning, targeting educated entrepreneurs, out-of-school youth, and resilient value chain actors like smallholder farmers. Through the establishment of Agri-Food Systems and Entrepreneurship Centres at each of the 12 primary universities, including the UFS, the programme delivers community-embedded, experiential education designed to nurture start-ups, scale innovations, and generate employment. Business incubation hubs at these institutions offer seed grants, mentorship, and market exposure, creating a pipeline for viable agricultural enterprises and ensuring that students are not only educated but also economically empowered.

The programme also strengthens the broader agricultural ecosystem through robust collaborations with National Agricultural Research



At the launch of the TAGDev 2.0 programme, Prof Johan van Niekerk, Prof Sam Adelabu, Prof Jan Swanepoel, Lacea Loader, Prof Paul Oberholster, Dr Molapo Qhobela, and Prof Corli Witthuhn

Institutes (NARIs), private sector actors, and policy institutions. By involving stakeholders from research, finance, and industry, TAGDev2.0 ensures that innovations and technologies – such as climate-smart production practices, seed systems, and post-harvest solutions – are effectively co-created and disseminated to end-users. The programme further seeks to de-risk agriculture from climate shocks by supporting mitigation efforts like agroforestry and climate leadership training, as well as integrating greenhouse gas reduction strategies into agricultural curricula and practice.

At the UFS the integration of TAGDev2.0 is aligned with its broader commitment to inclusive education, innovation, and agricultural transformation by contributing to curriculum development, hosting incubation hubs, and participating in cross-continental research and policy initiatives. It also plays a central role in supporting climate adaptation through its expertise in plant breeding, agronomy, and community engagement.

European Union-funded Projects

The UFS, through the Department of Sustainable Food Systems and Development, is an active participant in a number of high-impact European Union (EU)-funded projects that aim to transform higher education, foster sustainable agricultural development, and stimulate innovation through global partnerships. The driver of all the EU-funded projects is Prof Corli Witthuhn. The projects, which reflect our commitment to engaged scholarship, educational development, lifelong learning, and research, include:

- **MASSTER** (Managing [South] Africa and Senegal Sustainability Targets through Economic-diversification of Rural-areas) is funded by Erasmus+ under the Capacity Building in Higher Education (CBHE) programme. This three-year initiative supports higher education institutions (HEIs) and agricultural extension services in South Africa and Senegal to empower farmers and students with income generation, innovation, and sustainability skills. The UFS collaborates with the Weihenstephan-Triesdorf University of Applied Science (HSWT in Germany), Université du Sine Saloum El-Hâdj Ibrahima (USSEIN in Senegal), Université

Gaston Berger (UGB in Senegal), Ziguinchor University (UASZ in Senegal), Stellenbosch University (South Africa), Tshwane University of Technology (South Africa), University of Naples Federico II (UNINA in Italy), AME (France), and APSSS (Serbia).

- **AGRI-MOCKS** (Mastering Opportunities-scouting, Career-guidance and Key-job Skills in Agriculture) is funded under the Erasmus+ Virtual Exchange Programme. It prepares African youth for agricultural employment through digital learning and entrepreneurship development. The UFS is a core contributor, working with HSWT (Germany), Kumasi Institute of Tropical Agriculture (Ghana), HAWASSA University (Ethiopia), UGB (Senegal), and Häme University of Applied Science (Finland).
- **MAINSTREAM** (Mobility 4 Agricultural International Networks Supporting Thematic Resilience and Enhancing Adaptation and Mitigation) is supported through the EU Horizon Europe programme. It enhances research and innovation capacity by integrating African universities into global research networks. The UFS works alongside HSWT (Germany), Mountains of the Moon University (Uganda), USSEIN (Senegal), University of Kara (Togo), JOOUST (Kenya), and the University of Arsi (Ethiopia).
- **STREAMING** (Sustainable Trade Regimes with Europe and Africa through Mapping Innovation, New-Technology and Growth-Mindset) is a Horizon Europe initiative exploring how digitalisation and innovation can foster equitable trade relations between Europe and Africa. The UFS is partnered with HSWT (Germany), USSEIN (Senegal), Wageningen University (Netherlands), University of Agriculture in Krakow (Poland), University of Gabes (Tunisia), University of Kara (Togo), JOOUST (Kenya), University of Arsi (Ethiopia), and Vrije Universiteit Brussel (Belgium).

These EU-funded collaborations significantly boost the UFS research impact, promote inclusive agricultural innovation, and nurture a new generation of African scientists and entrepreneurs capable of driving food system transformation.

ACADEMIC CITIZENSHIP AND COMMUNITY ENGAGEMENT

Over and above some of the initiatives described above, the Department was actively involved in making a difference in the community.

Soy Product Campaigns were conducted, which reached over 2,000 learners and hosted tasting booths in local supermarkets and expos.

The Wool Wise Community Project was recognised for its innovative use of wool, receiving accolades at the OVK Innovation Competition held in conjunction with the Karoo Winter Wool Festival in Middelburg from 13 to 16 June 2024.



The prize-winners at the gala evening of the OVK Innovation Competition on 13 June, from the left, in front: Emily Segame, Sophia Mekhoe, Sarah Lenong, Maserame Sebonyane, Ntabiseng Ndabeni; back, from the left, Elizabeth Mwana, Carlize van Zyl Carien Vorster, Jana Vermaas, Doretha Jacobs, and Nelly Olayi

PARADYS EXPERIMENTAL FARM

The Paradys Experimental Farm (PEF) forms an important and integral part of the Department of Sustainable Food Systems and Development

and also provides support and services to other departments in the Faculty, such as Animal Science, Plant Sciences, Zoology and Entomology, and Soil, Crop and Climate Sciences. 2024 marked a pivotal year for the PEF with major progress in innovation, infrastructure development, commercial partnerships, research, and student engagement. The year was defined by strategic partnerships, operational improvements, expanded teaching capacity, and a reaffirmed commitment to aligning with Vision130, the institutional strategy to transform UFS into a globally relevant, socially just, and sustainable university by 2034. The goal is to become an Agricultural Innovation and Training Hub in South Africa.

Key Developments and Sponsorships

A number of partnerships are in place which have added immense value to the PEF's research and production chains and helped increase production efficiency and reduce costs. The following major equipment and infrastructure improvements were made possible through generous industry collaboration:

- An 8-row precision planter was donated by Rovic & Leers, which has been integrated into crop production and research, and used in student training.
- A full set of farm maintenance tools, including chainsaws, brush cutters, tillers, pole pruners, and more was donated by STIHL South Africa. A formal collaboration agreement outlines branding, training, and data use on their equipment.
- New irrigation systems were installed in both greenhouse tunnels with the aim of supporting and enhancing research. The additional net tunnel serves as student community support and is being used by Kovsie ACT to produce crops for students.
- The 9500P Centre Pivot Irrigation System was upgraded by Lindsay Africa (Zimmatic) optimising crop production under water-scarce conditions and acting as a practical training tool for students. With the addition of the upgrades the pivot now includes a new watering package which enhanced irrigation capabilities for the farm fodder production. The pivot serves as a

pilot plant for Zimmatic who are continuously gathering data to support ongoing improvements to their products and serve as a valuable exhibition for students at the farm.

- Franklin Electric supported the acquisition of a high-output energy-efficient pump system to improve irrigation performance and reduce electricity costs.
- Irrigation infrastructure for the farm's developing recreational and showground space, intended for farmers' days and community training, was sponsored by Renew Irrigation
- Molatek provided lick supplements to improve livestock health, carcass quality, and grazing efficiency.
- A range of high-yield forage seeds were supplied by Limagrain, which will help to boost fodder production. Two MSc students from Limagrain will be enrolled at the UFS to further their studies on crop yields.



Livestock Enterprise

In line with new sustainability and profitability goals, the PEF sold off excess animals to match herd sizes with grazing and fodder capacity.

The first stage of dairy pen renovations was started and rebuilt with the help of UFS Estates. Their team also assisted with the renovation of calf rearing pens and painting of buildings. This has helped with the farm's overall aesthetics and the yard now has a refreshed corporate image.

In terms of cattle, the PEF has 205 beef cattle (Afrikaner and crossbreeds), and 89 dairy cattle (including 22 cows in production). The cattle conception rate was 80% (90% for heifers). We have 80 breeding ewes, with a conception rate of 95% and a lambing percentage of 90%.

Dairy Processing Unit (DPU)

The Paradys Dairy Processing Unit continued to offer students practical experience in milk production, dairy cattle handling, automated milking systems, and cheese and yoghurt production. Commercial distribution occurred both on and off campus. In 2024, the unit was placed under operational review to develop a new business plan and educational model in order to balance profitability with core missions of education, community outreach, and research. In 2025 a specialist consultant will assist with establishing production standards, protocols and advise on product development and formulation.

Fermentation Unit

The Paradys Fermentation Unit was fully commissioned in 2024. Sponsored in part by South African Breweries (SAB) and supported by a strong collaboration with ZZ2 and NovaLogix, this unit is a flagship for microbial product development, brewing education, and applied fermentation sciences.

The Unit, which has a 500 L brew house with distillation, bottling, canning, and kegging capabilities, will be used primarily for education purposes with envisaged commercial production. A bottled water project is planned for 2025.

R&D initiatives (current and planned) include the development of microbial inoculants for crop productivity, and the development of probiotic products (with NovaLogix), and the production of silage inoculants, effective microbes, and fermented crop inputs.

Research Activities

The PEF supports a wide range of interdisciplinary research activities with various UFS departments, including:

- Orthnaïrovirus circulation and tick-vector dynamics
- GM maize grain and stover effects on lamb performance
- Seasonal diversity of forensically relevant flesh flies
- Field adaptation of South African rotavirus strains
- Non-regenerative anaemia mitigation in sheep
- *Mycobacterium bovis* comparison studies

In addition, the experimental farm hosted numerous



postgraduate field trials related to microbial product validation, irrigation efficiency, and orchard management.

Educational Integration and Community Engagement

The PEF remains a cornerstone of the UFS's agricultural education and community engagement.

In its role to support the integration of teaching and learning, the PEF hosted practical modules for the undergraduate Sustainable Food Production Development, Agriculture and Consumer Sciences programmes, including Animal Production Practicals (ANIG 2602, ANIG 3704), Wool Fibre Production (ANIF 2624), Reproductive Physiology (ANIP 4814/6814), Food Products from Animals (ANIF 3714), Monogastric Production Systems (ANIG 3754), Ruminant Nutrition and Physiology (ANIN 4864, ANIP 2614), and practical visits for students from Agricultural Innovation (SFAI 263) Sustainable Food Systems Development.

The PEF also facilitated UFS interdisciplinary academic tours for UFS faculties, including Economic and Management Sciences, Law, and Natural and Agricultural Sciences

Community training initiatives included animal handling and welfare workshops, stockmanship and animal husbandry, branding, vaccination, and breed planning, and school group practical visits

A number of farmers' days were hosted, such as an Agricultural Drone Demonstration, the Lucerne Production Day, an Irrigation Systems Demo (with Lindsay Africa), a Feed Catalogue Expo, and animal branding and health days.

We also provided farm exhibitions to secondary and tertiary education institutions, and visitors from institutions abroad, such as Jim Fouché Highschool, Fichardt Park High School, Lesotho High School, Glen Agricultural College, Texas Tech University (TTU), and Aeres University of Applied Sciences (Netherlands).

Stakeholder tours were facilitated for delegations from ZZ2, SAB, Mastercard Foundation, Standard Bank, Lindsay Africa, STIHL, and Limagrain, as well

as visits from local and national government officials evaluating agri-education opportunities.

In addition, the PEF was involved in the Kovsie ACT food security project by providing training and assistance for student farmers, securing a location and funding to renovate the vegetable tunnels on the farm for use by the South Campus.



POSTGRADUATE STUDENTS

During 2024, 155 students successfully completed their Postgraduate Diploma in Sustainable Agriculture (13 with distinctions) and 89 students obtained their Master's in Sustainable Agriculture, four with distinctions.

Two students completed the MSc majoring in Consumer Science, two the MSc majoring in Food Science, and one the MAgic with specialisation in Food Nutrition Security.

Six candidates completed their PhD in Sustainable Agriculture degrees and graduated:

Pieter Bruwer

Thesis: Establishing effective communication between the agricultural researcher and the farmer with special reference to the large-scale sugar cane, soybeans and maize industry – a comparative case study in South Africa

Supervisor: Prof JA van Niekerk

Co-Supervisor: Dr Bradley Flett

Melanie de Bruyn

Thesis: Crop systems for sustainable agriculture in the North-Western Free State, South Africa

Supervisor: Prof JA van Niekerk

Co-Supervisor: Dr A Nel

Siyaze K Gantsho

Thesis: Integrated innovation strategies in sustainability of agriculture cooperatives in Lejweleputswa District, Free State Province, South Africa

Supervisor: Prof JA van Niekerk

Co-Supervisor: Prof JW Swanepoel

Thabiso E Mokhesengoane

Thesis: Agro-ecological rangeland condition assessment of extensive land-reform pastoral farming sites in the Bloemfontein magisterial area post two wet seasons preceded by drought

Supervisor: Prof JA van Niekerk

Co-Supervisor: Dr HC van der Westhuizen

Benjamin Ramakgodu

Thesis: Evaluating the impact of government support programs on the development of land reform farms in South Africa

Supervisor: Dr QN Qwabe

Co-Supervisor: Prof JW Swanepoel

Carel Wessels

Title: Exploring the poor uptake of new agricultural-based technologies in rural communities in South Africa

Supervisor: Dr JJ Anderson

RESEARCH OUTPUTS

Research Articles

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Taole-Kolisang, L., Makamane, A. & Khetsha, Z. 2024. Enhancing rural livelihoods and empowering youth through agripreneurship: An analysis of the comprehensive rural development programme in QwaQwa, Free State, South Africa. *International Journal of Applied Research in Business and Management* 5(2)

Van Niekerk, J.A., Venter, P. & Van der Watt, E. 2024. Sustainability of New Generation Commercial Farmers in South Africa: A North-West Province Case Study. *South African Journal of Agricultural Extension* 52(3): 103-131.

Zenda, M., Malan, P.J. & Geyer, A.C. 2024. An Analysis of the Wool Characteristics That Determine the Wool Price for White Wool in South Africa. *South African Journal of Agricultural Extension* 52(1): 210-230.

Zenda, M., Malan, P.J. & Geyer, A.C. 2024. An analysis of the wool characteristics that determine wool price in South Africa. *Scientific African* 23: e02005.

Conference Contributions

Conference Papers / Posters

Du Toit, A., Mpemba, O. & Rebe, S. 2024. Managers' implementation of safe food handling practices in their QSR environments. Paper delivered at the 16th International SAAFECS Conference in conjunction with IFHE Africa, Cape Town, South Africa. 13-15 March 2024.

Korir, J. & Oldewage-Theron, W. Status of Policy Coherence and Coordination for Enhanced Multisectoral Nutrition Programming in Kenya. Poster presented at the Academy of Nutrition and Dietetics Food & Nutrition Conference & Expo (FNCE) in Minneapolis, MN, United States. 5-8 October 2024.

Makamane, A.S. 2024. *Evaluating the training needs of smallholder farmers in Zambia*. Poster presented at the 57th South African Society for Agricultural Extension (SASAE), Bloemfontein, South Africa. 26-29 October 2024.

Makamane, A.S. 2024. *Evaluating the training needs of smallholder farmers in Zambia*. Paper delivered at the 34th International Food and Agribusiness Management Association (IFAMA), Almeria, Spain (Oral presentation) 17-20 June 2023

Rebe, S., Cronje, N., Redelinghuys, N., Pretorius, W. & Du Toit, A. 2024. *Exploring the consumption of maize products, side dishes and snacks preferred by consumers at a public tertiary institution*. Paper delivered at the 16th International SAAFECS Conference, Cape Town, South Africa. 13-15 March 2024.1: 23-42

Sosa-Holwerda, A., Park, O.H., Thompson, L., Niraula, S., Albracht-Schulte, K. & Oldewage-Theron, W. *The role of Artificial Intelligence in nutritional dietary assessment: An article review*. Poster presented at the American Society of Nutrition Conference in Chicago, IL, USA. 29 June-2 July 2024.

Tinta, N. 2024. *The multifaceted impact of income-generating activities for people with disabilities*. Paper delivered at the 16th International SAAFECS Conference in conjunction with IFHE Africa, Cape Town, South Africa. 13-15 March 2024.

Vermaas, J.F., Firdm L. & Gericke, A. 2024. *Baa baa black sheep, what can be done with your wool? A comparison of dorper and merino felted textiles*. Paper delivered at the 16th International SAAFECS Conference in conjunction with IFHE Africa, Cape Town, South Africa. 13-15 March 2024.



STAFF (2024)

Head of Department:
Prof JA van Niekerk

- Professors:** Prof M Boshoff, Prof JA van Niekerk, Prof C Oberholster, Prof Oldewage-Theron, and Prof RC Witthuhn
- Associate Professors:** Dr AE Nesamvuni, Prof Hlami Ngwenya, and Prof JW Swanepoel
- Affiliated Professors:** Prof EL van Staden and Dr SL Venter
- Senior Lecturers:** Dr JH Barnard, Dr C Bothma, Dr PW Bruwer, Dr MA de Bruyn, Dr A du Toit, Dr I van der Merwe, Dr M Krugel, Dr MK Thobejane, Prof P Venter, and Dr I van Der Merwe
- Lecturers:** Dr N Cronje, K Green, Dr AS Makamane, L Mdiya, Dr N Tinta, Dr JF Vermaas, H van der Merwe, and AB Zulu
- Lecturers (units):** TA Colbert, Dr KS Matlhoko, AA Muller, Dr BD Nkosi, KP Rasebapatja, PZ Swart, and Dr BB van Rooyen
- Junior Lecturers (units):** A de Bruin, NS Dlamini, KE Nematshema, Dr VF Nkoi, and M Vermeulen
- Research Fellows:** Dr DB Adelabu, Dr LS Magwaza, Prof VM Mbengwa and Dr S Zantsi
- Programme Director:** Dr I van der Merwe

- Professional Services (5/8):** SJ Mjamba, Dr M Claassen, Prof GE Swan, JS Isaacs, Dr N Scheepers, and HS Smit
- Senior Officers:** A Calitz, GCA Green, D Jacobs, and L van der Walt
- Officers:** R Coetzee, C Denner-Vorster, and Y Xatasi
- Senior Assistant Officers:** ME Seithleko and W van der Walt
- Messenger:** LE Khalata
- Intern:** TV Kekana





BUILDING
SCIENCES



DEPARTMENT OF
ARCHITECTURE

FACULTY OF NATURAL AND AGRICULTURAL SCIENCES



C O N T A C T D E T A I L S

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OVERVIEW OF 2024

In 2024, the Department celebrated significant achievements, highlighted by two public PhD viva exams with supporting exhibitions, which were well attended and streamed to an international audience. The 35th Sophia Grey Memorial Lecture series, which included a Master Class by visiting Adjunct Professor Jeremy Smith and an architectural tour of the Free State Goldfields led by Kobus du Preez, proved to be truly memorable.

ACHIEVEMENTS

Staff Achievements

Prof Gerhard Bosman received special recognition as a National University Teaching Awards (NUTA) Nominee at the UFS Exceptional Academic Achievers Award for 2024.

Adjunct Professor Jeremy Smith won ‘The Most Beautiful, Innovative and Iconic Building’ at The Dubai International Best Practices Award for Sustainable Development at the United Nations World Government Summit, in Dubai 2024.

Student Achievements

The following awards were made at the Annual Corobrik Prize-giving to the March (Prof) degree:

- 1st Prize: Michail Cloete
- 2nd Prize: Janka van Zyl
- 3rd Prize: Chris van Heerden
- Best use of masonry: Paige Myburgh

TEACHING AND LEARNING

Teaching in 2024 proved complicated due to the loss of two members of staff, who took positions at other institutions. The Department had to rely on several temporary contract positions to fill the gaps in the teaching plan. The recruitment of new staff was challenging but successful.

Digital Fabrication

The digital fabrication lab became fully operational after addressing health and safety concerns. Students who received induction training may now use the lab for 3D printing and laser cutting of their designs under the supervision of our trained operators, Mpendulo Myeni and Lindelo Keswa.

Service Learning

In June, the Earth Unit conducted two tours to the Basotho Cultural Village near Phuthaditjhaba.

Twenty-nine students visited and participated for three days in different parts of a service-learning assignment. Prof Gerhard Bosman and Hein Raubenheimer invited 15 students and two staff members from the Faculty of Architecture of Chulalongkorn University, Bangkok, to participate in the three-day workshop with the UFS Architecture students.



Students involved in activities at the Basotho Cultural Village

Rose Garden Vita Activa

On 7 June 2024, Dr Hendrik Auret and Marita Meyer organised a rescriptive event at the historic Prince’s Rose Garden during which Honours-level architecture students engaged creatively (and rescriptively) with a colonial relic to question assumptions about heritage preservation and broaden the heritage landscape.



The historic Prince’s Rose Garden, site of the Vita Activa

Construction Day

Construction Day was a new initiative by the construction lecturers to enrich students' technical literacy through specialist input and industry engagement. The event featured lectures by three professionals – structural engineer Henning Brisley spoke on structural principles and common pitfalls, senior architectural technologist Leon Titus delivered two compelling talks on sewerage and roofing, and architect Lana Bramley presented on compliance with SANS10400 Part XA: Energy Efficiency.

In parallel, a product exhibition was held in the corridor, where suppliers showcased a range of construction materials. This introduced students to the world of product specification and allowed for direct engagement with industry representatives.

RESEARCH, INNOVATION AND RESEARCH COLLABORATION

Prof Noble was invited in February 2024 to attend the annual practice-based PhD conference at The Bartlett School of Architecture, University College London. The visit also involved discussions concerning future PhD collaboration with The Bartlett. Prof Noble presented a seminar on his research – titled 'Mediating Public and Private Spaces' – at The Bartlett during the PhD conference week. The opening of the annual PhD exhibition, on



The opening of The Bartlett PhD exhibition

the evening of 20 February, was held in memory of Prof Jonathan Hill, credited with establishing design-based research in the UK.



Postgraduate students at the NUST Department of Architecture and Spatial Planning

Dr Hendrik Aurent's research involves his alternative architectural site analysis methods. In August 2024, he invited the Namibia University of Science and Technology (NUST) in Windhoek to share these methods with the postgraduate students at the Department of Architecture and Spatial Planning at NUST.

Dr Aurent was invited to present a research workshop on his alternative architectural site analysis methods to postgraduate students at the Belfast School of Architecture and the Built Environment (Ulster University) during November 2024. The National Future Professors Programme funded this workshop.



Participants at the research workshop at the Belfast School of Architecture and the Built Environment

ACADEMIC CITIZENSHIP AND COMMUNITY ENGAGEMENT

This year the Department hosted the 35th Sophia Gray Memorial lecture titled *In the Making of Meaningful Things*, presented by Earthworld architects, Andre Eksteen and Braam de Villiers. The exhibition was a successful event held at Olievenhuis.



From the left, Braam de Villiers, Jonathan Noble, and Andre Eksteen

The Sophia Gray also included two side events – a design masterclass and an architectural tour. The 'Sustainable Smalls' masterclass was conducted by visiting Adjunct Professor Jeremy Smith from New Zealand. It proved to be an energetic and creative session, with 57 architects and students attending.



Participants in the masterclass

The architectural bus tour to the Free State Goldfields, led by Kobus du Preez, was a joyful occasion, attended by some 50 architects and students.



Roman Catholic Cathedral of St Patrick's, Kroonstad, known for its architectural beauty and historical significance

In April 2024, Dr Hendrik Aurent was invited to present the SAIAshare#33 online webinar, which is marketed to all architectural professionals in South Africa. More than 300 architectural professionals attended. The talk was titled 'Poetically rescripting architectural heritage resources' and explained three case studies of creative solutions to real-world heritage challenges developed by the Permit Committee of the Free State Provincial Heritage Resources Authority.

In October, Prof Jonathan Noble was invited to chair an internal CHE review of the Architecture Department of the Durban University of Technology.

In April, Prof Gerhard Bosman visited the Faculty of Architecture of Chulalongkorn University, Bangkok, where he lectured to second-year students in construction and first-year students in design in the International Program Architecture and Design (INDA).

Prof Bosman was invited to teach and train earth-construction principles at the Himalayan Institute of Alternatives for Ladakh (HIAL), Phyang Village near Leh in India, in July 2024. As part of the Sun and Earth Festival, he presented sun-dried earth block (adobe) production and construction workshops to 42 students and 38 professionals.



Prof Gerhard Bosman (back row, third from left) and participants at the Himalayan Institute of Alternatives for Ladakh in India

POSTGRADUATE STUDENTS

Twenty-nine (29) students graduated with the Bachelor of Architecture Honours, two with the Master of Architecture Research and 28 with the Master of Architecture (Professional). The following students achieved distinctions in the March Professional (Structured) graduating class:

- Jaco Robert Barnard
- Emihle Bunu
- Michail Thomas Cloete
- Nadia Doubell
- Jacquelin Johanna Fourie
- Johannes Petrus Jacobs
- Glory Kamthunzi
- Stephan Maischatz
- Paige Jill Ann Myburgh
- Jani Niehaus
- Meghan Pretorius
- Chris Reinhardt van Heerden
- Janika van Zyl
- Kian Volschenk

International PhD examiners Dr Jo Russell-Clarke (formerly at the University of Adelaide) and Adjunct Professor Jeremy Smith visited the Department to examine PhD candidates in January and August,

respectively, and to participate in the related week-long PhD symposia, which were well attended and streamed internationally. Patrick McInemy and Martie Bitzer presented their work as part of the events.

Patrick McInemy presented his practice-based PhD public viva and exhibition in January 2024, with his thesis titled 'From Silence to Light: establishing how ribbons of implicit design endeavour affect the ethos of a practice in a changing world. His supervisor was Prof Jonathan Noble.



Patrick McInemy's public viva and exhibition in January 2024

Martie Bitzer presented her design-led PhD public viva and exhibition in August 2024, with her thesis titled *Ecdysis: Shedding Skin as Performative Agent in the Negotiation of New Transitions for Architecture*. Her supervisor was Prof Noble.



Martie Bitzer's public viva and exhibition in August 2024

STAFF MATTERS

Multi-award-winning architect and Adjunct Professor at the UFS, Jeremy Smith, delivered his Inaugural Lecture on 27 August. The lecture titled 'Being Finished is finished' provided a remarkable view into the highly innovative nature of his practice as design director at Irving Smith Architects in New Zealand. The event was truly inspiring for those who attended.



Prof Jeremy Smith

Natalie Harper joined the staff as a lecturer in the second semester of 2024. She is currently teaching the Honours year design module and third-year history and theory of architecture.

Lefu Namane finalised his work visa application to join the staff as a lecturer in 2025.

Mpendulo Myeni completed his Master's in Audio and Visual Media, graduating in December 2024.



Mpendulo Myeni

RESEARCH OUTPUTS

Journal Articles

Auret, H.A. 2024. *Poiëse en poiëtiese denke in Die swye van Mario Salviati: 'n gereedmaak vir simpoiëse. Tydskrif vir Geesteswetenskappe* 64(4): 646-664.

Auret, H.A. & Du Preez, J.L. 2024. Rescripting contested monuments amid shifting regionings of concern: the case of the President M.T. Steyn statue. *Built Heritage* 8(53): 1-12.

STAFF (2024)

Head of Department:
Prof JA Noble

- Professor: Prof JA Noble
- Associate Professor: Prof G Bosman
- Adjunct Professor: Dr J Smith
- Adjunct Associate Professor: Dr T Hardman
- Senior Lecturers: Dr HA Auret, MM Bitzer, and JL du Preez
- Lecturers: N Harper, M Meyer, JH Nel, H Raubenheimer, and DPG van der Merwe
- Lecturers (Contract): L Bramley, J Gutter, A Herbert, K Salzman-McDonald, S Moffat, JD Smit, and P Smit
- Junior Lecturer: JI Olivier
- Research Fellow: Prof WH Peters
- Senior Assistant Officers: Z Bronkhorst and Y Nienaber
- Assistant Officer: LT Keswa and MQ Myeni
- Messenger: TJ Mohatlane



DEPARTMENT OF

QUANTITY SURVEYING AND CONSTRUCTION MANAGEMENT

FACULTY OF NATURAL AND AGRICULTURAL SCIENCES



CONTACT DETAILS

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OVERVIEW OF 2024

The Department of Quantity Surveying and Construction Management, housed within the Faculty of Natural and Agricultural Sciences at the University of the Free State,

continues to serve as an important pillar of the Building Sciences cluster alongside Architecture, and Urban and Regional Planning. The Department plays a significant role in developing built environment professionals who contribute meaningfully to addressing national imperatives, including the provision of scarce and in-demand skills in construction management, quantity surveying, and property-related fields. The Department's professionally accredited programmes are recognised on the Department of Labour's critical skills list.

All programmes are accredited by relevant professional councils, namely the South African Council for the Property Valuers Profession (SACPVP), the South African Council for the Project and Construction Management Professions (SACPCMP), the South African Council for the Quantity Surveying Profession (SACQSP), and the Royal Institution of Chartered Surveyors (RICS). In 2024, the Department submitted the required annual reports to all four professional bodies in compliance with accreditation obligations.

The year also marked a leadership transition in the Department. Dr Christopher Amoah concluded his term as Acting Head of Department at the end of 2024. The Department extends sincere appreciation to Dr Amoah for his steadfast leadership, strategic contributions, and commitment to excellence during his tenure. As the Department moves forward, we welcome Prof Benita Zulch as the new Head of Department and look ahead to continued innovation, academic growth, and engagement under her guidance.

ACHIEVEMENTS

Staff Achievements

Dr Mart-Mari Els was awarded her doctoral degree with a specialisation in Higher Education Studies at the Faculty of Education. The degree was conferred at the summer graduation ceremony of December 2024.

The UFS Future Professoriate Programme recognised Dr Christopher Amoah with an award for extraordinary scholarly growth in the last five years.

Hendri du Plessis and Dr Somarie Holtzhausen (Department of Curriculum Studies and Higher Education) won the third Best Paper Award at the Association of Schools of Construction of Southern Africa (ASOCSA) Annual Conference 2024.

Student Achievements

The Department is pleased to congratulate the following students who received prizes for their outstanding academic work.

Hanno Calitz was shortlisted for the ASAQS Turner and Townsend Award, Thoko Radebe and Rynard Otto for the Great Outcomes Award, and Milné Botha and Bianca Groenewald for the Gold Medal Award.

Rynard Otto won the National ASAQS Great Outcomes Award and presented at the SASQSP conference held in Durban on 21 and 22 October 2024.

The Department is proud to celebrate Prince Magagula, an Honours student, who was selected as a finalist in the 2024 Growthpoint Greenovate Awards, held at Growthpoint's Head Office in Sandton in partnership with the Green Building Council South Africa. His research, 'Exploring the Integration of Social Sustainability Principles into the Planning and Design Stages of Construction Projects from the Perspective of South

African Quantity Surveyors', was recognised for its innovative approach and relevance to sustainable development in the built environment.



Dr Mart-Mari Els



Prince Magagula (centre) at the 2025 Growthpoint Greenovate Awards

TEACHING AND LEARNING

The Department offers built environment-related programmes in Quantity Surveying, Construction Management (Undergraduate- and postgraduate level) and Real Estate Management (Property Studies) (Postgraduate level). Within these main areas, numerous professional and career opportunities can be found in both the public and private sectors within the Construction Built Environment (CBE) and related fields. The developments in teaching and learning highlight the Department's commitment to delivering relevant and innovative curricula, which prepare students for the challenges and opportunities of the modern workforce. Face-to-face lecturing formed the cornerstone for the residential programmes supported

by a blended learning approach through face-to-face contact sessions and Blackboard, particularly for the Compact programmes at the undergraduate and Honours levels, together with the structured Master's students. Lecturers use a variety of teaching, learning and assessment strategies to support and develop students to achieve various outcomes and



Rynard Otto

develop graduate attributes. The basic philosophy in the Department is “Student-Centered and Student Engaged Hands on Real-Life Approaches to Learning and Teaching”. This philosophy is translated into practice by staff in classroom contexts across all modules. Some approaches allow maximum student engagement, where the student is placed at the centre of the learning. Overall, the progression rate per module was found to be satisfactory across programmes.

The table below summarises the enrolment figures as per the relevant programmes presented at the Department, and the number of students who successfully completed their degrees in 2024.

Table 1: Department of Quantity Surveying and Construction Management enrolments and completions (2024)

| PROGRAMME | ENROLMENTS | COMPLETIONS |
|--|------------|-------------|
| BSc in Building Science (Residential) | 12 | 1 |
| BSc in Construction Economics and Management (Residential) | 54 | 9 |
| BSc in Construction Management (Compact) | 11 | 0 |
| BSc in Quantity Surveying (Compact) | 42 | 7 |
| TOTAL | 119 | 17 |

During the year, several site visits around Bloemfontein were undertaken to expose students to construction activities to enhance their classroom learning experiences.



Prof Gerhard Bosman (back row, third from left) and participants at the Himalayan Institute of Alternatives for Ladakh in India



Students on site visits in and around Bloemfontein

RESEARCH, INNOVATION AND RESEARCH COLLABORATION

Hendri Du Plessis’s research group continued its research under the theme ‘An evaluation of the Fourth Industrial Revolution (4IR) readiness of learning institutions and various professionals in the South African Construction Industry: An exploratory study’. Hendri also delivered a paper on his work at The Association of Schools of Construction of Southern Africa (ASOCSA).

Dr Christopher Amoah collaborated with academics from Nelson Mandela University (South Africa), Akenten Appiah-Menka University of Skills Training and Entrepreneurial Development (Ghana), and Cape Coast Technical University (Ghana). These collaborations focused on research in public

procurement, contractor development, and empowerment policies in construction. They resulted in multiple joint publications and conference contributions, strengthening comparative perspectives within the African construction context.

Dr Opeoluwa Akinradewo maintained collaborative research links with scholars from the University of Johannesburg (South Africa), Walter Sisulu University (South Africa) and the INTI International University (Malaysia), contributing to a number of joint publications in the field of built environment innovation. This collaboration involved research projects on the adoption of augmented reality technologies in the built environment education and training, sustainable cities and transport infrastructure, and construction/demolition waste management.

Prof Kahilu Kajimo-Shakantu collaborated on scholarly work with colleagues from both South Africa and abroad, including the Copperbelt University in Zambia. The collaboration was on various localised research projects that the colleagues from the other institutions were conducting with their undergraduate and postgraduate students on various topics within sustainable built environments. Prof Kajimo-Shakantu provided support and input, especially in the publications arising from the respective research. These partnerships contributed to advancing research in sustainable construction and infrastructure development.

ACADEMIC CITIZENSHIP AND COMMUNITY ENGAGEMENT

In 2024, several academic staff members of the Department actively contributed to external academic and professional communities. Each participated in engaged scholarship activities, including external co-supervision, moderation, and review work for postgraduate studies and academic

conferences, with some particular contributions highlighted below:

Dr Amoah was appointed to the editorial board of *Acta Structilia* in 2024 and contributed significantly to the global academic community through peer review activities. He served as a reviewer for several international journals, including *Rural Society*, *Knowledge and Process Management*, *Journal of Immigrant and Refugee Studies*, *Indoor and Built Environment*, *Journal of Responsible Production and Consumption*, *Modern Supply Chain Research and Applications*, *Journal of Construction Project Management and Innovation*, *European Journal of Education*, and *International Perspectives on Health Equity*.

Prof Kajimo-Shakantu participated as a panellist at the 11th African Real Estate Society (AFRES) International Conference in Livingstone, Zambia, from 10 to 13 September 2024. At the same conference, she was an invited speaker at the Master Class event with a topic titled ‘Towards Sustainable, Smart, Resilient, and Inclusive African Cities through Upgrading Infrastructure and Retrofitting’. The conference was themed ‘Smart Cities in Africa for the 21st Century’ and focused on promoting sustainable, smart, resilient, and inclusive African cities through infrastructure upgrading and retrofitting. Her participation highlighted the Department’s commitment to contributing to continental discussions on urban development and innovation in the built environment. Based on her expertise, Prof Kajimo-Shakantu was also invited to give input into the Real Estate Management Curriculum review at the Copperbelt University in Zambia.

In 2024, the Department of Quantity Surveying and Construction Management strengthened its longstanding ties with professional industry bodies, most notably the Association of South African Quantity Surveyors (ASAQS). The Department hosted an ASAQS representative tour with the Free State Chapter for a collaborative visit focused on curriculum alignment, academic-industry cooperation, and increased student and staff engagement. Staff members also contributed to the profession by serving on various ASAQS committees, reflecting the Department’s active role in shaping industry discourse and academic relevance.

OTHER ACTIVITIES

Honours Breakfast and Industry Send-Off

To celebrate the achievements of the 2024 Honours cohort, the Department hosted a special Honours Breakfast. Each student was presented with a branded hard hat and Honours jacket as symbolic tokens of their transition into professional practice. This tradition fosters a sense of pride and identity as graduates prepare to enter the industry as ambassadors of the Department and the University.



Honours students with their symbolic site-ready hard-hats

First-Year Student Welcoming

The Department formally welcomed its 2024 first-year students through a dedicated orientation event. To commemorate the occasion, each student received a branded safety vest and blue hard hat, introducing them to the values of the built environment profession and the Department's culture of inclusion and professionalism. These gestures create an immediate sense of belonging and signal the beginning of a meaningful academic and professional journey.



First-year welcoming

ASAQS Student Engagement Event

Quantity Surveying Honours students participated in the ASAQS Young Professionals Event hosted at the Protea Hotel by Marriott in Bloemfontein. The event featured soft skills development, career guidance, and networking opportunities with seasoned industry professionals. Students gained valuable insights into current industry expectations and forged connections that will support their transition into the workplace.



Staff and students at the ASAQS Young Professionals Event

POSTGRADUATE STUDENTS

The Department offers postgraduate degrees at Honours, Master's and Doctoral levels in Quantity Surveying (QS) and Construction Management (CM). It also offers a Master's by research and a PhD programme in Property Science. The postgraduate programmes also include a Master's by coursework degree in Land and Property Development Management (MLPM), specialising in either Project Management (PM) or Property Valuation (VL).

The total number of postgraduate students enrolled

in the various programmes in 2024 was:

Table 2: Department of Quantity Surveying and Construction management postgraduate students (2024)

| PROGRAMME | |
|--|----|
| BSc Honours Construction Management (CM) Residential | 5 |
| BSc Honours Construction Management (CM) Compact | 23 |
| BSc Honours Quantity Surveying (QS) Residential | 18 |
| BSc Honours Quantity Surveying (QS) Compact | 57 |
| Master of Land and Property Development Management with specialisation in Project Management | 26 |
| Master of Land and Property Development Management with specialisation in Valuation | 24 |
| MSc (Construction Management) | 4 |
| MSc (Quantity Surveying) | 5 |
| MSc (Property Science) | 3 |
| PhD (Construction Management) | 4 |
| PhD (Quantity Surveying) | 3 |
| PhD (Property Science) | 6 |

At Honours level, 34 students graduated. Five received their degrees in CM Residential, two in CM Compact, thirteen in QS Residential, and fourteen in QS Compact.

Five students completed the Master of Land and Property Development Management, with a specialisation in Project Management, while four completed with specialisation in Valuation.

Henrico Gouws obtained his MSc (Quantity Surveying), with distinction.

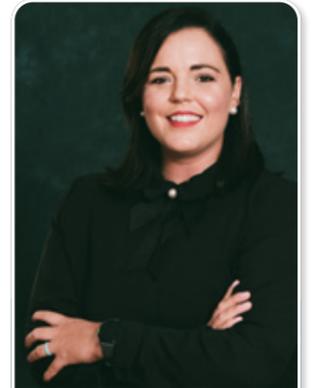
STAFF MATTERS

The Department welcomed Dr Opeoluwa Akinradewo as a Senior Lecturer and Catherine Robbertse as a Lecturer. Their expertise and contributions are highly valued as we continue to strengthen the academic team.



Dr Opeoluwa Akinradewo

We bid farewell to Cameron Ferreira, Thapelo Mogorosi and Andile Madiehe. The Department thanks them for their service and wishes them success in their future endeavours.



Catherine Robbertse

RESEARCH OUTPUTS

Research Articles

Akinradewo, O., Aigbavboa, C., Emere, C., Ebiloma, D. O., Akinshipe, O. & Oke, A. 2024. Barriers to the Adoption of Unmanned Aerial Vehicles for Construction Projects in South Africa. *Engineering Proceeding* 76(1): 12. DOI: 10.3390/engproc2024076012.

Akinradewo, O., Hafez, M., Aigbavboa, C., Ebekoziem, A., Adekunle, P. & Otasowie, O. 2024. Innovating Built Environment Education to Achieve SDG 4: Key Drivers for Integrating Augmented Reality Technologies. *Sustainability* 16(19): 8315. DOI: 10.3390/su16198315.

Amoah C., Bamfo-Agyei, E. & Simpeh, F. 2024. Student accommodation selection factors: the perspective of tertiary students in Ghana. *Journal of Real Estate Literature* 33(1): 40-60 (online). DOI: 10.1080/09277544.2024.2426320.

Amoah, C. 2024. Challenges of black construction professionals with Black Economic Empowerment as a Procurement Policy in South Africa. *Journal of Public Procurement* 24(4): DOI: 10.1108/JOPP-05-2023-0032.

Amoah, C. 2024. Prominent factors causing quality issues in government social housing construction in South Africa. *International Journal of Productivity and Quality Management* 43(4): 423-439. DOI: 10.1504/IJPM.2024.143223.

Amoah, C. & Le Roux, L. 2024. Students' Challenges with Online Remote Teaching and Learning in South Africa. *International Journal of Construction Education and Research* pp.1-21. DOI: 10.1080/15578771.2024.2423632.

Amoah, C. & Smith, J. 2024. Barriers to the green retrofitting of existing residential buildings, *Journal of Facilities Management* 22(2): 194-209. DOI: 10.1108/JFM-12-2021-0155.

Camngca, V.P., Mwavani, H.D.J., Amoah, C & Ayesu-Koranteng, E. 2024. Underutilisation of information communication and technology in the public sector construction project's implementation. *Journal of Facilities Management*. 22(1): 1-20. DOI: 10.1108/JFM-10-2021-0128.

Ibrahim, K., Agidani, J. Oke., A.E., Ikuabe, M. & Kajimo-Shakantu K. 2024. Assessing Work-Life Balance Strategies Employed by Nigerian Builders. *International Journal of Construction Management*. DOI: 10.1080/15623599.2024.2384215.

Ibrahim, K., Amoah, C., Simpeh, F. & William, J. 2024. Adoption challenges of sensing technologies on construction sites in sub-Saharan African countries. *Engineering, Construction and Architectural Management*. DOI: 10.1108/ECAM-05-2024-0600.

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STAFF (2024)

**Acting Head of Department:
Dr C Amoah**

Associate Professor: Prof K Kajimo-Shakantu

Senior Lecturers: Dr O Akinradewo and
Dr C Amoah

**Lecturers
(Permanent):** T Bremer, H du Plessis,
B du Toit, M-M Els,
C Ferreira (resigned),
L le Roux, PM Oosthuizen,
and C Robbertse

Lecturers (Contract): A Deacon, D Huggett,
C Mukumba, C Skibbe,
L Spencer, L Stott, and
W Strydom

Programme Directors: C Ferreira (resigned) and
H du Plessis

**Affiliated Research
Fellows:** Prof T Haupt, Dr K Ibrahim,
Dr F Muleya, and
Dr A Opawole

Officers: A Beukes,
TH Mogorosi (resigned),
A Mosimanegape, and
E van der Walt

**Senior Assistant
Officers:** AB Madiehe (resigned)

Messenger: N Mohapi



DEPARTMENT OF URBAN AND REGIONAL PLANNING

FACULTY OF NATURAL AND AGRICULTURAL SCIENCES



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OVERVIEW OF 2024

The Department of Urban and Regional Planning is one of 11 planning schools that was established country-wide in 1975. As a postgraduate department, it offers two Honours, three Master's, and two PhD programmes, with eight Short Learning Programmes (SLPs). In 2024 the Department enrolled students from neighbouring countries such as Lesotho, Namibia and Zimbabwe. The qualifications offered to 110 students enrolled in 2024 were:

1. Bachelor of Spatial Planning Honours
2. Bachelor of Spatial Planning Honours with a specialization in Human Settlements
3. Master of Urban and Regional Planning (Professional)
4. Master of Urban and Regional Planning (Research)
5. Master of Human Settlements (Research)
6. PhD in Urban and Regional Planning
7. PhD in Human Settlements

The Department has six permanent academic staff and one support staff member, with 11 contractual appointments.

ACHIEVEMENTS

Staff Achievements

Prof Abraham Matamanda completed his term as part of the third cohort of the Future Professors Programme. The Programme serves the best and brightest of a transformed next generation South

African Professoriate. It is one of six national collaborative initiatives hosted by the Department of Higher Education and Training and individual South African universities.



Prof Abraham Matamanda at the closing function of the Future Professors Programme

Prof Verna Nel has been appointed as co-chair of the International Geographical Union (IGU) Commission on the Geography of Governance Steering Committee 2024-2028. The IGU is an international, professional and non-governmental organisation established for the development of Geography. The purpose is to promote geography through coordinating and initiating geographical research and teaching across the world.

Student Achievements

Our PhD candidate, Tebello Putsoane, was a fifth-place winner of the South African Council for Planners (SACPLAN) 2024 Student Essay Competition.



South African Council for Planners 2024 winners

RESEARCH, INNOVATION AND RESEARCH COLLABORATION

The SARChI Research Chair in City-Region Economies is primarily housed in the Faculty of Economics; however, the nature of the Chair requires a strong multi-disciplinary approach. Hence the appointment of Prof Abraham Matamanda as the deputy chair is highly appropriate. Cities are potential platforms for progress because they make people and firms more productive. Agglomeration creates positive value and facilitates learning and creativity. It also generates efficiencies for public infrastructure and essential services. Yet urbanisation of the population does not automatically lead to rising prosperity or inclusion, especially if it accompanied by congestion, social instability, public health risks or inflated property prices. The research seeks to understand the determinants of urban economic success and the obstacles faced to improve policy and practice – for government, the private sector and civil society. The intention is to analyse the factors and forces that drive economic development across the urban system, and that help and hinder urbanisation contributing to economic and social development.

Prof Matamanda's research has focused on urban land governance and land markets in southern African cities, trying to understand the dynamics of placemaking and the planning of city regions. In this regard, his work has largely focused on small towns and urban centres, including peri-urban areas, mining towns, and informal settlements.

In efforts to gain more insights and share experiences on the Small-Scale Rental Housing (SSRH) sector, Prof Matamanda worked with the Human Sciences Research Council (HSRC) to establish a network of urban researchers across southern Africa to undertake comparative analyses of this important phenomenon in South Africa, Zimbabwe, Angola, Botswana, Lesotho, Eswatini, and Namibia. The network includes researchers, policymakers, and NGOs working in the housing sector. The team is tackling the knowledge and policy gap on SSRH,

while also strengthening the regionalisation and internationalisation agenda emphasised by the UFS. In 2024, the team hosted a workshop on the Bloemfontein Campus, with over 50 participants from Southern African countries deliberating on best practices and policy gaps in SSRH.



Beyond southern Africa, Prof Matamanda is also championing the UFS agenda of regionalisation and internationalisation through collaborations with researchers (Prof Alonso Ayala and Mariya Khan) from the Institute for Housing and Urban Development Studies at Erasmus University Rotterdam in the Netherlands, and Professor Daniel Inkoom at the Kwame Nkrumah University of Technology in Kumasi, Ghana.

Prof Matamanda was the lead PI of an NRF-funded project exploring the impact of COVID-19 on young people in low-income households and their adaptations to food, education, and leisure/play during the lockdown. This was an international collaborative project with researchers from South Africa, Brazil, and the UK, which provided many lessons and insights into the lived experiences of young people and their adaptations to the COVID-19 pandemic.

Prof Yandisa Mashalaba, Thomas Stewart, and Dr Kgosi Mocwagae were involved in the Mangaung Housing Demand Study (MHDS) in collaboration with the UFS Centre for Development Support. For the MHDS the municipality has identified

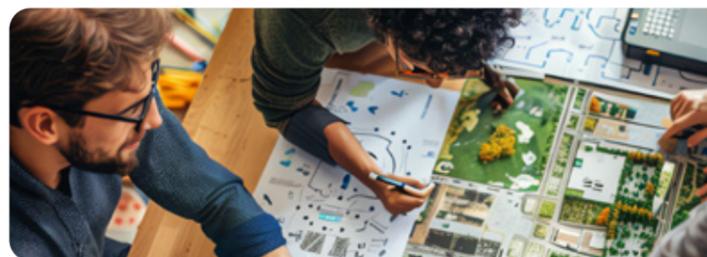
three land parcels (Hillside View, Vista Park 1 and 2), that had between 15 000 and 18 000 middle-income housing opportunities. In addition, Cecelia Park 1, Brandkop 702, Caleb Motshabi, Raceway Park, Airport Node, and Estoire are greenfield developments whose demand also had to be determined on behalf of the municipality.

ACADEMIC CITIZENSHIP AND COMMUNITY ENGAGEMENT

Dr Kgosi Mocwagae accompanied 13 Master of Urban and Regional Planning students on a service-learning field trip to the Thabo Mofutsanyane District Municipality. This forms part of the Applied Regional Planning Project on 'Planning for a Sustainable District Development Model for the Thabo Mofutsanyana District Municipality'. They visited Clarens, Bethlehem, and Senekal, where they interacted with municipal officials, local businesses, and some community members.



Applied Regional Planning students at Golden Gate for the Applied Regional Planning Project



POSTGRADUATE STUDENTS

In 2024, a total of 92 postgraduate students were enrolled in the Department of Urban and Regional Planning. In terms of the breakdown in the individual degrees, this translated to:

- Bachelor of Spatial Planning Honours 44
- Bachelor of Spatial Planning Honours (specialisation in Human Settlements) 5
- Master of Urban and Regional Planning (Professional) 21
- Master of Urban and Regional Planning (Research) 5
- Master of Human Settlements (Research) 5
- PhD in Urban and Regional Planning 9
- PhD in Human Settlements 3

Fourteen (14) students graduated with the Bachelor of Spatial Planning Honours in 2024. Michelle Madilonga graduated with distinction. At the annual Faculty Prize-giving in 2024, she won the award for the best Bachelor of Spatial Planning Honours for 2023.



Dr Kgosi Mocwagae with Michelle Madilonga, best Bachelor of Spatial Planning (Honours) student in 2023

A further ten students graduated with a Bachelor of Spatial Planning Honours specialising in Human Settlements.

Eleven (11) students graduated with the Master of

Urban and Regional Planning (Professional). Gerda Bezuidenhout graduated with a distinction. Gerda won the prize for the best Master's student in this category for 2023.



Dr Kgosi Mocwagae and Gerda Bezuidenhout, best Master of Urban and Regional Planning (Professional) student in 2023

POSTDOCTORAL RESEARCH FELLOWS

The Department hosted two postdoctoral research fellows in 2024, namely Dr Johannes Bhanye and Dr Shamiso Mafuku. Johannes Bhanye was a highly productive in terms of publications, with eight published peer-reviewed papers in 2024.

RESEARCH OUTPUTS

Research Articles

Andres, L., Moawad, P., Kraftl, P., Stevens, S.D., Marais, L., Matamanda, A., Bizzotto, L. & Giatti, L. 2024. Children and young people's access to food, education, play, and leisure in times of crisis: An international, integrative review of policy responses, impacts, and adaptations during the COVID-19 pandemic. *Children & Society* 00: 1-17. DOI: 10.1111/chso.12924.

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STAFF (2024)

**Head of Department:
Dr K Mocwagae**

Associate Professors: Prof Y Mashalaba and Prof A Matamanda

Affiliated Professors: Prof M Campbell and Prof V Nel

Senior Lecturers: Dr K Mocwagae and T Stewart

Lecturers: A Mgwele-Hlazo and S Rammile

Research Fellows: Prof I Chirisa and Prof D Steyn

Programme Director: Prof Y Mashalaba

Senior Assistant Officer: T Ntsiu





NATURAL
SCIENCES



DEPARTMENT OF CHEMISTRY

FACULTY OF NATURAL AND AGRICULTURAL SCIENCES



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OVERVIEW OF 2024

The Department of Chemistry focused on the strategic priorities of the University of the Free State (UFS) and the Faculty of Natural and Agricultural Sciences (NAS). The Department is spread over the three UFS campuses, with the South Campus concentrating on the extended BSc programme, with 250 students in total. These numbers have dwindled over the years, so much so that it was decided to move the practical sessions

on the South Campus back to the Bloemfontein Campus in 2025. The Qwaqwa Campus caters to 200 local residential students and specialises in Polymer Science research. The Bloemfontein Campus teaches approximately 560 undergraduate students and conducts research in all four classic divisions of Chemistry, namely Analytical, Inorganic, Organic, and Physical Chemistry. In 2024, the postgraduate students on the Bloemfontein Campus included 18 Honours, 21 MSc, and 26 PhD students. The Department hosted one intern and 10 Postdoctoral Fellows from Nigeria, Morocco, Ghana, Iran, and South Africa. The Qwaqwa Campus hosted four Honours, six MSc, and four PhD students.

The Department maintained its high level of research outputs with the assistance of three affiliate professors, namely Roodt, Conradie, and Swarts. The Department has the following research affiliates who assist with publications: Proff B Bezuidenhout, CR Dennis, K Akpomie, and Drs A Malloum, A Adeniyi, D Ugwu, and R Mogale. The outputs of the Qwaqwa Campus continue to be a challenge.

I would like to acknowledge our personnel for their hard work, commitment, and loyalty, which ensured the successful completion of the 2024 academic year. The total number of accepted publications is about 10 more than last year when we had 112 articles in internationally accredited journals. The continued contribution and support of all personnel in the Department of Chemistry, the Dean's Office, and the Faculty are gratefully acknowledged.

ACHIEVEMENTS

Staff Achievements

Dr Ernie Langner and Dr Marianne Conradie-Bekker received a C2 rating from the NRF in 2024.

Three staff members in Physical Chemistry and one from the Qwaqwa Campus were promoted at the end of 2024 – Prof Lizette Erasmus and Prof Lyudmila Moskaleva to Full Professors, and Dr Ernie Langner and Dr Julia Mofokeng to Associate Professors.

Prof Lyudmila Moskaleva served as a co-leader of Working Group 3 of the European COST Action

CA21101 'COSY'. She presented invited lectures at the COST Action CA21101 'COSY' Workshop, in Madrid, Spain, at the 2024 CHPC National Conference, in Gqeberha, South Africa, and a guest lecture within the Cluster of Excellence 'Materials for Energy Conversion and Storage' at the Institute for Materials Chemistry, at Vienna University of Technology, Vienna, Austria. She was an invited Session Chair for the Chem4Energy Annual Conference, in Muldersdrift, South Africa, and the 2024 CHPC National Conference, in Gqeberha, South Africa. Prof Moskaleva co-organised and chaired the Young Scientist Forum of Working Group 3 of the European COST Action CA21101 'COSY'.

Prof Jeanet Conradie delivered an invited oral presentation at the 13th International Conference on Porphyrins and Phthalocyanines (ICPP-13), held in Niagara Falls and Buffalo, NY, USA from 23 to 28 June 2024.



Prof Jeanet Conradie delivering an invited presentation at ICPP-13 in June 2024, Niagara Falls & Buffalo, USA

Prof Vladimir Azov delivered a lecture at the Inorganic and Carman Conference held at Champagne Sports Resort (Central Drakensberg) in June 2024 and Prof Anke Wilhelm delivered a lecture at the 23rd International Congress of the ISE and the 2nd International Congress of the African Phytomedicine Scientific Society (APSS), held in Cape Town, South Africa, in October 2024.



Prof Anke Wilhelm at the 23rd International Congress of the ISE and the 2nd International Congress of the African Phytomedicine Scientific Society (APSS)

Tsietsi Tsoetsi was elected Chairperson of the NAS Qwaqwa Campus Marketing Committee. He was also invited to chair the poster session at the Sasol Virtual Postgraduate Seminar: Driving Sustainable Innovation, held on November 13 and 14, 2024.

Prof Puseletso Mofokeng was invited to be part of the Plenary Discussion and chair a session at the 5th International Conference on Bio-based Polymers and Composites – BiPoCo 2024, held in Esztergom, Hungary, from 1 to 5 September 2024. Prof Mofokeng also attended the Curriculum Renewal Programme (CRP) Qwaqwa Cohort organised by UFS Centre for Teaching and Learning (CTL), held at Golden Gate Hotel (5 to 9 February 2024), and received the Curriculum Renewal Innovation in Higher Education Certificate after the course.

Dr Litheko Nkabiti was awarded his PhD at the University of the Western Cape (UWC) during this period. He continued his research on photo-catalytic hydrogen production via ammonia splitting using photocatalysts, and Radebe Mothepane Mbongo, from the Qwaqwa Campus, obtained her Master's degree in chemistry.

The UFS nominated Prof Alice Brink for the SA Women in Science Award (SAWISA): Distinguished Women Scientists category.

Student Achievements

Students from Inorganic Chemistry experienced a successful year in 2024. Hannah van Dyk received the Academic Award as the Best student in Chemistry for the year 2023 at the NAS Faculty Prize-giving

on 16 April 2024. PhD student Francois Jacobs was awarded first prize for his oral presentation at the International FreeStatePhyChem-2024 Symposium, in Bloemfontein on 6 and 7 February 2024. Francois was also awarded the prestigious David Blow bursary to attend the DLS/CCP4 Data Collection and Structure Solution Workshop 2024 in Oxford, UK, in November 2024. This bursary is awarded to only one or two students on the African continent to receive advanced training in Synchrotron development.



Hannah van Dyk and Prof HG Visser at the NAS Faculty Prize-giving 2024

Leandri Liebenberg's paper at the 2023 student symposium was chosen to be published in the *Suid-Afrikaanse Tydskrif vir Natuurwetenskap en Tegnologie*. Dr Elham Jalali won the first prize for the best student poster at the 6th FreeStatePhyChem-2024 Symposium in November 2024.

PhD student Kgalaletso Otukile and postdocs Dr Cameron Matthews and Dr Rashid Issahaku actively participated in the exhibition at the National Science



PhD student Kgalaletso Otukile and postdocs Cameron Matthews and Rashid Issahaku at the National Science Week Launch on 28 September 2024

Week Launch on 28 September 2024, during which they represented the National Institute for Theoretical and Computational Sciences (NITheCS).

Dr Yuel Abraha was awarded the Best PhD in Chemistry 2023 at the NAS Faculty Prize-giving. Dr Ernie Langner was his supervisor.



Dr Yuel Abraha and Prof HG Visser at the NAS Faculty Prize-giving 2024

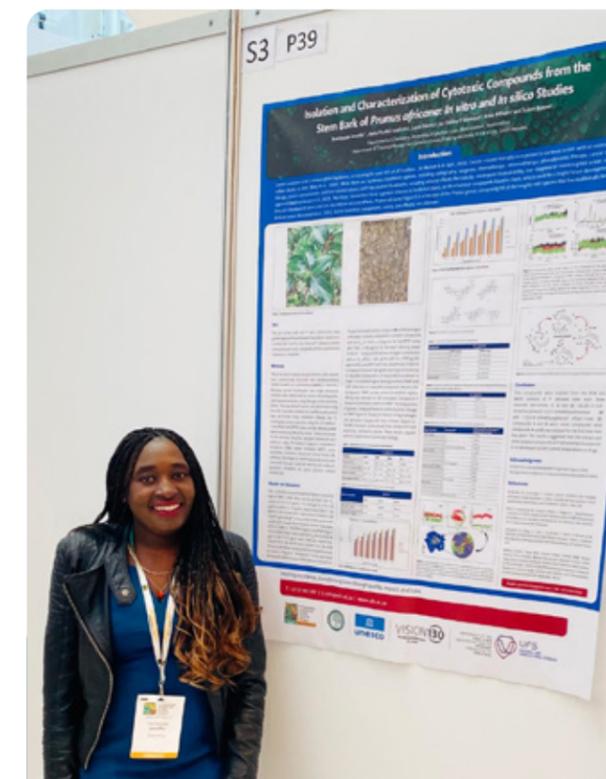
Adelaide Mashweu presented a flash presentation and a poster on her research synthesising novel functional peptide nanostructures for targeted drug delivery at the ACS Fall 2024 Conference in Denver, USA. She also delivered an oral presentation on the same topic at the 6th International FreeStatePhyChem Symposium held at the UFS in November 2024.



Adelaide Mashweu in Denver, USA

Francois de Beer delivered a talk on metalloproteins at the 23^{ste} Jaarlikse Studentesimposium in die Natuurwetenskappe in October 2024 at the UFS.

Jennifer Nambooze presented a poster on her research isolating and characterising cytotoxic compounds from the stem bark of *Prunus africana* at the International Natural Product Congress in July 2024 in Krakow, Poland.



Jennifer Nambooze in Kraków, Poland

Samkelisiwe Khambule (PhD student) won first prize at the Sasol Virtual Postgraduate Seminar, held on 13 and 14 November 2024.



TEACHING AND LEARNING

The BSc Hons course content for Inorganic polymers and polymer reactions on the Qwaqwa Campus was revised and updated. New themes included a comprehensive introduction to inorganic polymer and industrial applications.

RESEARCH, INNOVATION AND RESEARCH COLLABORATION

Analytical Chemistry Division

Prof Karel von Eschwege (NRF C2-rated), as head of Analytical Chemistry, traditionally specialises in photochromic and photo-catalytic research, with potential applications in sensors of diverse kinds and in the renewable energy sector, where these dye compounds are used as photocatalysts in the electrophotoreduction of H_2O or CO_2 to H_2 or CO . He also started working on commercial projects involving new chipboard wood binders, the strengthening of wood for material and construction applications, and the modification of activated carbon in water filtration systems. He supervises a PhD project on the latter topic and another, in collaboration with the University of Pretoria, investigating particulate matter pollution in Bloemfontein and the larger Free State area, while a Master's project entails new approaches in the use of nano-particle functionalised activated carbon for pollution control. A full-time postdoctoral fellow is researching abundant local wood species' potential for conversion into commercialised applications, and he has also done some work on photo-catalytic osmium charge transfer complexes and direct atmospheric water absorption salts.

Prof Von Eschwege continued his collaboration on femtosecond laser spectroscopy with the Laser Research Institute at the Department of Physics at Stellenbosch University and with the University of

Pretoria Medical Faculty on fine particulate matter in atmospheric pollution, together with universities in Sweden. He also has ongoing collaborations with the University of Gaborone in Botswana, the Ain Shams University in Cairo, Egypt, and the University of Yaoundé, Cameroon.

Dr Rebotsamang Shago focuses on analysing and characterising nanomaterials conjugated with porphyrin macrocycles for the adsorption of heavy metals in wastewater. Dr Mpho Mathebula serves as co-researcher while being co-responsible for Chemistry 2nd- and 3rd- year, and Honours practicals in Analytical and Inorganic Chemistry.

Dr Christo van Staden is contracted to help establish a new Isotope laboratory and to lecture on Analytical Chemistry.



Inorganic Chemistry Division

The Inorganic Chemistry Division consists of several research groups which are managed by Prof Deon Visser (C2-rated), Prof Johan Venter, Prof Alice Brink (Y1-rated), Prof Marietjie Schutte-Smith (Y2-rated), and Dr Dumisani Kama. The research is supported by Dr Mpho Mathebula, Officer – Professional Services.

Prof Deon Visser's research is focused on turning waste products into value. They are looking at electric arc furnace dust, aerated autoclaved concrete, waste bark from a tannin extraction process, etc. The team managed to secure funding of R3 million over three years from NTE company, R660 000 over three years from AgriSulph, and is in the process of negotiating funding from Aertec. They developed and are busy registering a gold extraction patent with great potential.

Prof Marietjie Schutte-Smith's research is related to challenges in agriculture, water remediation,

the wool industry, extraction of valuable organic compounds in plant/fungal material, and metal separation, all topics falling under material science and inorganic chemistry with industrial applications.

Prof Visser and Prof Schutte-Smith collaborated with national industry partners MycoSure, AerTec, Gerber&Co, and Agrisulph). At academic institutions, they collaborate with Dr Amanda-Lee Manicum (Tshwane University of Technology), Dr Frikkie Malan (University of Pretoria), Dr Jana Vermaas (UFS, Sustainable Food Systems and Development), and Prof Katinka de Wet (UFS Department of Sociology). Internationally they collaborate with Prof Gilles Gasser and Dr Kallol Purkait (PSL University, Chimie ParisTech), Prof Bruno Goud (PSL University, Institut Curie), Prof Fabio Zobi (Fribourg University), Dr Lucie Rárová (Palacky University), Prof Justin Wilson (Cornell University) and Prof Roger Alberto (University of Zurich).

Prof Johan Venter's research focuses on fundamental studies of organometallic complexes of mainly the platinum group metals with catalytic application. His studies provide a better insight into the intricate role of ancillary ligands by modelling their effects on the reactivity and outcome of catalytic reactions. This, combined with mechanistic elucidation, contributes to the knowledge base to improve the design and working of catalysts. Novel ways to evaluate these reactions have been established. Prof Venter collaborates with Prof Belay at the University of Bahir Dar in Ethiopia/Hunan University, Changsha, China. In May, he paid a research visit to Prof Landman's group at the University of Pretoria.



Prof Alice Brink's research focuses on metallo-drug development, incorporating the interoperable usage of chemical and macromolecular crystallography and researching electronic reactive materials. During 2024, the research was supported by grants from the NRF Competitive Support for Y-rated

Researchers and the UFS-CUT Interdisciplinary Grant in collaboration with the Central University of Technology (CUT). The research group was generously provided with synchrotron beam time at the DIAMOND Light Source, UK, in association with the SA Bag Time within the South African Structural Biology Consortium, as well as at the Italian Synchrotron: Elettra Sincrotrone Trieste in collaboration with the University of Warsaw, Poland. In March, the research group hosted the US Distinguished Professor, Prof N Gerasimchuk (Missouri State University, US), a global leader in cyanoxime chemistry. Several seminar lectures were presented, and new thallium chemistry protocols were shared between institutions.

Prof Brink continued her collaboration with Prof John Helliwell from the University of Manchester, UK, with generous support from the Manchester Institute of Biotechnology, Prof Dirk Opperman (UFS Department of Microbiology and Biochemistry), and the South African Structural Biology Consortium. She also collaborated with Prof T Makhafola (CUT), Prof N Gerasimchuk (Missouri State University, US) Prof R Kamiński, and K. N. Jarzemska (Warsaw University of Technology, Poland).

In 2024, Prof Brink completed the Fellowship with the Department of Higher Education and Training (DHET) Future Professors Programme (Cohort 1) – a flagship programme of the DHET which is a national, collaborative initiative aimed at developing the qualities of academic excellence and leadership in university scholarship to contribute to the development of a future South African professoriate. She was supported by the DHET Future Professors Programme, which enabled research to be conducted at the Cambridge Crystallographic Data Centre (CCDC), Cambridge University, and was selected to join the CCDC 'CSD Champion' network, which aims to promote the global research of structural science.

Dr Dumisani Kama's research expertise lies in inorganic and organometallic chemistry, particularly in synthesising phosphine-based rhenium, technetium, platinum, palladium and rhodium complexes for catalysis and radiopharmaceutical applications. In 2024, his research was supported by the Chemistry Department HOD, Prof HG Visser, and the University's Central Research Fund (CRF).

Dr Kama's new collaboration with Dr Martin Smith from Loughborough University secured the NRF Competitive Support for Unrated Researchers (CSUR) grant for 2025–2027, allowing Dr Kama to work alongside an expert in organometallic chemistry. He is also actively collaborating locally with Dr O Alexander (UWC) and Dr P Mpungose (CPUT).

Dr Kama is also expanding his research into Energy Frameworks and Atom-Atom Interactions, a computational approach to understanding intermolecular forces in solid-state chemistry. His recent CrystEngComm 2024 paper on this work was selected as a cover page publication, marking a significant step in this emerging research direction. Additionally, he was selected by the UFS as one of the promising members and selected to join the DHET Future Professors Programme.

Physical Chemistry Division

Dr Ernie Langner's research group comprised two PhD students and one MSc student. The group's research focused on the application of Metal-Organic Framework nano-particles in drug delivery and the immobilisation of metal/metal oxide nano-particles on Biochar and Activated Carbon. As part of a shared project with Prof von Eschwege, the densification of wood after removing its lignin was investigated. Dr Langner collaborates nationally with Dr Kobus van der Walt (Central University of Technology) on developing polypropylene powders for laser sintering.



Prof Lizette Erasmus's research group comprised four PhD students, three MSc students, and two postdoctoral fellows. Their research focuses on materials science and nanotechnology. Projects during 2024 included (i) optimisation of cross-metathesis reactions mediated by Grubbs II catalyst, (ii) gold recovery from e-waste, (iii)

green extraction of chitin from waste mushrooms, (iv) superabsorbent polymers for agricultural and hygiene sectors, (v) Rh-containing oximes and cyanoximes with biomedical application, and (vi) valorisation of phthalates in nappies and hygiene products. Prof Erasmus collaborates nationally with Dr Zolile Dlamini (Central University of Technology) and Prof VS Vallabhapurapu (University of South Africa) on the use of plant extracts to be used in memory devices and internationally Prof JW Niemantsverdriet from SynCat@DIFFER in the Netherlands on gold and iridium complexes.

Dr Eleanor Müller's research concentrates on anti-cancer agents and the syntheses of possible chemotherapeutic drugs, including polymeric or nanoparticulate drug-carrier systems. Possible anti-cancer drugs include synthetic organometallic compounds and complexes containing natural compound fragments. She manages a cell-culture lab, where all newly synthesised compounds are tested in-house for anti-cancer activity. Through the UFS Industrial Mentorship programme, she collaborates with researchers in the Pharmacology Department at the University of Pretoria (Prof Natalie Schellack and Prof Werner Cordier). She also collaborates internationally with Prof JW Niemantsverdriet from SynCat@DIFFER in the Netherlands.

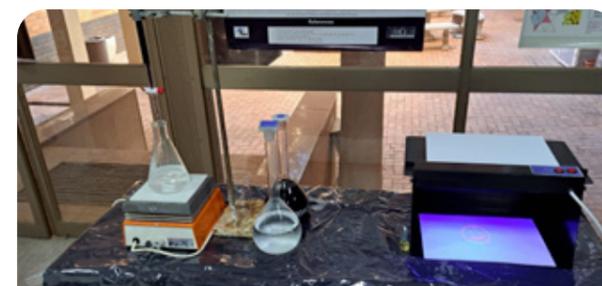
Prof Lyudmila Moskaleva's holds a C1 NRF-rating. Her research investigates the surface reactivity of solids at the atomic level using first-principles quantum chemical methods, molecular dynamics, statistical theory, microkinetic modelling and thermodynamics. Prof Moskaleva's group consisted of two PhD students and one postdoctoral fellow. Currently, computational studies are focused on chemocatalysis with gold-based alloys, rare earth oxides, and electrocatalysis (oxygen reduction reaction and CO₂ reduction). In addition, the group is working on mechanistic studies and modelling of rate constants of reactions relevant to hydrocarbon combustion and on modelling the structure and properties of luminescent organometallic complexes.

Prof Moskaleva collaborates with Prof R Ramakrishnan from Tata Institute of Fundamental Research in Hyderabad, India, funded jointly by NRF and DST (India), on the computational modelling of elementary processes in hydrocarbon combustion.

She also collaborates with Prof Zhi-Jian Zhao from Tianjin University, China, on the electrochemical reduction of carbon dioxide, Prof María-Pilar de Lara Castells from CISC, Madrid, on a Spanish National Research project with the focus on the computational studies supported subnanometric clusters of coinage metals, and the group of Prof T Risse, Freie Universität Berlin, Germany, on the selectivity of alcohol oxidation on Au-based catalysts. A new collaboration has been established with Prof N. Gerasimchuk, from Missouri State University, USA, on understanding cis-trans isomerism in square-planar d⁸ complexes of group VIII (Ni-triade) metals with cyanoximes.

Prof Jeanet Conradie's group consisted of one PhD student and two postdoctoral fellows (till June 2024). Their research focuses on the synthesis, characterisation, computational chemistry, electrochemistry, kinetics, etc., of ligands, transition metal complexes, transition states, and reaction-intermediates for application in drugs, dye-sensitised solar cells (DSSC), catalysis, etc. Prof Conradie, a C1 NRF-rated researcher, collaborates internationally with Prof Abhik Ghosh (Department of Chemistry and Centre for Theoretical and Computational Chemistry, University of Tromsø, Tromsø, Norway), Prof JH Potgieter (University of the Witwatersrand and Manchester Metropolitan University, Manchester, UK), Claude P Gros (Université de Bourgogne, Dijon Cedex, France), Karl M Kadish (University of Houston, Texas), Carl Wamser (Portland State University, Oregon) and Prof Elisa Tomat (The University of Arizona, Tucson). In Africa, she collaborates with Prof Constant Tcheka (University of Ngaoundere, Cameroon), Dr Jean Jules (Fifin University of Ngaoundere, Cameroon) Prof Fridolin Nya Tchangnwa (University of Maroua, Cameroon), Prof Kovo G Akpomie (University of Nigeria, Nsukka, Nigeria), and Dr Adebayo A Adeniyi (Federal University Oye-Ekiti, Nigeria).

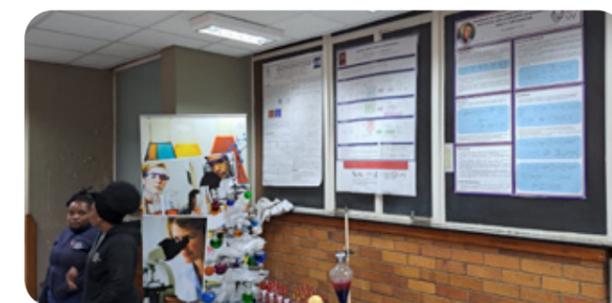
Emeritus Professor Jannie Swarts visited Prof Hans Niemantsverdriet in October 2024 to further a 17-year-long research collaboration. Three publications emanated from this visit.



Organic Chemistry Division

The Organic Chemistry division consists of four distinct research directions – Phytochemistry and Tannin Extract research (Dr Susan Bonnet and Prof Anke Wilhelm), Organic synthesis based on homogeneous catalysis (Dr Charlene Marais), supramolecular chemistry (Prof Vladimir Azov), and Nuclear Magnetic Resonance (NMR) reaction progression (Dr Rudi Swart).

In 2024, Prof Azov's research group comprised four PhD students and two MSc students, which explored a broad range of topics within supramolecular chemistry, molecular self-organisation, and the development of redox- and light-controllable molecular receptors, devices, and materials. Current projects focus on synthesising redox-active tetrathiafulvalene (TTF) derivatives and non-canonical amino acids featuring donor/acceptor groups and metal binding centres. In addition to his core research, Prof Azov actively participates in collaborative projects investigating weak interactions in molecular crystals, exploring complex formation and gas-phase reactivity using mass spectrometry, and developing stereoselective heterogeneous catalysts. Prof Azov continued his collaboration with Prof Hennecke, Prof Ballet and Prof Martin at Vrije Universiteit Brussel in Belgium. The project pursues the synthesis of unnatural amino acids containing donor/acceptor groups or metal binding centres that can be used to prepare hydrogelators for biomedical applications or novel biologically active compounds. Prof VA Azov also collaborates with Dr Warneke at the University of Leipzig in Germany, investigating gas phase reaction mechanisms and the application of methods of mass spectrometry for the synthesis of new compounds and materials on the nanoscale. This collaboration also involves scientists from Purdue University and the Pacific Northwest National Laboratory (PNNL).



The Marais group focuses strongly on organic synthesis, specifically homogeneous catalysis (e.g., olefin metathesis, transfer hydrogenation, the Sonogashira reaction, Heck reaction, and carbonylation) in synthesising pharmaceutical targets. The current focus is the synthesis of flavonoids, stilbenoids, and analogues with confirmed or potential anti-cancer and antidiabetic activity. An NRF-Thuthuka grant with joint contributions from the NRF and the UFS supported the research group. The Marais group consisted of two PhD students, two MSc students, and one MSc (Nanochemistry) student in 2024. Dr Charlene Marais also co-supervises a PhD student with Prof Azov and collaborates with Chemical Process Technologies and the South African Medical Research Council. She also collaborated with Dr Carmien Tolmie (UFS Department of Microbiology and Biochemistry).

In the Phytochemistry Group, Dr Susan Bonnet and Prof Anke Wilhelm investigated the development of commercial drugs and phytomedicines from indigenous knowledge to treat and sedate patients suffering from psychotic diseases, cancer, and diabetes. In the central nervous system project, they collaborated with the University of Vienna (Prof S Khom) to access bioassays and identify GABA_A modulators. It offers an ideal opportunity to investigate African traditional medicine used to treat psychosis, provide scientific explanations for its efficacy, identify the active molecules involved, and develop phytomedicines and commercial antipsychotic drugs. In addition, investigations into libraries of synthetic compounds with GABAergic and other biological activities are in progress. The cancer research includes both phytochemical and synthetic compounds, and testing is done in collaboration with Dr L Rarova at Palacky University in the Czech Republic and the antidiabetic project tests all substances in collaboration with Dr Chika Chukwuma at the Central University of Technology (CUT). Dr Bonnet and Prof Wilhelm also collaborated with Dr A Messi at Yaounde University in Cameroon.

Prof Wilhelm and Dr Rudi Swart collaborated with Q-Cape Herbs (based in South Africa and the Netherlands) to extract valerianic acid from *Valeriana officinalis* roots. They also collaborated with Dr Z Dlamini (Central University of Technology) and Prof VS Vallabhapurapu (University of South Africa) on the

use of plant extracts to be used in memory devices. Funding was secured for this project from the UFS/CUT Interdisciplinary Research seed funding.

Dr Bonnet is also running projects investigating black wattle, green wattle, and *Acacia mangium* extract (phytochemical analysis, aminomethylation, carboxylation, etc.). The extraction of wattle bark extract with green solvents and the extraction of lower mass oligomers were also investigated. Prof Wilhelm, Dr Bonnet, and Dr Swart are members of the NTE group, where they collaborate with the wattle extract company in Pietermaritzburg.

Prof Wilhelm manages the zebrafish bioassay in the Department of Chemistry. Her primary research focuses on isolating active GABAergic compounds using a larval zebrafish locomotor bioassay. The established collaboration with the University of Vienna investigates the GABAergic activity of South African botanicals in searching for novel anti-epileptic drugs.

Dr Rudi Swart's Research Group is dedicated to sustainable food and water purification, using a synthetic organic chemistry approach to tackle global challenges. Their research focuses on synthesising natural plant hormones to enhance root growth and developing methods to recycle essential plant minerals. Dr MR Swart is a member of the AAC group, where he collaborates with AERTEC, a company in Cape Town.

As Manager of the NMR facility, Dr Swart contributes to the research within all the groups in the Department of Chemistry by implementing new NMR techniques to advance their research. He has assisted more than 20 postgraduate students from different research groups with delicate and advanced multi-nuclear NMR experiments. Dr Swart also assists various other universities and companies in conducting NMR analyses as third-stream income for the department.



Qwaqwa Campus Research Polymer Composites

The Qwaqwa Chemistry Department's polymer composites research advances sustainable solutions across key areas. In water management, we develop nanocomposite membranes, smart hydrogels, biodegradable packaging, and water quality sensors. For medical applications, we design biodegradable implants, tissue scaffolds, and biocompatible drug delivery systems. Our recycling innovations include chemically modified and recyclable polymers to promote a circular economy. We also engineer flame-retardant formulations, semiconducting composites (with conductive fillers and hybrid structures) for flexible electronics, and energy storage materials like phase-change composites. By merging materials chemistry, nanotechnology, and polymer science, our interdisciplinary work delivers functional, eco-friendly solutions with applications in environmental protection, healthcare, industrial sustainability, and next-gen technologies.

The UFS NAS Complex System Hub coordinates the interdisciplinary project 'Two-Tier Fungal and Polymer-Based Water Filtration System for Environmental Water Reclamation'. This innovative research, led by Prof Patrick Voua Otomo (Zoology and Entomology) in collaboration with UFS researchers (Dr JP Mofokeng (Chemistry), Prof M Gryzenhout (Genetics), Dr Bienvenu Fouda Mbanga (Chemistry), Dr LS Mokoena (Chemistry), Dr PP Mokolokolo (Chemistry), and Sanele Mnkandla (Zoology and Entomology)), combines fungal bioremediation with advanced polymer filtration technologies. The project aims to develop a sustainable, dual-stage water purification system for environmental reclamation, addressing critical water quality challenges through this unique integration of biological and materials science approaches. The overall project includes:

- Dr Puseletso Mofokeng and Dr Petrus Mokolokolo, in collaboration with the Centre for Global Change and Department of Chemistry's Postdoctoral Fellow Project on 'Sustainable membrane water treatment adsorbents for the QwaQwa community', using binary biodegradable polymer blends filled with carbonaceous materials-risk and vulnerability science centre.

- A PhD project on 'Studies on morphology, thermal, thermomechanical and mechanical properties of PLA/PCL/nanofillers blend nanocomposites' using both nanocellulose fillers and surface modified TiO₂ for use in personal hygiene applications.
- A collaborative project with the Council for Scientific and Industrial Research (CSIR), on an MSc project on 'Design and Tailored Biodegradable Composites for 3D Printing of Medical Device Applications'.
- A collaborative project with the Libyan Advanced Centre for Chemical Analysis (LACCA), on 'Preparation and characterisation of graphene oxide/zirconium phosphate (GO/ZrP) and graphene oxide/titanium phosphate (GO/TiP) composites for water purification'.

In addition, a research collaboration was established between Dr Mofokeng and Prof Blanke Škipinaat the University of Banja Luka, in Serbia, for a research project on 'Dielectric properties polymer nanocomposites'.

ACADEMIC CITIZENSHIP AND COMMUNITY ENGAGEMENT

Prof Johan Venter, Dr Ernie Langner, Dr Rudi Swart, Dr Dumisani Kama, and Dr Legapa Nkabiti make up the Chemistry Department's exhibition team. They



Dr Dumisani Kama (on the left, demonstrating) and Dr Legapa Nkabiti at the Eunice Science Day

presented various 'Chemagic Shows' and interactive sessions at local schools (e.g. the Sentraal Youth Summit, Eunice Science Day, Jim Fouche Open Day) and the UFS Open Day, while promoting Chemistry amongst learners.

They also partnered with the UFS Centre for Mineral Biogeochemistry (CMBG) in co-presenting the Tritech National Science and Technology Fair in Tzaneen, where they were involved in organising and facilitating Chemistry-related group activities and the presentation of a show.



UFS staff and students at the Tritech National Science and Technology Fair in Tzaneen

Academic citizenship and community engagement activities in the various divisions are summarised below.

Analytical Chemistry

Dr Rebotsamang Shago was a reviewer and moderator in several NRF funding instruments. Prof Karel von Eschwege was a reviewer for various international journals and an examiner of local and overseas MSc and PhD theses. Due to his expertise, he constantly advises companies in the renewable energy sector, including solar, wind, H₂-production and latest energy storage technologies.

With the help of Dr Refilwe Matshitse, the Analytical Chemistry Division also started offering professional analytical services to local and outside clients. Instruments include the following:

- ASAP porosity analyser
- Thermogravimetric analyser

- Differential scanning calorimetry
- X-ray powder diffraction
- Opus microscope optical imaging
- Inductively coupled plasma-optical emission spectrometry
- Malvern analytical
- Fourier transform infrared spectroscopy.

Clients typically include:

- University of the Free State: Chemistry, Physics, Genetics, Pharmacology
- Durban University of Technology: Chemistry
- Central University of Technology: Mechanical and Mechatronics; Mechanical and Mechatronics Engineering Faculty of Engineering, Built Environment and Information Technology
- Kumba Future world
- Central Energy Corporation
- Stibium Holdings Mining Company
- Council for Scientific and Industrial Research (CSIR)
- Redstone Concentrated Solar Power Plant.

Inorganic Chemistry

Prof Alice Brink serves the scientific community as a member of the International Union of Crystallography (IUCr) Committee on Data (CommDat); the South African National Committee of the IUCr, and as the South African representative for the Cambridge Structural Database CSD Champion network. She also serves on the editorial board of Crystallography Reviews.

Prof Marietjie Schutte-Smith has a three-year contract as an external moderator for the University of KwaZulu-Natal (UKZN) for undergraduate modules. She is a reviewer for several international journals and an external examiner (MSc and PhD) for several national and international universities.

Prof Deon Visser is a reviewer for several prestigious international journals specialising in chemistry.

Physical Chemistry

All the lecturers of Physical Chemistry were reviewers for the NRF (Grant, Rating, and Bursary applications).

Prof Jeanet Conradie, Prof Ludmila Moskaleva, and Dr Ernie Langner organised the 5th (6 and 7 February 2024) and the 6th (12 November 2024) FreeStatePhyChem Symposia on the UFS Bloemfontein Campus. These Symposia were aimed at fostering interest among young researchers in Physical Chemistry and welcomed participants from UFS and other universities. Renowned international and national scientists presented invited lectures. The best student presentations were awarded with diplomas.



Participants at the 5th (above) and 6th (below) FreeStatePhyChem Symposia



Dr Langner presented a theme (Nano-sized Metal-Organic Frameworks) as part of the NSS821 (Advanced Nanochemistry) module for the Master's in Nanoscience students at the University of the Western Cape (UWC). He reviewed articles for the Journal of Taiwan Institute of Chemical Engineers and Surfaces and Interfaces, and was part of a team

presenting the Chemagic Show at Eunice Primary School Science Day for Homeschool learners and at the Sentraal Youth Summit. The team also helped to organise an interactive event and Chemagic Show at the Tritech Expo.

Together with Dr Wynand Nel from Computer Science and Informatics and Prof Liesl van As from Zoology and Entomology, Dr Langner also organised the annual 'Studentesimposium in die Natuurwetenskappe' for the Suid Afrikaanse Akademie vir Wetenskap en Kuns. It was held on the Bloemfontein Campus on 30 and 31 October 2024 and was attended by 90 postgraduate students and lecturers from the UFS, North-West University (NWU), University of the Witwatersrand, UNISA, CUT, University of Pretoria, and Stellenbosch University. The Department of Chemistry was one of the sponsors of the event.



Guest speakers at the Studentesimposium in die Natuurwetenskappe 2024 – Proff Eduan Kotzé and Paul Oberholster from the UFS, together with the organising committee, Dr Wynand Nel (UFS), Dr Rudi Pretorius (UNISA), Dr Ernie Langner (UFS), and Prof Liesl van As (UFS)

Dr Eleanor Müller is involved in the establishment of a joint short course hosted by the University of Pretoria on cell-culture work. She will present a section on the importance of chemistry in the biological field. She reviewed articles for Inorganica Chimica Acta, Inorganic Chemistry, Transition Metal Chemistry, and other journals. She was an external examiner for other universities at postgraduate levels.

Prof Moskaleva has frequently served as a reviewer for reputed international journals, including Nature Chemistry, Nature Catalysis, Applied Surface Science, Langmuir, The Journal of Physical Chemistry C, and ACS Applied Materials & Interfaces. As an Editorial Board Member of Scientific Reports (Nature Publishing Group, Q1) she regularly handles submissions to the journal. In April 2024, she was invited by the German Research Foundation (DFG) as an international expert for the evaluation of a DFG Research Group, HyPerCat, in Karlsruhe, Germany. She was a member of the interview panel for a Physical Chemistry Senior Lecturer/Associate Professor position at the University of KwaZulu-Natal and served as an external moderator for Physical Chemistry modules and an external examiner for a PhD thesis at the University of Namibia.

Prof Moskaleva and Dr Langner were members of the European COST Action CA21101 COSY with currently ~300 members (mainly from EU countries, and in which South Africa acts as a partner country). Prof L Moskaleva is currently a co-leader of Working Group 3, 'Confined Metal and Metal-Oxide Nano-particles and Clusters Down to the Subnanometer Scale'. She co-organised and co-chaired the Young Scientist Forum of WG3 on 9 December 2024.

Prof Conradie is the Physical Chemistry Editor for the South African Journal of Chemistry. She is a member of SACI, the Academy of Science of South Africa (ASSAf), the International Society of Electrochemistry (ISE), and the Society of Porphyrins and Phthalocyanines (SPP). She also acted as an external examiner for one international and three national universities at postgraduate levels. One of her articles features on the front page of Comptes Rendus Chimie 2024 27 S1 (Special Issue French/Nordic Special Issue on Materials and Coordination Chemistry). She was a reviewer for several international journals.

Organic Chemistry

In 2024, Prof Vladimir Azov was a member of the NRF Thuthuka review panel and evaluated one PhD and one MSc thesis. He also reviewed manuscripts for several prominent chemistry journals, including the Journal of Organic Chemistry, Chemistry – A European Journal, European Journal of Organic Chemistry, Molecules, ChemPlusChem,

and ChemSelect. Additionally, Prof Azov is an editor for Scientific Reports, a journal published by Springer Nature.

Dr Susanna Bonnet served on the SACI Organic Division Committee and as an external examiner for two universities. She was appointed Guest Editor of the Special Issue of Molecules 'Separation Technology and Applications of Functional Natural Products and Pharmaceutical Molecules'.

Prof Anke Wilhelm acted as external examiner for two PhD theses and one MSc dissertation. She was also appointed guest editor for the Special Issue of Pharmaceutics 'Recent Advances in Inhibitors for Targeted Therapies' for 2024/2025. She serves on the editorial board of the South African Journal of Chemistry as one of the organic chemistry editors and her memberships on editorial boards include the South African Veterinary Council (SAVC), the South African Association for Laboratory Animal Science (SAALAS), Zebrafish Husbandry Association (ZHA), and SACNASP.

Dr Charlene Marais reviewed articles for Arkivoc and was appointed as an external examiner by two universities. She was invited to write a chapter for Advances in Heterocyclic Chemistry to be published in 2025.

The Organic Chemistry staff also acted as reviewers for the following internationally acclaimed journals: Journal of Natural Products, Journal of Organic Chemistry, Phytochemistry, Phytochemistry Letters, Natural Product Communications, Chemical Engineering Journal, and Russian Chemical Reviews and Molecules.

Prof Puseletso Mofokeng was a member of the organising committee for the Science Innovation Exchange (SIX) Global Events in partnership with the UFS. She also served as the external examiner for MSc dissertations from the University of Johannesburg (UJ) and Nelson Mandela University (NMU).

Tsietsi Tsetetsi and Dr Motshabi Sibeko facilitated the presentation of science shows for Selelekela Secondary and Makwane Comprehensive School, who visited the Department of Chemistry on the Qwaqwa Campus.

OTHER ACTIVITIES

Prof Karel von Eschwege assists with the Chemistry Department's commercialisation drive towards third-stream income.

Prof Wilhelm, Dr Bonnet, and Dr Swart are part of the Algae group investigating and setting up an algae plant at the UFS, and Prof Visser, Prof Schutte-Smith, Prof Wilhelm, and Prof Azov manage the Small Molecule Unit, which will commercialise various molecules ranging from pesticides to pharmaceuticals. The staff of the centre consists of Dr Anwar Noreljaleel (permanent researcher) and a postdoctoral fellow.

Dr Lesia Mokoena presented a short course (first semester of 2024) and hosted a workshop (May 2024) on quantitative research, in conjunction with the Centre for Graduate Support.

Prof Visser manages the purchase of large equipment for the Faculty, which saved almost R7 million for the 2024 and 2025 period.

POSTGRADUATE STUDENTS

In 2024, ten students graduated with the BSc Honours, majoring in Chemistry. On the Qwaqwa Campus, four students graduated with the BSc Honours, majoring in Polymer Science.



T Mokoena (Best Honours student 2023) and C Sepadile (PPS) at the NAS Faculty Prizegiving 2024

At Master's level, nine candidates graduated with the structured/taught MSc in nanoscience. They were SA Cele (cum laude), BA Kalimashe, SN Khoza, SG Mchunu, S Motlout, P Tshehla, MMH Mogashoa, N Kheswa, and AP Tlhaole. E Athanasopolous graduated (cum laude) with an MSc (by research) with a specialisation in Chemistry.

On the Qwaqwa Campus, four candidates graduated with an MSc (by research) with specialisation in Polymer Science, namely P Naidoo, SA Nyawo, LA Tsotetsi, and Z Zikode. Two candidates graduated with the MSc with specialisation in Chemistry (B Motsoenyane and M Radebe).

The following candidates graduated with Doctoral degrees in 2024:

Lenard Carrol

Thesis: Investigating adsorbate mobility and surface reactions on gold catalysts and graphene: An Ab Initio Molecular Dynamics Study.

Supervisor: Prof L Moskaleva

Francois Jacobs

Thesis: Rhenium model drug development on the interoperable interface between small molecule and macromolecular structures.

Supervisor: Prof A Brink

Lesia Mokoena

Thesis: Preparation and characterisation of graphene oxide and polylactic acid/Poly(3-hydroxybutyrate-CO-3-hydroxyvalerate)/graphene oxide polymer composites for water purification.

Supervisor: Prof JP Mofokeng

Deidre van der Westhuizen

Thesis: Analysis and Source Apportionment of Atmospheric Particulate Matter in Central, North, and Western Free State

Supervisor: Prof K G von Eschwege

Co-Supervisor: Prof J Wichmann

Christo van Staden

Thesis: Structural and computational evaluation of dimeric Au(I) and Ag(I) bis(diphenylphosphino) amine complexes

Supervisor: Prof HG Visser

Co-supervisors: Prof M Schutte-Smith and Dr DV Kama

POSTDOCTORAL RESEARCH FELLOWS

The Department of Chemistry hosted 11 Postdoctoral Fellows in 2024 on both campuses, from six different countries:

- Ajiboye, Timothy Nigeria
- Elmakki, Mohammed Sudan
- Issahaku, Rashid Ghana
- Jacobs, Francois South Africa
- Jalali, Elham Iran
- Manyeruke, Meloddy Zimbabwe
- Matthews, Cameron South Africa
- Mbang, Bienvenu South Africa
- Mogale, Refilwe South Africa
- Naghizadeh, Matin Iran
- Van Staden, Christo South Africa

Dr Abdul Rashid Issahaku (Phytochemistry group) was selected to deliver an oral presentation at the



Dr Abdul Rashid Issahaku at the University of Yaoundé 1 in Cameroon.

Humboldt Kollege Research Hub Network Meeting, which was held at the University of Yaoundé 1, in Cameroon from 11 to 13 November 2024.

STAFF MATTERS

After a tenure of 39 years, Prof Walter Purcell retired at the end of 2024, leaving a legacy of academic excellence in the Chemistry Department, where he had served in multiple capacities, including lecturer, professor, and Academic Head.

At the end of June 2024, Dr Scebi Mkhize resigned from the Qwaqwa Department of Chemistry. Dr Lesia Mokoena was appointed in the same department.

RESEARCH OUTPUTS

Research Articles

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Conference Contributions

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Jacobs, F.J.F. & Brink, A. 2024. *Molecular trends in rhenium complexes: From amino acid mimics to proteins*. Paper delivered at the 5th International FreeStatePhyChem 2024 Symposium, Bloemfontein, South Africa. 6–7 February 2025.

Langner, E.H.G., Mphuthi, L. Erasmus, E. 2024. *Metal-exchanged ZIF-8 and ZIF-67 nano-particles with enhanced catalytic activity*. Paper delivered at the Chem4Energy Annual Conference, Muldersdrift, South Africa. 20–24 March 2024.

Maphakisa, M.D., Botlhoko, O.J. & Mofokeng, J.P. 2024. *Design and tailored biodegradable composites for 3D printing of medical devices applications*. Paper delivered at the Sasol Virtual Post Graduate Seminar. 13–14 November 2024.

Marais, C., Swart, M.R., Twigge, L., Erasmus, E. & Bezuidenhoudt, B.C.B. 2024. *Cross-Metathesis, p-Cresol, and the Second-Generation Grubbs Catalyst: Fitting the Pieces*. Paper delivered at the 6th International FreeStatePhyChem-2024 Symposium, Bloemfontein, South Africa. 12 November 2024.

Mashweu, A.R., Bertouille, J., Martin, C., Ballet, S., Hennecke,

U. & Azov, V.A. 2024. *Stabilisation of gel-forming peptide nanostructures through the incorporation of acceptor and donor non-canonical amino acids*. Paper delivered at the 6th International FreeStatePhyChem-2024 Symposium, Bloemfontein, South Africa. 12 November 2024.

Matthews, C., 2024. *Determining Lennard-Jones parameters for chemical kinetics modelling, via Python scripting*. Paper delivered at the 5th International FreeStatePhyChem 2024 Symposium, Bloemfontein, South Africa. 6-7 February 2024.

Mogale, R., Jalali, E., Schutte-Smith, M., Visser, H.G. & Erasmus, E. 2024. *Synthesis and Characterization of Chitin-Based Superabsorbent Polymers for Fertilizer Slow Release, Water Absorption Kinetics and Effect on Plant Growth*. Paper delivered at the 6th International FreeStatePhyChem-2024 Symposium, Bloemfontein, South Africa. 12 November 2024.

Mokoena, L.S. & Mofokeng J.P. 2024. *Morphology and thermal properties of PLA / PHBV / GO polymeric composites for possible application in water purification*. Paper delivered at the 5th International Conference on Bio-Based Polymers & Composites (BiPoCo), Esztergom, Hungary. 1-5 September 2025.

Mokoena, L.S. & Mofokeng J.P. 2024. *Preparation of poly (lactic acid) (PLA) / poly (3 - hydroxybutyrate-co-3-hydroxyvalerate) (PHBV) / graphene oxide (GO) composites for the removal of lead ions (Pb(II)) in water*. Paper delivered at the 5th International Conference on Bio-Based Polymers & Composites (BiPoCo), Esztergom, Hungary. 1-5 September 2024.

Mokoena, T.E., Mokoena, L.S. & Mofokeng, J.P. 2024. *Effect of functionalised titanium dioxide (TiO₂) and microcrystalline cellulose (MCC) on the properties of PLA/PCL blends for potential applications in personal hygiene*. Paper delivered at the Sasol Virtual Post Graduate Seminar, South Africa. 13-14 November 2024.

Moskaleva, L.V. 2024. *Computational modelling of functional materials and chemical reactivity using molecular dynamics, DFT and wave-function-based approaches*. Invited paper delivered at the 2024 CHPC National Conference, Gqeberha, South Africa. 1-4 December 2024.

Moskaleva, L. & Carroll, L. 2024. *Formation and catalytic activity of 1D gold oxide chains from density functional theory*. Paper delivered at the Chem4Energy Annual Conference, Muldersdrift, South Africa. 20-24 March 2024.

Moskaleva, L., Carroll, L. & Dononelli, W. 2024. *Exploring the Mysteries of Nanoporous Gold: A Computational Study of its Surface Characteristics and Catalytic Performance*. Paper delivered at the 5th International FreeStatePhyChem 2024 Symposium, Bloemfontein, South Africa. 6-7 February 2025.

Moskaleva, L., Carroll, L., Li, Y. & Olaniyan, O. 2024. *Exploring the Surface Properties and Catalytic Behavior of Nanoporous Gold: A Computational Study*. Invited paper delivered at the COST Action CA21101 "COSY" Workshop, Madrid, Spain. 26-27 September 2024.

Nambooze, J., Issahaku, A.R., Kvasnicová, M., Rárová, L., El Mansouri, A., Wilhelm, A. & Bonnet, S. 2024. *Bioassay-guided isolation and characterisation of cytotoxicity compounds from the leaves of *Annona muricata* and in silico studies of the active cytotoxicity compounds*. Paper delivered at the 6th International FreeStatePhyChem-2024 Symposium, Bloemfontein, South Africa. 12 November 2024.

Otukile, K.P., Kandpal, S.C., Matthews, C., Chakraborty, S., Moskaleva, L.V., Ramakrishnan, R. 2024. *Oral presentation, Reaction Kinetics of R + 3O₂ Reaction: Transition State Theory Study with Master Equation Modeling*. Paper delivered at the 5th International FreeStatePhyChem 2024 Symposium, Bloemfontein, South Africa. 6-7 February 2025.

Otukile, K.P., Kandpal, S.C., Matthews, C., Chakraborty, S., Moskaleva, L.V. & Ramakrishnan, R. 2024. *The Branched Hydrocarbon Radicals with O₂ Reactions: Computations of the Product Channels Rate Constants at Low Temperatures*. Paper delivered at the 6th International FreeStatePhyChem-2024 Symposium, Bloemfontein, South Africa. 12 November 2024.

Otukile, K.P., Matthews, C. & Moskaleva, L.V. 2024. *Chain propagation and termination in the low-temperature combustion of n-alkanes*. Paper delivered at the Chem4Energy Annual Conference, Muldersdrift, South Africa. 20-24 March 2024.

Roodt, A. 2024. *A Lament: Where have all the flowers (read: Detailed Reaction Mechanism Studies) gone?* Invited lecture delivered at the University of Lund Department of Chemistry Colloquium, Lund, Sweden. 16 June 2024.

Roodt, A. 2024. *Crystallography (and Computing): To (Physical) Chemistry, Africa and Beyond...* Invited keynote lecture delivered at the 5th International FreeStatePhyChem 2024 Symposium, Bloemfontein, South Africa. 6-7 February 2024.

Roodt, A. 2024. *Historical perspectives of crystallography in (South) Africa and the establishment of the African Crystallographic Association (AfCA)*. Invited keynote lecture delivered at the South African Crystallographic Society meeting, Makhanda, South Africa. 22-24 January 2024.

Roodt, A. 2024. *Is it (still) important in Coordination Chemistry to understand kinetic principles and do (complete) kinetic-mechanistic studies?* Invited lecture delivered at the (International) Conference on Contemporary Coordination Chemistry. 17-19 June 2024, Copenhagen, Denmark. 17-19 June 2024

Seromo, L. & Mofokeng, J.P. 2024. *Synthesis, morphology, and structural properties of graphene oxide (GO) and its composites with transition metal phosphates for applications in water purification*. Paper delivered at the Sasol Virtual Post Graduate Seminar. 13-14 November 2024.

Syamala, V.V., Borowski, P., Bosman, L., Brink, A., Jarzemska, K.N., Kamiński, R., Paliwoda, D., Potempa, K. & Łaski, P. 2024. *Metallophilicity-assisted piezochromism in a Rh(I) complex: structural, energetic, electronic and spectroscopic investigations under pressure*. Paper delivered ECM 34: 34th European Crystallographic Meeting, Padova, Italy. 26-31 August 2024.

Wamser, C.C., Ghosh, A., Conradie, J., Wang, Walter, M.G. & Day, N.U. 2024. *Hyperporphyrins: Charge-transfer Interactions with meso-Aryl Substituents*. Paper delivered at the 13th International Conference on Porphyrins and Phthalocyanines (ICPP-13), Niagara Falls & Buffalo, USA. 28 June 2024.

Wilhelm, A., Smith, W., Kemp, G. & Bonnet, S. 2024. *Comparative investigation of biological active compounds of *Valeriana officinalis* harvested in South Africa and optimisation of harvesting seasons*. Paper delivered at the ISE-APPS2024 International Congress, Cape Town, South Africa. 23-26 October 2024.

Conference Posters

Aloumko, B., Foadin, C.S.T., Nya, F.T., Malloum, A. & Conradie, J. 2024. *Influence of metal oxides on circumcorannulene for the design of new push-pull corannulene models: applications in nano-electronics, optoelectronics and non-linear optics*. Poster presented at the 6th International FreeStatePhyChem-2024 Symposium, Bloemfontein, South Africa. 12 November 2024.

Blom, X., Mosoabisane, M.F.T. & Tsotetsi, T.A. *Computer Simulation and Experimental Study on the Compatibility of Poly(lactic acid)/Poly(β -Caprolactone) Blends Reinforced TiO₂ nano-particles*. Poster presented at the Sasol Virtual Post Graduate Seminar, South Africa. 13-14 November 2024.

Conradie, J. 2024. *Synergy between Experiment and Theory: X-ray Crystallographic and Computational chemistry study of selected molecular systems*. Poster presented at the 6th International FreeStatePhyChem-2024 Symposium, Bloemfontein, South Africa. 12 November 2024.

Conradie, J. & Ugwu, D. 2024. *Synthesis of Heterocyclic Bidentate Ligands using Click Reaction*. Poster presented at the 5th International FreeStatePhyChem 2024 Symposium, Bloemfontein, South Africa. 6-7 February 2024.

Conradie, M.M. 2024. *Exploring Bathochromic Shifts in Cu(β -diketonato)₂*. Poster presented at the 6th International FreeStatePhyChem-2024 Symposium, Bloemfontein, South Africa. 12 November 2024.

Jacobs, F.J.F., Helliwell, J.R. & Brink, A. 2024. *A time resolved crystallographic series of rhenium movement in a model protein*. Poster presented at the DLS/CCP4 Data Collection and Structure Solution Workshop 2024. Diamond Light Source at Rutherford Appleton Laboratory, Harwell Campus, United Kingdom. 24 November to 2 December 2024.

Jalali, E., Schutte-Smith, M., Erasmus, E. & Visser, H.G. 2024. *A new generation of antimicrobial textiles by employing nanomaterials*. Poster presented at the 5th International FreeStatePhyChem 2024 Symposium, Bloemfontein, South Africa. 6-7 February 2024.

Jalali, E., Erasmus, E., Schutte-Smith, M. & Visser, H.G. 2024. *Efficient Removal of Tetracycline from Aqueous Solutions Using Fe Nanoparticle-Embedded Carbon Fiber Sorbent*. Poster presented at the 6th International FreeStatePhyChem-2024 Symposium, Bloemfontein, South Africa. 12 November 2024.

Malloum, A. & Conradie, J. 2024. *Hydration of p-Aminobenzoic Acid*. Poster presented at the 5th International FreeStatePhyChem 2024 Symposium, Bloemfontein, South Africa. 6-7 February 2024.

Mashweu, A.R., Martin, C., Ballet, S., Hennecke, U. & Azov, V.A. 2024. *Non-canonical amino acids with donors and acceptors for the stabilisation of gel-forming peptide nanostructures*. Poster presented at the ACS Fall 2024, Denver, USA. 17-22 August 2024.

Mateyise, N.G.S., Conradie, M.M. & Conradie, J. 2024. *Exploring the electrochemical and theoretical aspects of nickel(II) complexes with varied 2,2':6',2''-terpyridine ligands*. Poster presented at the 5th International FreeStatePhyChem 2024 Symposium, Bloemfontein, South Africa. 6-7 February 2024.

Mateyise, N.G.S., Conradie, M.M. & Conradie, J. 2024.

Investigating the theoretical and electrochemical properties of complexes of nickel(II) with different 2,2':6',2''-terpyridine Poster presented at the 5th Commonwealth Chemistry Posters - Building Networks to Address the Goals (Online). 11-12 September 2024.

Matthews, C., Nhlapo, L., Radebe, S., Brink, A. & Moskaleva, L.V. 2024. *A computational investigation of metal substitution within two metalloenzymes*. Poster presented at the 6th International FreeStatePhyChem-2024 Symposium, Bloemfontein, South Africa. 12 November 2024.

Naghizadeh, M. & von Eschwege, K.G. 2024. *Comparative Study on Various Low-Cost Feedstock Materials for Pressed-Wood Applications*. Poster presented at the 6th International FreeStatePhyChem-2024 Symposium, Bloemfontein, South Africa. 12 November 2024.

Nambooze, J., Issahaku, A.R., Rárová, L., El Mansouri, A., Wilhelm, A. & Bonnet, S. 2024. *The isolation and characterisation of cytotoxicity compounds from the stem bark of *Prunus africana*, in vitro and in silico studies*. Poster presented at the International Natural Product Congress, Krakow, Poland. 13-17 July 2024.

Okechukwu, I.S., Ofoefule, A.U., Akpomie, K.G. & Conradie, J. 2024. *The effects of Terminalia catappa husk and Pinus pinaster dust additives on the refractory properties of Nsukka clay in the production of insulating bricks*. Poster presented at the 5th Commonwealth Chemistry Posters - Building Networks to Address the Goals (Online). 11-12 September 2024.

Otukile, K.P., Kandpal, S.C., Matthews, C., Chakraborty, S., Moskaleva, L.V. & Ramakrishnan, R. 2024. *Towards Accurate Prediction of the Thermochemistry and Kinetics of Key Elementary Steps in Low-Temperature Hydrocarbon Combustion*. Poster presented at the 27th International Symposium on Gas Kinetics and Related Phenomena, Leeds, UK. 15-18 July 2024.

Ugwu, D. & Conradie, J. 2024. *Electrochemical behaviour of β -diketone inspired chalcones*. Poster presented at the 5th Commonwealth Chemistry Posters - Building Networks to Address the Goals (Online). 11-12 September 2024.

Wilhelm, A., Smith, W., Kemp, G. & Bonnet, S. 2024. *Comparative investigation of biological active compounds of *Valeriana officinalis* harvested in South Africa and optimisation of harvesting seasons*. Poster presented at ISE-APPS2024 International Congress, Cape Town, South Africa, 23 -26 October 2024.



STAFF (2024)

Head of Department:
Prof HG Visser

BLOEMFONTEIN CAMPUS:

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|---------------------------|--|
| Professors: | Prof VA Azov and Prof W Purcell |
| Associate Professors: | Prof A Brink, Prof E Erasmus, Prof L Moskaleva, Prof M Schutte-Smith, Prof JA Venter, Prof KG von Eschwege, and Prof A Wilhelm |
| Senior Lecturers: | Dr S Bonnet, Dr DV Kama, Dr EHG Langner, Dr C Marais, and Dr E Muller |
| Lecturers: | Dr L Nkabiti, Dr R Shago, and Dr MR Swart |
| Researcher: | Dr A Noreljaleel |
| Research Fellows: | Prof BCB Bezuidenhout, Prof J Conradie, and Prof A Roodt |
| Programme Directors: | Prof JA Venter and Dr R Shago |
| Chief Officer: | Dr MM Conradie-Bekker |
| Senior Officers: | M Coetzee and R Wales |
| Officers: | Dr MW Mathebula and Dr R Matshitse |
| Senior Assistant Officer: | ED Andrews |
| Technical Assistants: | J Mafahle, LP Maxhaka, and E Tau |

QWAQWA CAMPUS:

| | |
|---------------------------|---|
| Subject Head: | Dr PP Mokolokolo |
| Associate Professors: | Dr JP Mofokeng |
| Lecturers: | Dr M Malimabe, Dr M Mngomezulu, Dr LS Mokoena, Dr PP Mokolokolo, Dr M Sibeko, and Dr T Tsotetsi |
| Academic Facilitator: | M Mbongo |
| Officers: | C König, P Leche, and S Nyawo |
| Senior Assistant Officer: | M Motsoeneng |

SOUTH CAMPUS:

| | |
|---------------|---|
| Coordinators: | Dr R Meintjies (theory modules) and L Siegert (practical modules) |
| Facilitators: | F de Beer, C de Klerk, M du Plessis, and L Siegert |
| Assistant: | M Ramapaeane |



DEPARTMENT OF COMPUTER SCIENCE AND INFORMATICS

FACULTY OF NATURAL AND AGRICULTURAL SCIENCES



CONTACT DETAILS

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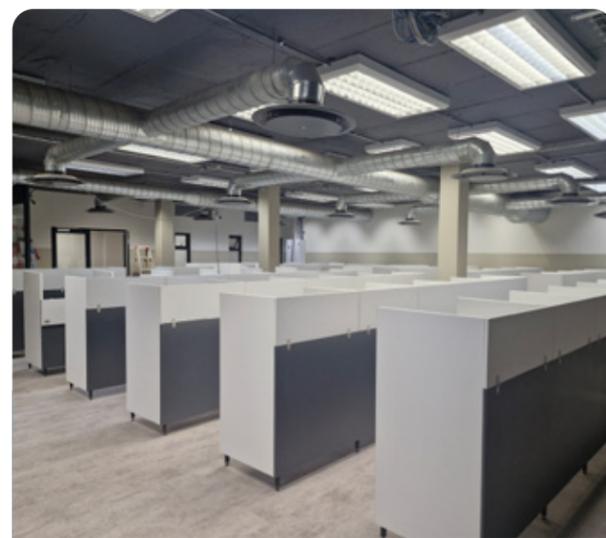
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OVERVIEW OF 2024

The Department of Computer Science and Informatics continues to grow with the increasing number of undergraduate and postgraduate students. As a result, our laboratories are being utilised to their full capacity. We completed the upgrade of our new postgraduate laboratory (WWG223) to a hybrid laboratory. As soon as the corresponding venue on the Qwaqwa Campus is completed, real-time Honours lectures will be facilitated between the two campuses. To assist with sufficient lab space due to the growth in student numbers, Prof Paul Oberholster, Dean of the Faculty of Natural and Agricultural Sciences, and the previous Dean, Prof Danie Vermeulen, graciously allocated two venues in the Agriculture Building. The labs are being renovated and will be ready to use from February 2025. The labs can seat 78 and 96 students, respectively.



*Upgrading of the new labs in the
Agriculture Building*

Successful Advisory Board meetings were held in 2024, and valuable input from industry members was implemented where possible. Third-year students also participated in a work-integrated-learning project at one of our Advisory Board members, BBD Software Development, in Sandton, Johannesburg, during the June-July UFS recess period.

ACHIEVEMENTS

Staff Achievements



Dr Ben Mase

Dr Ben Mase completed his PhD.

The Department has three NRF-rated staff members, namely Prof Eduan Kotzé, Dr Ruth Wario, and Dr Andronicus Akinyelu, and one NRF-rated research fellow, namely Dr Burgert Senekal.



*Dr Andronicus
Akinyelu*

Dr Akinyelu was included on Stanford University's list of the World's Top 2% of Scientists for 2024.

Student Achievements

A paper by one of our Honours students, J-L du Toit, co-authored by Prof Eduan Kotzé, was accepted for oral presentation at the 2024 International Conference on Artificial Intelligence, Computer, Data Sciences and Applications (ACDSA) at the University of Seychelles held on 1 and 2 February 2024. The paper also appeared in the full conference proceedings.

The University of the Free State (UFS) Department of Library and Information Services (LIS) hosted the LIS

Honours and Undergraduate Seminar (LISHURS) on 5 April 2024, facilitating a vibrant exchange of ideas, research findings, and innovative projects among undergraduate students and researchers. The seminar showcased undergraduate and Honours research and featured insightful presentations covering various topics from different faculties.

The presentations were adjudicated, and Nadean Barkhuizen, one of our Honours students, won second prize for her presentation titled 'Virtual Reality Computer Assembly: Building Technical Skills through Immersive Learning'. Her lecturers were Prof Lizette de Wet and Dr Bennie Botha.

The Department's Advisory Board is one of the most successful boards in the Faculty. Our board members annually sponsor prizes for our top students at the NAS Faculty Prizegiving ceremony. Industry involvement with the Department, their presence at the prizegiving ceremony, and their contribution to acknowledging top academic achievements were noticed and commended. The prize-winners for 2023 who were awarded at the Faculty Prizegiving in 2024 were:

- CSIL1511 & CSIL1521 Angelique Jansen van Rensburg and Thulisile Confidence Ntuli
- CSI 1st year Johannes Hermanus Spies and Thulisile Confidence Ntuli
- CSI 2nd year Johannes Hendrik de Lange
- CSI 3rd year Jocelyne Smith
- BCIS 1st year Darell Velenkosini Nkosi
- BCIS 2nd year Nokwazi Fortunate Khoza
- BCIS 3rd year Sfiso Gift Ntuli
- CSIS6809 Honours Project Nadean Elizabeth Barkhuizen and Johannes Louis du Toit
- BCIS6809 Honours Project Ilano Zendo Smith

Jocelyne Smith, an Honours student, won third prize at the annual *Suid-Afrikaanse Akademie vir Wetenskap en Kuns (SAAWK)* Student Symposium held in Bloemfontein at the end of October 2024. She is an Honours student but competed against Master's and PhD students. She also presented her work at the annual Southern African Conference on Artificial Intelligence Research (SACAIR) Postgraduate Student Conference Day, held from 4 to 6 December 2024 in Bloemfontein.

TEACHING AND LEARNING

The Electronic Computer Literacy Assessment (ECLA) program is used across the three UFS campuses to assess the first-year computer literacy modules. Usually, four to five thousand students are registered for these modules in an academic year. Continuous expansions and updates are made to improve and expand functionality.

Registered CSIS3784 students visited BBD Software Development (BBD), one of our advisory board members in Sandton, for a week-long work-integrated learning (WIL) experience from 1 to 5 July, before lectures commenced for the second semester. The students enjoyed the experience, although it was challenging. This was the first time that the students were assessed on what they had done during the WIL week, as last year's event was a pilot project.

A Tech Fair was held on 16 October 2024. Three IT companies, namely BBD, Microzone Solutions, and RuXSys IT Solutions, showcased their projects, and 80 students attended the presentations. The event was a huge success and may become an annual event. BBD also presented a successful and popular student workshop on 16 and 17 October 2024. The collaborative effort between the Department of Computer Science and Informatics and BBD



Students attending the Tech Fair

showcased their dedication to equipping students for their professional paths. This event established a bridge between aspirations and opportunities, linking young minds' ambitions with the promising avenues that await them.

RESEARCH, INNOVATION AND RESEARCH COLLABORATION

Blockchain Technology

The Blockchain Technology research area falls within the Fourth Industrial Revolution (4IR) domain and is led by Dr Wynand Nel, assisted by Dr Rouxan Fouché. The research group continued its research on alternative consensus algorithms for blockchain systems. This group focuses on the proof-of-work consensus algorithm of Bitcoin and on creating alternative algorithms that can dramatically reduce the energy requirement of the Bitcoin network. Furthermore, the group investigates the practical application of Blockchain Technology in whistleblowing and NGO financial sustainability. Three Honours students completed their Honours projects in 2024, each focusing on Blockchain Technology. Currently, one Master's student contributes to Blockchain-related projects.

Business Intelligence and Text Mining

The Business Intelligence and Text Mining (BITM) research group, led by Prof Eduan Kotzé, continued working on natural language processing problems, including general text classification, neural language models, conversational agents, and generative Artificial Intelligence (GenAI). Currently, Prof Kotzé's group is involved in two departmental projects. The first project utilises large language models to grade C# code, while the second focuses on detecting Generative AI in C# code. The group currently includes three PhD students and four Master's students, all working on NLP-related topics such as abusive language detection, neural machine translation, sentiment analysis, and text classification tasks.

Prof Kotzé continued to work with Prof W Daelemans at the Computational Linguistics and Psycholinguistics (CLiPS) research centre at the University of Antwerp, Belgium. They are jointly working on natural language processing research projects, investigating methods and algorithms to automatically detect abusive language online in South Africa and to develop conversational agents. Prof Kotzé visited Antwerp University in early February 2024.



Prof Eduan Kotzé on his visit to Antwerp University in Belgium

Dr Burgert Senekal and Dr Oluwafemi Oriola (from Nigeria) continued their fellowship with Prof Kotzé's research group, and Dr Adewuyi Adegbite (from Nigeria) joined the research group as a postdoctoral fellow.

Computer Science Education

In 2024, the Computer Science Education (CSE) research group, led by Prof Liezel Nel, achieved significant milestones in advancing the pedagogy of computer science. Two PhD candidates successfully completed their degrees, contributing valuable research to the field. Additionally, three Master's students are actively engaged in CSE-related projects, furthering the group's commitment to enhancing educational strategies. Prof Nel was elected to the Decoding the Disciplines Core Committee, which is working towards establishing a formal international organisation for Decoding practitioners. This appointment underscores the group's dedication to innovative methodologies and its influence in the global academic community.

Dr Christina van Staden continued her fellowship with Prof Nel's research group.

Dr Pakiso Khomokhoana's research also falls under Computer Science Education. He presented a paper at the 2024 SACLA conference in Gqeberha in July 2024. Dr Khomokhoana co-authored a paper with Tlholohelo Nkalai, which was also presented at the SACLA conference.

Digital Inclusion and Community Engagement in IT

Dr Rouxan Fouché's research focuses on addressing the digital divide by improving digital literacy and technology access, particularly in rural and underserved communities surrounding the UFS. Through tailored computer literacy training and direct engagement with local needs, this research empowers individuals with essential digital skills for meaningful participation in today's society. By integrating service-learning into collaborative, community-based IT projects, the work fosters civic responsibility and contributes to local economic and social development, while providing students with real-world opportunities to apply their IT knowledge to tackle pressing societal



Dr Rouxan Fouché at the Society 5.0 conference



Dr Wynand Nel at the Society 5.0 conference

challenges. Dr Fouché and Dr Wynand Nel presented conference papers at the Society 5.0 conference in Moka, Mauritius in June 2024.

Eye-Tracking

Prof Tanya Stott continued collaborative eye-tracking research with research fellow Dr Luna Bergh as well as colleagues from other UFS departments. The current project investigates gaze movements while reading a narrative text that has been formatted using a bionic font. Additionally, the latest project investigates eye movements while identifying relationships between displayed primates.

Human-Computer Interaction

The research interest of Prof Lizette de Wet falls within the discipline of Human-Computer Interaction (HCI). The main focus is on evaluating the usability and user experience of applications in various disciplines. These evaluations could use more traditional evaluation methods, such as observation, questionnaires, and interviews, conducted in a controlled environment (in our departmental usability laboratory), or at the venue or environment where the application is used. Our evaluations also incorporate physiological methods,



Students using VR equipment in a hardware practical session

such as using brain-computer interfaces (of which the department has a few different versions), as well as virtual reality (VR) technology.

VR environments are created at Honours and Master's levels in various application areas, for example, to be incorporated as possible additional teaching methods. These environments are subsequently evaluated in terms of their usability and user experience using our VR technology, which includes Oculus Quest 2 headsets, as well as a Microsoft HoloLens 2. Dr Bennie Botha attended the International Conference on Human Interaction and Emerging Technologies (IHET) in Venice, Italy, (26 to 28 August) and presented a paper co-authored by Prof de Wet.



Dr Bennie Botha at the International Conference on Human Interaction and Emerging Technologies (IHET) in Venice, Italy

Dr Bennie Botha visited higher education institutions in Kenya, Tanzania, and Botswana as part of the Digitalisation project to advance infection prevention and control through the use of virtual reality. A needs analysis was conducted during the visits, and partnership-building events were organised where the institution could voice its needs and concerns.



Dr Bennie Botha (far right) at Moi University, Kenya

At the same time, they seek to foster collaboration and build partnerships for the project and other postgraduate initiatives.

Research on Qwaqwa Campus

Dr Andronicus Akinyelu's research interests include machine learning, deep learning, computer vision, medical diagnostics, sustainable agriculture, and responsible artificial intelligence. His research focuses on developing machine learning and deep learning techniques for various applications, including COVID-19 detection, lung cancer diagnosis, brain tumour identification, malaria parasite detection, crop disease detection, climate change mitigation, and gaze estimation on mobile devices. He actively engages in interdisciplinary research and collaborates with local and international researchers across various disciplines and universities in South Africa and abroad.

Gavin Dollman developed a deep learning-based drone ortho mosaic land cover classifier to develop a predictive model for prospecting new fossil sites from the Elliot Formation in South Africa.

Dr Ben Mase completed his PhD, which focused on exploring how the development of novices' basic programming skills can be advanced using a meta-cognitive scaffolding model.

Adebola Musa's areas of research interest include deep learning, machine learning and artificial intelligence. He developed deep learning-based refinement for Ayo game strategies.

Dr Ruth Wario's research focus areas are HCI and Information and Communications Technology for

Development (ICT4D). Through ICT4D research, Dr Wario has explored ways in which ICTs can be used to enhance development in the areas of health, agriculture, and education.

ACADEMIC CITIZENSHIP AND COMMUNITY ENGAGEMENT

Information Technology Service Learning (ITSL) Project 2024

The CSIS2642 service-learning students provided computer literacy training to participating community members through the annual ITSL project. The ITSL project was organised and implemented for the 11th year by Dr Rouxan Fouché, assisted by Dr Wynand Nel. Individuals from Mangaung and surrounding communities were recruited with the help of community partner organisations (Mangaung Concerned Residents Organisation, the South African Red Cross and loveLife) responsible for the selection process. The ITSL project included computer literacy training in Microsoft (MS) Word and MS Excel. The training was presented over ten weeks, with classes each Friday from 10:00 to 13:00 in a UFS computer laboratory.

There are currently two implementations of the project each year, one at the loveLife Youth Development Centre in Botshabelo and the other



Participants at the certificate handover ceremony in December 2024

at the UFS Bloemfontein Campus. The certificate handover ceremony was held in December 2024, and 275 Bloemfontein and Botshabelo participants received certificates. Various stakeholder group speakers addressed and congratulated the project participants during this ceremony.

Community projects: Robotics and Python

Zirke le Roux coordinates the Department's community programme to introduce school learners to logical, computational, and programmatic thinking to help them develop their problem-solving skills. The initiative offers two programmes: Robotics, where participants build and programme LEGO EV3 Mindstorms robots, and Python, which teaches fundamental programming concepts using the popular Python programming language. Originally started before the COVID-19 pandemic, the project was revived in 2022 and has been running successfully since then. In 2024, participation soared, with 24 learners enrolled in Robotics and 62 in Python. While the majority of participants were school learners (Grades 1 to 12), there were also some parents, UFS students, and staff who took part in the Python program.

A key highlight of the Robotics programme was an informal competition at the end of 2024, during which participants showcased their 'destroyer' robot-machines that could detect nearby objects and shoot them with plastic balls (featuring full 360°



Robot built by learners in the Robotics programme using LEGO EV3 Mindstorms

movement). In the Python programme, six learners had the opportunity to compete in the national Programming Olympiad, hosted by the Institute of Information Technology Professionals South Africa (IITPSA). Throughout the year, it was evident that the learners thoroughly enjoyed the experience, which gave them valuable opportunities to enhance their problem-solving abilities.

POSTGRADUATE STUDENTS

Members of staff of the Department of Computer Science and Informatics supervise postgraduate students at Honours, Master's, and PhD levels.

Honours students must pass an Honours project (year module) in which they are required to identify, plan, analyse, and design either a working system (Computer Science and Informatics [CSI] and Data Science [DS] projects) or a horizontal prototype (Bachelor of Computer Information Systems [BCIS] projects). The annual increase in the number of students results in a heavier workload for each project supervisor in the Department, as supervision is conducted on a one-on-one basis. Since project supervision is highly time-intensive and requires many dedicated hours, the staff must be commended for their hard work and commitment.

The Department hosted the annual Honours project days in October 2024, during which students showcased their Honours projects. The Information Systems Honours students presented their horizontal prototypes using Axure RP. Despite having limited time to familiarise themselves with the platform, the quality of the projects was exceptional. A total of nine BCIS students, nine CSI students, and two additional CSI students from the Qwaqwa Campus presented their Honours projects. Three Data Science students were also part of the group. All the students who presented their projects successfully passed.

The Department provided financial support to nine PhD students and 15 Master's students throughout the year. The following degrees were

conferred during the April and December 2024 Graduations:

- Bachelor of Science Honours majoring in Computer Science and Informatics: 15
- Bachelor of Science Honours majoring in Data Science: 5
- Bachelor of Computer Information Systems: 2

Two PhD candidates obtained their doctoral degrees during the December 2024 graduation ceremonies:

Tipson Maleti

Thesis: Decoding the debugging process: An exploration of self-theories, challenges, and strategies to inform a tailored instructional approach for novice programmers

Supervisor: Prof L Nel

Mokotsolane Ben Mase

Thesis: Advancing the skills development of novice programmers through metacognitive scaffolding: A customised neo-Piagetian stage model

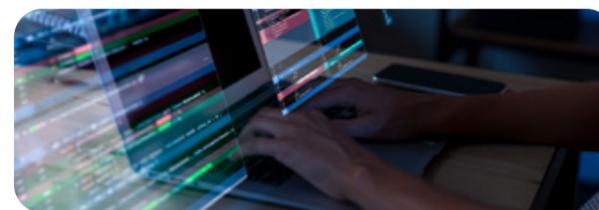
Supervisor: Prof L Nel

POSTDOCTORAL RESEARCH FELLOWS

The Department hosts one postdoctoral research fellow, Dr Adewuyi Adegbite from Nigeria, who is working with Prof Eduan Kotzé's research group.

STAFF MATTERS

Noloyiso Tlali joined the Department as the Assistant Officer on South Campus.



RESEARCH OUTPUTS

Research Articles

Atsa'am, D.D., Gbaden, T. & Wario, R. 2024. DrugApp: A simulation of drug suspects and offenders classification. *International Journal of Simulation and Process Modelling* 21: 3. DOI: 10.1504/IJSPM.2024.143843.

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Boersema, G.C., Van Rensburg, G.H. & Botha, B.S. 2024. Contextualising knowledge translation in nursing homes: A transdisciplinary online workshop. *The Journal for Transdisciplinary Research in South Africa* 20:1. DOI: 10.1402/td.v20i1.1477.

Fourie, C., Botma, Y. & Botha, B.S. 2024. High-fidelity burns moulage makes simulations "Come Alive". *Teaching and Learning in Nursing* 19 (2024). DOI: 10.1016/j.teln.2023.10.019.

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Oriola, O. & Kotzé, E. 2024. Improving the detection of multilingual South African abusive language via skip-gram using joint multilevel domain adaptation. *Transactions on Asian and Low-Resource Language Information Processing* 23: 2. DOI: 10.1145/3638759.

Senekal, B. 2024. ChatGPT as a source of information about Russian military involvement in Ukraine (2014-present). *Communicatio: South African Journal for Communication Theory and Research* 2024:1. DOI: 10.1080/02500167.2024.2405018.

Senekal, B. 2024. Die afbakening van die kern van die Afrikaanse poëtiesisteen (2000-2022). *Tydskrif vir Letterkunde* 61: 2.

Senekal, B. 2024. "Gee raat": 'n Netwerkwetenskaplike verkenning van die doeltreffendheid van boerate met spesifieke verwysing na die behandeling van epilepsie en slapeloosheid. *LitNet Akademies* 21:3. DOI: 10.56273/1995-5928/2024/j21n3f1.

Senekal, B. 2024. 'n Visuele verkenning van Suid-Afrika se posisie in die globale bestanddeel-resep-netwerk. *Suid-Afrikaanse Tydskrif vir Natuurwetenskap en Tegnologie* 43:1.

Senekal, B. & Kotzé, E. 2024. What makes poetic language different? An experiment in genre recognition using word co-occurrence networks in Afrikaans. *Southern African Linguistics and Applied Language Studies* 43. DOI: 10.2989/16073614.2024.2367436.

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Bergh, L. 2024. Brave broken heart? The story of the late radio journalist Suna Venter. In: *100 Years of Radio in South Africa. South African Radio Stations and Broadcasters Then & Now*. S. Nkoala & G Motsaathebe (Eds). Switzerland: Palgrave MacMillan. pp. 171-187.

Conference Contributions

Conference Proceedings

Akinyelu, A.A. & Esho, E.O. 2024. Deep learning for sustainable food systems: Mitigating climate change through food waste reduction. In: *19th Conference on Industrial Electronics and Applications (ICIEA)*, Kristiansand, Norway. 05-08 August 2024. W. Changyun, Z. Jing & R.A. Juan (Eds). Institute of Electrical and Electronics Engineers (IEEE). pp. 1-6.

Botha, B.S. & De Wet, L. 2024. The best fit framework for Human Computer Interaction research – Is it possible? In: *12th International Conference on Human Interaction and Emerging Technologies (IHET) 2024*, Venice, Italy. 26-28 August 2024. W. Karwowski & T. Ahram (Eds). Applied Human Factors and Ergonomics (AHFE) AHFE Open Access. pp. 47-56.

Du Toit, J.L. & Kotzé, E. 2024. The automatic detection of abusive language in Dota 2 chat messages. In: *2024 International Conference on Artificial Intelligence, Computer, Data Sciences and Applications (ACDSA)*. Mahe, Seychelles and online. 01-02 February 2024. J. Zelime & M. Gooroochurn (Eds). Institute of Electrical and Electronics Engineers (IEEE). pp. 467-474.

Fouché, R.C. & Nel, L. 2024. Bridging the digital divide: Assessing the impact of a community-focused service-learning project. In: *Proceedings of the 53rd Annual Conference of the Southern African Lecturers' Association (SACLA) 2024*. Gqeberha, South Africa. 17-19 July 2024. T. Gundu, N. Gcaza & A. Calitz (Eds). Nelson Mandela Metropolitan University. pp. 17-30.

Fouché, R.C. & Nel, W. 2024. Closing the gap: Leveraging recorded video lessons for digital inclusion in rural South Africa. In: *Society 5.0*. Moka, Mauritius. 26-28 June 2024. K. Hinkelmann & H. Smuts (Eds). Communications in Computer and Information Sciences (CCIS). Springer Cham. pp. 111-122.

Fouleback, R.Z.L., Akinyelu, A.A., Ranirina, D. & Mpinda, B.N. 2024. Malaria parasite detection in microscopic blood smear images using deep learning techniques. In: *2024 International Joint Conference on Neural Networks (IJCNN)*, Yokohama, Japan. 30 June – 5 July 2024. A. Hirose, I. Hisao & C. Jayne (Eds). Institute of Electrical and Electronics Engineers (IEEE) Xplore. pp. 1-8.

Khomokhoana, P.J. 2024. Leveraging strategies used in teaching theoretical Informatics subjects to CSI and Business Students. In: *Proceedings of the 53rd Annual Conference of the Southern African Lecturers' Association (SACLA) 2024*. Gqeberha, South Africa. 17-19 July 2024. T. Gundu, N. Gcaza & A. Calitz (Eds). Nelson Mandela Metropolitan University. pp. 1-16.

Khomokhoana, P.J. & Nkalai, T.S. 2024. Cognitive processes used by students in understanding aggregation and composition: A case of first-year BCIS students. In: *Proceedings of the 53rd Annual Conference of the Southern African Lecturers' Association (SACLA) 2024*. Gqeberha, South Africa. 17-19 July 2024. T. Gundu, N. Gcaza & A. Calitz (Eds). Nelson Mandela Metropolitan University. pp. 116-131.

Kotzé, E. & Senekal, B. 2024. Afrikaans literary genre recognition using embeddings and pre-trained multilingual language models. In: *2024 International Conference on Artificial Intelligence, Computer, Data Sciences and Applications (ACDSA)*. Mahe, Seychelles and online. 01-02 February 2024. J. Zelime & M. Gooroochurn (Eds). Institute of Electrical and Electronics Engineers (IEEE). pp. 439-444.

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Kotzé, E. & Senekal, B. 2024. Evaluating the GPT-3.5 and GPT-4 large language models for zero-shot classification of South African violent event data. In: *7th International Conference on Artificial Intelligence, Big Data, Computing and Communication Systems (icABCD) 2024*. Mauritius. 01-02 August 2024. S. Pudaruth & U. Singh (Eds). Institute of Electrical and Electronics Engineers (IEEE). pp. 66-78.

STAFF (2024)

**Head of Department:
Prof JE Kotzé**

BLOEMFONTEIN CAMPUS:

| | |
|-----------------------------------|--|
| Professor: | Prof P Blignaut (Contract) |
| Associate Professors: | Prof L de Wet, Prof JE Kotzé, Prof L Nel, and Prof T Stott |
| Senior Lecturer: | Dr W Nel |
| Lecturers: | Dr B Botha, Dr R Fouché, L Grobbelaar (Contract), Dr P Khomokhoana, J Marais, T Nkalai, and J Vieira (Contract) |
| Junior Lecturers: | N Barkhuizen (Contract), J Bothma (Contract), C Cilliers, G le Roux (Contract), R Phuthi (Contract), and S Serfontein (Contract) |
| Research Fellows: | Dr L Bergh, Dr O Oriola, Dr B Senekal, and Dr C van Staden |
| Officer: | S Opperman |
| Senior Assistant Officers: | S Mocwana, S Radebe (Technical Assistant), R Smith (resigned), and J Stallenberg (Technical Assistant) |
| Assistant Officer: | S de Klerk (transferred from South Campus) |

QWAQWA CAMPUS:

| | |
|----------------------------|--|
| Subject Head: | Dr B Mase |
| Senior Lecturer: | Dr R Wario |
| Lecturers: | Dr A Akinyelu, G Dollman, Dr MB Mase, and A Musa |
| Junior Lecturers: | T Lesesa and B Sebastian |
| Assistant Officers: | M Mahakoe and M Makhanya (Technical Assistant) |
| Secretary: | P van der Merwe |

SOUTH CAMPUS:

| | |
|----------------------------------|---------------------------------|
| Junior Lecturer: | M Thakaso |
| Senior Assistant Officer: | L Mohlomi (Technical Assistant) |
| Assistant Officer: | N Tlali |



DEPARTMENT OF
ENGINEERING SCIENCES
 FACULTY OF NATURAL AND AGRICULTURAL SCIENCES



C O N T A C T D E T A I L S

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OVERVIEW OF 2024

In 2024 the Group of Engineering Sciences published fourteen papers and four book chapters, registered one patent, and hosted one international conference. Together with internal and external departments, we co-supervised eight MSc, five PhD, and six Honours students. Six MSc and one PhD graduated in 2024. The Group submitted 12 funding proposals and two Expressions of Interest, of which one funding application was successful. The Group recalibrated its focus on ecological engineering sciences and generating the ideal multidisciplinary postgraduate student. Seven new themes within the Complex Systems Hub were explored, to connect to industry. One staff member (Sandile Dladla) commenced with the first year of his PhD project.

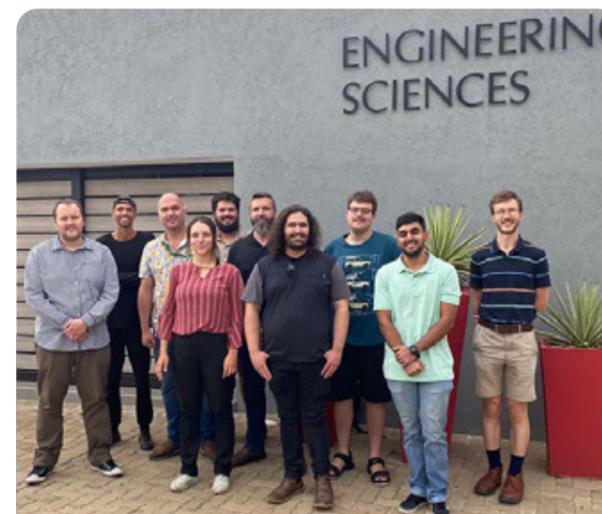


ACHIEVEMENTS

Staff Achievements

Dr Abdolhossein Naghizadeh registered a patent and was awarded funding for waste beneficiation projects as part of the Faculty of Natural and Agricultural Sciences (NAS) Complex Systems Hub.

Dr Jacques Maritz is part of a prestigious team, together with Stellenbosch University and Queen Mary University of London (QMUL), which was awarded a £499,258 (approximately R 11.5 million) research grant by the Science and Technology Facilities Council of UK Research and Innovation (UKRI) agency. This grant will support a statistical physics-based analysis of South Africa's power grid.



The Grid Related Research Group, focusing on complexity science and ecological engineering sciences

Student Achievements

Muhammad Cassim, a second-year student in Engineering Sciences, participated in the Winter University project for Young Engineers in Pskov, Russia, from 25 November to 9 December 2024. The winter school aims to strengthen relationships among young engineers and deepen international interaction via skills improvement, joint projects, and social cohesion. The programme boasts a densely packed education block, project block, and cultural block. Cassim is part of the UFS Grid

Related Research Group and actively participates in research centred on complexity science. He intends to complete his BSc Physics degree with Engineering subjects and progress towards postgraduate studies in the UFS Department of Physics.



Second-year student Muhammad Cassim was the only undergraduate globally to attend this prestigious Winter University project in Russia

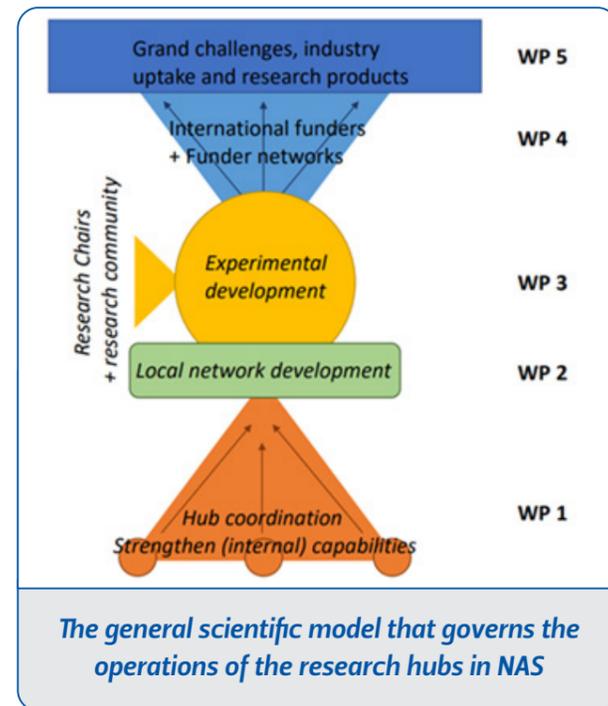
Damund de Klerk, (MSc student) as part of the industrial ecology and green concrete research group, published an article in the high-ranking journal of *Construction and Building Materials* (IF 7,4), with the title 'Recycled cement use to produce fly ash-based geopolymer binders suitable for ambient curing: Comparison with slag effects'. This effort puts the UFS at the forefront of industrial ecology.

TEACHING AND LEARNING

The Group of Engineering Sciences has embraced the need to generate stronger postgraduate candidates who can continue studies up to PhD level in minimum time, especially in Ecological Engineering Sciences, and be able to articulate to international universities to sustain collaborations. The teaching and learning strategy was developed to include research-led teaching styles and real word problems. Work integrated learning was implemented towards students to join research activities from an early stage.

RESEARCH, INNOVATION AND RESEARCH COLLABORATION

The Group facilitated the technical launch of NAS Complex Systems Hub. The NAS Research Hubs are designed to facilitate integration to deliver on market needs and consequently generate significant income through value creation in the market. The Complex Systems Hub addresses the need to showcase UFS core competencies and services by leveraging world class expertise and infrastructure.



Engineering Sciences committed to the waste beneficiation, industrial ecology, computational ecological engineering sciences, and complexity science component of the Complex Systems Hub. The Grid Related Research Group facilitated the formation of a project in the Hub on 'The complexity of a just and sustainable energy transition demands an understanding of various social-environmental and social-technological interactions, both on a global and local scale', that aims to interface social and resource network dynamics.

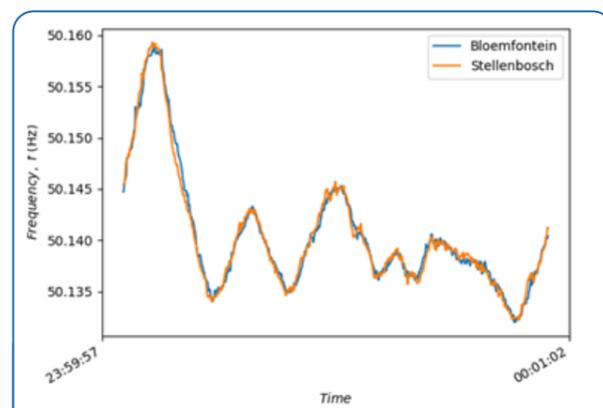
As part of the Engineering Sciences strategy

to generate ideal graduates to articulate to postgraduate programmes at the UFS or enter the job market as highly employable candidates, we are focusing on the cultivation of unique research offering with impactful projects in the fields of Green Concrete (waste beneficiation), Complex Systems, and Hydro-Science. Through this effort, research becomes our primary focus interwoven with student mentorship, focusing on the theme of ecological engineering sciences, with strategic integration of the Complex Systems in Ecological and Nature-Based Science.



Visual illustration of the research activities at Engineering Sciences with strong focus on Ecological Engineering Sciences

For many years the Grid Related Research Group (complexity science), led by Dr Jacques Maritz, has been actively collaborating with the Department of Physics at the Norwegian University of Life Sciences



A depiction of the complexity associated with tracking and describing the stability of power systems; high resolution dynamics measured at two different locations in South Africa, tell the story of a very complicated physics model that governs these systems

(NMBU) under the leadership of Prof Leonardo Rydin Gorjao. Recently, the two entities expanded their multi-disciplinary endeavours and collaboration by exchanging postgraduate students with the aim of advancing the field of complexity science and ecological engineering science. With their paper on 'Data-Driven Modelling of Frequency Dynamics Observed in Operating Microgrids: A South African University Campus Case Study' in *IEEE Access*, the group pioneered the data driven stability studies associated with South African microgrids.



Gerhard Venter

Gerhard Venter was awarded a prestigious PhD position in NMBU's Department of Physics, to be supervised by the UFS and NMBU research groups. In this position, Venter will merge the fields of complexity, graph theory, and dynamical systems to investigate complex dynamics

in power grid networks. This exchange will open the door for future multi-disciplinary endeavours between South African and Norwegian complexity science research groups.

Funding opportunities were explored through the Long-Term Joint EU-AU Research and Innovation Partnership on Sustainable Energy (LEAP-SE) and the Long-term Europe - Africa WEF-Nexus Multilateral Research Programme (LEAFWEF) consortia meetings, and student exchanges were facilitated with Norwegian University of Life Sciences (NMBU, Norway) and Queen Mary University of London (QMUL). The group hosted one visiting professor (Prof Leonardo Gorjao) from Norway.



The Green Concrete (Industrial Ecology) Research Group continued their collaboration with the University of Johannesburg on the of 3D Printing

of Houses project (one MEng and one PhD being supervised) and with Nelson Mandela University on various research projects (two MEng and one PhD are being supervised). They also conducted research projects on formulation of green concrete based on Laterite Soil, in collaboration with Yaoundé University II, in Cameroon.

Other civil engineering sciences engagements include collaboration with Central University of Technology on a research project on derivation of alkali activator from waste materials (1 MEng supervised). A project on calcium aluminate cements, in collaboration with IMERYS Pty Ltd (France), is in the planning stay.

The Hydro-Science research group engaged with the Higher Education Partnerships in Sub-Saharan Africa (HEPSSA) on the project titled 'An industry-based approach to review the Agricultural Engineering curriculum and further develop the capacity of institutes of higher learning in South Africa', and with the Water Resource Commission (WRC) on the 'Development of an automated hydrograph analysis tool to estimate catchment response time.



Sandile Dladla, Engineering Science Lecturer and lead of the Hydro-science research



ACADEMIC CITIZENSHIP AND COMMUNITY ENGAGEMENT

Members of Engineering Sciences were part of the local organising committee and the scientific organising committee for the Southern African Conference on AI Research (SACAIR2024), focussing on Artificial Intelligence for Societal Impact. The conference was held on the Bloemfontein Campus from 2 to 6 December 2024. Engineering Sciences led the tutorial sessions on AI applications and the unconference student section. This multi-, inter-, and transdisciplinary conference is the premium, annual AI conference in Southern Africa. The conference brought together nationally and internationally established and emerging researchers from various disciplines, including Computer Science, Mathematics, Physics, Statistics, Informatics, Humanities, and Philosophy. As in the past, the focus is on growing a formidable network of talented students working in AI from across Africa.

POSTGRADUATE STUDENTS

Dr Jacques Maritz was the co-supervisor of Riaan Bezuidenhout for his PhD in Computer Science and Informatics. The title of his thesis was 'Verifiable proof of randomness: efficient consensus for permissionless blockchain systems', and he was supervised by Dr Werner Nel, from the Department of Computer Science and Informatics.

Dr Abdolhossein Naghizadeh was also involved in the co-supervision of other students who graduated from other universities.

STAFF MATTERS

One new staff member was introduced into the Group in 2024. Zukile Xelelo was appointed as Lecturer

and joined the Hydro-Science research group working on water quality.



Zukile Xelelo

RESEARCH OUTPUTS

Research Articles

Ekolu, S.O., Mudzanani, P., Mofokeng, M.T.M., Maiyana, M.C. & Naghizadeh, A. 2024. Experimental Investigation and Classification of Wastewater Treatment Sludge as Pozzolan for Cement. *Journal of The Institution of Engineers (India): Series A* 105: 675-685. DOI: 10.1007/s40030-024-00806-4.

Fetuga, I.A., Olakoyejo, O.T., Abolarin, S.M., Adio, S.A., Gbegudu, J.K., Adewumi, O.O., Aderemi, K.S. & De Oliveira Siqueira, A.M. Computational fluid dynamics of free convection and radiation on thermal performance of light emitting diode applications with trapezoidal-finned heat sink. *Case Studies in Thermal Engineering* 61105078. DOI: 10.1016/j.csite.2024.105078.

Fetuga, I.A., Oluwatusin, O., Abolarin, S.M., Olakoyejo, O.O., Adelaja, A.O., Olaoye, D.Z., Adeleke, A.S., Gbegudu, J.K. & Aderemi, K.S. 2024. Influence of stenosis severity on hemodynamics flow at low Reynolds numbers: A computational fluid dynamic study. *Nigerian Journal of Technological Development* 20(4): 10-24. DOI: 10.4314/njtd.v20i4.1621.

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Immelman, R., Van der Westhuizen, I.P., Van Soelen, B., Maritz, J. & Vaidya, B. 2024. Polarisation and SED Modelling of Magnetised Relativistic AGN Jets using RMHD Simulations. *IAU General Assembly: Art. no.* 2182.

Kaze, R.C., Bikoko, T.G.L.J., Adesina, A., Amba, J.C., Cengiz, Ö., Naghizadeh, A. & Kamseu, E. 2024. Influence of calcined laterite on the physico-mechanical, durability and microstructure characteristics of portland cement mortar. *Innovative Infrastructure Solutions* 9(7): 248. DOI: 10.1007/s41062-024-01564-9

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volcanic-scoria and clay brick wastes using rice husk ash-NaOH activator: Fresh and hardened properties. *Sustainable Chemistry and Pharmacy* 40: 101627. DOI: 10.1016/j.scp.2024.101627.

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Magugu, K., Ekolu, S.O., Naghizadeh, A. & Quainoo, H. 2024. Influence of Ferrochrome Slag Co-Binder on Mechanical Behaviour of Fly Ash Geopolymer Mortars. *Advances in Science and Technology* 145: 3-17. DOI: 10.4028/p-KXM4Po.

Maritz, J.M., Gorjão, L., Bester, P., Esterhuysen, N., Erasmus, S., Riekert, F., Immelman, R., Geldenhuys, T., Viljoen, A & Bodenstein, C. 2024. Data-Driven Modeling of Frequency Dynamics Observed in Operating Microgrids: A South African University Campus Case Study. *IEEE Access* 12: 14466-14473, 2024. DOI: 10.1109/ACCESS.2024.3357945.

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Abolarin, S.M., Shitta, M.B., Oluwasanya, O.G., Eguma, C.A., Gbadegehin, A.O., Ogedengbe, E.O. & Lagrange, L. 2024. Chapter 5: Building energy efficiency improvements and solar PV systems integration. In: *Clean Energy for Low-Income Communities: Technology, deployment and challenges*. D.S-K. Ting & J.A. Stagner (Eds). The Institution of Engineering and Technology. p.p. 119-161 DOI: 10.1049/PBPO251E_ch5.

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Ewim, D.R.E., Scott, T.O., Eloka-Eboka, A.C., Abolarin, S.M. & Adelaja, A.O. 2024. Nanofluid Flow Through Non-Circular Cross-Section for Thermo-Hydraulic Enhancement of Energy Systems. In: *Localized Energy Transition in the 4th Industrial Revolution*. 1st Edition. O.T. Laseinde & A.C. Eloka-Eboka (Eds). Boca Raton, Taylor and Francis: CRC Press. pp.132-148. ISBN9781032651958. DOI: 10.1201/9781032651958.

Other Outputs

Patents

Filed Applications:

Naghizadeh, AH. 2024. *Accelerating agent for setting of fly ash geopolymer mixture: Production from recycled aluminium waste (filing in progress)*. Provisional Patent Application South Africa in process.

STAFF (2024)

Head of Department:
Dr JM Maritz

Senior Lecturers: Dr JM Maritz and Dr A Naghizadeh

Lecturers: S Dladla and Z Xelelo

Affiliated Lecturers: E Boje and J Haefele

Programme Manager: L Lagrange

Researchers: D de Klerk and S Nel

Chief Officer: D Lubbe

Senior Assistant Officer: Z Mngomezulu

Technical Assistants / Interns: S Dladla, B Leeuw, and FH Solomon



DEPARTMENT OF GENETICS

FACULTY OF NATURAL AND AGRICULTURAL SCIENCES



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OVERVIEW OF 2024

In 2024, the Department of Genetics had a productive year marked by achievements across all areas of our work. We celebrated several staff milestones, including Dr Sue-Rica Schneider and Dr Letecia Wessels completing their PhDs, and Mthe Manqana earning his MSc degree. Dr Tinus Viljoen won the Faculty of Natural and Agricultural Sciences (NAS) Flash Fact competition. Research continued in seven broad specialisations, with 29 papers

published, two book chapters, and seven conference presentations, underscoring the Department's research and postgraduate training activities. Our research capacity was further bolstered by the acquisition of next-generation sequencing equipment, expanding our genomics research capabilities. Teaching and learning remained a priority, with strong student numbers and pass rates across 33 undergraduate and Honours courses. Staff actively engaged with methods to improve teaching and learning through approaches such as training courses and the improvement of course material. Two of our students presented their research at major conferences – the Southern African Society for Human Genetics (SASHG) and Southern African Wildlife Management Association (SAWMA) events. The Department also deepened its national and international collaborations, working closely with partners such as the South African National Botanical Institute (SANBI), public and private nature reserves, the South African Police Service (SAPS), schools, and academic institutions both locally and abroad. Staff continued to make meaningful professional contributions outside the university, serving on committees and engaging in professional societies. Outreach initiatives also saw success, with Dr Gerda Marx hosting a practical session for Grade 12 learners, sparking interest in genetics among the next generation. Our international exposure grew through participation in courses and research projects, particularly with the University of Montana (USA) and SANBI. The Department also took significant steps in advancing research on medicinal mushrooms, with Prof Marieka Gryzenhout making progress in establishing industry collaborations. In terms of staff members, Dr Gryzenhout was promoted to Associate Professor, while one staff member resigned. Looking ahead, we aim to continue fostering a culture of academic excellence, research innovation, and meaningful engagement to strengthen our department's impact.

ACHIEVEMENTS

Staff Achievements

In 2024, the Department of Genetics celebrated several academic achievements and research milestones. Dr Sue-Rica Schneider and Dr Letecia Wessels successfully completed their PhD degrees. This brings the proportion of academic members of staff in the Department with PhDs to 84.6%. Furthermore, Professional Officer Mthe Manqana completed and received his MSc degree.



From the left, Dr Letecia Wessels, Dr Karen Ehlers, Prof Paul Grobler, Prof Renate Rebello, and Dr Sue-Rica Schneider

Dr Tinus Viljoen won the NAS Faculty's Flash Fact competition, earning funding to attend an international conference as a reward.



Winners of the NAS Flash Fact Competition, including Dr Tinus Viljoen from the Department of Genetics (second from right)

Three staff members received NRF-ratings. Dr Marieka Gryzenhout advanced from a C2 to a C1 rating, while Prof Paul Grobler retained his C2 rating. Affiliated staff member Prof Brian Reilly was also recognised with a C3 rating, highlighting the Department's continued research excellence. In recognition of her contributions to research and academia, Dr Gryzenhout was promoted to Associate Professor.

TEACHING AND LEARNING

During the 2024 academic year, the Department of Genetics offered a total of 15 undergraduate modules and 18 at the Honours level. The number of students per undergraduate module varied, with a high of 399 in BLGY1623, and Genetics modules typically ranging from 89 to 168 students. For Forensics modules, student numbers ranged from 28 to 50. Overall, numbers reflected a slight decrease in enrolment for second- and third-year courses. At the Honours level, class sizes ranged from 4 to 19 students, while all 31 students participated in the Techniques, Literature Review, and Year Project modules. Pass rates for undergraduate modules were between 76% and 100%, with all Honours modules achieving a 100% pass rate in 2024.

Dr Morne du Plessis served as a trainer at the BioDATA Advanced Course, held at Kruger National Park, during which he facilitated training in biological data analysis for 11 Norwegian and 14 South African students from multiple institutions. In addition, he co-signed a collaboration agreement with SANBI to develop a curriculum for Biodiversity Informatics, with the goal of integrating this emerging research field into university programmes and creating short learning courses to support its growth.



RESEARCH, INNOVATION AND RESEARCH COLLABORATION

In 2024, the Department made notable strides in research outputs, with 29 papers published in accredited journals, two book chapters, and six conference presentations, highlighting the growing impact of the Department's research.

The Department of Genetics undertakes research across eight broad themes, with strong interdisciplinary collaboration among staff and various specialisation areas:

1. Behavioural Genetics

Zurika Murray obtained NRF-funding for 2024-2026 for her research on psilocybin and psilocin's effects on neural organoids. She and her students are also studying genetic variation related to stress resilience and substance use among South African adolescents. These projects involve close collaboration with Dr Jaco Wentzel, affiliated member of staff, and Dr Angelique Lewies from the Department of Cardiothoracic Surgery in the Faculty of Health Sciences.

2. Conservation- and Population Genetics

Prof Paul Grobler and his students are investigating the population genetics of white rhino in



Participants at the SAWMA Conference in Windhoek, Namibia

collaboration with the Munywana Conservancy.

Prof Grobler and Prof Brian Reilly, along with four students from the Department of Genetics, attended the annual SAWMA Symposium in Windhoek, Namibia, in October 2024. The Department contributed two research papers, with Prof Grobler chairing one session. Zuan Grobler presented his MSc research on white rhino genetics.

Projects on aspects of the population genetics of a range of other species also continue, including large antelope and molluscs.



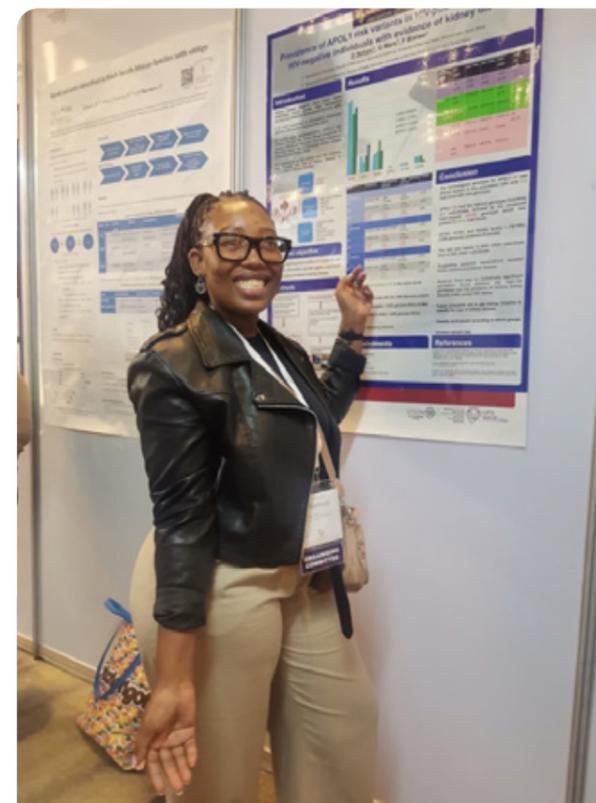
Staff and students during a field excursion to the Doornkloof Nature Reserve, Northern Cape. From the left, Prof Paul Grobler, Kabirr Singh, Ruan Jacobs, Jady Carelse, and Ayanda Nkabinde

Prof Grobler is also supervising a project with Dr Karen Ehlers on species identification in wildlife forensics, and he is working with Prof Brian Reilly and a PhD student on an analysis of the sustainability of current paradigms for conservation in South Africa. Prof Grobler, Dr Du Plessis and Prof Reilly are studying the use of non-invasive samples to assess genetic variation as demographic parameters in various species, including kudu, porcupine, and aardvark.

Further research of Dr Du Plessis is focussed on dragonflies, hoverflies and molluscs, with a strong genomics element. He received funding from SANBI for two research initiatives – one investigating mussels as vectors of disease and another assessing dragonfly diversity through barcoding and imaging techniques.

3. Human Genetics

Dr Gerda Marx is working on DNA methylation of inflammation genes, with one MSc and one PhD student, and APOL1 gene mutations in HIV and kidney disease. Dorah Notani (MSc student) presented a poster on the Prevalence of APOL1 risk variants in HIV positive and negative individuals with evidence of kidney disease at the SASHG Conference that took place in Sun City from 27 to 29 October 2024.



Dorah Notani presenting her poster at the SASHG Conference

Prof Renate Rebello works on the genetic analysis of biomarkers PLGF and s-Flt1, with Dr Sue-Rica Schneider. She is also using a bioinformatic approach to evaluate candidate Pre-eclampsia genes.

4. Fungal Systematics

Prof Marieka Gryzenhout, together with Zurika Murray, is involved in research on the biological properties of psychoactive medicinal mushrooms. She also works on biodiversity of macrofungi in South Africa. Prof Gryzenhout made good progress on the establishment of contract research opportunities with medicinal mushroom industries. She also

renewed her license from the South African Health Products Regulatory Authority license to conduct research on the illegal substances, psilocybin and psilocin. Dr Tinus Viljoen collaborates with Prof Gryzenhout on the psilocybin work.

Prof Gryzenhout prepared a new edition of the *Field Guide for Mushrooms and Other Fungi from South Africa*, incorporating 200 new species.

5. Plant Molecular Genetics and Genomics

Dr Frank Maleka and his research team made progress in the field of molecular genetics, particularly with *Clivia* species. Research focused on the genus *Clivia*, including identifying and differentiating *Clivia* accessions and cultivars in South Africa, investigating genetic variants related to flower pigmentation, and researching flower morphogenesis genes in pendulous and non-pendulous *Clivia* species. As part of this work, *Clivia miniata* was nominated for genome sequencing under the 1KSA programme. Dr Maleka also collaborated with Dr Gesine Coetzer from the UFS Department of Soil, Crop, and Climate Sciences, focusing on genetic characterisation of cactus pear cultivars (*Opuntia ficus-indica*) and genome-wide genetic variants related to fruit quality traits in cactus pear.

6. Forensic Genetics

In the field of Forensic Genetics, Dr Letecia Wessels is studying the seasonal abundance and diversity of forensically important flesh flies (Sarcophagidae) in the central Free State. Tshepiso Motolo is involved in this project. Dr Karen Ehlers is conducting innovative research on the use of environmental DNA from crime scenes to link suspects to specific environments. Dr Ehlers has also initiated two new forensic DNA database projects in collaboration with the South African Police Service (SAPS) and SANBI, focusing on wildlife forensics.

7. Forensic Science

Dr Tinus Viljoen continued his research on forensic ink analysis, including using techniques such as VSC, Microscope, TLC, and GC/MS for age determination of black and red pen inks. Tshepiso Motolo is also investigating pre-appearance interval and biology

of forensically important Coleoptera in central South Africa, and the interaction between Pathology vs Forensic Entomology.

Dr Ehlers, Dr Viljoen, and Dr Letecia Wessels attended the South African Academy of Forensic Sciences (SAAFS) Conference at the University of Pretoria. The theme of the conference was 'Stronger Together: Strength in Diversity', and Dr Ehlers highlighted the UFS contributions to forensic science training and research, while Dr Viljoen presented on fraudulent document analysis.



Dr Tinus Viljoen, Dr Karen Ehlers, and Dr Letecia Wessels at the SAAFS Conference, with Dr Stefan Jansen van Vuuren, Forensic Pathologist, on the right

8. Wastewater Monitoring

Dr Maleka, Dr Grobler, and Dr Marx completed a project with the South African Medical Research Council (SAMRC) focused on monitoring SARS-CoV-2 virus levels in wastewater treatment plants in the Mangaung Metropolitan Municipality. The project resulted in MSc student, Anneli Pietersen, completing her degree at the end of 2024. The focus will now move to monitoring of other compounds in wastewater.

Expanding capacity for research in genomics in the Department

The Department has expanded its capacity for next-generation sequencing (NGS) and genomics research. This was bolstered by the acquisition of key equipment, including an ONT Mk1c sequencer

and Qubit fluorometer, provided by the SAMRC and Diplomics through a collaborative MOU. This equipment is enabling the establishment of a genomics/NGS facility within the Department, managed by Dr Maleka in partnership with Dr Du Plessis, a specialist in genomics and bioinformatics. The aim is to establish capacity relating techniques such as low coverage genome sequencing and RAD sequencing, that will be applied in several of the specialist fields discussed above.

Research collaboration

As is clear from the descriptions of the specialised areas above, staff in the Department of Genetics are currently working with a large number of collaborators, including:

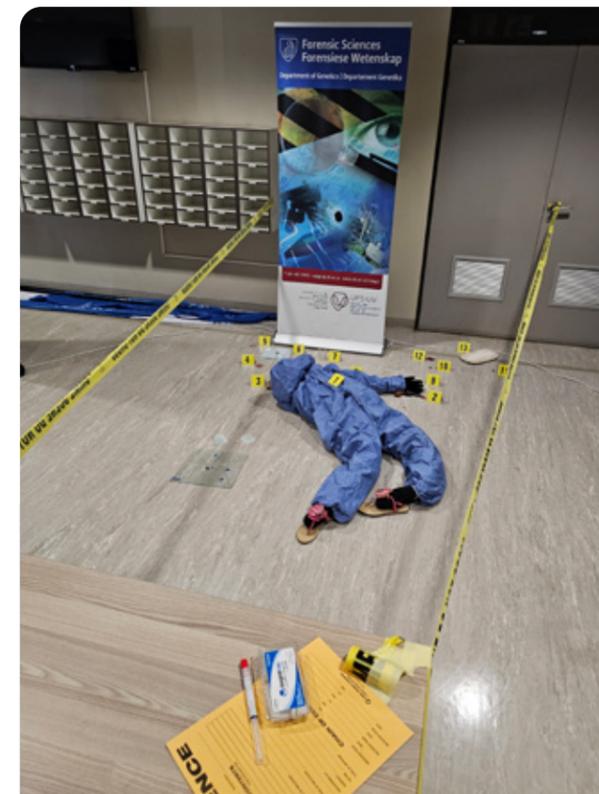
- SANBI, both as part of the recent UFS-SANBI initiative, and with individual scientists in SANBI in the Conservation and Forensic fields.
- The South African Police Service (SAPS).
- Individual researchers at the University of Pretoria, Stellenbosch University, the University of the Western Cape, Northern Cape Department of Agriculture, Environmental Affairs, Rural Development and Land Reform, and the Mummywana Conservancy in KwaZulu-Natal.
- Various industry partners such as Psyence, Druids Garden, Aether Apocathery, Harmonic Mycology and We Are Life Within.
- Jimmie Roos Special School.

Within the UFS, staff work across departmental and faculty borders with the Faculty of Law, Faculty of Health Sciences (Departments of Dietetics, Internal Medicine, Medical Microbiology and Virology, and Cardiothoracic Surgery), Faculty of the Humanities (Department of Psychology) and Farmovs. Within our own Faculty, the Department has strong research links with the Departments of Soil, Crop and Climate Sciences, Plant Sciences, and Microbiology and Biochemistry.



ACADEMIC CITIZENSHIP AND COMMUNITY ENGAGEMENT

As part of the Department's outreach initiatives, Dr Gerda Marx conducted a practical session for Grade 12 learners at Dr Viljoen High School in Willows on 8 August 2024. This engagement provided students with hands-on exposure to genetics, fostering interest in the field. To the same end, the Department also participated in a Faculty recruitment day.



Forensics Science display at the Faculty recruitment day

International exposure was strengthened through participation in the University of Montana and SANBI ConGen course presented in December 2024. Prof Paul Grobler presented on the statistical analysis used for individual identification and matching, while Dr Karen Ehlers delivered a lecture on the comparison between the application of forensic DNA analysis of human vs wildlife in South Africa.

Prof Gryzenhout was a featured speaker at the second Hogsback Mushroom Festival.

Several staff members are members of professional academic societies. Prof Grobler serves on the council of SWAMA and Dr Ehlers on the National DNA / Forensic Oversight board. Dr Gryzenhout is Vice-President of the South African Genetics Society.

Staff members serve on various committees at the UFS. Dr Wessels serves on the Environmental and Biosafety Ethics Committee (EBREC), while Dr Ehlers is involved with both the General Human Research Ethics Committee (GHREC) and the Appeal Committee (RAC), and Prof Grobler is a member of the Animal Research Ethics Committee (AREC).

POSTGRADUATE STUDENTS

There was a total of 31 Honours, 24 MSc, and 9 PhD students registered in 2024 in the Department of Genetics. The students who graduated in 2024 with the MSc in Genetics were:

- Dladla, ML
- Manqana, MM
- Müller, S
- Notani, MD
- Oosthuizen, H
- Wiid, SL

The following candidates graduated with the PhD:

Louis-Stéphane Le Clercq (Genetics)

Thesis: Biological clock measures: assessing the association between the circadian and epigenetic clock as predictors of migration phenology and biological aging in wildlife

Supervisors: Prof DL Dalton, Prof JP Grobler, and Prof A Kotzé

Sue-Rica Schneider (Genetics)

Thesis: Genetic determinants of schizophrenia and bipolar I disorder in selected southern African population groups

Supervisors: Prof R Rebello, Prof E Cason, and Prof JJ Spies

Letecia Wessels (Forensic Genetics)

Thesis: Investigating the feasibility of molecular techniques in augmenting insect-based post-mortem interval estimation

Supervisors: Dr K Ehlers and Dr S Brink

POSTDOCTORAL RESEARCH FELLOWS

Dr Z Zhao (from China), has been a postdoctoral fellow in the Department since 2024, working in the Evolutionary Generics Group under Prof Grobler.

STAFF MATTERS

The Department welcomed Dr Jaco Wentzel as an Affiliated Lecturer, acknowledging his extensive collaboration with Zurika Murray in the Behavioural Genetics focus area.

Dr Sonja Brink resigned as Lecturer in Forensic Science and a replacement has been appointed to join the Department from 1 January 2025.

RESEARCH OUTPUTS

Research Articles

Achilonu, C.C., Gryzenhout, M., Marais, G.J., Johar, D., Ghosh, S. & Hassanin, S.O. 2024. Antifungal activity of *Carya illinoensis* extracts against *Alternaria alternata* pathogen and their cytotoxicity effects on HEK-293T cells: HPLC analysis of bioactive compounds. *Discover Applied Sciences* 6: 67. DOI: 10.1007/s42452-024-05721-8.

Ahmed, M.A.A., Ali, M.F., Abd El-Tawab Bader, N.A., Khalaphallah, R., Ghallab, Y.K. & Ghosh, S. 2024. 16s rDNA gene analysis

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Clements, H.S., Do Linh San, E., Hempson, G. et al., Grobler, J.P., et al. & Woodhouse, G.M. 2024. The bii4africa dataset of faunal and floral population intactness estimates across Africa's major land uses. *Scientific Data* 11: 191. DOI: 10.1038/s41597-023-02832-6.

De Bruyn, M., Dalton, D.L., Mwale, M., Ehlers, K. & Kotze, A. 2024. Development and validation of a novel forensic STR multiplex assay for blue (*Anthropoides paradiseus*), wattled (*Bugeranus carunculatus*), and grey-crowned crane (*Balearica regulorum*). *Forensic Science International: Genetics* 73: 103100. DOI: 10.1016/j.fsigen.2024.103100.

Dehghani, M.H., Ahmadi, S., Ghosh, S., Khan, M.S., et al. & Ansari, K. 2024. Sustainable remediation technologies for removal of pesticides as organic micro-pollutants from water environments: A review. *Applied Surface Science Advances* 19: 100558. DOI: 10.1016/j.apsadv.2023.100558.

Dingiswayo, L., Adelabu, O.A., Arko-Cobbah, E., Pohl, C., Mokoena, N.Z., Du Plessis, M. & Musoke, J. 2024. Hypervirulent *Klebsiella pneumoniae* in a South African tertiary hospital – Clinical profile, genetic determinants, and virulence in *Caenorhabditis elegans*. *Frontiers in Microbiology* 15: 1385724. DOI: 10.3389/fmicb.2024.1385724.

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M., Chen, J.-J., Zhumagul, M., Wang, M., Ghosh, S., Abbasi, A.M., Yuldashev, A., Mamarakhimov, O., Alosaimi, A.A., Berdieva, D. & Rapior, S. 2024. Exploring biodiversity and ethnobotanical significance of *Solanum* species in Uzbekistan: unveiling the cultural wealth and ethnopharmacological uses. *Frontiers in Pharmacology* 14: 1287793. DOI: 10.3389/fphar.2023.1287793

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Kemp, L., Dalton, D.L., Mwale, M., Grobler, J.P., Madisha, M.T., van Wyk, A.M., Mokgokong, P.S., Jansen, R. & Kotze, A. 2024. Broad-scale genetic assessment of Southern Ground-Hornbills (*Bucorvus leadbeateri*) to inform population management. *Global Ecology and Conservation* 52: e02963. DOI: 10.1016/j.gecco.2024.e02963.

Le Clercq, L.S., Kotzé, A., Grobler, J.P. & Dalton, D.L. 2024b. Methylation-based markers for the estimation of age in African cheetah, *Acinonyx jubatus*. *Molecular Ecology Resources* 24: e13940. DOI: 10.1111/1755-0998.13940.

Le Clercq, L.S., Phetla, V., Osinubi, S.T., Kotzé, A., Grobler, J. P. & Dalton, D.L. 2024a. Phenotypic correlates between clock genes and phenology among populations of Diederik cuckoo, *Chrysococcyx caprius*. *Ecology and Evolution* 14: e70117. DOI: 10.1002/ece3.70117.

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Smith, J.H. & Singh, M. 2024. Unlocking secrets: Bioinformatics' impact on forensic bio-examinations. *International Journal of Network Security & Its Applications* 16(2): 1–15. DOI:10.5121/ijnsa.2024.16201.

Van Wyk, A.M., Schulze, E., Labuschagne, K., Thamae, S., Kotzé, A. & Dalton, D.L. 2024. Hybridization in an isolated population of blesbok and red hartebeest. *Ecology and Evolution* 14: e11194. DOI: 10.1002/ece3.11194.

Books/Chapters in Books

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Conference Contributions

Conference Papers

Diseko, L. & Marx, G.M. *The relationship between host genetic make-up and Human Immunodeficiency Virus in a South African population*. Paper delivered at the South African Society of Human Genetics (SASHG) Conference. Sun City, Rustenburg, South Africa. 27–29 October 2024.

Ehlers, K. *UFS: Forensic Sciences*. Paper delivered at the South African Academy of Forensic Conference, Pretoria, South Africa. 5–6 July 2024.

Grobler, Z., Ehlers, K. & Grobler, J.P. *Genetic diversity and optimal composition of founder populations in an intensely managed*

Southern white rhino population. Paper delivered at the Annual symposium of the South African Wildlife Management Association, Arebbusch Travel Lodge, Windhoek, Namibia. 7-10 October 2024.

Naidoo, P. & Maleka, M.F. *Transcriptome sequencing and digital expression analyses of flower morphogenesis genes in Clivia.* Paper delivered at the South African Society for Bioinformatics & South African Genetics Society BIO2024, Pretoria, South Africa. 23-25 September 2024.

Notani, D., Marx, G.M. & Bisiwe, F. *Prevalence of APOL1 risk variants in HIV-positive compared to HIV-negative individuals with evidence of kidney disease.* Paper delivered at the South African Society of Human Genetics (SASHG) Conference, Sun City, Rustenburg, South Africa. 27-29 October 2024.

Reilly, B.K. *Adaptive management in practice: A scale related ecological risk model for DinoKenge Game Reserve.* Paper delivered at the Annual symposium of the South African Wildlife Management Association, Arebbusch Travel Lodge, Windhoek, Namibia. 7-10 October 2024.

Viljoen, JA. *Investigating ink: Analysing questioned samples with microscopy, VSC and TLC.* Paper delivered at the South African Academy of Forensic Conference, Pretoria, South Africa. 5-6 July 2024.

Conference Posters

Diseko, L & Marx, G.M. 2024. *The relationship between host genetic make-up and Human Immunodeficiency Virus in a South African population.* Poster presented at the SASHG Conference, Sun City, Rustenburg, South Africa. 27-29 October 2024.

Notani, D. & Marx, G.M. 2024. *Prevalence of APOL1 risk variants in HIV positive and negative individuals with evidence of kidney disease.* Poster presented at the SASHG Conference, Sun City, Rustenburg, South Africa. 27-29 October 2024.

STAFF (2024)

**Head of Department:
Prof JP Grobler**

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| Professor: | Prof JP Grobler |
| Associate Professor: | Prof R Rebello |
| Affiliated Professor: | Prof FE Zachos (Austria) |
| Affiliated Associate Professor: | Prof BK Reilly (Tshwane University of Technology) |
| Senior Lecturers: | Dr K Ehlers, Dr M Gryzenhout, and Dr G Marx |
| Lecturers: | Dr S Brink, Dr M du Plessis, Dr F Maleka, T Motolo, Z Murray, Dr S Schneider, Dr T Viljoen, and Dr L Wessels |
| Affiliated Lecturer: | Dr A Lucassen (SAPS) |
| Programme Directors: | Dr K Ehlers (Forensics) and Dr G Marx (Genetics) |
| Senior Professional Officer: | M Manqana |
| Senior Assistant Officer: | B Henn |
| Assistant Officer: | B Radise |
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DEPARTMENT OF GEOGRAPHY

FACULTY OF NATURAL AND AGRICULTURAL SCIENCES



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OVERVIEW OF 2024

Over the past year, the Department of Geography has undergone significant developments and achievements which reflect our commitment to academic excellence and innovation. The Department has undertaken a curriculum renewal to enhance graduate employability and align academic offerings with industry needs, supporting the University's Vision 130. This renewal introduces three updated programmes – BSc Environmental Geography, BSc Geography Specialisation, and BA with Specialisation in Geography. Through this curriculum renewal, we introduced a third-year excursion module, providing students with hands-on experience in physical and human geography research. Furthermore, the curriculum now features expanded GIS and Remote Sensing modules alongside a newly introduced Geographical Ethics module designed to equip students with the skills to navigate ethical challenges in geographical contexts.

The Department extends its gratitude to Tobeka Mehlomakhulu, who retired in June after many years of dedicated service. She made significant contributions to the Department throughout her tenure by advancing and enhancing its engagements with Rural Geography. Her expertise and commitment played a pivotal role in fostering a deeper understanding of rural landscapes and their complexities. Her legacy will continue to inspire both colleagues and students.

The Department remains committed to excellence, innovation, and inclusivity. We look forward to the department's continued growth and success, which is driven by the invaluable contributions of our faculty, students, and stakeholders.

ACHIEVEMENTS

Staff Achievements



Dr Adriaan van der Walt

Dr Adriaan van der Walt was appointed as a member of the *African Journal of Climate Studies* Editorial Board. Dr Van der Walt was also selected to be part of the local organising committee of the Southern African Mountain Conference (SAMC2025) to be held in March 2025.

Prof Jay le Roux was appointed to serve on the Editorial Board of the *International Soil and Water Conservation Research Journal*.

Dr Elizabeth Rudolph was elected as the South African Representative for the International Geographical Union and International Association of Geomorphologists Joint Commission on Geomorphology and Society.

Prof Ralph Clark, Director of the Afromontane Research Unit (ARU) and Research Fellow in the Department, was appointed as the Chair of the 2024 Southern African Mountain Conference (SAMC).

Student Achievements

Basani Nkuna, a PhD student, was awarded Best Oral Presenter at Nelson Mandela University during the event held from 9 to 11 September. The South African Young Academy of Sciences (SAYAS) funded the event, which was centred around the theme 'Advancing the International Decade of Sciences for Sustainable Development'.

TEACHING AND LEARNING

Three of our postgraduate students, Bongumusa Sibisi (Honours), Elizabeth Carr (Honours) and Colby Weiss (MSc), joined a group of French and South

African researchers on an excursion to the Eastern Free State. They participated in a showcase at the Afromontane Research Unit (ARU) on our Qwaqwa Campus. The showcase offered invaluable insights into the work being done on the Subantarctic islands, exploring their interconnectedness and importance in understanding the Southern Hemisphere's climate. The team also had the opportunity to hike around Golden Gate Highlands National Park and up the Witsieshoek chain ladder route to the Tugela Falls. The excursion was funded by the NRF-PROTEA France bilateral grant and organised by Dr Rudolph.



Department of Geography postgraduate students (from left to right) Bongumusa Sibisi, Elizabeth Carr, and Colby Weiss during the ARU showcase excursion of the eastern Free State

On the Qwaqwa Campus, second-year Process Geomorphology (GEOP 2614) students participated in an excursion to Golden Gate Highlands National Park as part of their curriculum. Likewise, third-year Rural Geography (GEOH 3724) students undertook a field trip to Golden Gate Highlands National Park, the Basotho Cultural Village, and Clarens, focusing on tourism and local economic development.

RESEARCH, INNOVATION AND RESEARCH COLLABORATION

In 2024, Dr Katlego Mashiane worked on a study that leveraged the power of machine learning to assess

vegetation dynamics. This study utilised satellite remote sensing and random forest algorithms to predict species richness and diversity in sub-alpine grasslands, enhancing monitoring capabilities for these ecosystems. Furthermore, he co-authored a book chapter that explores the impacts of climate variability on rangeland ecosystems, emphasising the role of remote sensing in assessing these changes. Through his research, Dr Mashiane aims to enhance the understanding and management of grassland ecosystems, particularly in global environmental change.



Prof Jay le Roux continued research for the Water Research Commission (WRC) that has been running from April 2022 to March 2024. The research aims to develop a hydrological soil map of South Africa (HYDROSOIL). Prof George van Zijl (North-West University) is the project leader. The lack of a detailed and accurate hydrological soil map has recently been identified as hindering progress in hydrological modelling. The current best national soil information dataset, the land type survey, is widely used for such purposes but is inadequate for various reasons. This study created hydrological soil (HYDROSOIL) maps of six ecologically and/or economically priority catchment areas in South Africa, including the Tsitsa River Catchment (TRC). Using the HYDROSOIL maps, this study applies SWAT in the TRC. Comparing the results and accuracies of the two input datasets (Land Type input versus HYDROSOIL input) allows appraisal of the performance of the data.

Prof Le Roux is also actively involved in another WRC project on a landslide early warning system for South Africa (LEWSSA), running from April 2023 to March 2025. The project leader is Prof Johan van Tol (UFS).



Prof Jay le Roux

South Africa does not have a Landslide Early Warning System (LEWS) and relies only on forecasted rainfall to speculate on the potential for landslides to occur. First, historic landslides will be mapped from satellite imagery and ground-truthed to improve and establish an inventory of landslides in coastal areas of KwaZulu-Natal and the Eastern Cape, followed by the creation of a landslide susceptibility map depicting site-specific sensitivity to landslides. Rainfall thresholds and soil moisture contents derived from satellite imagery will be downscaled to local scales as surrogates for in-situ measurements. Finally, cloud-based computing will be used to access open-source satellite imagery, compute antecedent soil moisture and, together with rainfall forecasts, determine if the thresholds for landslide will be exceeded.

Dr Adriaan van der Walt is one of the collaborators and researchers who received funding from the Water Research Council (WRC) for a proposed project titled 'Development of climate and water availability indices app to support decision-making across South African water management areas'.

Dr Elizabeth Rudolph and her collaborators from the University of Fort Hare and UNISA, working alongside two French institutions, Centre de Recherche et d'Enseignement des Géosciences de l'Environnement (CEREGE) and the Geoscience Department at Université Paris-Saclay (GEOPS), collaborated to investigate the paleoclimate of the Southern Hemisphere. The NRF-PROTEA bilateral funding instrument supports the project and involves a team of geomorphologists, geologists, climate modellers, and physicists. They are focused on reconstructing the glacial and volcanic history of two island groups, the Prince Edward Islands (South African territory) and the Kerguelen Archipelago (French territory). The goal is to gain insights into past climate conditions to enhance future climate models and better predict climate

change and its impacts to inhabit territories of the Southern Hemisphere.



Dr Marike Stander (left), Dr Melissa Hansen (middle), and Dr Adriaan van der Walt (right) at the 35th International Geographical Congress, held in Dublin, Ireland

Dr Marike Stander attended a post-conference field trip on peatland degradation and restoration in Ireland, supported by the Geomorphology Association of Ireland and the Commission on Land Degradation & Desertification.



From the left, Prof Chiaki Oguchi (Graduate School of Science and Engineering, Saitama University), Dr Marike Stander (Department of Geography, UFS), and Prof Takashi Oguchi (Center for Spatial Information Science, University of Tokyo; Vice-President, International Association of Geomorphologists), at the former raised bog that is being actively rehabilitated

As part of an Afromontane Research Unit (ARU)-led initiative, Prof Ralph Clark included Solomon Zondo, Dr Melissa Hansen, and Ntebohiseng Sekhele in a Norway-South Africa bilateral research proposal submitted in 2024. The proposal was successful, with Prof Clark serving as the South African Principal Investigator (ZA PI). The project will facilitate international collaboration and capacity development, including a research exchange visit for Solomon Zondo to Norway scheduled for October 2025.

ACADEMIC CITIZENSHIP AND COMMUNITY ENGAGEMENT

In September 2024, Dr Rudolph and her national and French collaborators hosted a colloquium at the Afromontane Research Unit, UFS Qwaqwa Campus, to share research insights. Geography students also presented their work on the Marion and Gough Islands. The event, Sub-Antarctic Islands: Sentinels of Change, welcomed scientists and the public both in-person and online on 9 September 2024.



Prof Vincent Clark (second from left) and Dr Elizabeth Rudolph (third from left) and with their South African and French collaborators during the research colloquium at the Afromontane Research Unit, UFS Qwaqwa Campus



Dr Marike Stander contributed to public science communication through a feature article published in *Daily Maverick* on 26 March 2024, titled 'Marion Island: Digging Dirt and the Roaring Forties'. The article explores the Marion Island research conducted by the Sub-Antarctic Landscape and Climate Interactions Group, with which she assists, helping to make geoscience more accessible to the public. She also shared her insights from her PhD research on soil erosion during a feature on OFM Radio and in an associated article published on 11 January 2024, titled '*Beter begrip nodig vir grondbewaring*'. The discussion emphasised the need for a better understanding of soil conservation in South Africa.

On the Qwaqwa Campus, the Department hosted an outreach programme with Selelekela Secondary School in Phuthaditjhaba. The school brought the science matric cohort to the Department for lessons on map work and GIS and Remote Sensing demonstrations.

Dr Sanele Mbambo is a member of the US-Africa Collaborative, an initiative between the United States and African academics, practitioners, civil society, professionals and governments. He is also a member of the newly established Centre of Excellence for Smart Villages and Human Settlements. The Centre is formulated through collaboration between the US-Africa Collaborative, the Ilima Foundation and the African Chamber of Commerce.

One of the key developments in 2024 was the successful continuation and sustainability of the weather stations initially established under the Mountain-to-Mountain Programme. Despite the conclusion of the programme in late 2023, Prof Ralph Clark of the ARU ensured the continued viability

of these stations through strategic partnerships. These partnerships, facilitated in part through the ARU, provided essential financial support, data management assistance, and mentoring opportunities. In particular, the ongoing involvement of Zandile Mncube (Geography Technician) was strengthened through international exposure and capacity development initiatives. Notably, the ARU's access to funding and technical partnership resources not readily available within the Geography Department played a critical role in sustaining the stations. The average annual cost of servicing and maintenance is approximately R50,000, with exceptional cases such as a R30,000 repair (June–July 2024) being fully funded by ARU and its collaborators.

POSTGRADUATE STUDENTS

A total of 28 Honours students, 29 Master's students, and 20 Doctoral students were enrolled in our programmes on both the Bloemfontein and Qwaqwa Campuses.

M Phaswana, M Phala, S Moloise, T Mudau graduated with an MSc in Geography, M Pherane graduated with an MA in Geography, and N Tyhokolo graduated with an MSc in Environmental Geography.

Four PhD candidates graduated in 2024. They were:

Ryan Anderson

Thesis: Medium to long-term impacts of rainfall on large gully networks in the Eastern Cape, South Africa

Supervisor: Prof JJ le Roux

Kowanai Mhlanga

Thesis: Political economy of urban settlement demolitions and state power in Zimbabwe: A case study of Harare Metropolitan Province since 2013

Supervisor: Dr MM Hansen

Nthabeliseni Munyai

Thesis: Evaluating Environmental Factors & Fire Disturbance Influencing Species Diversity in a Mountainous Protected Area

Supervisor: Prof SA Adelabu

Wisdom Sibanda

Thesis: Participation of Refugee Women in Water and Sanitation: Reflection on experiences of Tongogara Refugee Camp, Zimbabwe

Supervisor: Dr MM Hansen

POSTDOCTORAL RESEARCH FELLOWS



Dr Ona Gwate

Dr Colbert Jackson and Dr Femi Durowoju continued with their postdoctoral fellowships led by Prof Adelabu. They have since taken up some teaching duties in the Department and continue to be actively involved in the geospatial lab.

Dr Onalenna Gwate was affiliated with the Department of Geography as a postdoctoral fellow until March 2024, working on the EU Biodiversity-funded *RangeX* project, for which Prof Ralph Clark serves as the South African Principal Investigator. Although the project officially concluded on 31 December 2024, academic outputs are still

forthcoming. A key milestone in the final project phase was a writing retreat held in Germany in November 2024, which Dr Gwate attended as part of the collaborative manuscript development process.

STAFF MATTERS

Dr Adriaan van der Walt was appointed as the Acting Academic Head of the Department.

Moleboheng Pherane was appointed as a New Generation of Academics Programme (nGAP) Human Geography Lecturer with duties commencing on 1 October 2024.

Prof Tom Okello was appointed as Associate Professor on the Qwaqwa Campus from 1 September 2024. He is responsible for the Environmental Geography modules.

Kholeka Sikhosana, Ntebohiseng Sekhele, Solomon Zondo, and Zandile Mncube were accepted into the Researcher Excellence Accelerator Programme (REAP) in 2024.



Prof Adelabu at the Earth Observation for Africa Symposium at the European Space Agency in Rome, Italy from 23 to 26 September 2024

RESEARCH OUTPUTS

Research Articles

- Adagbasa, E.G., Samuel, K.J., Durowoju, O.S. & Obidiya, M.O.** 2024. Drowning in the Sea: A Digital Shoreline Analysis of Coastline Changes in Ilaje, Nigeria. *Papers in Applied Geography* 10(4): 301-318.
- Altoom, M.B., Adam, E., Ali, K.A. & Jackson, C.M.** 2024. The Spatiotemporal Analysis of Drought and Impact on Millet Production across North Darfur State using Standardized Precipitation Index (SPI) and Reconnaissance Drought Index (RDI). *South African Journal of Geomatics* 13(1): 193-213.
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- Boardman, J.** 2024. Communicating soil erosion in the UK: How should we present extreme events? *The Geographical Journal* 190(2): e12554.
- Boardman, J.** 2024. Local and regional British journals: natural history, geology, geography and ecology, their role and value. *Proceedings of the Geologists' Association* 135(2): 137-140.
- Carr, A.S., Chase, B.M., Birkinshaw, S.J., Holmes, P.J., Rabumbulu, M. & Stewart, B.A.** 2024. Palaeo-landscapes and hydrology in the South African interior: Implications for human history. *South African Journal of Science* 120(3-4): 1-4.
- Daemane, M.E., Adelabu, S.A. & Ramoelo, A.** 2024. Assessing species richness, diversity and assemblage of forest patches within a grassland matrix in the Afrotemperate ecosystems. *Phytocoenologia* 52(1).
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- Gwate, O., Dlomu, M.G., Toucher, M., Le Roux, P.C., Martin, G.D. & Clark, V.R.** 2024. Endemic darling or global change menace? A review of the woody encroacher *Leucosidea sericea* on the eastern Great Escarpment of southern Africa. *South African Journal of Botany* 174: 307-317.
- Jackson, C.M., Durowoju, O.S., Adelabu, S.A. & Adeniyi, S.A.** 2024. An assessment of Kenya's forest policy and law on participatory forest management for sustainable forest management: Insights from Mt. Kenya Forest Reserve. *Trees, Forests and People* 19:100770.
- Kalaoane, R.C., Matamanda, A.R., & Bhanye, J.I.** 2024. The complex web of land use planning, legislation and urban mobility in Maseru, Lesotho. *Discover Sustainability* 5(1): 40.
- Kruger, J.A., Roffe, S. & Van der Walt, A.J.** 2024. AgERA5 representation of seasonal mean and extreme temperatures in the Northern Cape, South Africa. *South African Journal of Science* 120(3-4). DOI: 10.17159/sajs.2024/16043.
- Mapaura, A., Canavan, K., Richardson, D.M., Clark, V.R., Sutton, G.F. & Steenhuisen, S.L.** 2024. The impact of *Nassella trichotoma* (Nees)

Hack. ex Arechav. on plant diversity, richness and soil properties in South Africa. *South African Journal of Botany* 173: 175-183.

- Mashiane, K., Ramoelo, A. & Adelabu, S.A.** 2024. 'Prediction of species richness and diversity in sub-alpine grasslands using satellite remote sensing and random forest machine-learning algorithm'. *Applied Vegetation Science* 27(2). DOI: 10.1111/avsc.12778.
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Books/Chapters in Books

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Conference Contributions

Conference Papers

Adelabu, S.A. 2024. *Grass Curing in a Protected Mountainous Environment: Estimation and Modelling for Fire Danger Assessment*. Paper delivered at the Earth Observation for Africa Symposium, ESA-ESRIN, Frascati, Italy. 23–26 September 2024.

Charton, J., Rudolph, E., Hedding, D. W., Jomelli, V., Nel, W., Schimmelpfennig, I. & Verfaillie, D. 2024. *Climatic drivers of deglaciation at two southern Indian Ocean islands during Marine Isotopic Stages 3 and 2*. Paper delivered at the Australasian Quaternary Association (AQUA) Biennial Meeting, Minjerribah, Australia. 24–28 June 2024.

Hansen, M. 2024. *The Production of Space in the Maloti-Drakensberg Transfrontier Conservation Area*. Paper delivered at the 35th International Geographical Congress, Dublin City University, Dublin, Ireland. 24–30 August 2024.

Kruger, J.A., Van der Walt, A.J. & Roffe, S.J. 2024. *Heatwave trend analysis across the Northern Cape, South Africa: 1980–2020*. Paper delivered at the International Conference on Integrated Responses to the Intensification of Extreme Climate and Weather Events in Developing Economies, Stellenbosch, South Africa. 22–24 May 2024.

Le Roux, J.J., Van Tol, J.J., Mararakanye, N., Mudaly, L., Weepener, H.L. & Van der Laan, M. 2024. *Southern African soil, land cover and weather generator file databases for SWAT applications*. Paper delivered at the Combined Congress, Wilderness Hotel, South Africa. 22–25 January 2024.

Mashiane, K. 2024. *Prediction of species richness and diversity in sub-alpine grasslands using satellite remote sensing and random forest machine-learning algorithm*. Paper delivered at the Earth Observation for Africa Symposium, ESA-ESRIN, Frascati, Italy. 23–26 September 2024.

Mbambo, S.B. 2024. *Advancing climate-resilient and sustainable human settlements: Innovative building technologies in South Africa*. Paper delivered at the Public Innovation, Development and Sustainability Conference at the Garden Court Marine Parade, Durban. 24–25 October 2024.

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Innovation, and the Future of Local Societies: Keeping Pace in a Changing Knowledge and Political Landscape, Clarens, Free State. 09–10 October 2024.

Okello, T.W. 2024. *Unlocking Africa's industrial potential: Leadership and STEM convergence for sustainable growth*. Paper delivered at the Sustainable Industries Conference, CSIR International Convention Centre, Pretoria, South Africa. 11–12 September 2024.

Okello, T.W., Chitongo, L., & Nuwarinda, H. 2024. *Decolonisation of climate science: Elevating African voices and expertise*. Paper delivered at the International Qwaqwa Interdisciplinary Conference, University of the Free State, Qwaqwa Campus, South Africa. 20–21 November 2024.

Okello, T.W., Chitongo, L., Nuwarinda, H. & Kariuki, P. 2024. *Restructuring climate finance: Prioritising African leadership in the global context*. Paper delivered at the International Qwaqwa Interdisciplinary Conference, University of the Free State, Qwaqwa Campus, South Africa. 20–21 November 2024.

Okello, T.W., Chitongo, L., Nuwarinda, H. & Matiso, L. 2024. *Climate imperialism: The role of the Global North in Africa's climate crisis*. Paper delivered at the International Qwaqwa Interdisciplinary Conference, University of the Free State, Qwaqwa Campus, South Africa. 20–21 November 2024.

Rudolph E. M. 2024. *Sub-Antarctic Marion Island's Quaternary glaciations: insights and unknowns*. Paper delivered at the VIII édition Colloque Climat et Impacts, Online and Paris, France. 6–8 November 2024.

Rudolph, E. M., Charton, J., Hedding, D. W., Jomelli, V., Nel, W., Schimmelpfennig, I. & Verfaillie, D. 2024. *Glacier chronologies for Marine Isotopic Stages 3 and 2 from the southern Indian Ocean: evidence from ³⁶Cl CRE dating on the Kerguelen and Marion islands*. Paper delivered at the XI Scientific Committee on Antarctic Research (SCAR) Open Science Conference, Pucón, Chile. 19–23 August 2024.

Van der Walt, A.J. 2024. *Regional specific studies of extreme temperatures and human thermal comfort across southern Africa*. Paper delivered at the Biennial Conference of the Society of South African Geographers (SSAG), North-West University, South Africa. 16–18 September 2024.

Van der Walt, A.J., Kruger, J.A & Roffe, S.J. 2024. *High-resolution analysis of heatwave trends in the Maloti-Drakensberg region, southern Africa: 1979–2021*. Paper delivered at the International Geography Congress, Dublin, Ireland. 24–30 August 2024.

Zondo, S.A. & Mukwada, G. 2024. *The State of transhumance in Namahadi Catchment Area in the Wake of Climate Change*. Paper delivered at the Society of South African Geographers (SSAG) Biennial Conference, Northwest University, Potchefstroom, South Africa. 16–18 September 2024.

Conference Posters

Nel, W., Hedding, D. W. & Rudolph, E. M. 2024. *Increased warming of the sub-Antarctic islands in the 21st Century*. Poster presented at the XI Scientific Committee on Antarctic Research (SCAR) Open Science Conference, Pucón, Chile: 19–23 August 2024.

Nel, W., Hodgson, D., Hedding, D., Whittle, A. & Rudolph, E.

M. 2024. *Twenty-thousand-year lag between deglaciation and peat formation on sub-Antarctic Marion Island attributed to climate and sea level change*. Poster presented at the XI Scientific Committee on Antarctic Research (SCAR) Open Science Conference, Pucón, Chile. 19–23 August 2024.

Sikhosana, K.T., Van der Walt, A.J. & Matamanda, R.A. 2024. *Investigating Climate Variability in the City of Johannesburg and the Potential Role of Urban Ecological Infrastructure in Mitigating its Effects*. Poster presented at the 1st Climate and Health Africa Conference (CHAC), Harare, Zimbabwe. 29 – 31 October 2024.

Stander, M.H., Le Roux, J.J., Abd Elbasit, M.A.M. & Gang Liu. 2024. *Appointing soil types as source groups by using weathering indices as tracers*. Poster presented at the 35th International Geographical Congress 2024, Dublin City University, Dublin, Ireland. 25–30 August 2024.

Stander, M. H., Rudolph, E. M., Treasure, A. M., Lavery, C., Olivier, R. & Rossouw, M. 2024. *Sub-Antarctic Island Chronicles: From Huts to Bytes*. Poster presented at the XI Scientific Committee on Antarctic Research (SCAR) Open Science Conference, Pucón, Chile. 19–23 August 2024.

Conference Proceedings

Tiya, A.A., Soviti, M.K., Okello, T.W., Mazwi, V. & Mangaliso, R.N. 2024. *Comparative efficacy of organic and inorganic fertilisers on vegetable growth and yield in South Africa*. In: *Proceedings of the 11th International Conference on Agriculture*, 9(1), 114–129. DOI: 10.17501/26827018.2024.9108.

Research Reports

Le Roux, J.J. 2024: *Updated soil erosion risk map of the Limpopo River Basin*. Report delivered to Limpopo Watercourse Commission, UNDP-GEF Project.

Le Roux, J.J., Rakotoriavelo, M., & Clark, V.R. 2024. *Feedback on Madagascar trip to Ankaratra Massif and Masoala Peninsular Range*. Report delivered to the University of the Free State, Qwaqwa Campus, Afromontane Research Unit. online, 14 October 2024.

Van der Laan, M., Viviers, C., Maseko, S., Schutte, C., Thomson, A., Khoboko, P., Silberbauer, M, le Roux, J.J., Mudaly, L., Weepener, H., Hoogenboom, G., Raghavan, S., Clark, D. & Kunz, R. 2024: *Development of the Water Research Observatory and case studies on machine learning applications, WRC report 3121/1/23*. ISBN 978-0-6392-0593-9. Report delivered to the Water Research Commission, Pretoria, South Africa.

Van Zijl, G., Van Tol, J.J., Smit, E., Sehlapelo, M., Kock, A., Cloete, W., Faul, J., Le Roux, J.J., Riddell, E., Jacobs, A., Verwey, E., Cooke, V., De Clercq, W., Manyevere, A. & Lorentz S. 2024: *Towards a hydrological soil map of South Africa (HYDROSOIL) – developing a methodology and showcasing its uses*. WRC report 3145/1/24. ISBN 978-0-6392-0623-3. Report delivered to the Water Research Commission, Pretoria, South Africa.

STAFF (2024)

Head of Department (Acting):
Dr Adriaan van der Walt

BLOEMFONTEIN CAMPUS:

Associate Professors: Prof SA Adelabu and Prof JJ le Roux

Senior Lecturers: Dr RA Matamanda, Dr EM Rudolph, and Dr AJ Van der Walt

Lecturers: E Kruger, T Mehlomakhulu, MB Pherane, KT Sikhosana, and Dr MH Stander

Research Fellows: Prof J Boardman, Prof K Chatiza, Dr R Massey, Dr A Ramoelo, Dr R Rapolaki, and Dr S Roffe

Programme Director: Dr AJ van der Walt

Academic Facilitators: PB Ayantokun and C Weiss

Senior Officer: N van Dyk

Officer: S Brits

QWAQWA CAMPUS:

Subject Head: Dr MM Hansen

Associate Professor: Prof T Okello

Senior Lecturer: Dr MM Hansen

Lecturers: Dr P Mahasa, Dr K Mashiane, Dr S Mbambo, N Sekhele, and S Zondo

Research Fellows: Prof S Kudo, Prof G Mukwada, Dr S Schneiderbauer, and Dr M Tongwane

Affiliated Researcher: Prof VR Clark

Academic Facilitators: N Radebe and N Tyhokolo

Officer: Z Mncube

Senior Assistant Officer: M Lebeko

SOUTH CAMPUS:

Facilitator: R Mukwevo

DEPARTMENT OF GEOLOGY

FACULTY OF NATURAL AND AGRICULTURAL SCIENCES



CONTACT DETAILS

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OVERVIEW OF 2024

The Department of Geology is responsible for teaching and research in the geological sciences at the University of the Free State (UFS). The Department offers five undergraduate, three Honours, and four MSc programmes (Geology, Geochemistry, Environmental Geology, and Mineral Resource Management [MRM]), as well as a PhD by research. The Department offers 19 undergraduate modules, 10 Honours, and 12 structured MSc (MRM) modules.

2024 has been a very busy and productive year for

the Department in all areas. A total of 217 students were enrolled (127 undergraduate (for BSc), 17 for BSc Honours, 66 for MSc (46 in MRM, 21 in Geology, Geochemistry, and Environmental Geology), and 6 for PhD, and 48 students completed their studies (24 BSc, 13 BSc Honours, 8 MSc, and 3 PhDs) in 2024. Overall, the enrolment numbers increased compared to the preceding years.

The Department also performed well in terms of research by producing over 50 research outputs in 2024. This included 36 peer-reviewed articles and delivering one keynote lecture, two special lectures, convening three international symposia, and presenting 10 conference papers, conference proceedings, and one poster at various international and national conferences.

2024 saw the consolidation and expansion of research endeavours. The Centre for Advanced Orebody Knowledge (AOK) and the Merensky Group for Airborne Geological Image Classification (MAGIC) Lab are taking the Department to the highest level of achievement in research. This places the Department in a good position, enabling a significant increase in research output and postgraduate numbers since 2023, with significant potential for further growth in the next three to five years.

The first phase of the Geology Building renovation project has been completed, improving the utilisation of offices and rooms. The purpose of the renovation is not only to maintain and refurbish, but to create an improved management and administration setup and an improved staff lounge and departmental library, among others. The management and admin offices (the HoD, the Programme director (PD), and the finance and admin offices) are now next to each other to enable the team to function more efficiently. The renovated staff lounge and the library are fully operational, creating an atmosphere conducive to research, reading, and team building.

ACHIEVEMENTS

Staff Achievements

Prof John Carranza delivered a keynote presentation titled 'From Mapping of Mineral Prospectivity to Quantitative Estimation of Undiscovered Mineral Resources' at the IAEA Technical Meeting on Assessing and Quantifying Prognosticated and Speculative Uranium Resources, held in Rio de Janeiro, Brazil, from 4 to 8 November 2024.

Student Achievements

The Department of Geology annually recognises the best-performing students in first-, second-, and third-year categories by awarding prizes and financial incentives sponsored by the Department and supporters. The best and second-best student prize winners in 2024 were from the first-year cohort, Ranks Keamogetse (1st), Kali Kamohelo (2nd); from the second-year Thonek Sibitane (1st), Mpho Khunyeli (2nd); and the third-year Praise Ngwenya (1st), and Tumisang Mocoakae (2nd).



Recipients of the 2024 Best Second-year Geology Student awards – above, Thonek Sibitane (1st place) and below, Mpho Khunyeli (2nd place)



Recipients of the 2024 Best Third-year Geology Student awards – above, Praise Ngwenya (1st place) and below, Tumisang Mocoakae (2nd place)



Recipients of the 2024 Best First-year Geology Student awards – above, Ranks Keamogetse (1st place) and below, Kali Kamohelo (2nd place)



The Department would like to thank our loyal supporters, Kumba Resources, Philip Fouche, Wiley Publishers, and the Professional Provident Society (PPS) Insurance Company Ltd., who generously sponsored the awards and prizes for our best students. The Department would also like to express its gratitude to Mark Dimmick-Touw of Kumba Resources for attending the ceremony and handing over the awards together with Prof Bisrat Yibas, the Head of the Department.

TEACHING AND LEARNING

The Department offers five undergraduate programmes for the BSc, majoring in Geology, Environmental Geology, Geochemistry, Geology and Chemistry, and Geology and Physics. The modules presented integrate theory, laboratory, and geological field investigations, as well as visits to mines, mineral processing plants, geoscientific laboratories, and/or research centres.



Second-year students' geological field investigation at Mafube mountain retreat, Fouriesberg, eastern Free State

At the undergraduate level, the first-, second, and third-year students visited various geological sites to study the different geological aspects pertinent to the respective modules. The second-year students visited Mafube Mountain Retreat in the eastern Free State and Austin's Post at Kopanong, in the Xhariep District Municipality.

The third-year students visited the Northern Cape, visiting the Upington area and the Big Hole at Kimberley.



Third-year students at the Big Hole at Kimberley
[Photo credit: Hendrik Minnaar and Frederick Roelofse]

As part of the Applied Mineralogy Honours course, students undertook a field excursion to Gauteng, Mpumalanga, and Northwest provinces, visiting research institutions and laboratories, a Platinum mine, and a processing plant.



Honours students at the Vredefort Dome
[Photo credit: Ernest Moitse and Martin Clark]

RESEARCH, INNOVATION, AND RESEARCH COLLABORATION

Research and innovation activities in the Department are progressively increasing in various sectors of geological sciences.

Prof John Carranza is involved in several activities in two major EU-funded projects. In the Exploration Information System (EIS) project, Prof Carranza is involved in the testing of a computer EIS wizard developed in another work package of the same project using real data from the project's test sites in Europe, and test case studies and assessment for lithium-tin-tantalum-tungsten mineral potential in granite/pegmatite-related systems. The test case study in South Africa is the 450-km-long Orange River pegmatite belt. Prof Carranza collaborates with researchers from Agencia Estatal Consejo Superior de Investigaciones Científicas, Spain, BEAK Consultants GmbH, and Deutsche Lithium GmbH, Germany, Geological Survey of Finland, Geological Survey of Sweden, and Luleå University of Technology, Sweden, on the EIS project.

In the EU Charting the Road to the Green Energy Transition (SEMCRET project), he is responsible for 2D prospectivity modelling by integrating multi-geo-data obtained from publicly available geo-databases of the Geological Survey of Finland, as well as for machine learning on 3D prospectivity modelling and resource modelling using three project sites using data sets provided by the Czech Geological Survey, Polish Geological Institute, and Geological Survey of Finland. Associacao para a Investigacao e Desenvolvimento de Ciencias, Portugal, on the SEMCRET project.

In addition, Prof Carranza is the research competence leader of the Centre for Advanced Orebody Knowledge (AOK) under the SAMERDI funded by CSIR. The AOK Centre was launched in early 2023 and has subsequently established the governance of the Centre, set up a computing facility, and recruited five postgraduate students (one PhD and four MSc).

Prof Frederick Roelofse is actively involved on the steering committee of the International Continental Scientific Drilling Program (ICDP) Bushveld Drilling Project (BVDP). With the operational phase of the project having started in April 2024, he undertook several trips to Burgersfort to interact with the on-site team. Drilling at the Burgersfort rig commenced in April and continued right through to the end of the year.



The ICDP-BVDP drill rig at Burgersfort set up and ready to go
[Photo credit: Frederick Roelofse]

Prof Roelofse is collaborating with scientists at the University of the Witwatersrand (Prof Lew Ashwal and Prof Susan Webb), the GFZ German Research Centre for Geosciences (Dr Robert Trumbull and Dr Ilya Veksler), Cardiff University (Prof Wolf Maier), and the German BGR (Dr Wilhelm Nikonow) on several projects forming part of the Bushveld Complex ICDP project.



Dr Wilhelm Nikonow and Dominic Göricke of the BGR collecting magnetite samples from drill core forming part of the ICDP-BVDP project
[Photo credit: Frederick Roelofse]

The Merensky Group for Airborne Geological Image Classification (MAGIC) Lab, which is led by its principal investigator, Dr Martin Clark, celebrated its third year of operation. In 2024, the Lab refined its research focus and attended national and international conferences, at which its students presented papers.



The MAGIC research group attending the 2024 Merensky Week, hosted at the University of Pretoria by the Hans Merensky Legacy Foundation. From the left: N Mabogo (MSc candidate), Dr T Andongma (Postdoc), S Radebe (PhD candidate), and Dr M Clark (PI)

The MAGIC Lab also welcomed its first Postdoctoral Research Fellow, Dr Tende Andongma, who began a new project within MAGIC's research focus. With a refined research focus, the growing alignment of projects in the group aims to resolve key questions about and remotely identify elements and their concentrations. Drones, which are a central tool for the Lab, will yield the correct type of imagery in areas where satellite or aerial data is incomplete or inapplicable. With a certified drone pilot, MAGIC's drones are the first in UFS that be compliant to operate. The MAGIC Lab is poised to acquire a new hyperspectral imaging system in 2024, along with a new research project.



SACAA safety demonstration of MAGIC's Wingtra Gen II, the first in South Africa to be awarded beyond-visual-line-of-sight (BVLOS) capability

Dr Hendrik Minnaar's study on U-Pb zircon and monazite dating of migmatite leucosomes in the Paleoproterozoic Steinkopf Gneiss, Namaqua Metamorphic Province, has been completed. The results have been submitted for review to the *South African Journal of Geology*, and the results of the reviews are pending. As part of an MSc study with student Mthimculu Lepau, Rb-Sr and Ar dating of muscovite and feldspar from pegmatites in the Orange River Pegmatite Belt is planned. Collaborators and funding are currently sought.

Dr Robert Hansen conducted research into the thermodynamics of the use of biomolecules by inorganic ligands to determine the most optimal biomolecules to use in microbially facilitated

wetland biogeochemical systems. He has submitted his work as a paper to the Springer journal *Wetland Ecology and Management*. Dr Hansen is currently researching methods of determining release rates of polluting trace metals from sulphide minerals in Greenstone gold deposits. Papers on the work are expected to be submitted later in 2025. He collaborated with the UFS Department of Geography by presenting a talk on the biogeochemical cycling of carbon in the Berg River wetland system at the international symposium Quaternary climate and environmental change in the Southern Hemisphere, as well as studying the biogeochemical cycling of elements in the mires on Marion Island.

Dr Robert Muir continued his research project titled 'Environmental change across the Jurassic-Cretaceous boundary in South Africa', funded by DST-NRF Centre of Excellence in Palaeoscience (Genus) in collaboration with the University of Cape Town, Berkeley Geochronology Centre, and the University of Johannesburg. Dr Muir visited the Berkeley Geochronology Center in California, USA, in November to prepare samples in their ultra-clean uranium-lead laboratory and measure radioisotopic U-Pb compositions in zircon crystals using their Thermal Ionisation Mass Spectrometer (TIMS). The results will help resolve the extent and timing of volcanism that occurred when the supercontinent Gondwana started breaking apart. Visiting and working with a world-renowned geochronologist such as Dr Roland Mundil was an honour and a fantastic learning experience.



Dr Robert Muir measured radioisotopic U-Pb compositions in zircon crystals using the Thermal Ionisation Mass Spectrometer (TIMS) at the Ultra-clean Uranium-Lead Laboratory, the Berkeley Geochronology Center in California, USA

The Department continued to collaborate with the DSI-NRF Centre of Excellence for Integrated Mineral and Energy Resource Analysis (CIMERA), jointly hosted by the Department of Geology at the University of Johannesburg (UJ) and the School of Earth Sciences at the University of the Witwatersrand (Wits). In 2024, one PhD student, Justine Magson, and one MSc student, Johannes Malebati, are funded by DSI-NRF CIMERA. Justine submitted her PhD thesis titled 'Probing magma dynamics and mineralization in the Bushveld Complex using high-resolution, multi-isotope (Sr-Nd) analysis across major compositional and mineralogical discontinuities'. Justine is expected to graduate in 2025.

Johannes Malebati presented his research at the DSI-NRF CIMERA Annual Research Colloquium held in Johannesburg on 25 and 26 November 2024.



Dr Jarlen Keet and her MSc student, Johannes Malebati, at the DSI-NRF CIMERA Annual Research Colloquium

Dr Jarlen Keet and Johannes Malebati visited the SwissSIMS laboratory housed at Lausanne University, Switzerland, from June 28 to July 08, 2024, for the in situ multiple sulphur isotope analysis of sulphides from the Flatreef deposit. The data acquired during this visit will be instrumental for Johannes' dissertation and will significantly contribute to a collaborative manuscript.

Dr Megan Welman-Purchase is researching the environmental behavior of critical and hazardous elements, such as cyanide, arsenic, and uranium, in mining-impacted systems. The research uses environmental geochemistry and a multidisciplinary approach to unravel the complex geochemical interactions that govern contaminant mobility and



Johannes Malebati preparing samples for analysis in the preparatory room at Lausanne University

stability. Megan presented a paper at the BioGrip national launch on the Bloemfontein Campus on 31 October on the geochemical behaviour of arsenic in goldmine tailings.



Dr Megan Welman-Purchase (back row, third from left) with others at the BioGrip national launch

Rinae Makhadi continued her PhD study in Medical Geology at the University of Johannesburg (UJ). Her study is based on a multidisciplinary approach to assess if and how the presence of gold mining tailings dams poses a potential health threat to the environment and proximal communities. The

main aim of the study is to identify and assess the presence of Potentially Harmful Elements (PHEs) in gold tailings dams in the Welkom goldfields from existing geochemical data, and to determine possible human health and ecological implications. Rinae attended the International Geological Congress (IGC) that was held in Busan, South Korea, in August 2024, at which she presented on her PhD research in the medical and forensic geology session.



Rinae Makhade presenting her research findings at the 37th IGC conference in Busan, South Korea.

Through the PhD project, Rinae obtained an interdisciplinary grant together with Prof Lochner Marais, which will initiate collaboration between the Department of Geology and the UFS Centre for Development Support (CDS). Prof Marais has experience in public health data, household questionnaires, and mine closure in the Free State Goldfields. The collaboration will ensure that data suitable and representative of the study area is collected and ensure ethical compliance. Prof Michael Pienaar, from the UFS Department of Pediatrics and Child Health, will support the health component.

The role of regenerative agriculture in mining rehabilitation and new underground farming methodologies is being explored to be included in the MRM curriculum. Philip Viljoen of the MRM programme presented at the Theory of Constraints International Certification Organisation Innovation Summit held at Bad Nauheim, Germany, from 29 September to 2 October 2024. The summit brought together experts and practitioners from around the

globe to discuss and share the latest advancements in the Theory of Constraints (TOC). His presentation titled 'Innovation and Beyond Sustainability: Maximising flow of nature dependent enterprises now and in the future' was well-received, sparking insightful discussions and generating interest in the MRTM approach and TOC in regenerative farming.

The Department has excellent relationships with industry, as illustrated by Minerals Education Trust Fund (METF) subventions to all our full-time academic staff members to date. The feedback the Department received from mining companies on the quality of our graduates is very encouraging. As a result, student bursaries and research support (such as access to mine facilities and provision of research materials, such as drill cores and samples) are improving. Several Honours, MSc, and PhD research projects are supported by industry. Staff research and interaction with the industry have also improved significantly.

ACADEMIC CITIZENSHIP AND COMMUNITY ENGAGEMENT

Prof Carranza made several scholastic engagements in the year, including:

- 'From Mapping of Mineral Prospectivity to Quantitative Estimation of Undiscovered Mineral Resources' – keynote presentation to the IAEA Technical Meeting on Assessing and Quantifying Prognosticated and Speculative Uranium Resources, Rio de Janeiro, Brazil (4 to 8 November 2024).
- 'Introduction to Mineral Prospectivity Mapping' was given at the PDAC 2024 short course on New Innovations in Mineral System Approach and Mineral Predictive Mapping Applied to Critical Raw Materials Exploration and Assessment, in Toronto, Canada (1 March 2024).
- 'Artificial Intelligence (AI) in Mineral Exploration' – lecture given at EuroGeoSurveys 56th GM Directors' Workshop, Rovaniemi, Finland (20 March 2024).

Prof Carranza also convened sessions at international conferences/symposia such as 'Innovative Technology Developments in Mineral Deposit Science' at SEG2024 (Windhoek, Namibia, 27 to 30 November), 'AI-driven mineral prospectivity mapping' at the 37th International Geological Congress (Busan, South Korea, 25 to 31 August), and 'Data Science for Prediction' at the Gordon Research Conference: Geochemistry of Mineral Deposits (Newry, Maine, USA, 23 to 28 June).

Prof Roelofse continued to serve as chairman of the Paleoproterozoic Task Group of the South African Committee for Stratigraphy (SACS) and as a member of the South African National Committee for the ICDP. Prof Roelofse served on the scientific committee of the '100 Years of the Merensky Reef – Mineral, Metals and Mining Conference' that was held in Rustenburg in August 2024. He also served as guest editor for a special issue of the *South African Journal of Geology* in celebration of said conference and as guest editor for a special issue of *The Canadian Journal of Mineralogy and Petrology*.



Members of the scientific committee of the Merensky Centenary Conference, from the left, Prof Frederick Roelofse, Dr Martin Klausen (Stellenbosch University), Prof Rais Latypov, and Dr Sofia Chistyakova (University of the Witwatersrand)

[Photo supplied by Sofia Chistyakova]

Prof Roelofse continued to serve on the editorial board of *Die Suid-Afrikaanse Tydskrif vir Natuurwetenskap en Tegnologie*, and as the South African representative on the International

Mineralogical Association Commission on Gem Materials (IMA-CGM) and the councils of the Geological Society of South Africa (GSSA) and the Mineralogical Association of South Africa (MINSA).

Prof Roelofse was interviewed by RSG (Radio Sonder Grense) regarding a paper that was published in the journal *Microbial Ecology*, which reported sub-surface microbial colonisation of 2-billion-year-old rocks of the Bushveld Complex.

Dr Martin Clark was invited and participated in a field workshop to establish a Limpopo field guide, organised by Prof Dirk van Reenen (University of Johannesburg) with researchers from Japan, Russia, Switzerland, Norway, and Australia.



Participants in the Limpopo field trip to establish a Limpopo field guide, organised by Prof van Reenen (UJ)

Dr Robert Hansen presented a workshop to Knight Piesold (Pty) Ltd in October 2024 on the application of geochemical modelling to geochemical environmental risk assessments for mineral waste from mining activities. Dr Hansen also formed part of the specialist witness team for a mining client at a Department of Water Affairs tribunal in 2024, in which he fulfilled the role of specialist geochemist. He completed and submitted technical reports on the geochemical environmental risk assessment and modelling to two coal mining and one gold mining company.

Dr Megan Welman-Purchase was a member of the local organising committee for the MSSA 2024 conference hosted on the UFS Bloemfontein Campus from 2 to 5 December.

Ernest Moitsi served as a Co-opted Committee Member of the Mineralogical Association of South Africa (MINSA), where he contributed to advancing the goals and initiatives of the organisation.

The University held its open days from 18 to 20 July for Grade 9 to 11 learners. It was a great opportunity for the Department to interact with prospective students and showcase what we have to offer. A subsequent open day was then conducted on 27 July, specifically catering to Grade 12 learners who had submitted applications for admission to the UFS. During this event, the learners interacted with departmental staff, the Geology Student Association (GSA), and toured our facilities.



Geology staff and Geology Students Association (GSA) members interacting with learners

POSTGRADUATE STUDENTS

The Department of Geology offers a variety of postgraduate programmes, including Honours, four different MSc programmes (Geology, Geochemistry, Environmental Geology, and Mineral Resource Management [MRM]), and the PhD degree by research.

A total of 90 students (17 for BSc Honours, 67 MSc (46 in MRM, 21 in Geology, Geochemistry, and Environmental Geology), and 6 PhD) enrolled for postgraduate programmes in the Department, recording increased enrolment compared to the preceding years.

Twenty-five (25) postgraduate degrees were awarded (14 BSc Honours, 8 MSc (four in MRM, three in Geology, and one in Environmental Geology), and three PhDs (two in Geology and one in Environmental Geology)).

The 2024 MSc in MRM graduates were Darryl J Bennett, Hlulani K Mdluli, Bongani R Nobela, and Pateka Themba. MSc degrees were conferred on the following candidates who completed their MSc by research: Phuthego Moloto (Geology), Schalk Marthinus Reynders (Geology), Angela Kapapilo (Geology – with distinction), and Luvuyo Khulekani Ngubeni (Environmental Geology).



Phuthego Moloto (MSc graduate) giving a talk on her research at the 2024 Igneous and Metamorphic Studies Group meeting in Oribi Gorge, KwaZulu-Natal

PhD degrees were conferred on the following three candidates:

Jamie-Leigh Robin Abrahams (Environmental Geology)

Thesis: Prediction and mapping of trace metal contamination related to acid mine drainage via geochemistry and spectrometry

Supervisor: Dr MD Clark

Sodiq Abiodun Alimi (Geology)

Thesis: Data-Driven Predictive Mapping for Orogenic Gold Prospectivity in Wawa Area, Western Nigeria, using Machine Learning as a Predictive Tool

Supervisor: Prof J Carranza

Senzani Shane Nethenzheni (Geology)

Thesis: Assessment of the detrimental impact of landfill leachate on the local groundwater quality and the suitability of the Cape Flats aquifer for drinking water, City of Cape Town, Western Cape, South Africa

Supervisor: Dr R Hansen

POSTDOCTORAL RESEARCH FELLOWS

Three postdoctoral fellows were hosted by the Department of Geology in 2024.

Dr Tende Andongma joined the Department in June 2024, while Dr Shayantani Ghosal and Dr Nolokholo Sinovuyo Busakwe are in their second year with the Department. Dr Ghosal and Dr Andongma are working



Dr Tende Andongma (front) with Dr Hendrik Minnaar at a Lithium-bearing mine in the Northern Cape

on MAGIC projects under the supervision of Dr Martin Clark. Dr Busakwe works under the guidance of Prof Carranza in the EU-funded EIS research project.

STAFF MATTERS

After decades of service as a lab scientist, Dr Megan Welman-Purchase moved to an academic position as a Lecturer. Megan will continue to manage the geological laboratory in addition to her academic role of teaching and supervision.



Dr Megan Welman-Purchase assisting students in the Geo Lab

Dr Jarlen Keet attended the New Generation of Academics Programme (nGAP) Colloquium, which was held at the Boardwalk, Gqeberha, on 16 and 17 October. This was a congratulatory colloquium for nGAP lecturers who completed the programme in



Dr Jarlen Keet at the nGAP Colloquium held at the Boardwalk, Gqeberha

2023. It was an enriching and insightful event that included a diverse range of sessions and discussions aimed at advancing the goals of the New Generation of Academics Programme and celebrating the success of nGAP lecturers.

RESEARCH OUTPUTS

Research Articles

Abrahams, J.-L.R. & Carranza, E.J.M. 2024. Geochemical characterization of an AMD-affected stream: Detection of associated trace metal contamination using element 'dilution factors'. *Mine Water and the Environment* 43: 368-381.

Alimi, S.A. & Carranza, E.J.M. 2024. Gold-bearing quartz veins and associated rocks in the Wawa area, western Nigeria: Insights into their nature from field investigation, petrographic study, and geochemical analysis. *Journal of African Earth Sciences* 212: 105203.

Altermann, W., McCourt, S. & Roelofse, F. 2024. Proposal for the 5th adjustment and modification of the South African Code of Stratigraphic Terminology and Nomenclature. *South African Journal of Geology* 127(4): 797-802. DOI: 10.25131/sajg.127.0041.

Asadi Haroni, P., Asadi Haroni, H., Carranza, E.J.M., Asghari, O., Abedi, M. & Mirmohammadi, M. 2023. A cell-based association data integration method for locating potential drilling targets: A case study at the Dalli Cu-Au porphyry deposit in Iran. *Ore Geology Reviews* 165: 105859.

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Gao, M., Wang, G., Carranza, E.J.M., Qi, S., Zhang, W., Pang, Z., Li, X., & Xiao, F. 2023. 3D Au targeting using geological-geophysical datasets and machine learning in the Sanshandao-Cangshang

district, Shandong province, China. *Natural Resources Research* 33(1): 51-74.

Ibrahim, K.O., Orosun, M.M., Welman-Purchase, M.D. & Yusuf, M.A. 2024. Environmental Assessment of Heavy Metal Pollution around Industrial Area in Southwestern Nigeria. *Journal of Sustainable Natural Resources* 5(1): 40-51. DOI: 10.30880/jsunr.2024.05.01.005.

Jia, S., Liu, J., Wang, J., Carranza, E.J.M., Liu, C. & Cheng, F. 2024. Geochemistry and Zircon LA-ICP-MS U-Pb Geochronology of the Shuangwang Au Deposit, Shaanxi Province: Implications for Tectonic Evolution and Metallogenic Age. *Minerals* 14(4): 329.

Jogee, B.A., Bybee, M.G., Robb, L.J., Reid, L.D., Minnaar, H., Garicchi, L. & Bolhar, B. 2024. Assessing the geological relationships between the mafic-ultramafic intrusion in the Haib area and the Vuurdoed Subsuite, Richtersveld Subprovince. *South African Journal of Geology* 127: 55-70.

Keet, J.J., Roelofse, F., Gauert, C.D.K., Iaccheri, L.M., Grobler, F.D. & Ueckermann, H. 2024. Neodymium isotope variations in the Flatreef on Macalacaskop, northern limb, Bushveld Complex. *Mineralium Deposita* 59(275): 275-290. DOI: 10.1007/s00126-023-01202-x.

Kehinde I., Orosun M., Welman-Purchase M. & Yusuf M. 2024, Environmental Assessment of Heavy Metal Pollution around Industrial Area in Southwestern Nigeria. *Journal of Sustainable Natural Resources* 5(1):40-51. DOI: 10.30880/jsunr.2024.05.01.005.

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Liu, J., Weng, G., Carranza, E.J.M., Zhai, D., Wang, Y., Zhang, F., Gao, S. & Xu, L. 2024. Mineral assemblages and ore-forming physicochemical conditions of the La'erma and Qiongmo Au-Se deposits in the western Qinling, central China. *Minerals* 14(5): 507.

Magson, J., Roelofse, F., Bybee, G. & Bolhar, R. 2024. The Merensky-Bastard interval at Hackney, eastern Bushveld Complex: results of a combined Sr-Nd-isotopic investigation. *Contributions to Mineralogy and Petrology* 179(7). DOI:10.1007/s00410-024-02155-8.

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Naghizadeh A., Tchadjie L.N., Ekelu S.O. & Welman-Purchase M.D. 2024. Circular Production of Recycled Binder from Fly Ash-Based Geopolymer Concrete. *Construction and Building Materials* 415: 135098 DOI: 10.1016/j.conbuildmat.2024.135098.

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Olisa, O.G., Ajibade, O.M., Welman-Purchase, M.D., Ogunjinrin, O.A., Bamgboye, D.O. & Ayodele, M.O. 2024. Mineralogy,

Geochemistry, and Industrial Appraisal of Kaolin from Abeokuta Area, Southwestern Nigeria. *Geological Society of India* 100: 745-754. DOI: 10.17491/jgsi/2024/173896.

Radebe, S. & Clark, M. Dike-induced aquifer models derived from high-resolution multi-spectral satellite imagery. *Sci Rep* 14: 23747. DOI: 10.1038/s41598-024-75323-2.

Rahmani, N., Ranjbar, H., Nezamabadi-Pour, H. & Carranza, E.J.M. 2024. Neural network classification of lithological units based on integrated radar and multispectral data. *Acta geodynamica et geomaterialia* 21: 267-286. DOI: 10.13168/AGG.2024.0022.

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Welman-Purchase M.D., Castillo J., Gomez A., Matu A. & Hansen R.N. 2024, Cyanide First Insight into the Natural Biodegradation of Cyanide in a Gold Tailings Environment Enriched in Cyanide Compounds. *Science of the Total Environment* 906: 167174. DOI: 10.1016/j.scitotenv.2023.167174.

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Weng, G., Liu, J., Carranza, E.J.M., Zhai, D., Wang, J., Wang, H., Sun, B., Zhang, B., Zhang, F. & Wang, Y. 2024. Scheelite texture and geochemistry as a recorder of nature and timing of metallogenesis: An example from the Zhaishang Au-Sb-W Deposit, western Qinling, central China. *Contributions to Mineralogy and Petrology* 179(14).

Weng, G., Liu, J., Carranza, E.J.M., Zhang, F., Zhai, D., Wang, Y., Gao, S., Si, M., Su, Z. & Zhang, Y. 2024. Mineralogy of gold, tellurides, and sulfides from Lianzigou gold deposits in the Xiaolinling region, central China: Implications for ore-forming conditions and processes. *Minerals* 14(7): 675.

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Zhang, Z., Wang, G., Carranza, E.J.M., Du, J., Li, Y., Liu, X. & Sha, D. 2024. An uncertainty-quantification machine learning framework for data-driven three-dimensional mineral prospectivity mapping. *Natural Resources Research* 33: 1393-1411.

Conference Contributions

Conference Papers

Carranza, J. 2024. *From Mapping of Mineral Prospectivity to Quantitative Estimation of Undiscovered Mineral Resources.* Keynote address delivered at the IAEA Technical Meeting on Assessing and Quantifying Prognosticated and Speculative Uranium Resources, Rio de Janeiro, Brazil. 4-8 November 2024.

Enslin, S., Amelgio, L., Clark, M. & Galluser, F. 2024. *MAG ASSEGAI Drone magnetics platform collaborative program.* Paper delivered at the South African Geophysical Association, Windhoek, Namibia. 1-4 October 2024.

Esmailoghli, S., Tabatabaei, S.H. & Carranza, E.J.M. 2024. *Detection of Significant Multielement Geochemical Anomalies by an Infomax - Deep Autoencoder Network.* Paper delivered at IAGS2024 (30th International Applied Geochemistry Symposium, Adelaide, Australia. 14-18 October 2024.

Magson, J., Roelofse, F., Bybee, G. & Bolhar, R. 2024. *The Merensky-Bastard interval at Hackney, eastern Bushveld Complex: results of a combined Sr-Nd-isotopic investigation.* Paper delivered at the 100 years of the Merensky Reef – Minerals, Metals and Mining Conference, Rustenburg, South Africa. 15-23 August 2024.

Mou, N., Carranza, E.J.M., Wang, G. & Sun, X. 2024. *A Framework for Data-Driven Mineral Prospectivity Mapping with Interpretable Machine Learning and Modulated Predictive Modeling.* Paper delivered at the 37th International Geological Congress, Busan, South Korea, 25-31 August 2024.

Radebe, S. & Clark, M.D. 2024. *A Multispectral Approach for Structurally Controlled Groundwater Exploration and Management in the Main Karoo Basin: Integrating Spectral Indices and Machine Learning Models.* Paper delivered at Sustainable Horizons – Navigating the Future with Environmental Innovation, Centre for Environmental Management, University of the Free State. 11-12 October 2024.

Radebe, S. & Clark, M.D. 2024. *Deriving Dyke-Induced Aquifer Models from High-Resolution Multi-Spectral Satellite Imagery: A Novel Groundwater Exploration Approach for Arid Regions.* Paper delivered at Sustainable Horizons – Navigating the Future with Environmental Innovation, Centre for Environmental Management, University of the Free State. 11-12 October 2024.

Roelofse, F., Magson, J., Nicholson, M. & Nyakane, T. 2024. *Bifurcating chromitite layers of the UG1 footwall at Impala*

Platinum Mine, Rustenburg. Paper delivered at the 100 years of the Merensky Reef – Minerals, Metals and Mining Conference, Rustenburg, South Africa. 15-23 August 2024.

Veksler, I.V., Nikonow, W., Meima, J., Van Schijndel, V., Magson, J., Roelofse, F. & Trumbull, R.B. 2024. *Crystallization temperatures and signs of metasomatic reactions in the Main Zone of the Bushveld Complex, South Africa.* Paper delivered at AGU24, Washington, DC. USA. 9-13 December 2024.

Webb, S.J., Ashwal, L.D., Enslin, S.E., Hill, S.J., Manzi, M.S.D., Mapihloko, M., Mathopa, K., Hernandez, J.C., Roelofse, F., Kallmeyer, J., Trumbull, R., Klemm, R., Allwright, A.J., Maupa, T., Suzuki, Y. & Van Rooyen, J. 2024. *Geophysical investigations of the ICDP Bushveld Drilling Project (BVDP): Developing a Bushveld Complex reference section for academia, industry, and South Africa.* Keynote address delivered at the 18th SAGA Biennial Conference and Exhibition, Windhoek, Namibia. 1-4 October 2024.

Zhang, Z., Li, Y., Wang, D., Carranza, E.J.M., Yang, S., Sha, D., Fang, F., Zhang, Z. & Dong, Y. 2024. *Deep Learning-Based Predictive Modeling of Mineral Prospectivity with a Class-Balanced Focal Loss Function for Tackling Training Data Inequality.* Paper delivered at SEG2024 (Society of Economic Geologists Conference, Windhoek, Namibia. 27-30 November 2024.

Conference posters

Malebati, J., Keet, J. & Gauert, C. 2024. *In situ multiple sulphur isotope analysis by SIMS of pyrrhotite, pentlandite, and chalcopyrite in the Flatreef, northern limb, Bushveld Complex.* Poster presented at the 100 Years of the Merensky Reef – Minerals, Metals and Mining Conference, Rustenburg, South Africa. 15-23 August 2024.

Mashele, P., Ashwal, L.D., Hayes, B. & Roelofse, F. 2024. *Testing for magma additions through mineral-scale characterisation of selected Upper and Upper Main Zone subunits.* Poster presented at the DSI-NRF CIMERA Annual Research Colloquium 2024, Johannesburg, South Africa. 25-26 November 2024.



Staff of the Department of Geology 2024: From front row left to back row right: Rinae Makhadi, Ernest Moitsi, Dr Nokokholo Busakwe (Postdoc), Prof Bisrat Yibas-Babsos, Dr Shayantani Ghosal (Postdoc), Dr Tende Andongma (Postdoc), Wayne Nel, L Moghaisa, Tshina Nemudivhiso, Dr M Welman-Purchase, Dr Jarlen Keet, Dr Sadiq Alimi, Thendo Mapholi, Dr Hendrik Minnaar, Dr Robert Hansen, Charlene van der Vyver, Prof Frederick Roelofse, Dr Martin Clark, Justine Magson, and Dr Robert Muir (Absent: Prof John Carranza)

STAFF (2024)

**Head of Department:
Prof B Yibas**

Professors: Prof J Carranza and Prof B Yibas

Associate Professor: Prof F Roelofse

Affiliated Professors: Prof DE Miller and Prof R Schemers

Affiliated Associate Professors: Prof CD Gauert and Prof GJB Germs

Senior Lecturers: Dr M Clark, Dr R Hansen, Dr H Minnaar, and Dr R Muir

Lecturers: M Dimmick-Touw, Dr JJ Keet, J Magson, R Makhadi, ME Moitsi, and J Nel

Junior Lecturer: T Mapholi

Affiliated Lecturers: E Bergh, T Diale, Prof C Dohm, Dr DH Prinsloo, K van der Merwe, A van Niekerk, A Venter, P Viljoen, and Prof K Visser

Programme Directors: Dr JJ Keet and M Dimmick-Touw (MRM MSc)

Research Fellows: Dr W Archer, Prof WP Colliston, Dr RJ Giebel, Dr PG Meintjes, Dr L Nel, HCF Pretorius, Dr MJ van der Merwe, and Prof WA van der Westhuizen

Senior Assistant Officers: A Felix, L Moqhaise, and C van der Vyver

Technical Officers: Dr M Purchase, P Lehloenyana, and D Radikgomo

DEPARTMENT OF

MATHEMATICAL STATISTICS AND ACTUARIAL SCIENCE

FACULTY OF NATURAL AND AGRICULTURAL SCIENCES



C O N T A C T D E T A I L S

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OVERVIEW OF 2024

In 2024 Frans Koning led the Department to its highest research performance in its history by ensuring a stable and conducive research environment. It was his 10th year leading the Department and thus the end of his second and final term as Academic Department Head. He ended his leadership on a high note, and his efforts throughout the last decade are tremendously appreciated by the Department.

ACHIEVEMENTS

Staff Achievements

Prof Maxim Finkelstein received the 2024-2026 Ewha Global Fellow (EGF) award from Korea's top university, Ewha Womans University, for his excellent research collaboration with their researchers, specifically Prof Ji Hwan Cha.

TEACHING AND LEARNING

The Department again achieved a record student intake. With the number of applicants growing rapidly due to high demand for our offerings, the Department can be selective and accept only top-quality students. The Department continues to innovate on teaching practices and proactively prepares for future curricula to stay ahead of industry requirements.

RESEARCH, INNOVATION AND RESEARCH COLLABORATION

In 2024, the Department published 52 research papers – more than ever before. The standards of the papers themselves were also worthy of praise

and note. The charge of excellence was led by Maxim Finkelstein, Sandile Shongwe, Delson Chikobvu, and Fábio Corrêa.

While Prof Finkelstein's research focuses on reliability and engineering problems, much of the Department focuses on finance research. The Department also supports a variety of scientific fields through consultation and collaboration, resulting in joint publications with many other departments and faculties.

The Department of Mathematical Statistics and Actuarial Science consistently has one of the largest contingents at both the national conferences of the South African Statistical Association and the Actuarial Society of South Africa. Staff members give presentations, attend talks and workshops, take part in meetings, and collaborate with their peers.

ACADEMIC CITIZENSHIP AND COMMUNITY ENGAGEMENT

Prof Michael von Maltitz joined the executive of the South African Statistical Association. He is responsible for the funding portfolio and is secretary of the education committee of the Association.

Department members presented talks for StatsNetSA, a statistics supervisor network joining academic staff across the country.

Dr Ariane Neethling was reappointed to the South African Statistics Council for the term 2024 to 2027. She provides a critical bridge between academia, industry, and the public sector.

The Department forged new industry connections in 2024 and continues to make its voice heard on UFS committees and forums.

POSTGRADUATE STUDENTS

In 2024 the Department had 41 enrolled Honours students, 35 Master's students, and 13 PhD students.

At the April 2025 Graduation ceremony, the Department celebrated its graduates of 2024. These included 37 Honours students (nine with distinction), eight Master's students (two with distinction), and two PhD candidates.

Our Master's graduates were Masekoameng, John Lehlaka (Supervisor: ME Girmay); Nteka, Phoka Clement (Supervisor: Prof D Chikobvu); Pretorius, Wilben (Supervisor: Z Ludick); Masena, Thabiso Ernest – with distinction (Supervisor: SC Shongwe); Netshiozwi, Unarine – with distinction (Supervisor: SC Shongwe); Monareng, Joy (Supervisor: Dr MR Sjölander); Mushori, Providence (Supervisor: Prof D Chikobvu); and O'Connor, Vittorio Jaydon (F Koning).

Our PhD graduates were:

Coster Chideme

Thesis: Stochastic Modelling and Forecasting of Blood Donations at a Blood Bank in Zimbabwe

Supervisor: Prof D Chikobvu

Owen Jakata

Thesis: Statistical Modelling of Financial Risk in the South African Industrial and Financial Markets

Supervisor: Prof D Chikobvu



Prof Maxim Finkelstein



Prof Michael von Maltitz



POSTDOCTORAL RESEARCH FELLOWS

In 2024 our three postdoctoral fellows formed an integral part of the Department. They shone in every aspect of their roles. They were Dr Ali Yeganeh (from Iran, with Sandile Shongwe as mentor/supervisor), Dr Tendai Makoni (from Zimbabwe, with Prof Delson Chikobvu as mentor/supervisor), and Dr Joseph Odunayo Braimah (from Nigeria, with Prof Fabio Correa as mentor/supervisor).

STAFF MATTERS

Staff took part in a departmental teambuilding event in 2024, to everyone's delight. Departmental cohesion was as strong as ever, both when working towards achievements and when relaxing in the shade, or at dinner.



Departmental dinner

RESEARCH OUTPUTS

- Asadi, M. & Finkelstein, M.** 2024. On variability of the man remaining lifetime at random age. *TEST* 33: 717-730. DOI: 10.1007/s11749-023-00917-3.
- Ashiagbor, A.A., Essel-Mensah, K.A., Hesse, C.A. & Gidisu, G.** 2024. Predicting non-performing loan in Ghana using Sarima model. *Advances and Applications in Statistics* 91(7): 921-942. DOI: 10.17654/0972361724050.
- Beyers, C., Essel-Mensah, K.A. & Tsomocos, D.P.** 2024. A computable general equilibrium model of the monetary policy implications for financial stability in South Africa. *South African Journal of Economics* (Online). 1-29. DOI: :10.1111/saje.12383.
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Conference Contributions

Burger D.A., Van der Merwe, S., Van Niekerk, J., Lesaffre, E. & Pironet, A. 2024. *A quantile regression model for bounded longitudinal data and survival data*. Paper delivered at the 65th Annual Conference of the South African Statistical Association, Protea Hotel, Techno Park, Stellenbosch. 18-22 November 2024.

Chakraborty N., Balakrishnan N. & Finkelstein M. 2023. *On precedence tests with double sampling*. Paper delivered at the 65th Annual Conference of the South African Statistical Association, Protea Hotel, Techno Park, Stellenbosch. 18-22 November 2024.

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Finkelstein, M. 2024. *Heterogeneity ruses: some surprising effects and paradoxes of survival*. Plenary lecture delivered at the 65th Annual Conference of the South African Statistical Association, Protea Hotel, Techno Park, Stellenbosch. 18-22 November 2024.

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Makoni, T. & Chikobvu, D. 2024. *Quantifying the COVID-19 impact on South Africa's new car sales: A time series intervention approach*. Paper delivered at the 65th Annual Conference of the South African Statistical Association, Protea Hotel, Techno Park, Stellenbosch. 18-22 November 2024.

Makoni, T. & Chikobvu, D. 2024. *Quantifying the impact and recovery of South Africa's manufacturing sales from the COVID-19 pandemic: A time series intervention approach*. Paper delivered at the Southern Mathematical Sciences Association (SAMSA) Conference, University of Namibia, Windhoek, Namibia. 26-29 November 2024.

Masena T.E. & Shongwe S.C. 2024. *Quantifying loss to the SA wholesale and retail industries using interrupted time series models*. Paper delivered at the 65th Annual Conference of the South African Statistical Association, Protea Hotel, Techno Park, Stellenbosch. 18-22 November 2024.

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Oduwayo, B.J. & Correa, F.M. 2024. *Enhanced process monitoring: the bootstrapped cumulative sum-exponentially weighted moving average (BCUMSUM-EWMA) control chart approach*. Paper delivered at the 65th Annual Conference of the South African Statistical Association, Protea Hotel, Techno Park, Stellenbosch. 18-22 November 2024.

Verster A., 2024. *How your NRF application is rated*. Paper delivered at the 65th Annual Conference of the South African Statistical Association, Protea Hotel, Techno Park, Stellenbosch. 18-22 November 2024.

STAFF (2024)

Head of Department:
F Koning

Distinguished Professor: Prof M Finkelstein

Emeritus Professor: Prof R Schall

Associate Professors: Prof A Verster, Prof D Chikobvu, Prof F Corrêa, Prof K Essel-Mensah, and Prof M von Maltitz

Affiliated Professor: Prof A Ring

Affiliated Associate Professor: Prof D Burger

Senior Lecturers: F Koning, J Blomerus, L Voges, Dr M Diko, and Dr S van der Merwe

Contract Senior Lecturer: Dr A Neethling

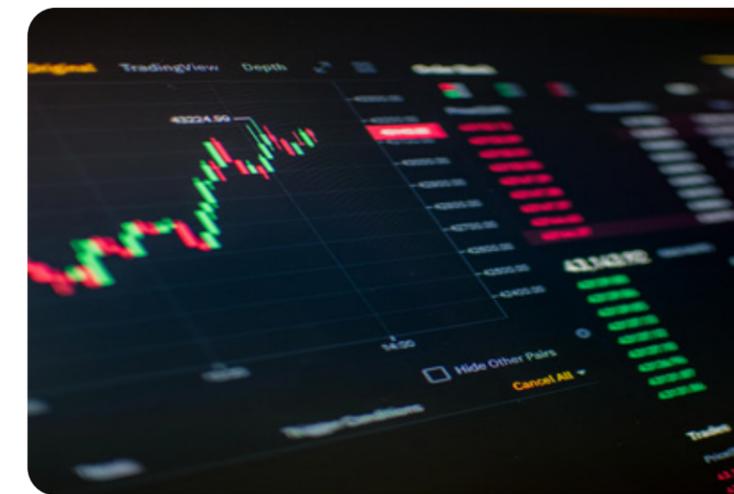
Lecturers: Dr L da Silva, E Girmay, Dr M Sjolander, Dr N Chakraborty, S Shongwe, W Oosthuizen, and Z Ludick

Contract Lecturer: L Laubscher

Research Fellow: Prof A van der Merwe

Programme Director: J Blomerus

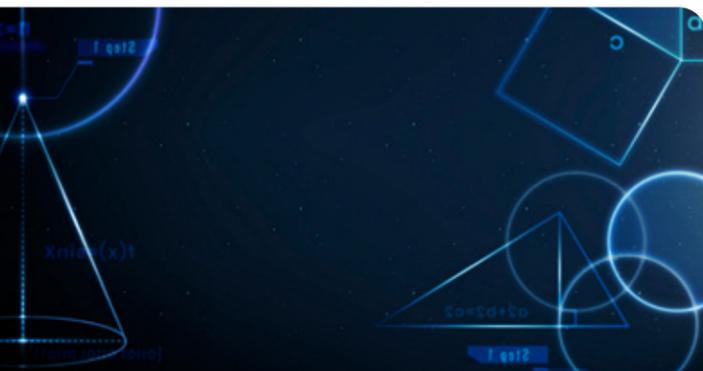
Secretary: E Mathee



DEPARTMENT OF

MATHEMATICS AND APPLIED MATHEMATICS

FACULTY OF NATURAL AND AGRICULTURAL SCIENCES



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OVERVIEW OF 2024

The Department of Mathematics and Applied Mathematics had a productive year in 2024, marked by notable achievements across research, teaching, and student engagement. Staff accomplishments included two new NRF-ratings and continued leadership in professional societies. The Department maintained a strong research presence, with significant contributions in areas such as graph theory, functional analysis, and mathematical modelling. While overall research output was slightly lower than in 2023, key projects advanced toward completion, setting the stage for a strong 2025. Teaching and learning efforts focused on improving student success, particularly in large first-year modules.

Student achievements were celebrated, with top performers recognised at the Faculty Prize-Giving Ceremony. Postgraduate recruitment remained a challenge, particularly in attracting Honours students, but new strategies are being explored to address funding and accessibility concerns.

The Department also expanded its engaged scholarship activities, with staff members actively involved in reviewing for academic journals, organising mathematics competitions, and contributing to national Olympiads. With these efforts, the Department continues to build its academic reputation while fostering a dynamic learning and research environment.

Looking ahead, 2025 presents opportunities for further growth, with new research initiatives, enhanced student support strategies, and strengthened national and international collaborations.

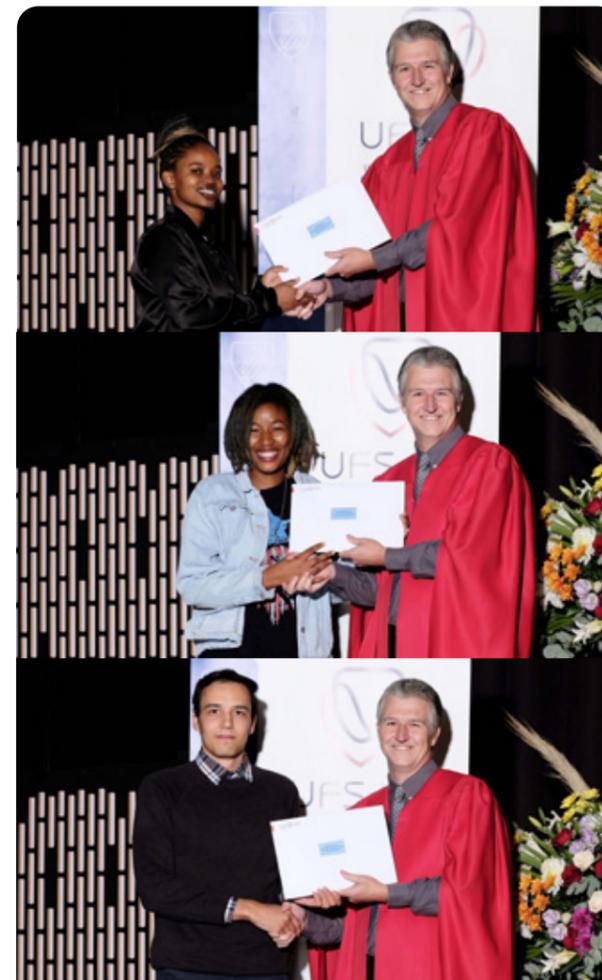
ACHIEVEMENTS

Staff Achievements

Dr Yibeltal Terefe and Dr Christian Budde both received new NRF-ratings. Dr Terefe obtained a C3-rating whereas Dr Budde obtained a Y1-rating. In 2024, Dr Budde was also confirmed in the position of General Secretary of the South African Mathematical Society (SAMS).

Student Achievements

Thulisile Ntuli, Noluthando Makhanya and Hendrik Combrinck received the CB van Wyk prizes for, respectively, the best first-year, second-year and third-year student in Mathematics and Applied Mathematics in 2023. These prizes were officially awarded at the Faculty Prize-giving Ceremony in April 2024.



From the top, Thulisile Ntuli, Noluthando Makhanya, and Hendrik Combrinck with Dr Venter at the Faculty Prize-giving

TEACHING AND LEARNING

In 2024, the Department offered 24 undergraduate modules, with some facing challenges, particularly large first-year courses where pass rates were under pressure. Targeted interventions, including the repeat of the Calculus course, have yielded some positive results. Building on these successes, additional measures are planned for 2025 to further improve student outcomes and strengthen pass rates across key modules.

RESEARCH, INNOVATION AND RESEARCH COLLABORATION

Research output was slightly lower in 2024 than 2023, yet still above the five-year running average. However, the expectation is that 2025 will be a growth year as some projects from 2024 start reaching a finalisation stage.

In 2024, Prof Jeandrew Brink continued with laying the foundation for the establishment of a research group on pulsar timing. It was the first time in the Department's history that a course on Signal Processing was offered. Prof Brink's two MSc students



Prof Jeandrew Brink at the IAU symposium in Cape Town

in this research field will both submit their dissertations in 2025 and with the added promise of high-quality publications emerging from their research. With these students continuing collaboration and PhD studies with Prof Brink, the pulsar timing research group can gain some momentum.



From the top, Dr Christian Budde, Dr Marieme Lasri, and Sello Mbambo at the FAOTSA workshop

Dr Christian Budde had a productive year with his research concentrating on evolution equations, operator semigroups and networks as part of functional analysis. He is particularly interested in well-posedness of abstract Cauchy problems, extrapolation spaces, and perturbation theory of operator semigroups. From his fruitful national and international collaboration, but also as single author, a total of five papers were published. Continuing their collaboration, Dr Christian Seifert, from the Institute of Mathematics at the Hamburg University of Technology, Germany, visited Dr Christian Budde in Bloemfontein during February 2024. One joint paper was published in 2024.

During 2024, Prof Tomas Vetrik further strengthened his collaboration with researchers from Slovakia and Slovenia, namely Prof Marcel Abas and Prof Martin Knor from the Slovak University of Technology in Bratislava, Slovakia, and Prof Riste Škrekovski from the University of Ljubljana in Slovenia. Two papers were published.

Prof Johan Meyer continued his collaboration with Prof W-F Ke from the National Cheng Kung University, Tainan, Taiwan, with two papers published in 2024. Prof Meyer visited Taiwan in November.

ACADEMIC CITIZENSHIP AND COMMUNITY ENGAGEMENT

Most staff members functioned as reviewers for academic journals. Dr Christian Budde, besides serving as reviewer for multiple international journals, also served as reviewer for the Environment and Bio-Safety Research Ethics Committee (EBREC) at the UFS.

Prof Vetrik again reviewed for multiple international journals and served on the editorial boards of the *Journal of Discrete Mathematics and its Applications* and the *Iranian Journal of Mathematical Chemistry*. He was also the associate editor of the *Open Journal of Discrete Applied Mathematics*.

Prof Meyer engaged in the setting and moderation of Olympiad papers for nationally written maths Olympiads and again organised the UFS students' participation in the annual SATMO (SA Tertiary Maths Olympiad).

Dr Elizabeth Maritz organised the UFS students' participation in the annual WITS Mathematics competition and Dr Renier Jansen and Dr Christiaan Venter were again involved with Nautilus Mathematics.

Under the auspices of the Mathematics Club, π -Day was celebrated on 13 March (a day early for logistical purposes), with Dr Venter delivering a talk on aspects such the history of π , its ubiquitousness and its calculation. A second activity held by the Mathematics Club was the first edition of the Integration Champ competition on 5 April. Integration Champ evaluated participants' understanding and proficiency in integration. The winners in 2024 were Mngqobi Madlala (1st prize) and Lilitha Komani (2nd prize).



First and second prize Integration Champ winners Mngqobi Madlala (above) and Lilitha Komani (below)



POSTGRADUATE STUDENTS

In terms of postgraduate activity, 2024 saw four new Honours students registering. Attracting more talented Honours students remains one of the biggest challenges in the Department. For 2024, similar to 2023, more than 50 applications were received, however, about half of those did not qualify in terms of the minimum prerequisites. The largest obstacle for those who qualify seems to be a lack of funding.

One student was enrolled for a Master's in Mathematics and two students were enrolled for a Master's in Applied Mathematics. One student was enrolled for PhD studies.

POSTDOCTORAL RESEARCH FELLOWS

Dr Marieme Lasri from Morocco joined the Department in August 2023 as Postdoctoral Researcher. She continued in 2024 under the supervision of Dr Christian Budde.

STAFF MATTERS

Dr Yibeltal Terefe resigned in April 2024 as Senior Lecturer but fortunately rejoined the Department as a research fellow from September 2024.

RESEARCH OUTPUTS

Research Articles

Boava, G., De Castro, G.G., Gonçalves, D. & Van Wyk, D.W. 2024. Algebras of one-sided subshifts over arbitrary alphabets. *Rev. Mat. Iberoam.* 40(3): 1045-1088.

Budde, C.J. 2024. On bi-continuous cosine families. *Quaest. Math.* 47(8): 1589-1611.

Budde, C.J. & Seifert, C. 2024. Perturbations of non-autonomous second-order abstract Cauchy problems. *Anal. Math.* 50: 733-755.

Budde, C.J. 2024. A Banach bundle approach to dynamical processes on changing networks. *Poincare J. Anal. Appl.* 11(1): 53-66.

Budde, C.J. & Kramar Fijavž, M. 2024. Well-posedness of non-autonomous transport equation on metric graphs. *Semigroup Forum* 108(2): 319-334.

Budde, C.J. & Kreulich, J. 2024. On Splittings and Integration of Almost Periodic Functions With and Without Geometry. *Semigroup Forum* 108(2): 335-364.

Das, K.C., Vetrik, T. & Yong-Cheol, M. 2024. Relations between arithmetic-geometric index and geometric-arithmetic index. *Mathematical Reports* 26 (1): 17-35.

Jubeir, M., Daniel W. & Van Wyk, D.W. 2024. Characterizing Rickart and Baer ultragraph Leavitt path algebras. *Journal of Algebra* 643: 153-174.

Ke, W-F. & Meyer, J.H. 2024. Are zero-symmetric simple nearings with identity equiprime? *Czech Math J* 74: 1289-1298.

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Knor, M., Škrekovski, R. & Vetrik, T. 2024. Metric Dimension of Circulant Graphs with 5 Consecutive Generators. *Mathematics* 12(9): 1384.

Koutou, O., Afassinou, K., Ouedraogo, A. & Diabate, A.B. 2024. Mathematical analysis of the effects of precarious health system on COVID-19 transmission dynamics: case of Burkina Faso. *Annals of Mathematics and Computer Science* 25: 1-18.

Temesgen, D. A., Kassa, S.M., Terefe, Y.A. & Asfaw, M.D. 2024. Modeling on cost effectiveness of monkeypox disease control strategies with consideration of environmental transmission effects in the presence of vaccination. *Modeling Earth Systems and Environment* 10: 6105-6132.

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Van Wyk, D.W. & Williams, D.P. 2024. Properties preserved by groupoid equivalence. *Journal of Operator Theory* 91(1): 239-259.

Vetrik, T. 2024. Degree-based indices of hypergraphs: Definitions and first results. *Asian-European Journal of Mathematics* 17(4): 2450023.

Vetrik, T. & Abas, M. 2024. Multiplicative Zagreb indices of trees with given domination number. *Communications in Combinatorics and Optimization* 9 (1): 89-99.

Conference Contributions

Brink, J. 2024. *Black Holes – Deep Dive – Applications of Resonant Structures*. Paper delivered at the International Astronomical Union (IAU) Symposium on Gravitational Wave Astrophysics, Cape Town, South Africa. 6-8 August 2024.

Budde, C.J. 2024. *Delay equations in sequentially complete locally convex vector spaces*. Paper delivered at the 14th AIMS Conference on Dynamical Systems and Differential Equations, Abu Dhabi, UAE. 16-20 December 2024.

Budde, C.J. 2024. *How to approach stability of bi-continuous semigroups?* Paper delivered at the Functional Analysis and Operator Theory South Africa (FAOTSA) meeting, AIMS, Muizenberg, South Africa. 17-19 March 2024.

Budde, C.J. 2024. *Perturbations of non-autonomous second-order abstract Cauchy problems*. Paper delivered at the One-parameter semigroups of operators (OPSO) meeting (online), Université Laval, Canada. 6 July 2024.

Budde, C.J. 2024. *Perturbations of non-autonomous second-order abstract Cauchy problems*. Seminar talk presented at the Bergische Universität Wuppertal, Wuppertal, Germany. 29 August 2024.

Budde, C.J. 2024. *Perturbations of non-autonomous second-order abstract Cauchy problems*. Seminar talk presented at Stellenbosch University, Stellenbosch, South Africa. 12 November 2024.

Budde, C.J. 2024. *Perturbations of non-autonomous second-order abstract Cauchy problems*. Paper delivered the South African Mathematical Science (SAMS) Congress, Pretoria, South Africa. 4-6 December 2024.

Budde, C.J. 2024. *Perturbations of non-autonomous second-order abstract Cauchy problems*. Paper delivered at the 14th AIMS Conference on Dynamical Systems and Differential Equations, Abu Dhabi, UAE. 16-20 December 2024.

Budde, C.J. 2024. *Positive Desch-Schappacher perturbations of bi-continuous semigroup on AM-spaces*. Paper delivered at the International Workshop on Operator Theory and its Applications (IWOTA), University of Kent, Canterbury, Canterbury, UK. 12-16 August 2024.

Budde, C.J. 2024. *Positive Miyadera-Voigt perturbations of bi-continuous semigroups*. Paper delivered at the Conference on Ordered Structures with Applications (COSA), Kenitra, Morocco. 5-9 February 2024.

Budde, C.J. 2024. *Well-posedness of non-autonomous transport equations on metric graphs*. Paper delivered at the International Workshop on Operator Theory and its Applications (IWOTA), University of Kent, Canterbury, Canterbury, UK. 12-16 August 2024.

Budde, C.J. 2024. *Well-posedness of non-autonomous transport equations on metric graphs*. Paper delivered at the International Symposium on Mathematical Theory of Networks and Systems (MTNS), Cambridge, UK. 19-23 August 2024.

Swartz, E. 2024. *Uiterste resultate vir twee Grafekindekse*. Paper delivered at the Student Symposium in the Natural Sciences of South African Academy of Science and Art, Bloemfontein, South Afrika. 30-31 October 2024.

Terefe, Y.A. 2024. *A mathematical model for the transmission dynamics of trichomoniasis*. Paper delivered at the International Conference on Mathematical Methods and Models in Biosciences (BIOMATH), Cutty Sark Resort, Scottburgh, South Africa. 16-21 June 2024.

Vetrik, T. 2024. *Large graphs of given degree and diameter*. Seminar talk presented at the King Mongkut's University of Technology Thonburi, Bangkok, Thailand. 29 August 2024.

Vetrik, T. 2024. *Metric dimension of graphs*. Seminar talk at the University of Fiji, Lautoka, Fiji. 26 June 2024.

Research Reports

Venter, C. 2024. *Retirement Planning Model Validation*. Report delivered to Craffies Coaching.

STAFF (2024)

Head of Department:
Dr C Venter

BLOEMFONTEIN CAMPUS:

| | |
|---------------------------|--|
| Professor: | Prof T Vetrik |
| Emeritus Professor: | Prof JH Meyer |
| Associate Professor: | Prof J Brink |
| Senior Lecturer: | Dr C Budde |
| Lecturers: | Dr RS Jansen, Dr A Kriel, Dr ECM Maritz, Dr E Ngounda, E Swartz, Dr C Venter, and JG Venter (Contract) |
| Junior Lecturers: | LMV Sepeesa (Contract), PE Stoffberg (Contract), and J van der Mescht (Contract) |
| Research Fellows: | Dr DW van Wyk and Dr YA Terefe |
| Programme Director: | Dr E Ngounda |
| Senior Assistant Officer: | T Jansen |

QWAQWA CAMPUS:

| | |
|---------------------|--|
| Subject Head: | Dr NR Loufouma Makala |
| Senior Lecturer: | Dr K Afassinou |
| Lecturers: | HC Faber, Dr NR Loufouma Makala, and SP Mbambo |
| Programme Director: | HC Faber |



DEPARTMENT OF

MICROBIOLOGY AND BIOCHEMISTRY

FACULTY OF NATURAL AND AGRICULTURAL SCIENCES



CONTACT DETAILS

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OVERVIEW OF 2024

The Department of Microbiology and Biochemistry is dedicated to providing comprehensive undergraduate education and postgraduate training in Biochemistry, Microbiology, and Biotechnology. Our research spans several key themes, with a particular focus on human and animal health, as well as green chemistry. A significant area of research within human health is the study of pathogenic yeasts. The critical importance of understanding these pathogens and developing strategies to combat infections is underscored by Prof Carlien Pohl-Albertyn's role as the current holder of the NRF SARChI Research Chair in Pathogenic Yeasts.

A notable development in 2024 was the appointment of Prof Wynand Goosen, a distinguished leader and scholar in the field of Tuberculosis One Health. Prof Goosen brings extensive expertise and a broad network across medicine, veterinary sciences, environmental studies, and governmental sectors. His connections include various funding agencies such as Wellcome, EDCTP, NIH, National Geographic, and the US Wild Animal Health Fund. He is currently engaged in discussions within his networks to establish an 'African One Health Centre of Excellence' in South Africa by mid-2026.

In 2024, the Department's postgraduate cohort included 19 Honours, 30 MSc, and 25 PhD students. Staff changes during the year included the resignation of Dr Julio Castillo, who accepted a position at the University of Huelva in Spain, and the appointments of Prof Wynand Goosen and Dr Lesley Caine-Sigeje. Additionally, we saw the retirements of Charlotte Maree, Prof Rob Bragg,

and Prof Martie Smit, with both Prof Bragg and Prof Smit being appointed as Emeritus Professors following their retirement.

ACHIEVEMENTS

Staff Achievements

Prof Carlien Pohl-Albertyn was appointed as an honorary professor at the University of Kent in the UK and received a C1 NRF-rating for the period 1 January 2025 to 31 December 2030.

Dr Odepemi Ogundeji received a C3 NRF-rating for the period 1 January 2025 to 31 December 2030 and Prof Wynand Goosen received a C1 rating for the same period.

Dr Winschau van Zyl successfully obtained research funding from the National Research Foundation under the Thuthuka Post PhD track for his research aimed at the discovery and development of novel antimicrobial peptides active against multi-drug-resistant pathogens.

Student Achievements

At the annual Faculty prize-giving, Anazea Zapke and Tori Williams shared the Inqaba Biotechnical Industries prize for the Best Honours Student in Microbiology. Sinead Suter received the Bernard Prior Prize for Best Honours Student in Biochemistry.



Sinead Suter receiving the Bernard Prior Prize

Hendrik Steyn received the James du Preez Prize for best MSc dissertation in Microbiology/Microbial Biotechnology and Armand Bolsenbroek received the JP Van der Walt Prize for the best MSc dissertation in yeast science.



Hendrik Steyn receiving the James du Preez Prize



Armand Bolsenbroek receiving the JP van der Walt Prize

Two PhD students won Best Poster Presentation awards at the 16th International Congress on Yeasts, held in Cape Town from 29 September to 3 October 2024. Corinne Fourie, PhD in Biochemistry, received the best poster award in the category 'Fantastic Yeasts', which was sponsored by the Wiley journal *Yeast*. and Karabo Setsiba, PhD in Microbiology, received the FEMS yeast research poster prize.

Martin Visser, a PhD student in Biochemistry, was sponsored by the Chan Zuckerberg Initiative to attend a two-week Cryo-EM training workshop at the Unit for Electron Microscopy, University of Cape Town. He received theoretical and practical training in Cryo-EM and TEM, as well as in data analysis. Martin also participated in a month-long research visit to the Federal Institute for Risk Assessment (BfR) in Berlin, Germany, in September 2024. During this visit, he received training in rotavirus replication in cell culture and rotavirus reverse genetics.

RESEARCH, INNOVATION AND RESEARCH COLLABORATION

The Department of Microbiology and Biochemistry conducts research across several key themes:

- Microbial Diversity:** A core research area is the study of pathogenic yeasts. The Department maintains a yeast culture collection with over 3,000 isolates from various habitats in South Africa and globally, serving as a national resource for researchers and industries. Research on yeasts, particularly those from the genera *Candida* and *Cryptococcus*, is crucial for understanding and combating infections in immunocompromised individuals. This research is supported by the NRF SARChI Research Chair in Pathogenic Yeasts.
- Drugs and Vaccines:** This theme focuses on the rational design of next-generation drugs and vaccines, leveraging knowledge of biological targets or infectious agents. Research efforts are directed towards developing treatments and preventive measures for infections and diseases affecting humans, animals, and plants.
- Green Chemistry:** This area emphasises the use of microorganisms or enzymes to produce chemicals through bioprocesses that utilise renewable feedstocks, generate less pollution, or remediate existing pollution. These processes are more energy-efficient and specific compared to traditional chemical methods.

- Human and Animal Health:** Despite only a minority of microbes being pathogenic, they have a significant impact on human health and economic activities involving animals. Research in this theme aims to understand pathogenic microbes and the biochemistry of certain non-infectious diseases to enhance treatment options and improve quality of life.
- Food Biotechnology:** Here focus is placed on the production, preservation, quality control, and R&D of food products derived from plants, animals, or microorganisms. Their work includes ensuring food quality and safety, utilising food waste, and developing novel and enhanced food products.

Safe and novel food products and processes

Three important studies are being done with the goal of contributing to the knowledge of food quality, safety, and security.

Prof Celia Hugo and her research group are currently involved in a study on the microbial, chemical, and sensory quality of crocodile meat for human consumption. The effect that the crocodile culling methods have on these characteristics is investigated. This study is undertaken in collaboration of Prof Jan Myburgh of the University of Pretoria and Prof Arno Hugo of the UFS Department of Animal Science.

A study on beef carcasses investigating the origin of the Bone taint defect in these carcasses and ways to mitigate the defect, is ongoing. This study is undertaken in collaboration with Sparta Welkom Abattoir, Prof Arno Hugo and Prof Errol Cason from the UFS Department of Animal Science, and Prof PE Strydom from Stellenbosch University.

A study on scoby, the microbial culture used to produce kombucha, is investigating the possibility of developing fruit leathers from the scoby. This study is in collaboration with Dr Carina Bothma in the UFS Department of Sustainable Food Systems and Development. The goal of all these studies is to contribute to the knowledge of food quality, safety and security.

The research on milk metabolomics of African animals undertaken by Prof Garry Osthoff was expanded to

include more species. The dynamic changes from colostrum to mature milk of the white rhinoceros were described by nutrients and metabolites and were published. An interspecies comparison of milk metabolomes of white rhinoceros, giraffe, and dromedary showed that the preferred metabolic pathways to synthesise milk nutrients may differ between species. It was deemed necessary that the metabolomic studies be expanded from milk to the whole animal so that the whole path of nutrient usage can be mapped. A first study on metabolites in giraffe faeces gave promising results, as well as a PhD degree and two publications. The changes in metabolites through the whole digestive tract and blood of giraffe is underway.

The research on the functional properties of *Opuntia* (prickly pear plants) mucilage polysaccharides in collaboration with Prof Maryna de Wit (Department of Sustainable Food Systems and Development) led to an MSc thesis. It was found that cladodes' storage time may affect the mucilage's physical properties.

In January 2024, the UFS entered into a collaboration with ZZ2, a well-known South African fresh produce company, that culminated in the launch of a new company, named NovaLogix. The main aim of NovaLogix is the development and production of a probiotic consortium that can be used in the production of fresh produce to enhance and sustain plant health and growth. The NovaLogix laboratory is situated within the Department of Microbiology and Biochemistry at the UFS. In 2024, Prof Koos



Visit to ZZ2, from the left, Dr Winschau van Zyl (UFS), Dr Nomtembeko Dube (UFS), Piet Pretorius (ZZ2), Prof Koos Albertyn (UFS), Wiam Haddad (ZZ2 and CEO of Novalogix), Dr Christopher Rothman (UFS), and Faan Smit (ZZ2)

Albertyn (Head of Department), Dr Winschau Van Zyl, Dr Christopher Rothmann, and Dr Nomtembeko Dube visited ZZ2 in Limpopo province to discuss project ideas focused on improving production techniques, recipe enhancements and product commercialisation.

Biocatalysis, bioremediation, and bioprospecting

The Biocatalysis Group of Prof Dirk Opperman and Prof Martie Smit focuses on novel biocatalytic systems for the selective introduction of oxygen into molecules and the further conversion of these hydroxylated products in cascade reactions. Moreover, the group uses protein X-ray crystallography to explore the structure-function relationship of these biocatalysts through structure determination. This allows the study of their natural evolution and informs their experimental evolution through rational design and directed evolution. The group is currently exploring more industrially feasible routes to value-added products, including flavours and fragrances. Research is underway to engineer cytochrome P450 monooxygenases for peroxygenase activity as well as hydrogen peroxide-driven peroxygenases for biocatalytic oxyfunctionalisation reactions.

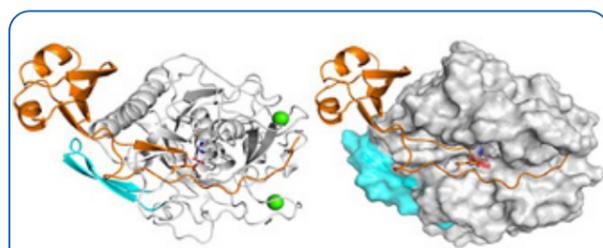
Prof Opperman is also the South African PI of the European Research Area Network (ERA-NET) Cofund on Food Systems and Climate (FOSC) project. The ThermoK project centres on the thermophilic



ThermoK meeting in Bergen, Norway, from the left, Prof Nils-Kare Birkeland (University of Bergen), Dr George Kontellias (University of Exeter), Prof Jean Armengaud (CEA), and Prof Dirk Opperman (UFS)

breakdown of keratin-laden biomass waste and has several international partners within the EU ERANET framework. Together with the research groups from Norway (University of Bergen and NORCE), the United Kingdom (University of Exeter), France (Commissariat à l'énergie atomique et aux énergies alternatives [CEA]), and Kenya (University of Nairobi), Prof Opperman continued his collaboration within the ThermoK consortium, to develop biotechnological routes to upcycle waste products and promote a circular economy. Prof Opperman attended the ThermoK consortium meeting in Bergen Norway in June 2024.

PhD student Michail Kruger presented his data on this project at the 7th African Light Source conference (AfLS2024, 18 to 22 November 2024).



Cartoon representation of the crystal structure of a keratinase, solved to 1.6 Å resolution, from *Fervidobacterium pennivorans* strain T presented by Michail Kruger at AfLS2024

Prof Dirk Opperman continued his ongoing collaborative projects with Prof Frank Hollmann and Dr Caroline Paul from Delft University of Technology (Netherlands), and Prof Selin Kara (Leibniz University Hannover, Germany) and visited these institutes in June 2024. The groups bring together experts in biocatalysis, including protein structure determination, directed evolution, and process development, and they are currently focusing on the application of biocatalysts.

The Biocatalysis Group is also one of five nodes of the Industrial Biocatalysis Hub (IBH) in South Africa, coordinated by the CSIR and funded by the Technology and Innovation Agency (TIA) and the Department of Science and Innovation (DSI). The IBH node at UFS focuses on developing industrially relevant biocatalysis technologies. Within the IBH node the

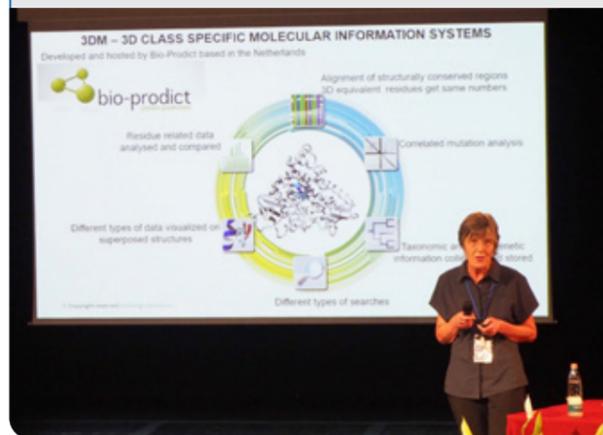
joint project, termed 'PiLacto', in collaboration with Prof Vlada Urlacher from the Heinrich Heine University Düsseldorf (HHU,) continued, with Prof Smit and Prof Opperman visiting HHU in Germany in June 2024.



PiLacto meeting at Heinrich Heine University (HHU, Düsseldorf, Germany). From the left, Dr Florian Tieves (HHU), Dr Marco Girhard (HHU), Dr Katja Koschorreck (HHU), Lauryna Droege (HHU), Prof Martie Smit (UFS), Prof Vlada Urlacher (HHU), and Prof Dirk Opperman (UFS)



Prof Opperman (above) and Prof Smit (below) presenting at the 16th International Symposium on Cytochrome P450 Biodiversity and Biotechnology conference in Torino, Italy



Prof Opperman and Dr Carmien Tolmie continued their collaboration with Dr Felix Ferroni from the Department of Physics at the Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET), Argentina, on the structural and functional characterisation of a copper nitrite reductase.

Prof Opperman was an invited speaker to the 16th International Symposium on Cytochrome P450 Biodiversity and Biotechnology conference in Torino, Italy (23 to 27 June 2024). Both Prof Opperman and Prof Smit presented talks on their research on structure-function relationships of cytochrome P450s. Prof Opperman and Prof Smit also presented papers at the 34th Conference of the Catalysis Society of South Africa (CATSA) in the Drakensberg from 3 to 6 November.

Improvement of human and animal health

Prof Trudi O'Neill's Molecular Virology Group has continued to study the diversity of rotavirus strains, focusing on the whole genome constellations of human field strains from Mozambique. In line with a One Health approach, their research has been expanded to include various animal strains, with a surveillance study on the incidence of bovine rotavirus in five locations – two in the Western Cape and three in the Free State. Additionally, the group is pursuing two strategies for developing a rotavirus vaccine: a replication-deficient vaccine using recombinant rotavirus proteins produced in yeast or bacteria, and the development of rotavirus reassortants using rotavirus reverse genetics. The latter is supported by a collaborative grant from the Deutsche Forschungsgemeinschaft (DFG) which received a no-cost six-month extension. As part of their search for a potential broad-spectrum antiviral, the group is also examining the role of lipids in rotavirus replication. This research, performed in collaboration with Prof Carlien Pohl, was expanded to also include potential polymicrobial interactions between the opportunistic yeast pathogen, *Candida albicans*, and rotavirus.

Prof Trudi O'Neill continued her collaboration with Dr Nilsa de Deus from the Mozambican National Institute of Health in Maputo (INS), on rotavirus

diversity in Mozambique. During August 2024, Benilde Munlela and Telma Isaias from INS visited the Molecular Virology group in Bloemfontein to process samples for whole-genome characterisation. Prof O'Neill is a co-promoter for Benilde Munlela registered at the New University of Lisbon in Portugal. She also continued to collaborate with Dr Celeste Donato from the Australian Pathogen Genomics Program at The Doherty Institute, Melbourne, Australia.

A new collaboration with Dr Khuzwayo Jere (University of Liverpool, United Kingdom and the Malawi Liverpool Wellcome Research Programme, Blantyre, Malawi) was initiated to investigate cell-mediated immune responses by rotavirus proteins.

The DFG-funded project on 'Antigens and reassortant strains for rotaviruses circulating in Africa (AfRota)' continued and includes researchers in Germany (Prof Reimar Johne and Dr Alexander Falkenhagen, Federal Institute of Risk Assessment, Berlin, Germany), Mozambique (Dr De Deus), and South Africa (with Prof O'Neill and Prof Albie van Dijk based at UFS). The project utilises the rotavirus reverse genetics system and aims to generate chimeric viruses for next-generation rotavirus vaccine development.

Members of the Molecular Virology Group attended the Virology Africa 2024 conference that was held in Stellenbosch from 15 to 18 April. Prof Trudi O'Neill and PhD student Corinne Fourie delivered oral presentations while other members of the group presented posters. Prof O'Neill was the co-chair for



Prof Trudi O'Neill (centre) with postgraduate students attending the Virology Africa 2024 Conference

the Biosurveillance and Veterinary Virology session. All the students received full sponsorship from the Poliomyelitis Research Foundation of South Africa.

Prof O'Neill and five members of the Molecular Virology group also attended the 9th European Rotavirus Biology Meeting that was held in Valencia, Spain, from 2 to 4 October 2024. Nikita Barron, Ralethoko Manamela, and Martin Visser delivered oral presentations, with other students reporting their results as poster presentations.



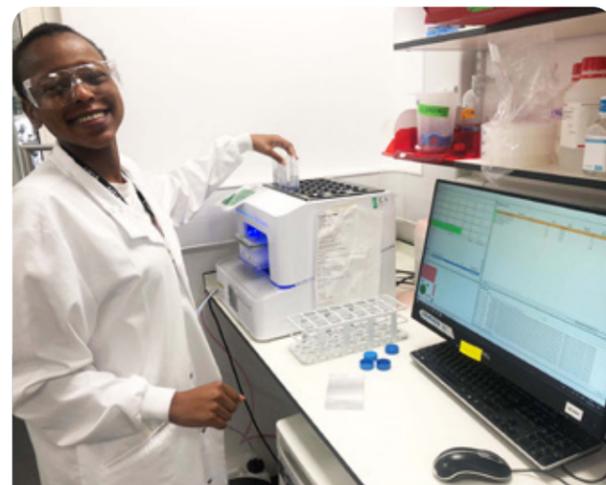
Prof Trudi O'Neill (left, 2nd row) with postgraduate students and other participants at the 9th European Rotavirus Biology Meeting, Valencia, Spain

Prof O'Neill and Dr Winschau van Zyl are working on an interdisciplinary project to develop a safe and more effective rotavirus vaccine for children by expressing rotavirus structural proteins in a safe-to-use probiotic microbe.

Dr Frans O'Neill is the PI of the Clinical Biochemistry Group, whose research concentrates on studying the metabolism of specific sterols in various animal species and also the recombinant production of reproductive hormones. The research on sterols includes a collaborative project involving giraffes. Additionally, they are exploring markers of stress in animals. In terms of reproductive hormones, the group has transitioned its focus from equine chorionic gonadotropin (eCG) to follicle-stimulating hormone (FSH), both of which play key roles in animal breeding.

Dr Carmien Tolmie leads the Structure-Based Drug Discovery Group, which uses structural biology methods to develop novel therapies to treat infectious diseases. A protein in a pathogen is rationally identified as a possible drug target, and the three-dimensional structure is determined using X-ray crystallography. The protein structure is used to guide further drug development efforts. The first of these projects focuses on the development of novel antifungal drugs against enzymes of the ergosterol biosynthesis pathway. Since 2023, delta-24 sterol methyltransferase has been studied as a target, from the pathogens *Candida albicans*, *Candida auris*, *Cryptococcus neoformans* and *Aspergillus fumigatus*.

In 2024, Nokwanda Mpotshane, an MSc Microbiology student, visited the Protein Crystallography Small Research Facility (PX-SRF), Centre of Medicines Discovery at the University of Oxford, for two months to produce an optimised protocol for SMT production, purification and crystallisation. This research was performed under the supervision of Prof Frank von Delft, Dr Lizbe Koekemoer, and Dr Michael Fairhead. The research visit was funded by a Catalyst grant from the Africa-Oxford Initiative and has been deposited as a preprint on the bioRxiv server.



Nokwanda Mpotshane (MSc student) during her research visit to the Protein Crystallography Small Research Facility, Centre for Medicine Discovery, University of Oxford

In 2024, SMT from *Leishmania* species has also been added in pursuit of creating a novel dual-purpose

antifungal and antiparasitic compound. This project will use X-ray crystallographic fragment screening to develop lead compounds that can be developed into novel inhibitors using medicinal organic chemistry. The fragment screening experiments will be performed in collaboration with the Xchem team researchers at the Diamond Light Source synchrotron, UK. To date, X-ray crystallographic fragment screening has not been used in the development of antifungal compounds.

Dr Tolmie successfully obtained a renewal of her Thuthuka funding from the National Research Foundation.

The Pathogenic Yeast Research Group currently consists of three academics – Prof Carlien Pohl-Albertyn (who holds the SARChI Research Chair in Pathogenic Yeasts, Prof Koos Albertyn, and Prof Olihile Sebolai. The group focuses on molecular virulence mechanisms and bioactive lipids' role in pathogenic yeasts, specifically *Cryptococcus neoformans* and several *Candida* species. They are also interested in the virulence of polymicrobial infections consisting of *Candida* spp. and the bacterium *Pseudomonas aeruginosa* as well as viruses.

Highlights of the research for 2024 include the findings that fungal co-infection can have a direct impact on the activation of SARS-CoV-2, as well as the discovery of antibiofilm activity of a novel group



Prof Jennifer Hiscock (Affiliated Professor in the Department of Microbiology and Biochemistry and Professor, School of Physical Sciences at the University of Kent) and Prof Carlien Pohl-Albertyn during a research visit at the University of Kent

of compounds, tested in collaboration with the University of Kent. Research within this group was conducted by three Postdoctoral Fellows, 19 PhD and MSc students, and four BSc Honours students.

Prof Pohl-Albertyn and Dr Chibuike Ibe (Postdoctoral research associate) received funding from the FAILSAFE (Fungal AMR Innovations for LMICS: Solutions and Access For Everyone) project amounting to ~R3.2 million rand. This fund was launched by the University of Exeter's MRC Centre for Medical Mycology in partnership with the UK Department of Health and Social Care's Global AMR Innovation Fund (GAMRIF) and aims to find solutions for antifungal resistance.

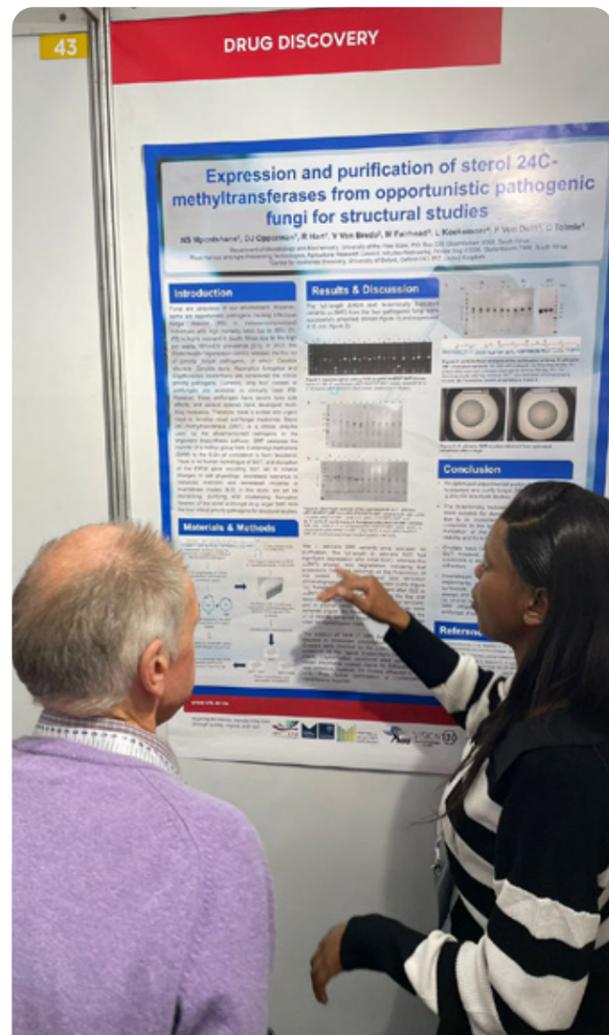
Kelebogile Letebele received an NRF facility-related travel and training fellowship to visit the University of Szeged, Hungary. Her host laboratory was the laboratory of Professor Attila Gácsér in the Department of Biology, focusing on fungal pathogens such as *Candida albicans*, *Candida auris*, and *Candida parapsilosis*. There, she worked on developing methods for the analysis of fungal extracellular vesicle lipids using ultra-high performance liquid chromatography-high resolution mass spectrometry (UHPLC-HRMS).

Kelebogile Letebele and Nokwanda Mpotshane (MSc student) attended the 28th Biennial Conference of the South African Society of Biochemistry and



Kelebogile Letebele with host and head of the Institute of Biology at the University of Szeged, Prof Attila Gácsér

Molecular Biology, which was held in Polokwane from 7 to 10 July 2024. Kelebogile delivered an oral presentation and Nolwanda presented a poster.



Nokwanda Mpontshane presenting her poster at the South African Society for Biochemistry and Molecular Biology

Prof Sebolai hosted Prof Wilber Sabitti from St Andrews University, Scotland, who presented a lecture on revolutionising tuberculosis treatment monitoring using the tuberculosis Molecular Bacterial Load Assay (TB-MBLA). This technology may be expanded to other respiratory pathogens. Prof Wilber Sabitti's visit coincided with a visit to the Centre for AIDS Programme of Research in South Africa (CAPRISA) at the University of KwaZulu Natal (UKZN).

The research of the Antimicrobial peptides and Probiotic bacteria group, led by Dr Winschau van Zyl, employs *in silico* genome mining strategies

and synthetic and molecular biology techniques, to discover, characterise, and produce novel and more effective antimicrobial peptides and probiotics with potential medical application. Antimicrobial resistance of both human and animal pathogenic microbes poses a global health threat to human well-being. Probiotic lactic acid bacteria and their antimicrobial peptides have considerable potential as alternatives to antibiotics, both in prophylactic and therapeutic applications. Lanthipeptides are a rapidly expanding family of natural compounds with diverse biological functions, which include antibacterial, antiviral, and anticancer activities. Current research activities include the development of heterologous protein expression systems to refine the expression of post-translationally modified cationic lanthipeptides and the use of next-generation sequence data for the discovery of novel peptides that may not be obtained natively. In 2024, one BSc Honours and two MSc students were recruited to focus exclusively on the discovery and development of bacterial expression systems to produce novel lanthipeptides with activity against multidrug resistant Gram-positive bacteria *Clostridium difficile* and *Staphylococcus aureus* which cause life-threatening gastrointestinal and soft tissue infections in patients who are immunocompromised. In 2024, using high performance computing and synthetic biology, several anti-clostridial and anti-staphylococcal lanthipeptides were identified *in silico* from various genome sequence databases, followed by chemical synthesis and cloning into bacterial expression systems for production. This work opens the door to the discovery of potentially novel antimicrobial peptides with improved therapeutic effects. Other projects focused on the development of an in-house gene-knockout system for *E. coli* BL21 for improved protein expression capabilities and the development of a next-generation probiotic vaccine for rotavirus infection in humans.

Dr Van Zyl is part of a multi-disciplinary collaborative research project based on the use of bioinformatics tools and synthetic biology to discover novel antimicrobial peptides active against multi-drug-resistant pathogens, which include Prof Leon Dicks (Stellenbosch University) and Dr Morne du Plessis (UFS Department of Genetics). As part of the collaboration, Dr du Plessis is currently acting as co-supervisor for two MSc students.

Mass Spectrometer Facility

On 27 November 2024, the Mass Spectrometry analytical facility had its official opening in the Department. In 2023, the Faculty approved the acquisition of two new mass spectrometers, a SCIEX QTRAP4500 and a SCIEX X500R QTOF. Lab renovation started in November of that year and was completed in early 2024, and the instrument installation followed in May 2024. The opening event was attended by about 35 people from various departments on the Bloemfontein Campus. Dr Gabré Kemp gave an introduction on the abilities of the new instruments and the services offered by the analytical facility to the campus community. The dealer for SCIEX in South Africa, Separations, also attended the function and presented the lab with a sign to show their commitment to supporting the facility.



Frikkie van der Merwe (left) of Separations presented Dr Gabre Kemp with the nameplate of the facility at the official opening ceremony

The services offered by the facility have now been expanded to include the screening for and quantitation of most organic analytes in various matrices of interest ranging from pesticides,



New mass spectrometers housed in the Mass Spectrometer Facility

pharmaceuticals, drugs, metabolites and plant extracts, to name but a few. Additionally, accurate mass analysis of any of these analytes is possible down to 2ppm accuracy to aid in chemical structure elucidation and unknown analyte identification.

ACADEMIC CITIZENSHIP AND COMMUNITY ENGAGEMENT

Dr Carmien Tolmie attended the South African Science Forum on 5 December 2024 to participate in the panel on Advancing Early Career Scientists and Researchers. This panel focussed on mentoring and mentorship, particularly from the point of view of early career researchers who have been part of mentorship programmes.



UFS staff members at the South African Science Forum, from the left, Dr Mpho Mafa (Department of Plant Sciences), Dr Mutshidzi Mulondo (Office of the Dean: Health Sciences), and Dr Carmien Tolmie

Prof Koos Albertyn and Prof Carlien Pohl-Albertyn were part of the organising committee for the 16th International Congress on Yeasts (ICY2024) held in Cape Town from 29 September to 3 October. Four staff members and nine pos-graduate students from the Pathogenic Research Group attended this conference.



UFS delegation attending the ICY2024 conference hosted in Cape Town

The UFS annual Open Day, now known as Connect2Kovsies, took place on 27 July 2024. In line with Vision 130, the University moved from a mass approach to a targeted approach in which prospective students who applied and received conditional offers were invited to explore and experience the University. The Department's exhibition was held in-house and included exhibitions from other departments that also offer Biological Sciences programmes at the undergraduate level, namely Genetics, Plant Sciences, Forensics Sciences, and Zoology and Entomology. The Department also took part in a mass marketing event targeting Grade 9 to 11 learners at the Callie Human from 18 to 20 July 2024. Both these events attracted much attention from prospective students. Personnel and students were on duty to answer questions from prospective students. In addition, departmental corporate pamphlets were available to provide additional information.

POSTGRADUATE STUDENTS

In 2024, 19 students were enrolled in the Department for the BSc Honours – 13 for Microbiology and six for Biochemistry. A total of 30 students were registered in the Department in 2024 for Master's degrees – 25 in Microbiology and 5 in Biochemistry. During 2024, 12 students were awarded Master's degrees:

- Barron, Nikita (Master of Science Majoring in Microbiology with distinction)

- Beneke, Carel Johannes (Master of Science Majoring in Microbiology with distinction)
- Belter, Bernadette (Master of Science Majoring in Microbiology with distinction)
- Delport, Bianca (Master of Science Majoring in Microbiology)
- Swart, Wanja (Master of Science Majoring in Microbiology)
- Christians, Byron Jarrad Martin (Master of Science Majoring in Microbiology)
- Lourens, Tristen (Master of Science Majoring in Microbiology)
- Senokoane, Retshegofaditswe (Master of Science Majoring in Microbiology)
- Swart, Ryno (Master of Science Majoring in Microbiology)
- Bolsenbroek, Armand Harm (Master of Science Majoring in Biochemistry with distinction)
- Marinkov, Marko (Master of Science Majoring in Biochemistry with distinction)
- Thusi, Ayanda Xolani (Master of Science Majoring in Biochemistry with distinction)

Twenty-one (21) students were registered for Doctoral degrees – 10 in Microbiology and 11 in Biochemistry. During 2024, the PhD was conferred on two students (both majoring in Microbiology):

Eduvan Bisschoff

Thesis: Investigating the molecular mechanisms behind antifungal resistance in *Candida auris*

Supervisors: Prof J Albertyn and Prof CH Pohl

Nozethu Mjokane

Thesis: Activation of the SARS-COV-2 spike protein by *Cryptococcus neoformans* proteases

Supervisors: Prof OM Sebolai, Prof J Albertyn, Prof CH Pohl, and Dr OMN Gcilitshana



POSTDOCTORAL RESEARCH FELLOWS

The Department of Microbiology and Biochemistry hosted four postdoctoral research fellows during 2024. These were:

- Dr Chibuikwe Ibe (from Nigeria)
- Dr Nozethu Mjokane (from South Africa)
- Dr Kamini Govender (from South Africa)
- Dr Nkhasi Lekena (from South Africa)

Dr Chibuikwe Ibe (Post-doctoral research associate) received funding from the FAILSAFE (Fungal AMR Innovations for LMICS: Solutions and Access For Everyone) project.

STAFF MATTERS

Prof Dirk Opperman delivered his inaugural lecture on 21 May 2024 at the Bloemfontein Campus. In describing his research, he explained that 'exploring' refers to the determination of the three-dimensional structures of proteins and enzymes, 'exploiting' involves the use of these enzymes to convert substrates into products of value, and 'evolving' pertains to mutating the DNA to change the protein, giving it different functions, activities, selectivity, or specificities. In his lecture, he also



At the inaugural lecture of Prof Dirk Opperman, from the left, Prof Paul Oberholster, Dean of the Faculty of Natural and Agricultural Sciences, Prof Opperman, Prof Vasu Reddy, Deputy Vice-Chancellor: Research and Internationalisation, and Prof Koos Albertyn, Head of the Department

raised the question of whether AI could replace the experimental determination of protein structures. His significant contributions to the field are reflected in more than 50 authored and co-authored papers, some of which are published in prestigious journals such as *Science*, *Nature Communications*, and *Angewandte Chemie*. As an NRF B-rated researcher, his work has received funding from various local and international organisations, including industries such as Sasol and the Global Challenges Research Fund.

Prof Wynand Goosen was appointed in October 2024. Prof Goosen's impressive credentials and extensive experience make him a valuable addition



Prof Goosen conducting vital TB research on chemically immobilised African buffalo (above) and African elephant (below) during a *Mycobacterium bovis* surveillance project in Kruger National Park



to the Department. Prof Goosen is a recognised leader and scholar in the field of Tuberculosis One Health, bringing with him a wealth of expertise and extensive networks across medicine, veterinary sciences, environmental studies, and governmental sectors. To date he has investigated and developed numerous novel approaches for improving the surveillance of pathogenic Mycobacteria spp. in livestock (cattle and goats), wildlife (>24 species), people and their environments in rural communities of South Africa. These approaches include targeting the bacteria directly through PCR and mycobacterial culturing from various specimens (host and environmental) or indirectly by developing species-specific immunological tests that can measure host cell-mediated immunological responses towards bacterial antigens. His appointment strategically bridges the gap between current research areas at the UFS that focus on pathogenic viruses and yeasts and the emerging focus on zoonotic bacterial and viral diseases within the Natural and Agricultural Sciences and the Health Science Faculties. One of the notable aspects of Prof Goosen's appointment is its potential for fostering inter-faculty research collaborations. His expertise in Tuberculosis One Health bridges existing research areas and emerging focuses, opening new avenues for collaboration between different departments and faculties.

RESEARCH OUTPUTS

Journal Articles

- Aborode, A.T., Kumar, N., Olowosoke, C.B., Ibanami, T.A., Ayoade, I., Umar, H.I., Jamiu, A.T., Bolarinwa, B., Olapade, Z., Idowu, A.R., Adelakun, I.O., Onifade, I.O., Akangbe, B., Abacheng, M., Ikimiukor, O.O., Awaji, A.A. & Adesola, R.O.** 2024. Predictive identification and design of potent inhibitors targeting resistance-inducing candidate genes from *E. coli* whole-genome sequences. *Frontiers in Bioinformatics* 4: 1411935. DOI: 10.3389/fbinf.2024.1411935.
- Aschenbrenner, J.C., Ebrecht, A.C., Smit, M.S. & Opperman, D.J.** 2024. Revisiting strategies and their combinatorial effect for introducing peroxygenase activity in CYP102A1 (P450BM3). *Molecular Catalysis* 557: 113953. DOI: 10.1016/j.mcat.2024.113953.
- Baker, T., Bester, A., Sebolai, O.M., Albertyn, J. & Pohl, C.H.** 2024. Biofilms on urban aquatic plastic pollution as a reservoir for pathogenic yeasts. *Journal of Water and Health* 22: 1826 DOI: 10.2166/wh.2024.133.
- Baker, T., Albertyn, J., Musoke, J., Sebolai, O. & Pohl, C.H.** Yeast-

contaminated water as a potential emerging health concern: a review. *Water SA* 50(4): 404–410. DOI: 10.17159/wsa/2024.v50.i4.4097

- Cebekhulu, S., Gómez-Arias, A., Matu, A., Alom, J., Valverde, A., Caraballo, M.A., Ololade, O., Schneider, P. & Castillo, J.** 2024. Role of indigenous microbial communities in the mobilization of potentially toxic elements and rare-earth elements from alkaline mine waste. *Journal of Hazardous Materials* 466: 133504. DOI: 10.1016/j.jhazmat.2024.133504.
- Didloff, J., Boukes, G.J., Van de Venter, M., Viljoen, B., Leed M., Blom, C., Dwyer, R.A. & Govender, S.** 2024. Investigation of the inhibition of respiratory bacterial pathogens and HIV-1 enzymes by twenty-one South African mushroom species. *South African Journal of Botany* 166: 375–385. DOI: 10.1016/j.sajb.2024.01.021.
- Dingiswayo, L., Adelabu, O.A., Arko-Cobbah, E., Pohl, C., Mokoena, N.Z., Du Plessis, M. & Musoke, J.** 2024. Hypervirulent *Klebsiella pneumoniae* in a South African tertiary hospital—Clinical profile, genetic determinants, and virulence in *Caenorhabditis elegans*. *Frontiers in Microbiology* 15: 1385724. DOI: 10.3389/fmicb.2024.1385724.
- Folorunso, O.S., & Sebolai, O.M.** 2024. A limited number of amino acid permeases are crucial for *Cryptococcus neoformans* survival and virulence. *International Journal of Microbiology* 5566438. DOI: 10.1155/2024/5566438.
- Freitag, A., Cluff, M., Pretorius, W., Bothma, C., Hugo, A. & Hugo, C.** 2024. Chemical, microbial, and sensory effects of natural preservatives as sulfur dioxide replacers in boerewors. *Journal of Food Processing and Preservation* 2024: 4336909. DOI: 10.1155/2024/4336909.
- Grobbelaar, A., Osthoff, G., Du Preez, I. & Deacon, F.** 2024. First insights into the fecal metabolome of healthy, free-roaming giraffes (*Giraffa camelopardalis*): An untargeted GCxGC/TOF-MS metabolomics study. *Metabolites* 14: 586. DOI: 10.3390/metabo14110586
- Herbert, J. & Van Dijk, A.A.** 2024. Identification of a cooperative effect between amino acids 169 and 174 in the rotavirus NSP4 double-layered particle-binding domain. *Journal of General Virology* 105: 002029. DOI: 10.1099/jgv.0.002029.
- Ibe, C. & Otu, A.A.** 2024. Post COVID-19 and fungal pathogens coinfection in Africa – Current status and future direction. *The Microbe* 4: 10152. DOI: 10.1016/j.microb.2024.100152.
- Ibe, C. & Pohl, C.H.** 2024. Update on the structure and function of *Candida albicans* drug efflux protein, Cdr1. *Fungal Genetics and Biology* 175: 103938. DOI: 10.1016/j.fgb.2024.103938
- McCarlie, S., Boucher-van Jaarsveld, C. & Bragg, R.** 2024. Differential expression analysis reveals possible new quaternary ammonium compound resistance gene in highly resistant *Serratia* sp. HRI. *Microorganisms* 12: 1891. DOI: 10.3390/microorganisms12091891
- McCarlie, S. & Bragg, R.** 2024. Impact of the stress response on quaternary ammonium compound disinfectant susceptibility in *Serratia* species. *Microorganisms* 12: 2240. DOI: 10.3390/microorganisms12112240
- McCarlie, S.J., Du Preez, L.L., Castillo Hernandez, J., Boucher, C.E. & Bragg, R.R.** 2024. Transcriptomic signature of bacteria exposed to benzalkonium chloride. *Research in Microbiology* 175: 104151. DOI: 10.1016/j.resmic.2023.104151.

- Meiring, C. & Labuschagne, M.** 2024. Using QUASR-PCR as a field-based genotyping assay for a tick acaricide resistance marker. *Scientific Reports* 14: 13584. DOI: 10.1038/s41598-024-64401-0.
- Mjokane, N., Akintemi, E.O., Sabiu, S., Gcilitshana, O.M.N., Albertyn, J., Pohl, C.H. & Sebolai, O.M.** 2024. *Aspergillus fumigatus* secretes a protease(s) that displays *in silico* binding affinity towards the SARS-CoV-2 spike protein and mediates SARS-CoV-2 pseudovirion entry into HEK-293T cells. *Virology Journal* 21: 58. DOI: 10.1186/s12985-024-02331-z.
- Mjokane, N., Sabiu, S., Folorunso, O.S. Gcilitshana, O.M.N., Albertyn, J. & Pohl, C.H., Sebolai, O.M.** 2024. Cryptococcal proteases exhibit the potential to activate the latent SARS-CoV-2 spike protein. *Journal of Infection and Public Health* 17: 263–270. DOI: 10.1016/j.jiph.2023.12.008.
- Mogotsi, M.T., Ogunbayo, A.E., Bester, P.A., O'Neill, H.G. & Nyaga, M.M.** 2024. Longitudinal analysis of the enteric virome in paediatric subjects from the Free State Province, South Africa, reveals early gut colonisation and temporal dynamics. *Virus Research* 346: 199403. DOI: 10.1016/j.virusres.2024.199403.
- Mogotsi, M.T., Ogunbayo, A.E., O'Neill, H.G. & Nyaga, M.M.** 2024. High detection frequency of vaccine-associated polioviruses and non-polio enteroviruses in the stools of asymptomatic infants from the Free State Province, South Africa. *Microorganisms* 12: 920. DOI: 10.3390/microorganisms12050920.
- Mooko, T., Bisiwe, F.B., Chikobvu, P., Morobadi, M.D., Mofokeng, T.R.P., Nyaga, M.M., Kemp, G., Goedhals, D. & Ndlovu, K.C.Z.** 2024. The prevalence of HIV resistance mutations and their influence on the shedding of HIV-1 into peritoneal dialysis effluent. *Journal of Medical Virology* 96: e29734. DOI: 10.1002/jmv.29734.
- Mooko, T., Bisiwe, F.B., Mondleki, E., Morobadi, M.D., Chikobvu, P., Nyaga, M.M., Bala, A., Goedhals, D., Mofokeng, T.R.P., Kemp, G. & Ndlovu, K.C.Z.** 2024. Steady-state pharmacokinetics of lamivudine in end-stage kidney failure persons with detectable and undetectable HIV-1 RNA in peritoneal dialysis effluent. *European Journal of Medical Research* 29: 374. DOI: 10.1186/s40001-024-01972-8.
- Munlela, B., Joào, E.D., Strydom, A., Bauhofer, A.F.L., Chissaque, A., Chilaulé, J.J., Maurício, I.L., Donato, C.M., O'Neill, H.G. & De Deus, N.** 2024. Whole-genome characterization of rotavirus G9P[6] and G9P[4] strains that emerged after rotavirus vaccine introduction in Mozambique. *Viruses* 16: DOI: 10.3390/v16071140.
- Odey, T.O.J., Tanimowo, W.T., Afolabi, K.O., Jahid, I.K. & Reuben, R.C.** 2024. Antimicrobial use and resistance in food animal production: Food safety and associated concerns in Sub-Saharan Africa. *International Microbiology* 27: 1–23. DOI: 10.1007/s10123-023-00462-x.
- Ojo A.O, Castillo J., Cason E.D. & Valverde A.** 2024. Biodegradation of chloroethene compounds under microoxic conditions. *Biotechnology and Bioengineering* 121: 1036–1049. DOI: 10.1002/bit.28630.
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- Osman, J.R., Castillo, J., Sanhueza, V., Miller, A.Z., Novoselov, A., Cotoras, D. & Morales, D.** 2024. Key energy metabolisms in modern living microbialites from hypersaline Andean lagoons of the Salar de Atacama, Chile. *Science of the Total Environment* 937: 173469. DOI: 10.1016/j.scitotenv.2024.173469.
- Osthoff, G. & Nieuwoudt, P.** 2024. Non-targeted metabolomics of white rhinoceros colostrum and its changes during early lactation by 1H nuclear magnetic resonance spectroscopy. *Metabolites* 14: 637. DOI: 10.3390/metabo14110637
- Steyn, H.J.F., White, L.J., Hilton, K.L.F., Hiscock, J.R. & Pohl, C.H.** 2024. Supramolecular Self-associating amphiphiles inhibit biofilm formation by the critical pathogens, *Pseudomonas aeruginosa* and *Candida albicans*. *ACS Omega* 9: 1770–1785. DOI: 10.1021/acsomega.3c08425.
- Strydom, A. Segone, N., Coertze, R., Barron, N., Strydom, M. & O'Neill, H.G.** 2024. Phylogenetic analyses of rotavirus A, B, and C detected on a porcine farm in South Africa. *Viruses* 16: 934. DOI: 10.3390/v16060934.
- Suzuki, Y., Webb, S.J., Kouduka, M., Castillo, J., Kallmeyer, J., Moganedi, K., Allwright, A.J., Klemm, R., Roelofse, F., Mapiiloko, M., Hill, S.J. & Aswal, L.D., Trumbull, R.B.** 2024. Subsurface microbial colonization at mineral-filled veins in 2-billion-year-old mafic rock from the Bushveld Igneous Complex, South Africa. *Microbial Ecology* 87: 116. DOI: 10.1007/s00248-024-02434-8.
- Van Hengst, J.M., Wolder, A.E., Sánchez, M., Huijbers, M.M.E., Opperman, D.J., Gilles, P., Martin, J., Hilberath, T., Hollmann, F. & Paul, C.E.** 2024. Ene-reductase-catalyzed oxidation reactions. *ChemCatChem* e202401447. DOI: 10.1002/cctc.202401447.
- Van Rooyen, B., DeWit, M., Osthoff, G. & Van Niekerk, J.** 2024. Cactus pear mucilage (*Opuntia* spp.) as a novel functional biopolymer: Mucilage extraction, rheology and biofilm development. *Polymers* 16: 1993. DOI: 10.3390/polym16141993.
- Wang, H-Y., Yu, Z-G., Zhou, F-W., Castillo Hernandez, J., Grandjean, A., Biester, H., Xiao, K-Q. & Knorr, K-H.** 2024. Microbial communities and functions are structured by vertical geochemical zones in a northern peatland. *Science of the Total Environment* 950: 175273. DOI: 10.1016/j.scitotenv.2024.175273.
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- Wolder, A.E., Heckmann, C.M., Hagedoorn, P.L., Opperman, D.J. & Paul, C.E.** 2024. Asymmetric monoreduction of α,β -dicarbonyls to α -hydroxy carbonyls by ene reductases. *ACS Catalysis* 14: 15713–15720. DOI: 10.1021/acscatal.4c04676.

Conference contributions

Baker, T., Albertyn, J., Musoke, J., Sebolai, O. & Pohl, C.H. 2024. *Pilot-scale water surveillance for fluconazole resistant pathogenic yeasts in Mangaung, South Africa.* Ppaer delivered at the 16th International Congress on Yeasts, Cape Town, South Africa. 29 September–3 October 2024.

Barron, N. Van Zyl, M., Strydom, A. & O'Neill, H.G. 2024. *Bovine Rotavirus In South Africa: Surveillance, Genome Characterisation And Cell Culture Adaptation.* Paper delivered at the 9th European Rotavirus Biology Meeting, Valencia, Spain. 2–4 October 2024.

Beneke, C.J., Albertyn, J. & Pohl, C. 2024. *The role of the High Osmolarity Glycerol (HOG) response pathway in Candida auris.* Poster presented at the 16th International Congress on Yeasts, Cape Town, South Africa. 29 September–3 October 2024.

Bolsenbroek, A., Bisschoff, E., Kemp, G., Sebolai, O., Pohl, C. & Albertyn, J. 2024. *The role of OLE2 and POX1-3 in prostaglandin E₂ production and virulence is conserved in Candida auris.* Paper delivered at the 16th International Congress on Yeasts, Cape Town, South Africa. 29 September–3 October 2024.

Coertzen, A., Mc Carlie, S.J. & Bragg, R.R. 2024. *Identification of NAD- independent Avibacterium paragallinarum isolates from plasmid extraction and transformation of reference serovars.* Poster presented at the International Union of Microbiological Societies Conference, Florence, Italy. 23–25 October 2024.

Coertzen, A., Bragg, R.R. & Mc Carlie, S.J. 2024. *Characterisation of Avibacterium paragallinarum and the exploitation of different genes to develop a novel molecular typing system.* Poster presented at the International Union of Microbiological Societies Conference, Florence, Italy. 23–25 October 2024.

Delpont, B., Bragg, R.R., Castillo Hernandez, J., Marais, & Mc Carlie, S.J. 2024. *Metagenomic evaluation of the bacterial diversity in peacan nut trees with overall decline.* Poster presented at the International Union of Microbiological Societies Conference, Florence, Italy. 23–25 October 2024.

Droege, L., Opperman, D.J., Smit, M.S. & Urlacher, V.B. 2024. *Engineering of fungal CYP505 for selective fatty acid hydroxylation.* Poster presented at the 16th International Symposium – Cytochrome P450 Biodiversity & Biotechnology, Turin, Italy. 23–27 June 2024.

Fourie, C., Ogunyinka, M.I, Legisa, D.M., Blasco, M., Albertyn, J. & O'Neill, H.G. 2024. *Exploring yeast expression platforms for recombinant rotavirus VP6 vaccine production.* Poster presented at the 16th International Congress on Yeasts, Cape Town, South Africa. 29 September–3 October 2024.

Fourie, C., Ogunyinka, M.I, Legisa, D.M., Blasco, M., Albertyn, J., O'Neill, H.G. 2024. *Analysis of microbially-produced rotavirus VP6 as a subunit vaccine candidate.* Paper delivered at the Virology Africa Conference 2024, Stellenbosch, South Africa. 15–18 April 2024.

Govender, K., Smit, M., Ebrecht, A. & Opperman, D. 2024. *Hydrogen peroxide driven O-demethylation of lignin derived monoaromatics.* Paper delivered at the 34th Annual Conference of the Catalysis Society of South Africa, Central Drakensberg, South Africa. 3–6 November 2024

Ibe, C., Kuloyo, O., Fourie, R. & Pohl, C.H. 2024. *Arachidonic acid inhibits Cdr1 efflux activity in C. albicans.* Poster presented at

the 16th International Congress on Yeasts, Cape Town, South Africa. 29 September–3 October 2024.

Jacobs, R., Lekena, N. & O'Neill, H.G. 2024. *Generation of a HiBiT-based reporter rotavirus.* Poster presented at the 9th European Rotavirus Biology Meeting, Valencia, Spain. 2–4 October 2024

Jawallapersand, P., Albertyn, J. & Pohl, C.H. 2024. *Influence of polyunsaturated fatty acids and eicosanoids on Candida albicans germ tube formation.* Paper delivered at the 16th International Congress on Yeasts, Cape Town, South Africa. 29 September–3 October 2024.

Krüger, M.W., Tolmie, C. & Opperman, D.J. 2024. *Structure of novel S8 keratinase.* Poster presented at the 7th African Light Source conference (AfLS 2024), Johannesburg, South Africa. 18–22 November 2024.

Letebele, P.K., Pohl, C.H. & Albertyn, J. 2024. *Role of EHT1, encoding a putative acyl-coenzymeA:ethanol O-acyltransferase, in Candida albicans.* Paper delivered at the 28th Biennial Conference of the South African Society for Biochemistry and Molecular Biology, Polokwane, South Africa. 7–10 July 2024..

Letebele, P.K., Pohl, C.H. & Albertyn, J. 2024. *Role of EHT1, encoding a putative acyl-coenzymeA:ethanol O-acyltransferase, in Candida albicans.* Paper delivered at the 16th International Congress on Yeasts, Cape Town, South Africa. 29 September–3 October 2024.

Lourens, T., Bisschoff, E., Pohl, C.H. & Albertyn, J. 2024. *Investigating the lipases of the multidrug-resistant yeast, Candida auris.* Poster presented at the 16th International Congress on Yeasts, Cape Town, South Africa. 29 September–3 October 2024.

Luthuli, K.S., Hiscock, J.R. & Pohl, C.H. 2024. *Antibiofilm potential of next-generation supramolecular self-associating amphiphilic salts.* Poster presented at the 4th AIDS-related Mycoses Workshop, Cape Town, South Africa. 10–12 July 2024.

Manamela, R., Albertyn, J. & O'Neill, H.G. 2024. *Strategies for improved rotavirus VP2 and VP6 expression in Ogatea polymorpha and Yarrowia lipolytica.* Paper delivered at the 9th European Rotavirus Biology Meeting, Valencia, Spain. 2–4 October 2024.

Mc Carlie, S.J. & Bragg, R.R. 2024. *Antimicrobial resistance islands; A new weapon for pathogens.* Poster presented at the International Union of Microbiological Societies Conference, Florence, Italy. 23–25 October 2024.

Mc Carlie, S.J. & Bragg, R.R. 2024. *Antimicrobials and antimicrobial resistance.* Poster presented at the International Union of Microbiological Societies Conference, Florence, Italy. 23–25 October 2024.

Mpontshane, N.S., Opperman, D.J., Hart, R., Van Breda, V., Fairhead, M., Koekemoer, L., Von Delft, F. & Tolmie, C. 2024. *Expression and purification of sterol 24C methyltransferases from opportunistic pathogenic fungi for structural studies.* Poster presented at the 28th Biennial Conference of the South African Society for Biochemistry and Molecular Biology, Polokwane, South Africa. 7–10 July 2024.

Ogundeji, A.O. & Pohl, C.H. 2024. *Biodiversity Biobanks SA Yeast culture collection, UFS: Meeting the needs of researchers.* Paper

delivered at the 16th International Congress on Yeasts, Cape Town, South Africa. 29 September–3 October 2024.

O'Neill, H.G., Coertze, R., Strydom, A., Segone, N. & Strydom, M. 2024. *Porcine diarrhea samples reveal high diversity of picobirnavirus genome.* Paper delivered at the Virology Africa Conference 2024, Stellenbosch, South Africa. 15–18 April 2024.

O'Neill, H.G., Du Preez, L.L., Van der Schyff, S.S. & Lekena, N. 2024. *Efficient reassortment of genotypes G1, G9 and G12 on rotavirus SA11 is supported by stable protein-protein interactions.* Poster delivered at the 9th European Rotavirus Biology Meeting, Valencia, Spain. 2–4 October 2024.

Opperman, D.J., Smit, M.S., Ebrecht, A.C. & Aschenbrenner, J.C. 2024. *Biocatalytic potential of fungal CYP505s.* Paper delivered at the 16th International Symposium – Cytochrome P450 Biodiversity and Biotechnology, Turin, Italy. 23–27 June 2024.

Opperman, D., Tolmie, C., Smit, M., Ebrecht, A. & Suter, S. 2024. *Biocatalytic asymmetric sulfoxidation of prochiral sulfides.* Paper delivered at the 34th Annual Conference of the Catalysis Society of South Africa, Central Drakensberg, South Africa. 3–6 November 2024.

Senokoane, R., Albertyn, J. & Pohl, C.H. 2024. *Influence of the deletion of FET99 on lipids and fluconazole susceptibility of Candida albicans.* Poster presented at the 16th International Congress on Yeasts, Cape Town, South Africa. 29 September–3 October 2024.

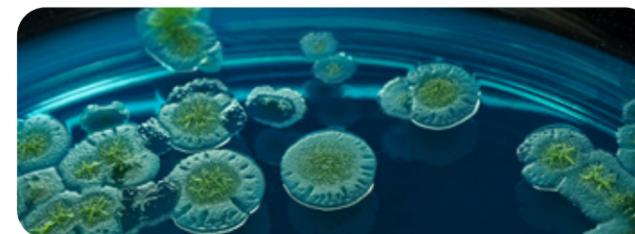
Setsiba, L.K., Albertyn, J. & Pohl, C. 2024. *The influence of iron permease, Fth2p, on lipids and fluconazole susceptibility of Candida albicans.* Poster presented at the 16th International Congress on Yeasts, Cape Town, South Africa. 29 September–3 October 2024.

Smit, M.S. *Evolution of a 3DM structure-based class specific molecular information system of the cytochrome P450 monooxygenases.* Paper delivered at the 16th International Symposium – Cytochrome P450 Biodiversity and Biotechnology, Turin, Italy. 23–27 June 2024.

Swart, W., Bragg, R.R. & Mc Carlie S.J. 2024. *Links between antibiotic and disinfectant resistance in species of Serratia.* Poster presented at the International Union of Microbiological Societies Conference, Florence, Italy. 23–25 October 2024.

Van Baalen, C.F., Albertyn & J., Pohl, C.H. 2024. *Development of gene editing tools to facilitate gene manipulation for Candida auris.* Paper delivered at the 16th International Congress on Yeasts, Cape Town, South Africa. 29 September–3 October 2024.

Van Zyl, M., Pohl, C.H. & O'Neill, H.G. 2024. *Supplementation of MA104 cells with eicosapentaenoic acid and rotavirus replication.* Poster presented at the 9th European Rotavirus Biology Meeting, Valencia, Spain. 2–4 October 2024.



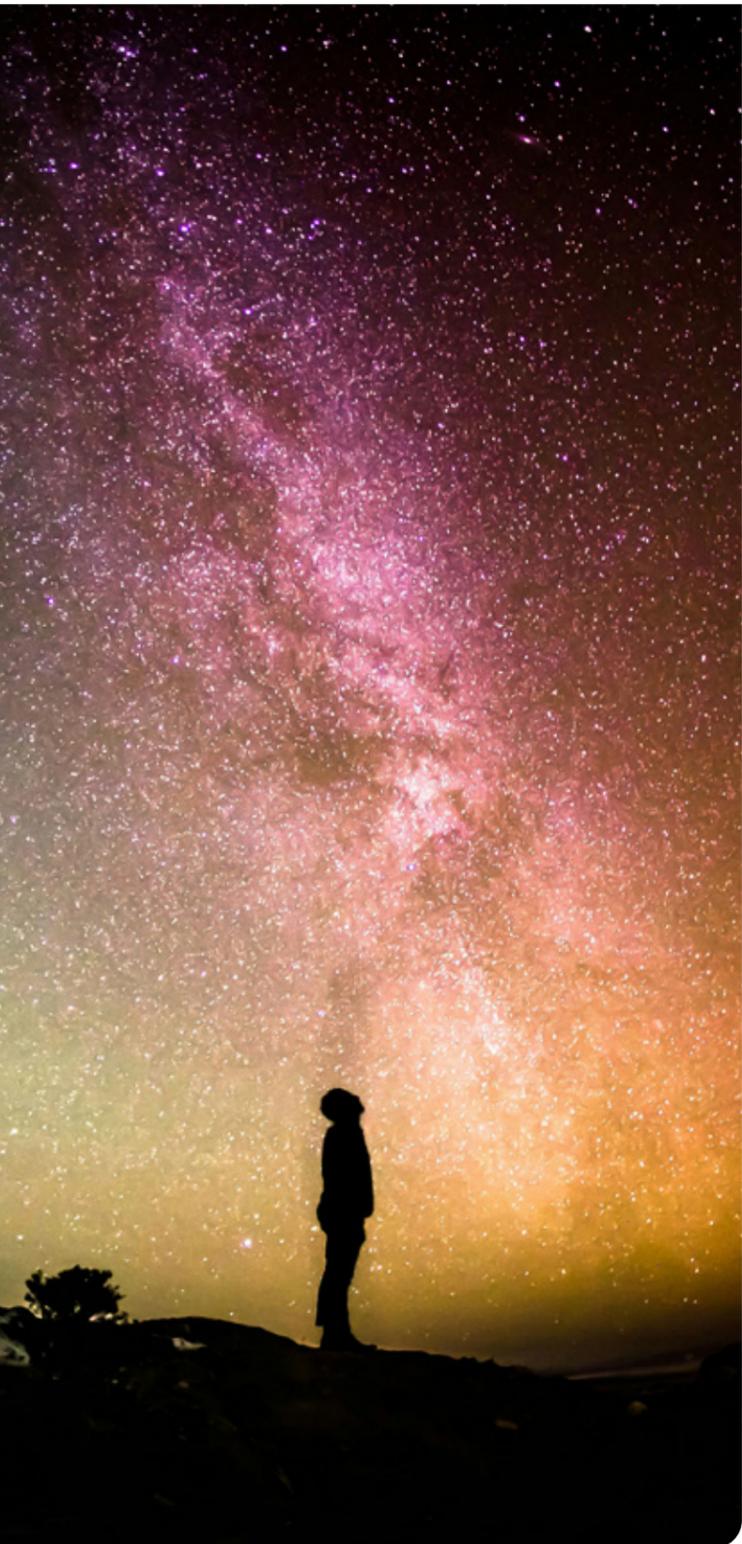
STAFF (2024)

**Head of Department:
Prof J Albertyn**

| | |
|---|---|
| Professors: | Prof R Bragg, Prof C Hugo, Prof G Osthoff, Prof T O'Neill, Prof C Pohl-Albertyn, Prof M Smit, Prof B Viljoen, Prof D Opperman, and Prof O Sebolai |
| Affiliate Professors: | Prof J Hiscock and Prof AA van Dijk |
| Associate Professor: | Prof W Goosen |
| Affiliate Associate Professors: | Prof A Valverde Portal and Prof AS Bareetseng |
| Senior Lecturers: | Dr F O'Neill and Dr C Tolmie |
| Affiliate Senior Lecturer: | Dr M Labuschagne |
| Lecturers: | Dr WF Van Zyl, P Letebele, and L Steyn |
| Senior Researchers: | Dr J Castillo-Hernandez and Dr G Kemp |
| Research Fellow: | Dr C Boucher |
| Technician: | Dr A Ebrecht |
| Senior Officer - Professional Services: | S Marais |
| Officers - Professional Services: | Y Makaum, Dr A Ogundeji, and C van Rooyen |
| Officer: | A Van der Westhuizen |
| Senior Assistant Officer: | E Van den Heever |
| Storeman: | M Mogopodi |
| Technical Help: | K Mashuga |

DEPARTMENT OF PHYSICS

FACULTY OF NATURAL AND AGRICULTURAL SCIENCES



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OVERVIEW OF 2024

2024 has been a growing and exciting year for the Department of Physics. The Department is recognised as one of the leading physics departments in the country, with research in astrophysics, phosphor and solid-state physics that is internationally recognised. The Department boasts a well-equipped nano surface characterisation laboratory (with

state-of-the-art research infrastructure), an observatory (Boyden) with a 1.5 m telescope and a digital planetarium. Most of the staff members are also involved with the Boyden Science Centre and the Naval Hill Planetarium, both of which are intensively involved with science engagement with local, provincial, and national communities. The undergraduate and postgraduate programmes are challenging and well-balanced and students exiting these programmes are of high quality and sought after by industry.

The Department had the opportunity to inaugurate the new wing of the Physics Building, which ensures that there is now enough office space for postgraduate students and staff members.

ACHIEVEMENTS

Staff Achievements

Physics are proud to announce that our SARCHI Research Chair, Prof Hendrik Swart, was awarded Highly Ranked Scholar status by ScholarGPS, which celebrates Highly Ranked Scholars™ for their performance in various fields, disciplines, and specialties. Prof Swart's prolific publication record, the high impact of his work, and the outstanding quality of his scholarly contributions have placed him among the top 0,05% of all scholars worldwide.



Prof Hendrik Swart

Prof Swart received Highly Ranked Scholar status (Lifetime) for ranking 16th in the discipline of Phosphor. Highly Ranked Scholars™ – Lifetime

refers to distinguished authors, including those who are currently active, retired, or deceased. These scholars are recognised for their exceptional lifetime scholarly contributions, placing them in the top 0,05% of all scholars. Their achievements are evaluated across four categories: overall (across all fields), within their specific field of study, within their discipline, and across all specialties with which they are associated. Additionally, Prof Swart received Highly Ranked Scholar status (prior five years) for ranking first in Condensed Matter Physics, 42nd in Physics, 155th in Sensor, 207th in Physical Science and Mathematics, and 969th in all fields.

Dr Selepe Motloutng, Dr Teboho Mokoena, Vanthini Adoons, and Dr Kamohelo Tshabalala from the Qwaqwa Campus received the Certificate for Curriculum Renewal Innovation in Higher Education, from the UFS Centre for Teaching and Learning.

Prof Richard Ocaya received a C2 NRF-rating.

Student Achievements

This year our students did not disappoint, winning a number of awards.

The Department encouraged the students and postdoctoral fellows to compete in the Faculty of Natural and Agricultural Science's Flash Facts competition. The elimination round was presented in the form of a mini conference on 6 June 2024 at Boyden Observatory which brought about excitement and fun for the competitors. Elimination round winners were MSc: Monica van der Walt; PhD: Thandi Mazibuko; Post Doc: Govind Nair; Astro MSc: Justin Cooper; Astro PhD: Natalie Matchett; and Staff: Edward Lee.

The Faculty round took place on 11 June where participants from Physics achieved the following:

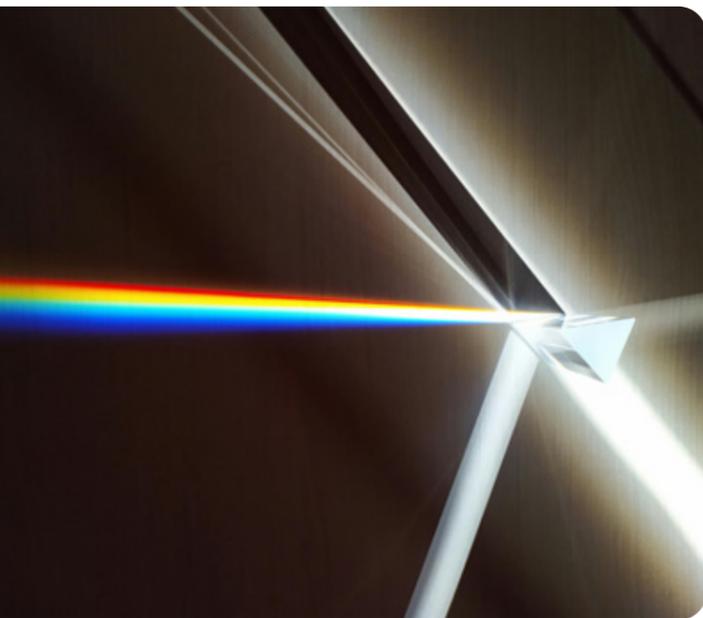
- 1st place PhD: Thandi Mazibuko
- 3rd place PhD: Natalie Matchett
- 2nd place MSc: Justin Cooper
- 2nd place Post Doc: Govind Nair

Thandi Mazibuko walked away with first place at the institutional round held on 11 October 2025, and she subsequently achieved second place in the national round on 25 October 2025.

The 68th Annual Conference of the South African Institute of Physics (SAIP) was held at Rhodes University from 1 and 5 July 2024, and brought together students, professionals, educators, and government officials. Our Physics students achieved the following awards:

- Publication MSc: Semiconductor: AA Abdallah (*Stability investigation of EU3+ doped CaF2 thin film with ZnO*)
- PhD poster presentation: Edward Lee (*SrVO3 tin films prepared using spin coating*)
- PhD poster presentation: Highly recommended: Vhahangwele Makumbane (*Structural and upconversion luminescence properties of pulsed laser-deposited Y2O3:Ho3+, Yb3+ thin films*)
- MSc poster presentation: Condensed Matter Physics: Lesole Ramolise (*Synthesis and thermometry properties of YVO4:Bi3+ Phosphor*)
- MSc oral presentation (Bush Vacuum): Johane Odendaal
- Photonics PhD Technology award: Lucas Erasmus

The Centre for Microscopy, with the assistance of Department of Physics, hosted the 58th Congress of the Microscopy Society of Southern Africa (MSSA 2024) from 2 to 5 December 2025. Boitumelo Tladi walked away with the award for the 'Best presentation for Material Science'.



RESEARCH, INNOVATION AND RESEARCH COLLABORATION

UFS Remote observing station

The UFS Remote observing station was installed in the Department of Physics' Astrolab to enable astronomical observations with telescopes outside Bloemfontein. With this station, observers can remotely operate the 1.0-meter and 1.9-meter telescopes located at the South African Astronomical Observatory in Sutherland, 727 km away. Both spectroscopic and photometric observations can be performed as the system has access to the spectrograph, SpUpNic, mounted onto the 1.9-meter telescope, and the high-speed optical cameras, SHOC, mounted on both telescopes.

The first observations were conducted by Hélène Szegedi on 3 January 2024 and a total of 11 weeks' observations have been completed thus far. Such a system is extremely beneficial as it enables UFS students and observers to have access to world-class instruments. The Boyden 1.5-m telescope and dome are currently being upgraded to enable remote observations and will be added to the UFS Remote observing station.



Hélène Szegedi

ROTSE Telescope Project

The ROTSE Telescope project was instigated by Prof David Buckley on behalf of the African Astronomical Society (AfAS) to bring the decommissioned telescope hosted at the H.E.S.S. site in Namibia back into operation as part of the SAAO Intelligent Observatory project. Boyden Observatory and the Astrophysics group is linked to these projects due to mutual interests and research aims. ROTSE (Robotic Optical Transient Search Experiment) is a wide-field (2.6-degree diameter) 0.45-meter diameter telescope, which operated at the H.E.S.S. site in Namibia until 2013, doing fast optical follow-up observations of GRBs (gamma ray bursts).

In November 2023 Hendrik J van Heerden, accompanied David Buckley (SAAO/SALT) and Willie Koorts (ex SAAO), visited the H.E.S.S. site for an investigation into the possibilities to get the telescope back into operation. During this visit the optics were cleaned and the computer systems and electronics inspected and powered up. Although some problems were identified, it was generally deemed to be viable to recommission the telescope.



From the left, Hendrik J van Heerden, David Buckley (SAAO/SALT), and Willie Koorts (formerly SAAO) at the H.E.S.S. site

A longer refurbishment visit was undertaken from 23 to 28 May 2024 by David Buckley (SAAO/UCT/UFS), Nicolas Erasmus (SAAO), Willie Koorts, and Pat van Heerden (UFS). During this visit the telescope mount controls and computer systems were brought back to full operation. The optics were collimated and focused, and a test camera

was mounted to test pointing and image quality. The visit ended with several observation runs on various objects indicating limiting magnitude, resolution and science viability of the system. A return visit took place in October 2024 to continue with returning the telescope to operations that are remotely accessible.



Slingshot Aerospace robotic telescope which will gather data on satellites in Low Earth Orbits (LOE) for users in the USA

Boyden Remote / Robotic Telescopes

Two additional telescope systems have been added to the Boyden Observatory.

- Slingshot Aerospace Space Situational Awareness (SSA) observing/monitoring systems consist of two systems – Varda and Horus. Slingshot Aerospace is a USA-based company specialising



MROSA (Masaryk-Remote-Observatory-South Africa) or affectionately called Milos Telescope

in SSA, i.e. the monitoring and tracking of satellites and space junk. These systems were installed and commissioned during April 2024. Continuous site support is provided as required.

- MROSA (Masaryk-Remote-Observatory-South Africa) or affectionately called Milos Telescope. This remote observable telescope system is a collaboration between UFS and Masaryk University in Brno, Czech Republic. This telescope, installed and commissioned during May 2024, is to be used for a variety of research projects.

Astrophysics Research

Hélène Szegedi (and her PhD supervisors, Prof Phil Charles and Dr David Buckley), attended the 45th COSPAR Scientific Assembly in Busan, South Korea from 13 to 21 July 2024). During the conference, Hélène presented their research on '[HP99] 159 – the first SSS with an evolved He donor' and Prof Charles presented their work on 'Symmetrical outbursts in long-orbital period CVs and Supersoft Sources'.

Prof Brian van Soelen and Joleen Barnard (PhD candidate) presented their research on the spectropolarimetry observations of blazars at the AGN Populations Across Continents and Cosmic Time meeting, held in Durham and Newcastle University, in the UK from 8 to 12 July. Brian van Soelen presented on SALT spectropolarimetry of flaring blazars, while Joleen Barnard showed the results for a long-term, spectropolarimetric survey of TeV emitting blazars.

During a three-day workshop on high mass Be X-ray binary systems (BeXRB 2024) that took place in Cape Town from 31 July to 2 August, Prof Brian van Soelen and Natalie Matchett (PhD candidate) presented the results of their research on gamma-ray binaries, in particular the results obtained with the Southern African Large Telescope (SALT). Prof Van Soelen showed results on the Long-term optical behaviour of the gamma-ray binary PSR B1259-63/LS 2883, while Natalie Matchett presented new insight into the gamma-ray binary system HESS J0632+057. Additionally, they were both co-authors of a presentation of the results shown by their long-term collaborator, Prof Maria Chernyakova (Dublin City University) on a 'Study of the broadband emission of gamma-ray binaries with a radio pulsar'.

In September, PhD student J-P Khumalo gave a presentation at the international PLUTO symposium in Torino (Italy) on his PhD simulations of accretion instabilities using the PLUTO code. The title of his presentation (co-authored with IP van der Westhuizen and PJ Meintjes) was 'Numerical modelling of white dwarf post-shock accretion columns using PLUTO code'.

From 2 to 4 October 2024, PhD student Spencer Tendai Madzime and MSc students John-Paul Khumalo, Tekano Mbonani, and Lurgasho Minnie gave oral presentations on their research at the High Energy Astrophysics in Southern Africa Conference (HEASA2024) held in Kruger National Park from 2 to 4 October.



IAU GA 2024

From 6 to 15 August 2024, for the first time in its 100-year history, the International Astronomical Union held its General Assembly meeting in Africa. This meeting occurs every three years and is the largest gathering of astronomers in the world.

Prof Brian van Soelen, Izak van der Westhuizen (PhD candidate), Natalie Matchett (PhD candidate), and Reuben Immelman (MSc candidate) presented their research at the meeting. As part of FM7: New Horizons at the interface between Computational Astrophysics and Big Data, posters were presented by Izak van der Westhuizen (Morphological differences in RMHD simulations of High and Low Lorentz factor AGN jets) and Reuben Immelman (Polarisation and SED Modelling of Magnetised Relativistic AGN Jets using RMHD Simulations). Prof Van Soelen was part of the Scientific Organising Committee for FM7 and Izak van der Westhuizen was a coordinator for the PLUTO Hackathon that was organised as a side event to the meeting.

As part of FM 12 The High-Energy Gamma-ray Universe: Results and perspectives with wide-field ground-based facilities, papers were delivered by Prof Van Soelen ('The multiwavelength view of the gamma-ray binary PSR B1259-63/LS 2883') and Natalie Matchett ('New insight into the gamma-ray binary system HESS J0632+057'). UFS co-authors were involved in presentations by Dr Kasai ('Redshift Measurement of Gamma-Ray Blazars for the Cherenkov Telescope Array') from the University of Namibia, and Hester Schutte ('Deciphering Blazar Emission Zones through Polarisation and Spectral Energy Distribution Studies') from North-West University.



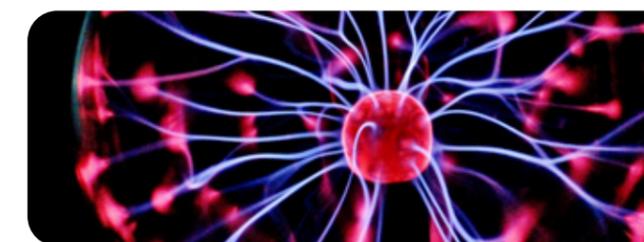
Dawie van Jaarsveld presenting his talk on the history of the Boyden Observatory

Dawie van Jaarsveld presented a talk on the history of the Boyden Observatory, titled 'The development of the Boyden Observatory Museum'.

In a significant moment for South African astronomical heritage, the UFS received historic photographic plates of comet 55P/Tempel-Tuttle during the 2024 International Astronomical Union (IAU) General Assembly. These plates, which were essential in confirming the comet's rediscovery, trace back to the 1960s when German astronomer Joachim Schubart and international collaborators identified the elusive comet using archival data from Boyden Observatory in Bloemfontein. The delivery of these plates, facilitated by Dr Markus Pössel, Senior Outreach Scientist at the Max Planck Institute for Astronomy and Director of the IAU's Office of Astronomy for Education, marks the culmination of a cometary saga that spans over 650 years. It also underscores the University's pivotal role in this extraordinary astronomical journey. The images were captured using the Metcalf 10-inch telescope, which remains at the Observatory.



Dr Markus Pössel (left) hands the photographic plates of comet 55P/Tempel-Tuttle to Dawid van Jaarsveld during the 2024 International Astronomical Union (IAU) General Assembly in Cape Town



ACADEMIC CITIZENSHIP AND COMMUNITY ENGAGEMENT

Two Observatories project

The Two Observatories team had an extremely productive and exciting year. In addition to ongoing science communication and education activities, highlights include the breadth of events at the Naval Hill Planetarium, with the venue also attracting arts productions and community interest groups from the camera club to the antique Mercedes club. At Boyden Observatory, a highlight has been the addition of two new robotic telescopes, a research telescope managed by the Czech Republic and a telescope managed by a company in the United States, which is observing satellites from Boyden. The Observatories continue to be a major attraction for visiting academics and high-profile guests of the UFS, which attest to their unique offerings.

Visitors to the Planetarium

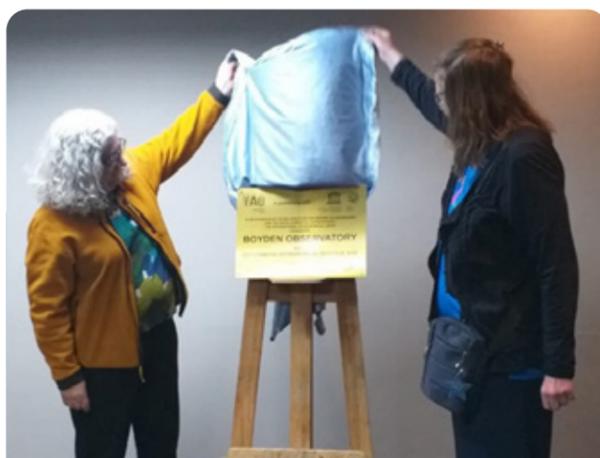
On 23 April 2024, a delegation from the US Embassy, including Ambassador Reuben Brigety and the Consul General in Johannesburg, Vincent Spera, visited the Naval Hill Planetarium. The connection between the observatories and the US dates to the 1920s since both observatories were established by universities in the US, namely Harvard University and the University of Michigan. Over the years, there has been regular contact between the UFS and many US organisations, including with NASA.

Prof Patrick Seitzer, Emeritus Prof of Astronomy at the University of Michigan and the international patron of the Friends of Boyden Observatory and the Naval Hill Planetarium, visited the Planetarium in April 2024. Prof Seitzer's presented a lecture to the public at the Planetarium on 27 April, on 'When Good Satellites Go Bad'. Before the presentation, he opened the Lamont Hussey Observatory in the foyer of the Planetarium and unveiled a plaque at Boyden Observatory on 26 April to commemorate the 20-year anniversary of the Boyden Observatory public facilities.



Pat Seitzer, Prof Patrick Seitzer, and Prof MJH Hoffman

A renowned group of astronomy heritage experts visited the observatories on 16 and 17 August 2024. Dr Sara Schechner, curator of Harvard University's Collection of Historical Scientific Instruments, Dr Ken Launie, former president of the Antique Telescope Society, and Prof Gudrun Wolfschmidt, IAU Chair of Commission C4WG Windows to the Universe: Classical and Modern Observatories, were in South Africa to attend the IAU Conference in Cape Town and made a special trip to Bloemfontein to see the Boyden collection in person. They provided invaluable insight into the historical instruments at Boyden Observatory and their enthusiasm and expertise were energising and inspiring. During their visit, they unveiled a plaque that will be displayed at Boyden Observatory, which confirms its designation by the IAU in partnership with UNESCO as an 'Outstanding Astronomical Heritage Site'.



Dr Schechner (left) and Prof Wolfschmidt (right) unveiling of the UNESCO Plaque at the museum

One exceptional production

The Naval Hill Planetarium was conceptualised and designed as a multi-functional venue and many music and theatre productions have been presented in the venue. Because of the capacity of the venue and its unique architecture and amphitheatre shaped auditorium, the Planetarium lends itself to intimate productions that are original and immersive. The dome and sound system contribute to the atmosphere and intensify aesthetic experiences. Most recently, producers have adapted productions or written plays specifically to take advantage of the Planetarium setting. This year, one production was worthy of special mention. *Die Waarheid oor Duiwe* was a rendition of a series of poems of Bloemfontein poet, Gisela Ulyatt, with original music composed for flute and piano. This production won the Vryskitters Award for 'Best Musical Production' during the Free State Arts Festival.

CLNS3702 Community Service Modules

This module is an elective credit-bearing course at the UFS. The purpose of the module is to improve content knowledge of science and math education students and give them practical experience in teaching learners from disadvantaged schools. Part of the course includes visits to Boyden Observatory for intensive workshop sessions. In 2024, 14 students enrolled in the CLNS3702 module.

POSTGRADUATE STUDENTS

During 2024 the Department delivered nine MSc graduates. On the Bloemfontein Campus, AO Mashalane, RA Abdallah, M van der Walt, J Cooper, TS Mbonani, and W Smit graduated with an MSc degree. On the Qwaqwa Campus, M Marole, D Molebatsi, and Q Nkomo graduated with MSc degrees.

Four candidates graduated with the PhD in 2024:

Vhahangwele Makumbane

Thesis: Down and up conversion layers for enhancing the performance of c-Si solar cell efficiency

Supervisors: Prof HC Swart, Prof RE Kroon, and Dr MYA Yagoub

Tebogo Motsei

Thesis: Nanostructured electrode and electrolyte for lithium-sulphur batteries in conjunction with self-healing Fe₂₄Cr electrodes for sodium-ion super-capacitors/batteries

Supervisors: Prof RO Ocaya (main) and Dr KG Tshabalala

Boitumelo Charlotte Tladi

Thesis: Construction of Co₃O₄/reduced graphene oxide heterostructure-based sensor with noble metal loading for LPG and propane detection

Supervisor: Prof RE Kroon

Co-supervisors: Prof DE Motaung and Dr ZP Tshabalala

Izak van der Westhuizen

Thesis: The modelling of synchrotron emission from active galactic jets using hybrid relativistic hydrodynamic simulations

Supervisor: Prof B van Soelen

POSTDOCTORAL RESEARCH FELLOWS

In 2024, the Department of Physics hosted fourteen post-doctoral research fellows – all involved in Solid-state Physics. They are:

- Dr VNK Basina, from India
- Dr EHH Hasabeldaim, from Sudan
- Dr D Janardhana, from India
- Dr PP Sukul, from India
- Dr RG Motsoeneng, from South Africa
- Dr NA Mustafa, from Sudan
- Dr GB Nair, from India
- Dr SN Ogugua, from Nigeria
- Dr SJ Panchu, from India
- Dr NJ Shivaramu, from India
- Dr SJ Tamboli, From India

- Dr ZP Tshabalala, from South Africa
- Dr MYB Yagoub, from Sudan
- Dr R Makole, from South Africa

STAFF MATTERS

Dr Kamohelo Tshabalala was appointed as Acting Assistant Dean in NAS Faculty from September 2024 to February 2025.



RESEARCH OUTPUTS

Research Articles

Abdalkreem, T.M., Swart, H.C. & Kroon, R.E. 2024. Novel protocol for rapid evaluation of plasmonic enhancement for up-converting phosphors applied to Y_2O_3 doped with Er^{3+} and Er^{3+}/Yb^{3+} . *Results in Optics* 16: 100704. DOI: 10.1016/j.rio.2024.100704.

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Barnard, J., Van Soelen, B., Acharya, S., Bottcher, M., Britto, R.J., Cooper, J., Buckley, D.A.H., Martin-Carrillo, A., Vaidya, B., Van der Westhuizen, I.P. & Zacharias, M. 2024. The optical spectropolarimetric behaviour of a selection of high-energy blazars. *Monthly Notices of the Royal Astronomical Society* 532: 1991–2005. DOI: 10.1093/mnras/stae1576.

Bashiar, O.K.M., Kroon, R.E., Swart, H.C. & Harris, R.A. 2024. Producing ZnO films that exhibited near-infrared (NIR) luminescence with a templated design procedure. *Physica B: Condensed Matter* 673: 415523. DOI: 10.1016/j.physb.2023.415523.

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Swart, H.C. 2024. *Guest of Honour.* Paper delivered at the International Conference on Physics for sustainable development (ICPSD-2024), Jammu, India. 4-5 April 2024.

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Tladi, B.C., Tshabalala, Z.P., Kroon, R.E., Swart, H.C. & Motaung, D.E. 2024. *Co₃O₄/rGO nanocomposite: Influence of Ag loading on LPG gas sensing characteristics.* Paper delivered at the 68th Annual Conference of the South African Institute of Physics, Rhodes University, South Africa. 1-5 July 2024.

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Conference Posters

Abdalkreem, T.M., Swart, H.C. & Kroon, R.E. 2024. *Plasmonic effect of gold nanoparticles on NaYF₄:Er, Yb up-converting phosphor.* Poster presented at the 58th Annual Conference of the Microscopy Society of Southern Africa, Bloemfontein, South Africa. 2-5 December 2024.

Abraha, Y.W., Motaung, D.E., Langner, E.H.G. & Swart, H.C. 2024. *Synergistic enhancement of Co₂-expoxide cycloaddition: A stable Ti₃C₂Tx@ML-SIF 9 (Mxene @ MOF) composite catalyst.* Poster presented at the 58th Annual Conference of the Microscopy Society of Southern Africa, Bloemfontein, South Africa. 2-5 December 2024.

Choeu, G.M., Swart, H.C. & Shingange, K. 2024. *Microwave-synthesized Zn₂SnO₄ nanostructures: Exploring the effect of annealing on morphological and structural properties.* Poster presented at the 58th Annual Conference of the Microscopy Society of Southern Africa, Bloemfontein, South Africa. 2-5 December 2024.

Divya, J., Shivaramu, N.J. & Swart, H.C. 2024. *Phase transformation from alpha-Bi₂O₃ to beta-Bi₂O₃ for enhanced photocatalytic degradation of rhodamine B.* Poster presented at the 58th Annual Conference of the Microscopy Society of Southern Africa, Bloemfontein, South Africa. 2-5 December 2024.

Duvenhage, M.M., Yagoub, M.Y.A., Lee, E., Swart, H.C. & Coetsee, E. 2024. *TEM and XRD investigation into the stability of strontium-doped CSPBI3 prepared under atmospheric conditions.* Poster presented at the 58th Annual Conference of the Microscopy Society of Southern Africa, Bloemfontein, South Africa. 2-5 December 2024.

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Kumar, B.V.N. & Kroon, R.E. 2024. *Influence of synthesis method on microstructure and luminescence of La₂Zr₂O₇:Bi, Tb pyrochlore phosphors.* Poster presented at the 58th Annual Conference of the Microscopy Society of Southern Africa, Bloemfontein, South Africa. 2-5 December 2024.

Lee, E., Harris, R.A., Terblans, J.J. & Swart, H.C. 2024. *Preparation of SrVO₃ thin films using spin coating.* Poster presented at the 58th Annual Conference of the Microscopy Society of Southern

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Makoloane, L.E., Terblans, J.J., Cronje, S. & Swart, H.C. 2024. *Phase evolution and surface morphology in copper-indium thin films: Stability of co-evaporated films.* Poster presented at the 58th Annual Conference of the Microscopy Society of Southern Africa, Bloemfontein, South Africa. 2-5 December 2024.

Makumbane, V., Yagoub, M.Y.A., Coetsee, E., Kroon, R.E. & Swart, H.C. 2024. *Structural and upconversion luminescence properties of pulsed laser-deposited $Y_2O_3:Ho^{3+}, Yb^{3+}$ thin films.* Poster presented at the 68th Annual Conference of the South African Institute of Physics, Rhodes University, South Africa. 1-5 July 2024.

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Nemulwi, M.I., Swart, H.C., Dhlamini, M.S. & Mhlongo, G.H. 2024. *Evaluation of the effects of Au addition into $ZnFe_2O_4$ nanostructures on acetone detection capabilities.* Poster presented at the 68th Annual Conference of the South African Institute of Physics, Rhodes University, South Africa. 1-5 July 2024.

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Nkomo, Q., Tshabalala, K.G., Swart, H.C. & Motloutung, S.J. 2024. *Effect of annealing temperature on barium zirconate ($BaZrO_3$)*

perovskites nanoparticles prepared by sol-gel method. Poster presented at the 58th Annual Conference of the Microscopy Society of Southern Africa, Bloemfontein, South Africa. 2-5 December 2024.

Pieterse, N., Harris, R.A. & Coetsee-Hugo, E. 2024. *Investigating the feasibility of designing a photon-based logic gate.* Poster presented at the 68th Annual Conference of the South African Institute of Physics, Rhodes University, South Africa. 1-5 July 2024.

Radebe, P.J. & Kroon, R.E. 2024. *Evolution of microstructure and upconversion luminescence of Tm, Yb-doped YF_3 during annealing for form Y_2O_3 .* Poster presented at the 58th Annual Conference of the Microscopy Society of Southern Africa, Bloemfontein, South Africa. 2-5 December 2024.

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Swart, H.C., Lee, E., Terblans, J.J. & Harris, R.A. 2024. *$SrVO_3$ thin films prepared using spin coating.* Poster presented at the 68th Annual Conference of the South African Institute of Physics, Rhodes University, South Africa. 1-5 July 2024.

Tladi, B.C., Tshabalala, Z.P., Kroon, R.E., Swart, H.C. & Motaung, D.E. 2024. *Insights into the morphology-performance relationship towards LPG sensitivity of Co_3O_4/rGO gas sensors loaded with silver nanoparticles.* Poster presented at the 58th Annual Conference of the Microscopy Society of Southern Africa, Bloemfontein, South Africa. 2-5 December 2024.

Tshabalala, Z.P., Swart, H.C. & Motaung, D.E. 2024. *Selective detection of Zolene compound utilizing $NiTiO_3/Co_3O_4$ heterostructures.* Poster presented at the 68th Annual Conference of the South African Institute of Physics, Rhodes University, South Africa. 1-5 July 2024.

Van der Westhuizen, I; Van Soelen, B; Vaidya, B. 2024. *Morphological differences in RMHD simulations of High and Low Lorentz factor AGN jets.* Poster presented at the 32nd General Assembly International Union (IAUGA 2024), Cape Town, South Africa. 6-15 Augustus 2024.

Yagoub, M.Y.A., Coetsee, E., Kroon, R.E. & Swart H.C. 2024. *Photoluminescent properties and stability investigation of Sr^{2+} doped $CsPbI_3$ nanocrystals.* Poster presented at the 68th Annual Conference of the South African Institute of Physics, Rhodes University, South Africa. 1-5 July 2024.

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Other Outputs

Patents

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STAFF (2024)

Head of Department:
Prof JJ Terblans

BLOEMFONTEIN CAMPUS:

| | |
|----------------------------------|--|
| Senior Professors: | Prof PJ Meintjes and Prof HC Swart |
| Professors: | Prof RE Kroon, Prof DE Motaung, and Prof JJ Terblans |
| Associate Professors: | Prof E Coetsee-Hugo, Prof RA Harris, Prof MJH Hoffman, and Prof B van Soelen |
| Affiliated Professors: | Prof KT Hillie and Prof G Mhlongo |
| Affiliated Associate Professors: | Prof JPK Hölsä, Dr V Kumar, and Dr J Prakash |
| Lecturers: | Dr S Cronje, DP van Jaarsveldt, H Szegedi, and IP van der Westhuizen |
| Researchers: | Dr M Duvenhage and LJB Erasmus |
| Senior Officer: | Dr HJ van Heerden |
| Officers Professional Services: | AJ Fourie, B Mohlala, and J Odendaal |
| Officer: | K Cronje |
| Assistant Officers: | Y Loots and D Mangope |
| QWAQWA CAMPUS: | |
| Subject Head: | Dr KG Tshabalala |
| Associate Professors: | Prof LF Koao and Prof RO Ocaya |
| Senior Lecturers: | Dr TP Mokoena and Dr KG Tshabalala |
| Lecturer: | Dr SJ Motloutung |
| Senior Officers: | V Adoons |
| Assistant Officers: | S Bogacwi |

DEPARTMENT OF
PLANT SCIENCES

FACULTY OF NATURAL AND AGRICULTURAL SCIENCES



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OVERVIEW OF 2024

The Department of Plant Sciences is a propulsive and unique department with a comprehensive approach, covering various aspects of plant science through its three divisions: Botany, Plant Breeding, and Plant Pathology. This interdisciplinary approach provides a well-rounded education and research environment. Plant Sciences fosters collaboration with both local and international researchers that demonstrates the staff's commitment to the growth and development of the Department which can significantly enhance its impact towards the Sustainable Development Goals. Teaching and learning are an integral part of the Department where staff members align the theory with application through diverse excursions at different teaching levels, enhancing job-related skills. During 2024, a total of 59 scientific papers were published in accredited journals, along with a book and four book chapters, while 76 presentations at national and international symposia, research days, and student symposia were delivered – confirming the active and productive research output of the Department. Many of these publications were co-authored with national and international collaborators which highlights the Department's strong global network and its role in contributing to the wider scientific community, enabling the Department to remain at the forefront of current developments in plant sciences. This was a year of growth and proof of Plant Sciences' dedication to both academic excellence and professional development, in which the Department hosted five Postdoctoral Fellows and more than a hundred postgraduate students, of whom 13 obtained BSc Honours degrees, 10 completed MSc degrees, and 6 MSc in Agriculture. Three Doctoral degrees were conferred.

ACHIEVEMENTS

Staff Achievements

Prof Botma Visser improved his NRF-rating in 2024 from a previous C2 to a current C1 rating. Prof Visser presented the keynote lecture at the 2024 edition of the Department of Botany and Plant Biotechnology Postgraduate Student Symposium at the University of Johannesburg titled 'Wheat rust surveillance in South Africa: past, present and future'.

Prof Maryke Labuschagne won the second prize in the 'Exceptional Supervisors Award' for 2024 at the UFS Exceptional Academic Achievers Awards.

Prof Sandy-Lynn Steenhuisen was invited to submit a full proposal to the Oppenheimer Memorial Trust New Frontiers Research Award after her concept note, aiming to refine the phylogeny of the *Protea* genus, was successfully accepted in January 2024. She was also a finalist for a National Science and Technology Forum (NSTF) Green Economy Award in July 2024. Prof Steenhuisen was invited to apply for a South African Research Chair position at UFS Qwaqwa in 2025, as part of the NRF's Decadal Plan Aligned Research Chairs initiative.

Dr Mpho Mafa was a semi-finalist in the NSTF Emerging Researcher Awards. He was also one of the UFS delegates that hosted an esteemed team from Botswana University of Agriculture and Natural Resources (BUAN), at which his research in the Carbohydrates and Enzymology Laboratory (CHEM-LAB) and its role in plant health and by extension its impact to food security and repurposing of the agro-waste were discussed. He was invited to participate as a panellist to the Early Career Researchers and Scholars (AECRS) at the South African Science Forum week, held at the CSIR Internation Convention Centre in December 2024.

Prof Rodney Moffet (UFS Qwaqwa Research Fellow) was awarded a Gold Medal by the Heritage Association of South Africa for his contribution to the preservation of indigenous knowledge and Basotho heritage.

Dr Dimitri Veldkornet was selected to advance from the Emerging Scholar Accelerator Programme to the Future Professoriate Mentoring Programme from 1 January 2025 to December 2026.

Prof Liezel Herselman was appointed as Vice-Dean of Teaching and Learning for the Faculty of Natural and Agricultural Sciences (NAS), after serving the Department of Plant Sciences as academic departmental head for more than 11 years.

Dr Angeline Jacoby was appointed as Programme Director for the Department. She was elected as treasurer to serve on the Southern African Plants Breeders' Association (SAPBA) executive committee during the 15th Southern African Plant Breeding bi-annual symposium that was held at the Monte Bella Estate in Bloemfontein, from 11to13 March 2024.

Student Achievements

Thabiso Masisi was selected to present a poster and Jesumayowa Ajidahun delivered a paper ('Exogenous abscisic and salicylic acids improve wheat tolerance to Russian wheat aphid Infestation') at the NRF Next Generation and Emerging Researchers Symposium held in Johannesburg in October 2024.

During the annual Faculty Prize-Giving various under- and postgraduate students received prizes.

In Plant Pathology, Sthandiwe Hlongwane received the best second-year incentive prize, Arinao Magwaba received the award for the best third-year student, and Amy Coetzer for the best Honours student. Lineo Maphobole was recognised for an exceptional MSc in Plant Pathology.

In Botany, Mercy Tsubella was awarded the Botanical Society of South Africa (Free State Branch) prize for best second-year student, Jaki du Plooy received the Van Schaik prize, the Botany prize, as well as the Botanical Society of South Africa (Free State Branch) prize for the best third-year student, Gaopalelwe Motshegwa was awarded the Botanical Society of South Africa (Free State Branch) prize for best Honours student, and



Dr Mpho Mafa

Christiaan Johannes Botha received the Botany prize for the best MSc student.

In Plant Breeding, the following students were awarded prizes in the different categories: Wian Botma (best second-year student), Janetta Strydom (best third-year student), Karabo Pule (best Honours student), Faith Kobedi (best MSc student), and Grant Richardson (best Doctoral student).

Amy Coetzer was awarded Best Presentation (in Afrikaans) at the Annual Conference of the South African Academy for Science and Arts hosted by the UFS on 30 and 31 October 2024.

Six students from the Department attended the 2024 edition of the Department of Botany and Plant Biotechnology Postgraduate Student Symposium at the University of Johannesburg (UJ) on 21 October. Doctoral candidate Selloane Lehasa (Qwaqwa Campus), supervised by Dr Pheello Mojau, won first prize for her PhD presentation, with Jeremiah Hlahla (Bloemfontein Campus) claiming the third prize. The Department is proud of our students' outstanding achievements, the professional way in which all presented their research, as well as the fun they had networking with peers from UJ.



Jeremiah Hlahla (left – from the Bloemfontein Campus) and Selloane Lehasa (right – from the Qwaqwa Campus) at the University of Johannesburg Postgraduate Symposium

Ntjabane Alfred Ntjabane received the certificate and Silver Medal in the Honours research projects' category at the Library & Information Services Honours and Undergraduate Research Seminar

(LISHURS) in 2024.

Mamosela Mohotloane received a bursary from the Council for Scientific and Industrial Research (CSIR) Department of Science and Innovation (DSI) Inter Programme Bursary Scheme (IBS) to continue with her PhD studies in 2025.

On the Qwaqwa Campus, Master's student Thembelihle Mbele was awarded the Best Student Presentation Award at the National Symposium on Biological Invasions in Kimberley (9 to 12 September 2024) and at the 19th Kimberley Biodiversity Research Symposium (18 September 2024). Doctoral student Lehlohonolo Donald Adams was awarded first prize for his speed presentation at the South African Wildlife Management Association Conference (6 to 11 October 2024), in Windhoek, Namibia, and second prize for his student presentation at the 16th Annual NRF-SAEON Graduate Student Network Indibano (16 to 20 September 2024) in Gqeberha. Masters' student Siyanda Shabalala was awarded a CSRC Leadership award at the UFS 2024 Executive Director of Student Affairs Prestige Awards in Bloemfontein (12 October 2024).

Karabo Moloji, a Doctoral candidate, was selected to be a part of a documentary, commissioned by Prof Vasu Reddy, UFS Deputy Vice-Chancellor for Research and Internationalisation, which will premiere at the 2nd Southern African Mountain Conference in 2025.



Karabo Moloji being interviewed for the documentary

Qwaqwa Master's student Zinhle Sithole received two bursaries – one from the South African Association of Botanists and a second from the Centre for Biological Control, Rhodes University. Arni le Roux, another Qwaqwa Master's student, received a bursary from the Centre for Global Change and a tuition bursary from the Ernst and Ethel Ericksen Trust.

Lesego Malekana, a Masters' student, was awarded a Swiss Government Excellence Scholarship to pursue his PhD under Dr Jake Alexander at the prestigious ETH Zürich, a leading science and technology institute in Switzerland.

Diana Mngomezulu won second prize in the Master's category at the annual Flash Fact competition in the NAS Faculty.



Diana Mngomezulu

TEACHING AND LEARNING

Dr Andri van Aardt and Dr Lize Joubert accompanied the third-year Botany students on an excursion to Moolmanshoek in the eastern Free State. The students had the opportunity to learn about field sampling and data collection techniques, the biodiversity of the Free State grasslands, and the impact of rehabilitation on degraded vegetation.

The Botany excursion module, BTNY2621, has increased in enrolment from 14 in 2022 to 25 in 2024. At the end of August, the students were exposed to new plant ecophysiological techniques used in the

field and taught to capture and process data at the Amanzi Game Reserve, 40 km from Bloemfontein. Dr Dimitri Veldkornet and Dr Mokoena (Boke) Moloji facilitated the excursion and were delighted by the enthusiasm and effort made by the students when they presented their findings to the lecturers and demonstrators. The overall feedback from the students was encouraging and lectures are hopeful for a larger number of students participating in the excursion in 2025.



Students on the Botany excursion 2024

During the first semester of 2024, Prof Steenhuisen led a number of off-site fieldtrips to Witsieshoek Mountain Lodge and the Royal Natal National Park for the third-year Vegetation Ecology module, where students were trained in vegetation sampling techniques and plant identification, and were able to experience the natural beauty of the areas surrounding the UFS Qwaqwa Campus. Additionally, from 8 to 10 March the Vegetation Ecology students went on a weekend fieldtrip to Golden Gate Highlands National Park, in conjunction



Students on field trip to Golden Gate Highlands National Park

with the Behavioural Ecology module taught by Prof Aliza le Roux of the Department of Zoology and Entomology. During this fieldtrip students from both courses collaborated to collect data and teach each other new techniques for the collection of field data for both plants and animals.

Dr Dalene Meintjes, from the UFS Centre for Teaching and Learning invited, Dr Rudo Ngara and Prof Steenhuisen to present a poster at the 2024 Annual UFS Learning and Teaching Conference held in September. The presentation summarised the work-integrated learning activities that the two academics incorporate in their day-to-day teaching engagements at both undergraduate and postgraduate levels.



Prof Sandy Steenhuisen and Dr Rudo Ngara at the UFS Learning and Teaching Conference

As part of the online seminars to MSc students who register for the Plant Breeding and Protection for Sustainable Production course in the Department of Plant Protection Biology at the Swedish University of Agricultural Sciences, Alnarp, Sweden, Dr Jacoby and Prof Boshoff presented lectures titled 'Nutritional improvement through biofortification' and 'Stem rust in wheat – the Southern African perspective', respectively.

In May 2024, Dr Moloï visited the University of Debrecen in Hungary through the Erasmus Teaching Mobility Program, and she also hosted Prof Brigitta Tóth to strengthen the academic collaboration.

RESEARCH, INNOVATION AND RESEARCH COLLABORATION

SARChI Chair on Disease resistance and quality in field crops

2024 was the ninth year of the SARChI Chair on Disease Resistance and Quality in Field Crops (held by Prof Maryke Labuschagne). The pathology part of the chair, led by Prof Willem Boshoff and Prof Botma Visser, concentrated on monitoring the rust disease causing fungal populations of important crops in South Africa; survey and genotypic characterisation of rust species of South African grasses; genetic reconstruction of three South African cereal rust populations using herbarium specimens; sequence analysis of the *avrSr35* and *avrSr50* genes in the South African *Pgt* (wheat stem rust) population; genetic and functional analysis of resistance/tolerance against strobilurin and azole fungicide application in the South African *Pgt*, *Pst* (wheat stripe rust) and *Pt* (wheat leaf rust) populations, and inhibition of their urediniospore germination and growth with smoke; molecular survey of *Berberis* species in South Africa; molecular and biochemical characterisation of the adult plant disease resistance response of wheat varieties against *Pgt* infection; and the molecular basis of all stage resistance of selected South African wheat cultivars and potential new germplasm sources.



On the quality side, led by Prof Labuschagne and Dr Angeline Jacoby, the project on the influence of heat and drought stress and a combination of the two on gluten protein and quality in durum and bread wheat, was completed, as was the project of the effect of the *wheat bread-making (wbm)* gene on protein quality. The project on resistant starch in South African wheat cultivars as a source of dietary fibre is still underway. The project on crop biofortification (maize, legumes and sorghum) and nutritional value has generated very good outcomes both in terms of research outputs and the release of commercial genotypes for production. Several students have completed their MSc and PhD degrees on the chair projects and the research led to several conference presentations, and publications in accredited journals. Prof Labuschagne collaborated with the University of Córdoba in Spain, with the International Institute for Tropical Agriculture in Nigeria and Zambia, with the International Crops Research Institute for the Semi-Arid Tropics in Kenya and Zimbabwe, the International Maize and Wheat Improvement Centre (CIMMYT) in Zimbabwe and the University of Namibia. Nationally she collaborated with the Agricultural Research Council.

Botany: Plant physiology/ biochemistry and molecular biology

Dr Arun Gokul continued with research regarding candidate microbial biocontrol agents (identified previously). These biocontrol agents were tested both *in vitro* and *in vivo* and showed no adverse effects on the growth and health of commodity crops treated; however, a marked reduction in disease incidents was observed. The potential control mechanism was different for each putative biocontrol isolate, with some affecting the nutrient solubilisation within the plants and others producing volatile organic compounds to deter colonisation and growth of the phytopathogen. He and his team also moved on to assessing how the introduction of this technology would impact existing agricultural practices. Dr Gokul is involved in a collaboration between the UFS and the University of the Western Cape (running for the fourth year). The team also continued a collaboration with the University of Zululand. The projects focus on the utilisation of endophytes and

other endosymbiotic microorganisms as biological agents to enhance plant resistance to pathogens, improve tolerance to abiotic stresses, and promote growth through biostimulator mechanisms. This collaboration has resulted in seven peer-reviewed articles in high impact factor journals.

Dr Boke Moloï specialises in plant ecophysiology, focusing on how abiotic stressors, like drought and elevated temperatures, and their combination affect the physiological, biochemical, and morphological responses of crops. She also leads a project exploring the use of natural biostimulants, biodegradable compounds, and micronutrients to mitigate these stresses in agricultural crops. Her work is vital for developing solutions to boost crop production in the face of climate change. Dr Moloï collaborated with Prof Ned Bowden from University of Iowa, USA, on a project involving the use of Cysteine derivatives for the improvement of drought tolerance in edamame. Dr Moloï and Dr Mafa worked on the edamame project investigating the role of the carbohydrates and amino acid osmolytes during drought or combined heat and drought stress, as well as the contribution of cell wall adjustment and modification during the abiotic stress. Dr Moloï also has an ongoing collaboration with Prof Brigitta Tóth, from the University of Debrecen, Hungary, on a project involving a PhD student who they jointly supervise. She visited the University of Nyíregyháza in Hungary, where she gave a lecture on 'Selenium's impact on enhancing drought tolerance in edamame'. During this visit she established a collaboration with Dr Csilla Tóth, a specialist in stress physiology, on heat and drought stress physiology at ultrastructural level.



Dr Rudo Ngara continued with her research investigating the molecular responses of selected cereal crops to drought stress, using multi-omics approaches. A notable highlight from her research group was the observed enrichment of photosynthesis-related proteins that were highly suppressed in the drought-tolerant maize variety, possibly to reduce photosynthesis-related oxidative stress damage under conditions of limited water supply. These results form part of Sellwane Moloi's Doctoral thesis, under examination and published in 2024, in collaboration with Dr Gokul and Dr Boke Moloi. Data analyses for the drought-responsive sorghum root transcriptome are underway, while preliminary RNA-SEQ data for the root drought-responsive microRNA have been generated. These data are pivotal in shaping Dr Ngara's future research focus. Dr Ngara collaborates with Dr Nemera Shargie from the Agricultural Research Council-Grain Crops on all her sorghum projects, and with Dr Dirk Swanevelder from the Agricultural Research Council-Biotechnology Platform & Core Facility on a sorghum transcriptome project. She continues to work with Stephen Chivasa from Durham University, UK, mainly on the metabolome and proteome analyses of plants in response to water deprivation.

Prof Botma Visser continued his research on wheat rust surveillance in South Africa through the PhD study of Isabella du Toit. The aim of her study is the implementation of MARPLE technology to rapidly identify variants of *Puccinia graminis* f. sp. *tritici* and *Puccinia striiformis* f. sp. *tritici*, that cause stem and stripe rust of wheat, respectively. This is done in collaboration with Prof Diane Saunders of the John Innes Centre (JIC) in Norwich, UK. As part of her study, Isabella spent two months at the JIC during which she received training on the MARPLE system. The collaboration with Prof Saunders resulted in a paper titled 'Comparative genomics identifies genetic markers linked to structural variations that differentiate *Puccinia graminis tritici* and *secalis formae speciales*'. A second project, by Jaki du Plooy, focused on the identification of possible effector genes involved in the wheat-*Puccinia graminis* f. sp. *tritici* pathosystem. Two possible effector genes were identified that will form the focus of her MSc study starting in 2025. Prof Visser's collaboration with Prof Melania Figueroa from the CSIRO in Australia resulted in a paper titled

'Genome-enabled analysis of population dynamics and virulence associated loci in the oat crown rust fungus *Puccinia coronata* f. sp. *Avenae*'.



The Carbohydrates and Enzymology Laboratory (CHEM-LAB) led by Dr Mpho Mafa includes research on plant carbohydrate metabolism, Carbohydrates-Active enzymes' (CAZymes) physiological functions during plant-pathogen/pest interaction, and the application of CAZymes in the synthesis of value-added products (VAPs) for the circular economy. All the work done by postgraduate students (Honours, MSc, and PhD) was overseen by Dr Mafa and published in four research articles in 2024. Dr Mafa worked with Dr Mohase and Dr Vicki Tolmay (Agricultural Research Council), on the wheat-aphids interactions projects, in which he studies the role of CAZymes and adjustments of carbohydrate metabolism during wheat infestation by aphids and he elucidates the protective function of the cell wall reinforcement processes during wheat infestations. He also investigated the CAZymes that have potential to be classified as effectors that make wheat susceptible to aphid infestation.

Dr Mafa also applied the carbohydrates or CAZymes in the biorefinery sector for the production of VAPs. He studied the chemical composition of the lignocellulose of the agricultural waste/biomass with high holocellulolytic content, develop enzyme cocktails that can extract and saccharify the holocellulolytic content to produce simple sugars that can be fermented to produce value added chemicals, e.g. ethanol, butanol, short fatty acids, and aromatic compounds. On this project he

collaborates with Dr S Malgas (University of Pretoria), Prof BI Pletschke (Rhodes University), and Prof Aniko Varnai (Norwegian University of Life Sciences).

The current projects under Dr Lintle Mohase's supervision focus on the interaction of wheat (*Triticum aestivum* L.) and the Russian wheat aphid (*Diuraphis noxia*, Kurdjumov). The team strives to dissect and describe various resistance components in host plants, including the biosynthetic pathways of defence-related metabolites, especially phytohormones, reactive oxygen species, and antioxidants. Additionally, components are profiled for aphid saliva in search of potential elicitors or effectors in wheat-aphid interactions. In striving for integrated pest management in the changing climatic conditions, they study the effect of drought on host resilience to the Russian wheat aphid and the mode of resistance therein. They also investigate the potential of various compounds, including salicylic acid, silicon, selenium, and fungal pathogens, as priming agents that confer host resistance to aphids. Lastly, the team assess the potential loss of aphid sensitivity to commercial insecticides. Dr Mohase and her team are supported in their research through their collaboration with Dr Astrid Jankielsohn, an entomologist from the ARC specialising in cereal aphids and their impact on wheat production, assessment of aphid responses to insecticides and co-supervision of students.



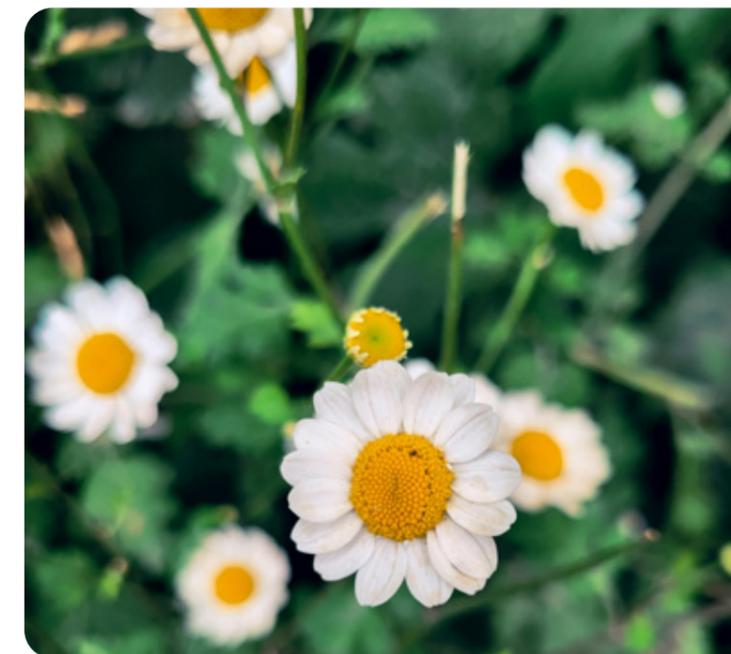
Botany: Phytomedicine and ethnobotany

Dr Pheello Mojau 's research involves bioprospecting for affordable and readily accessible herbal remedies for both diabetes mellitus and cancer. The aim is to reduce the dependence of sufferers of those diseases on Western/orthodox medicines that come with deleterious side effects. This research includes determining antimicrobial, antimycobacterial, anticancer and antidiabetic properties of medicinal plants. Dr Mojau continued to collaborate with Prof Rialet Pieters from North-West University on the study of anti-cancer properties of *Dioscorea sylvatica*.

Botany: Plant taxonomy and molecular systematics

Dr Lize Joubert (the curator of the GeoPotts Herbarium on the Bloemfontein Campus), and representatives from the Qwaqwa Herbarium collaborated with the National Science Collections Facility (NSCF) at the South African National Biodiversity Institute (SANBI) to image all the specimens in their main collections. During the next phase of this project the specimen data and images will be made available online to support research on the flora of central South Africa. This is a step towards developing the herbarium into a world-class herbarium with an online database.

Dr Mariëtte Jackson's research focuses on plant molecular systematics. In 2024, the systematics of



genus *Garuleum* (Asteraceae) were published, and more work is planned for the phylogeny of genus *Curio*, in the same family. Dr Joubert and Dr Jackson collaborated with Pieter Bester from SANBI on the systematics of *Nemesia*, a genus of indigenous snapdragons. The team was awarded a Botanical Education Trust Grant to continue the research in 2025. Dr Jackson also collaborates with Dr Lisa Rothmann on the soybean project, identifying seedborne diseases with molecular techniques and one student submitted his Masters' dissertation for examination end of 2024.

Botany: Palaeo-botany and ecology

Dr Andri van Aardt continued her research on pollen cores from Colbyn and the Rietvlei Dam from the Gauteng region, supplied by Dr Piet-Louis Grundling and co-workers and dated by Stephan Woodborne at iThemba LABS. Together with Prof Louis Scott, she collaborated with Palooma de la Perha Universidad de Granada, Spain, on a project on Marshall Rock Shelter (Eastern Cape) and with Piet-Louis Grundling and Althea Grundling on the reconstruction of past environments at Colbyn wetland. Dr Van Aardt also collaborated with Dr Michael Toffolo from CENIEH in Spain on the PEOPLE project, exploring the role of changing environments in the adaptation strategies of *H. sapiens* in the Middle and Late Pleistocene in the central interior of the country. This project also includes other researchers from Germany and the USA.

In terms of modern ecology, Dr Van Aardt is working on mapping of various vegetation types in the Free State in collaboration with Anisha Dayaram at



SANBI. She is also investigating various soil-plant relationships in National Parks across South Africa, with Prof Johan van Tol from the UFS Department of Soil Sciences at UFS.

Prof Louis Scott continued his research studies on several South African palaeoenvironmental sites. He worked with Dr Abraham Dabengwa, a postdoctoral researcher at the University of Witwatersrand, on the late Quaternary fire history of the savanna biome, and with researchers from North-West University on projects on modern pollen analysis. Both Prof Scott and Dr van Aardt collaborated with researchers from Spain on Marshall in the Eastern Cape.

Nomcebo Mngomezulu, under the supervision of Dr Dimitri Veldkornet, completed her MSc study on 'Salt marsh habitat loss due to erosion of the Berg Estuary, South Africa', which has contributed to the understanding of the vegetation and invertebrate species dynamics at the Berg River estuary in the face of ongoing erosion.

The RangeX project, funded by the Department of Science and Innovation (DSI) through a BiodiverSA call (Horizon 2020), is a collaborative reciprocal climate-change and transplant experiment consortium of international ecologists led by South African principal investigator Prof Ralph Clark (UFS Afromontane Research Unit [ARU]) and Swiss principal investigator Dr Jake Alexander (ETH Zürich), and includes collaborators from Switzerland, Norway, Denmark, Sweden, Germany, Chile, China and Australia. The project continued with several helicopter-aided research fieldtrips to their Alpine Research Station on the plateau of the Amphitheatre at 3100 masl in the Maloti-Drakensberg. South African co-PI Prof Steenhuisen, Postdoctoral Research Fellow Dr Stephanie Payne, UFS Plant Sciences affiliate Dr Onalenna Gwate, Master's student Lesego Malekana, and several team members from the ARU and Centre for Biological Control (CBC) at Rhodes University, conducted their third and final full cycle of plant trait measurements and camera trap observations to assess the effects of elevation and warming on range expanding plant species. Alongside other insect and pollinator data, Prof Steenhuisen and Dr Payne collected camera trap images of insect visitors to transplanted *Scabiosa* flowers. The images will be annotated and analysed with the aim of using the

images to train machine learning models to identify insect visitors to flowers, in partnership with Dr Jamie Alison at Aarhus University, Denmark. Lesego Malekana completed his Master's project on impacts of bush encroachment by woody Rosaceae species up an elevational gradient, as a component of the RangeX project.

As part of the outcomes for the RangeX project, Lesego Malekana and Dr Payne participated in a Policy and Practice Workshop, hosted by the ARU at the 59th Annual Congress of the Grassland Society of Southern Africa on 26 August, during which the results from the RangeX project were presented to various stakeholders. The South African RangeX team also travelled to Todtnauberg, Germany, to participate in the annual RangeX writing retreat. Here, progress of each of the regional projects was shared, data management was standardised, publications were planned and drafted, and future plans for continuing projects were discussed. Although the RangeX project reached completion in April 2024, when cameras were decommissioned, the RangeX site and the Alpine Research Station remain active for other projects to be conducted through the ARU.



UFS Qwaqwa Campus participants at the RangeX writing retreat (back row: first on the left, Prof Ralph Clark (ARU); middle row: second from the left, Lesego Malekana, and third from the right, Prof Sandy-Lynn Steenhuisen; kneeling: first from the right, Dr Onalenna Gwate, and third from the right: Dr Stephanie Payne)

The Northern Temperate Weeds project, led by Prof Grant Martin and Dr Kim Canavan, members of CBC at Rhodes University (both UFS Plant Sciences affiliates), continued with existing projects and launched new projects in 2024. Lehlonolo Adams completed his PhD assessing fleshy-fruited alien plant invasions in eastern South African grasslands, using community perceptions, seed germination and dispersal, and repeat photography. Karabo Moloji (PhD candidate) continued with her project assessing the potential role that invasive Rosaceae species may be playing as ecosystem engineers, and Zinhle Sithole (MSc) started her project untangling the possible cryptic invasion of a second *Rosa* species in the eastern Free State grassland. Siyanda Shabalala (registered in Department of Geography, under Prof Clark) is conducting research for his Master's on the importance of invasive woody species for the environment and surrounding Qwaqwa community. Sphindile Dlamini (registered in the Department of Zoology and Entomology, under Prof Le Roux) is conducting research on how the Qwaqwa community use invasive Australian Acacias and assessing the interactions of the *Acacia* species with seed dispersers. Tapiwanashe Mashamba submitted his MSc research on the invasive status of two Willow species in the eastern Free State and found that while the charismatic Weeping Willow seems to be in the decline, populations of the other, lesser-known Crack Willow are stable to increasing. Thembelihle Mbele completed her MSc research on the genetic diversity and distribution of pampas grass and was awarded two separate prizes for her research at two biological invasion conferences this year. Sanele Mfusi conducted a study on the distribution of two invasive Toadflax species in South Africa as part of his honours project for 2024. Both Thembelihle Mbele and Sanele Mfusi are developing risk analyses for these invasive species that could inform future policy regarding these species.

Lumko Mboyi (Director of Sustainability and Ecology for Conservation Exposure Education and Training [CEET] in KawZulu-Natal) continued with his MSc research on the invasion pattern and impacts of *Nassella tenuissima* in the Eastern Cape regions of the Drakensberg, in partnership with Prof Clark (ARU), Dr Anthony Mapaura (ARU), and Dr Canavan (CBC, Rhodes University).



[Photo credit: Anthony Mapaura]

Arni le Roux started his Master's project on macroinvertebrate assemblages and vegetation dynamics of high-elevation wetlands of the Eastern Escarpment of South Africa (with Dr Kyle Lloyd [Birdlife South Africa], Prof Michelle Greve [University of Pretoria], and Prof Mark Robertson [University of Pretoria], as co-supervisors). Thulile Buthelezi continued her Master's project evaluating the reproductive ecology of the endemic cushion plant *Euphorbia clavarioides*, which appears to be pollinated by flying insects.

Prof Sandy Steenhuisen continued her main collaboration with Prof Martin and Dr Canavan from the Centre for Biological Control (Rhodes University), with whom she co-supervises seven postgraduate students. This collaboration resulted in a new collaboration with another esteemed CBC researcher, Prof Martin Hill, as they form part of a supervisory team for a new Master's student, Mukololo Khaku, along with Dr Michelle Tedder (University of KwaZulu-Natal) and Prof Doug Harebottle (Sol Plaatje University). This resulted in a new international collaboration with Dr Andrew McConnachie of the Australia NSW Department of Primary Industries. Another new collaboration between Dr Tedder, Prof Harebottle, Prof Martin, and Dr Gokul was implemented late in 2024, with new setups of the Drought-Net project (Drought-Net) in Clarens and Kimberley being planned for 2025.

Prof Steenhuisen has also continued collaboration with Prof Colleen Downs (UKZN), co-supervising a

PhD candidate funded by the South African National Biodiversity Institute (SANBI), and the CBC. She also externally supervises one Doctoral candidate and one Master's student with Prof Glynis Goodman-Cron (University of the Witwatersrand) and one Masters' student with Dr Michelle Tedder (UKZN).

As part of the research on untangling the *Protea* phylogeny, Prof Steenhuisen collaborated with Prof Nora Mitchell (University of Wisconsin Eau-Claire, USA), Prof Robert Raguso (Cornell University, USA), and Prof Elizabeth Arnold (University of Arizona, USA). Prof Mitchell and three postgraduate students travelled to South Africa in January 2024 to conduct fieldwork on proteas and to attend the 49th annual South African Association of Botanists Conference in Richards Bay, KwaZulu-Natal.



Participants of the 49th Annual South African Association of Botanists Conference, hosted by the University of Zululand in Richards Bay, KwaZulu-Natal. From the left, Chase Fillion (University of Wisconsin-Eau Claire), Prof Nora Mitchell (University of Wisconsin-Eau Claire), Prof Sandy-Lynn Steenhuisen (UFS Plant Sciences), Anna Fregien and Carolyn Hansen (University of Wisconsin-Eau Claire)

Prof Steenhuisen is furthering her collaboration with the Mountain Invasion Research Network (MiREN), as she, along with members of the MiREN network, work together to implement new MiREN monitoring transects as part of her application for a SARCHI chair at UFS Qwaqwa.

Plant Breeding: Molecular plant breeding

Breeding disease-resistant crop varieties is a common goal for plant breeders across the globe to ensure the sustainability and growth of production of economically important crops. Prof Adré Minnaar-Ontong's research focuses on resistance breeding against *Sclerotinia* stem rot (SSR) in soybean, soybean sudden death syndrome (SDS), and associated phytotoxins as well as resistance to mycotoxins produced by *Fusarium* head blight (FHB) causal pathogens with the application of marker-assisted selection to integrate and combine major and minor effect genes or QTLs. She collaborates with breeding companies from industry, and researchers from the Agricultural Research Council and the University of Pretoria.

The *Sclerotinia* resistance research identified five South African soybean cultivars with partial resistance to *Sclerotinia* stem rot. These cultivars have now been included in a pre-breeding programme to further enhance resistance to SSR in local cultivars with the aim to improve soybean production in South Africa. One MSc student (Faith



Detached leaf assay used to evaluate susceptibility of South African soybean cultivars to *Sclerotinia* stem rot

Kobedi), who worked on this project, obtained her MSc Agric degree at the April 2024 graduations. With collaborators, the *Sclerotinia sclerotiorum* culture collection was established with more than 1000 isolates from eight of the nine South African provinces across multiple crops. The collection is maintained at UFS Plant Breeding.

A pre-breeding programme for Soybean sudden death (SDS) resistance was initiated using marker-assisted breeding approaches after the evaluation of the South African commercial soybean as well as edamame germplasm for potential resistance to this destructive disease. Furthermore, a diversity study was initiated to determine the causal pathogen of SDS as well as the distribution of the fungal species involved, in collaboration with the University of Pretoria. The culture collection for the collected *Fusarium* species is also maintained at UFS Plant Breeding.

Breeding for resistance against the mycotoxins associated with FHB causal species is important and contributes to food safety, impacting food security and sustainability. This research is funded by the SARCHI Chair in Disease Resistance and Quality of Field Crops. Several *Fusarium* species associated with FHB were identified, but *F. graminearum* was identified as the predominant causal species in South Africa. The mycotoxins involved, pose a threat to both human and animals. Knowledge gained from analyses will assist with the development of effective management and control strategies, i.e. resistance breeding against FHB and the mycotoxins associated. This will assist with improving wheat production in South Africa.

Dr Chrisna Steyn's research focuses on breeding for resistance against fungal diseases across a diversity of legume crops, particularly on diseases initiated by *Sclerotinia sclerotiorum* and *Fusarium* spp. on economically important legumes such as soybeans, cowpeas, pigeon pea, and Bambara groundnut. Research includes identification and profiling (morphology and DNA) of fungal isolates collected from legumes (cultivars and landraces) across South Africa. She uses different screening methods to optimise disease evaluation and resistance of the different legumes to the fungal pathogens involved. The information gained, will assist to promote improvement of disease management and

control strategies. This research is undertaken in collaboration with Prof Minnaar-Ontong and Prof Rouxlene van der Merwe as part of the ARC-DALLRD-UFS research chair, breeding vegetables and grains research focusing on breeding climate-resilient, nutrient-rich and disease-resistant legumes for human and industrial uses.



Cowpea greenhouse trial

Prof Van der Merwe's research focuses on breeding for resistance to pod shattering in vegetable-type soybean (in collaboration Prof Qiuying Zhang from the Northeast Institute of Geography and Agroecology at the Chinese Academy of Sciences). This research continued to make progress towards the development of an improved South African vegetable type soybean cultivar that shows resistance to pod shattering. Prof Adré Minnaar-Ontong assisted with marker-assisted selection of progenies grown in field trials. One MSc student (Kelvin Hlatshwayo) obtained his MSc Agric degree during the April 2024 graduations.

Plant Breeding: Conventional breeding

Prof Rouxlene van der Merwe's research on breeding for tolerance to drought and heat stress in vegetable-type soybean continued to make progress. This project, funded by the NRF-Competitive Support for Unrated Researchers, is done together with Dr Angeline Jacoby and Dr Boke Moloï, who assisted with the physiological and biochemical response analyses. Robert Coertzen obtained his MSc Agric and Estiaan Coetzee his BSc Hons degree during the April 2024 graduations.

Research on the impact of water-limited-stress on the morphology, physiology and nutritional quality of dry bean was completed in 2024. This project aimed to characterise dry bean cultivars in terms of drought stress tolerance and nutritional quality. This project was done in collaboration with Dr Jacoby, who assisted with nutritional quality analysis, Dr Moloï, who assisted with physiological response analyses, and Dr Deidré Fourie (Dry Bean Producers' Organisation), who co-supervised Lesole Sefume, who obtained his MSc Agric degree with distinction during the December 2024 graduations.

Prof Van der Merwe continued her research collaboration with TransFormus to evaluate the effect of enOrmus and Soil Life Combo on plant biomass and yield of vegetable-type soybean and maize cultivars under field and glasshouse conditions. The aim of this collaboration is to evaluate the effectiveness of using the different plant biostimulants on crop biomass and yield and to determine possible phytotoxic effects on plants. The report developed by Prof Van der Merwe will assist with the registration of the newly developed biostimulants as group 3 fertilizers with the Department of Agriculture, Forestry and Fisheries. This project is also done in collaboration with Dr Elmarie van der Watt at Agronomy (UFS). One student (Brandon da Paixao) obtained his BSc Agric Hons degree during the April 2024 graduations. Brandon also enrolled for the MSc Agric using the same project and submitted his MSc dissertation in November 2024.



Soybean greenhouse trial

Prof Van der Merwe initiated research collaboration with Dr Armand Smit, the KwaZulu-Natal Agricultural Technical Manager at Green Farms Nut Company,

on a project to establish a correlation between thrip insect levels on macadamias to nitrogen and calcium in the macadamia leaf. This project is being funded by Macadamias South Africa.

Dr Kwame Shamuyarira is involved in the Sorghum pre-breeding project, 'Evaluation of exotic germplasm as a precursor to sorghum pre-breeding', with Sorgho Pvt Ltd and the University of KwaZulu-Natal. Since when varieties were last released in South Africa, no new varieties have been developed. The team is currently importing germplasm from different sources globally to evaluate them locally and start a pre-breeding programme. Superior lines will be selected for further breeding to develop new varieties that are locally adapted to South Africa. The new varieties will help stimulate the growth of the sorghum industry in South Africa.

Plant Breeding: Wheat-quality and crop-nutritional value research

Dr Angeline Jacoby continued with research on the influence of abiotic stress on the nutritional profile and quality of crops such as wheat, maize, vegetable-type soybeans, dry beans, sorghum, and cassava. Nutritional screening includes the study of storage protein through size exclusion and reverse-phase high-performance liquid chromatography, including the determination of total starch, amylose, tryptophan, tannins, mineral content (especially iron and zinc) and the bioavailability of these minerals.

Dr Jacoby collaborated with Prof Maryna de Witt from the UFS Department of Sustainable Food Systems and Development on the study of proteins in *Opuntia* genotype mucilage. She also collaborated with Dr Amelework Assefa from the ARC-Vegetable, Industrial and Medicinal Plants on a casava project focusing on the nutritional value of the crop, and Prof Erik Alexandersson and D. Sajeevan Radha Sivarajan from the Swedish University of Agricultural Sciences in Alnarp, Sweden.

Plant Pathology: Cereal rust diseases

Prof Willem Boshoff continued with wheat cultivar and breeding line assessment for resistance to



Prof Willem Boshoff

rust pathogens. This research involves annual greenhouse and field screening with selected races of the three rust pathogens of wheat. During 2024, field trials were carried out near Greytown, KwaZulu-Natal. Results from this industry-funded project are annually shared with wheat breeders and published

in the National Wheat Production Guidelines of Agricultural Research Council-Small Grains (ARC-SG). This collaboration resulted in a paper on surveillance of *Puccinia graminis* f. sp. *tritici*.

A study to characterise isolates of the maize rust pathogen, *Puccinia sorghi*, was completed with the financial support of the Maize Trust. Field phenotyping of wheat and barley research populations to map rust resistance sources was successfully carried out in collaboration with Dr Renée Prins at Central Genetics (CenGen) and Prof Brian Steffenson at Minnesota University. A paper titled 'Mapping of resistance loci in wheat line Milan/S87230//Babax to South African races of *Puccinia striiformis* f. sp. *tritici*' was published.

Prof Boshoff also collaborated with Prof Brande Wulf and researchers at the King Abdullah University of Science and Technology (KAUST), Kingdom of Saudi Arabia, from which a paper titled 'Origin and evolution of the bread wheat D genome', resulted.

Plant Pathology: Soil microbial ecology and Soilborne Diseases

Dr Norman Muzhinji leads the Microbial Ecology and Soilborne Diseases research group, which focuses on soil health, soil-borne diseases of solanaceous crops, and sustainable agriculture. The group investigates host-pathogen interactions using advanced bioinformatics, including genomics and transcriptomics, to develop holistic disease management strategies. In collaboration with Dr Tika Adhikari and Prof Frank Louws from North

Carolina State University, whole genome sequencing resources for *Botrytis cinerea*, the causative agent of grey mould on small fruits was provided. They also conducted comparative genomics of *Colletotrichum* species associated with anthracnose in strawberries, as well as *Alternaria* isolates from tomatoes. In another study, they emphasise the role of soil microbiomes in soil and plant health, using metagenomics to assess soil health under various agricultural practices. Additionally, the potential of biocontrol agents is explored, particularly from plant microbiomes, to enhance crop productivity and manage diseases sustainably. This research aims to bridge ecological and socio-economic sustainability in agriculture.

Plant Pathology: Mycology

The Pecan Health Research Group at the UFS, led by Dr Gert Marais, in collaboration with the pecan industry, has been studying pecan diseases and their management since 2017. Ongoing projects that at the UFS include the diversity and distribution of the pecan scab fungus, *Cladosporium cladosporioides*, the benefit of mycorrhizal fungi in pecan orchards, and the cause of overall decline of pecans. For future research, the pecan orchard on the Paradys Experimental Farm outside Bloemfontein is under expansion.

[Photo credit: Dev Fourie]



At the beginning of 2024, Prof Clive Bock at the USDA in the USA visited the UFS, attended the Plant Pathology conference held in Clarens (22 to 24 January 2024), and travelled the pecan scab-stricken areas in South Africa together with representatives of the pecan industry (SAPPA) and the UFS. During the growing season of 2024, all pecan production areas were visited, including the Orange River from Luckhoff to Upington, Vaalharts, Jacobsdal, as well as various other areas in Limpopo, Mpumalanga, Gauteng, Eastern Cape, Western Cape, and KwaZulu-Natal. Farmers days were organised during these trips where the newest findings on student projects were shared with pecan producers and interested parties. A book guide (*Fungal diseases of pecans in South Africa*) was published in November 2024, including information on the most prominent diseases, their causative agents, management, and potential use of fungicides.

Plant Pathology: Epidemiology

Dr Lisa Rothmann leads the McLab Field Pathology and Epidemiology Research Group, which focuses on diseases affecting summer grain crops, including dry bean, sorghum, soybean, and sunflower. The group's mission is to inspire and lead impactful research, extension, and outreach initiatives that encourages sustainable disease management in a changing climate, promoting food security and safety, while empowering agricultural communities through our active participation.

Thabiso Masisi's Doctoral study, 'Incidence, management, and producer perceptions of fungal diseases in sorghum cropping systems' (funded by NRF-Thuthuka and the Sorghum Trust), is being conducted in partnership with Dr Lindy Rose (Stellenbosch University). An interdisciplinary component involves the UFS Department of Sociology, examining socio-economic factors influencing sorghum disease management decisions. Nomvula Moloi started her MSc Agric Plant Pathology research project, titled 'Fungal pathogens of grain sorghum and host-pathogen interactions', utilising samples collected during the 2023/2024 survey seasons. These surveys, funded by the Sorghum Trust, will continue in the growing season, covering producers' fields across

the Eastern Cape, Free State, KwaZulu-Natal, Limpopo, Mpumalanga, and North West. The team is also undertaking a project on "Seeds of knowledge: exploring fungi associated with uChokwane (teparay bean), a climate-smart landrace', supported by the Central Research Funds and NRF-Thuthuka. Results were presented at the Southern African Society for Plant Pathology in January 2024.



Thabiso Masisi and Nomvula Moloi conducting sorghum pathology tests

Soybean and sunflower cultivar evaluations were conducted in collaboration with the Agricultural Research Council-Grain Crops (ARC-GC). These trials, led by Annelie de Beer and Dr Safiah Ma'ali, were funded by the DSI, Technology Innovation Agency (TIA), the Oil and Protein Seeds Development Trust (OPDT), the Oilseeds Advisory Committee (OAC), and Grain SA. The evaluations focused on assessing cultivar tolerance to *Sclerotinia sclerotiorum*, and will continue during the 2024/2025 season, with contributions from Dr Derick van Staden and Koos Strydom. Research focusing on sclerotinia head rot management was led by Kwanele Sabela (MSc Agric student). This research is supported by the OPDT/OAC. Kwanele Sabela developed and validated a standard area diagram for evaluating sclerotinia head rot, to ensure accurate disease assessments are conducted by various individuals working on sclerotinia, e.g. breeders, agronomists, and agricultural extensionists. Marais Cloete initiated his

MSc Agric Plant Pathology research on soybean stem rot during the 2023/2024 growing season, focusing on early disease detection through remote sensing and alternative approaches to disease management.

The project titled 'Identifying and assessing soybean seedborne diseases, towards improving seed health through reducing prevalent fungal pathogens. was completed in 2024, under the leadership of MSc Agric student Neo Hlongwane. This work is supported by Central Research Funds. Research by Michelle Rossi (MSc Agric Plant Pathology), supported by Plantovita and the Dry Bean Organisation, investigates the race identification of *Colletotrichum lindemuthianum* isolated from South African production areas.

Dr Rothmann collaborated with AgriSeed/DMS Genetics in Delmas on soybean and sunflower field trials on the experimental farm, aimed at cultivar and fungicide evaluations.



In collaboration with the University of Stellenbosch, Dr Rothmann is co-supervising Mariana van Deventer's MSc Agric (Plant Pathology) research titled 'Modelling the effect of environmental conditions and inoculum load on the development of sclerotinia stem rot of canola in the Western Cape, led by Dr Diane Mostert (Stellenbosch University), Dr Gert Van Coller and Lizette Nowers (Western Cape Department of Agriculture), and co-funded by OPDT/OAC. The McLab Plant Pathology team spent a week assisting in canola stem rot disease evaluations in the southern Cape during the growing season.

The official Memorandum of Understanding between Grain SA and the UFS Plant Sciences was re-signed for the seventh term. Spearheaded by Dr Rothman, this entails the administration of the South African Sclerotinia Research Network, composed of a community of practice and a research consortium. The Network, which provides a platform for South African researchers, industry, and producers to work together towards a management solution for Sclerotinia diseases in South Africa, has continued their website and social media activities since the launch in September 2019.

ACADEMIC CITIZENSHIP AND COMMUNITY ENGAGEMENT

Dr Lisa Rothmann served on the Organising Committee for the 53rd Congress of the Southern African Society of Plant Pathology (SASPP) hosted by the UFS, held in Clarens in January 2024. As part of this role, she hosted keynote speaker Prof Emerson Del Ponte (Universidade Federal de Viçosa, Brazil), who was sponsored by ZZ2

In February, Dr Rothmann delivered a lecture at the Agricol | Don Mario Intacta RR2 Pro Soybean Launch to an audience of approximately 100 farmers in Reitz, Free State. The McLab research group also participated in the Agronomy Info Services farmer information day held in Delmas, Mpumalanga, in March. At this event, the group presented their

ongoing Sclerotinia disease management research conducted at the experimental farm in Delmas to an audience of over 200 farmers. In August, Dr Rothmann co-hosted a #SclerotiniaZA farmer's day in Ganyesa, North West, at which Marais Cloete facilitated discussions on sunflower head rot disease management. Additionally, in September Dr Rothmann was invited by Strauss Seed & Co to deliver an address at a canola farmers' day in Lydenburg, Mpumalanga.

Dr Rothmann completed her tenure as President of the American Phytopathology Society: African Division, which hosted a successful online meeting in September. The theme of the meeting was 'Plant Health Management for Sustainable Food Security and Safety'. She also served as the Master of Ceremonies at the National Grain Research Programme hosted at the UFS in April 2024.

Dr Rothmann has been selected to co-chair the Epidemiology Committee of the International Society for Plant Pathology. She is a member of the Scientific Committee for the Botrytis, Monilinia, and Sclerotinia symposium (International Symposium on Plant Pathogenic Sclerotiniaceae 2025), to be hosted by Aristotle University of Thessaloniki, Greece.

Scientific communication and popular articles produced by the McLab research group are regularly distributed through *SA Grain Magazine*, *Oilseed Focus*



Magazine, and *Pula Imvula Magazine*. Contributors include Dr Rothmann, Kwanele Sabela, Thabiso Masisi, Mariana van der Venter, and Marais Cloete. Topics covered include *Sclerotinia sclerotiorum* spore dispersal mechanisms, detection methods, and plant disease surveillance.

Dr Boke Moloi reviewed manuscripts for Horticulture and Agronomy (Q1) journals and served as an external examiner for the University of Zululand. She is also a co-Guest editor for a special issue in *Plants*, titled 'Navigating the Future of Agriculture: Balancing the Benefits and Challenges of Alternative Plant Nutrition Methods'.

Through the second-year Education module, Dr Moloi participated in a collaborative project between the Department of Zoology, Entomology, and Plant Sciences, sponsored by Leadership for Conservation in Africa. The initiative aimed to introduce conservation principles to non-conservation students. As part of the project, students designed posters, with the top three being donated to schools in Bloemfontein. Additionally, five trees were donated and planted at two schools in the city, further promoting environmental awareness.

Dr Andri van Aardt presented talks on the Pretoria FM programme 'Ek wil weet' in answer to questions from listeners. She was invited to present a talk on 'Goud in Grasvelde' at the Bloemspruit Garden Club. Her research on the firebreaks appeared as an article about the Golden Gate Highlands National Park, which contributed towards a research question of Park Management.

Dr Lize Joubert was elected to the South African National Plant Checklist Committee. The Geo Potts Herbarium (of which Dr Joubert is the curator), provided plant identification services to UFS researchers, students, external companies and members of the public.

Dr Dimitri Veldkornet was part of the NRF Geo & Marine, Marine & Research Review Panel and Thuthuka Research Review Panel (2024-2026).

The Department of Plant Sciences was invited to be part of a community engagement project to establish a library at Kagisano Combined School in the Ikgomotseng community (Soutpan, Free State province) in collaboration with the Library and Information Services (LIS) and the Faculty of the Humanities. Dr Veldkornet and Botany postgraduate students Nomcebo Mngomezulu, Masego Sekhurwane, Mamosela Mohotloane, and Sipelelo Zondo were responsible for creating a garden in front of the library.

Dr Mpho Mafa is a reviewer of nine Quartile 1 and 2 journals with impact factors that range from 9.7 to 3.0. These are *Journal of Chemical Ecology*, *Biomass Conversion and Biorefinery*, *European Food Research and Technology*, *Plant Physiology and Biochemistry*, *Basic and Applied Ecology*, *Agronomy*, *World Journal of Microbiology and Biotechnology*, *Biofuels*, *Bioproducts & Biorefining*, and *Bioresource Technology*.



Prof Sandy Steenhuisen

Prof Sandy Steenhuisen continued as an Executive Council member and Honorary Treasurer for the Council of the South African Association of Botanists, a Review Board Editor for the *South Journal of Botany*, Associate Editor for the *American Journal of Botany*, and a scientific member of the Free State Wetlands Forum, and the Alien Grass Working Group run by SANBI. She also continued as an external moderator for various South African universities. In addition, Prof Steenhuisen was part of the

UFS Qwaqwa organising committee for the Social Innovation Exchange (SIX) Conference.

In conjunction with the Department of Sociology Bloemfontein Campus, Prof Steenhuisen facilitated UFS Qwaqwa Campus' involvement in National e-Waste Day on 14 October 2024. She was interviewed, as a small-mammal pollination biology expert, by a Science and Health reporter from National Public Radio (USA) on her opinion of the recently discovered wolf pollination of red-hot poker in Ethiopia.

Dr Norman Muzhinji is an active reviewer of articles

submitted to *Plant Disease*, *Phytopathology*, *European Journal of Plant Pathology*, *Plant Pathology*, *Crop Protection*, *GMO Crops and Food*, *Phytopathology Research*, *Journal of Plant Pathology*, and *Journal of Phytopathology*. He continued as a review Editor for *Frontiers in Plant Science* – Plant Pathogen interaction.

Dr Rudo Ngara is guest editor for a Special Issue in *Plants* titled ‘Omics’ and ‘multi-omics’ insights into plant responses to abiotic stresses’, which runs from 01 July 2024 to 31 May 2025. Dr Ngara is also a Guest Editor for two Research Topics in the journal *Frontiers in Plant Science* – titled ‘The plant extracellular matrix; dynamics in composition and function in response to biotic and abiotic stresses’ (08 May 2024 to 24 February 2025) and ‘The Omics Applications for Pathogen Control and Disease Resistance’ (18 November 2024 to 3 June 2025).

Dr Linhle Mohase was a panel member in the African Origins Platform (NRF) applications evaluation meeting on 12 September 2024, and for the United Kingdom Research and Innovation (UKRI) Future Leadership fellowship Round 8 Panel Sift and Interview Meetings.

Prof Maryke Labuschagne is serving as chief editor for *Frontiers in Sustainable Food Systems* and serves on the editorial boards of the *Journal of Cereal Science* and *Cereal Chemistry*.

Prof Adré Minnaar-Ontong is an active reviewer of articles submitted to the *Journal of Fungi*, *Scientific Reports*, *Genetic Resources and Crop Evolution*, *BMC GWAS*, *Agronomy*, and *Discovery Sustainability*. She is a board member of the National Grain Research Programme. Prof Minnaar-Ontong was also an Agriculture ambassador where a Roadshows with Food for Mzansi to engage with schools on careers in agriculture were held.

Prof Minnaar-Ontong and Dr Chrisna Steyn served on the Organizing Committee of the Crop Research Platform (CRP) focusing on the innovative topic ‘Regenerative agriculture’, held from 3 to 5 April on the Bloemfontein Campus.

OTHER ACTIVITIES

The Plant Sciences Department at Qwaqwa Campus was granted funding to obtain a new Gas Chromatography–Mass Spectrometer (GCMS) and High-Performance Liquid Chromatography machine (HPLC) in 2024. Following renovations of a glassware storeroom into an analytical laboratory, the new equipment was installed, and training will commence in 2025. The acquisition of this machinery will allow for in-house analysis of volatile and liquid samples and create a potential third-stream income for the department through the analysis of samples for other researchers external to UFS. In addition to

these renovations, the NAS faculty renovated a room into a new laboratory for Dr Gokul for his lab group’s biotechnological research on plant endophytes.

In April 2024, Prof Steenhuisen, Dr Payne (Postdoctoral Fellow), and Lesogo Malekana (Master’s student) took part in the filming of a German documentary, facilitated by the ARU and Laurenz Media, which focused on the Drakensberg Mountains. Their research in the Maloti-Drakensberg was showcased as part of the documentary.

Prof Steenhuisen’s Qwaqwa Plant-Animal Interactions Research (QPAIR) Lab group undertook two on-campus writing retreats in 2024. These retreats created a space for students to work on their data, writing and publications, as well as giving them unrestricted access to their supervisors, while creating comradery within the lab group.

POSTGRADUATE STUDENTS

Honours graduates

At the 2024 graduations, nine students graduated with BSc Hons majoring in Botany (four on the Bloemfontein Campus and five on the Qwaqwa Campus), one student graduated with BSc Hons majoring in Plant Pathology, two students graduated with BSc Hons majoring in Plant Breeding and one student graduated with BSc Hons in Agriculture majoring in Plant Breeding.

Master’s graduates

Ten students graduated with an MSc:

- Macdonald, SE (Botany, Bloemfontein Campus)
- Mngomezulu, NT (Botany, Bloemfontein Campus)
- Mohotloane, MM (Botany, Bloemfontein Campus)
- Sedimo, G (Botany, Bloemfontein Campus)
- Zondo, SNN (Botany, Bloemfontein Campus)
- Masole, P (Botany, Qwaqwa Campus)
- Henema, NP (Botany, Qwaqwa Campus) – with distinction

- Malekana, LM (Botany, Qwaqwa Campus)
- Kobedi, FK (Plant Breeding) – with distinction
- Clayton, JJ (Plant Pathology)

Six students graduated with an MSc in Agriculture:

- Botha, FJ (Plant Breeding) – with distinction
- Coertzen, RD (Plant Breeding)
- Combrinck, M (Plant Breeding) – with distinction
- Hlatshwayo, KK (Plant Breeding)
- Sefume, LD (Plant Breeding) – with distinction
- Maphobole, LA (Plant Pathology) – with distinction

Doctoral graduates

Three candidates from the Department of Plant Sciences graduated with a PhD in 2024:

Chalachew Endalamaw Engida (Plant Breeding)

Thesis: Genetic diversity in yield traits and kernel composition of selected Ethiopian sorghum landraces

Supervisor: Prof MT Labuschagne

Mandla Victor Hlongwane (Botany, Qwaqwa Campus)

Thesis: Antimicrobial and antimycobacterial properties of *Lotononis lanceolata* and *Senecio harveianus*

Supervisor: Dr P Mojau

Grant Anthony Richardson (Plant Breeding)

Thesis: Understanding genotype by environment by management interactions in the western maize growing region of South Africa

Supervisor: Prof MT Labuschagne



Delegates at the 2024 National Grain Research Programme Research Day



POSTDOCTORAL RESEARCH FELLOWS

The Department of Plant Sciences hosted five Postdoctoral Research Fellows in 2024.

Dr Lee-Ann Niekerk (South Africa), hosted by Dr Gokul, participated in the Next Generation of Emerging Researchers Symposium which was hosted at the Birchwood Hotel from 23 to 25 October 2024. Dr Niekerk was selected to participate in the Global Young Scientists Summit (GYSS) in Singapore in January 2025, at which she will be presenting her research.

Dr Stephanie Payne was hosted by Prof Steenhuisen. In June 2024, Dr Payne, as an expert in southern African mountain flora along with Prof Peter Taylor (Department of Zoology and Entomology, Qwaqwa Campus), was invited to attend the first Global Mountain Biodiversity Assessment (GMBA) Workshop, hosted by the University of Lausanne and University of Bern in Davos, Switzerland, from 11 to 14 June 2024. Dr Payne was able to establish connections with high-calibre mountain researchers from across the globe and, arising from the workshop, is one of the leading authors



Dr Stephanie Payne and Prof Peter Taylor in Davos, Switzerland

(along with Dr Clara Pissolito [CIEFAP, Argentina] and Dr Davnah Urbach [GMBA, University of Bern, Switzerland]) on a high-impact publication on collecting and prioritising questions in mountain biodiversity research. Dr Payne's contribution to the global assessment is ongoing as the assessment progresses, and she is involved in the special session to be hosted by the GMBA at SAMC2025.

Dr Payne co-taught BIOL6834: Advanced Biostatistics in 2024 and co-supervised four MSc students (one graduated in April 2024) and one Doctoral candidate in the Department of Plant Sciences. She leads the South African component of the pollination and camera trap aspect of the internationally collaborative RangeX project in affiliation with the ARU. She took part in a Policy and Practice Workshop, hosted by the ARU at the 59th Annual Congress of the Grassland Society of Southern Africa on the 26th of August 2024, where the results from the RangeX project were presented to various stakeholders. Dr Payne is part of the local organising committee for the 2nd Southern African Mountain Conference (SAMC2025) to be held in March 2025.

Three Postdoctoral Research Fellows, Isaac Amegbor (Ghana), Tesfaye Mekonnen (Ethiopia), and Neila Abdi (Tunisia) worked in collaboration with Prof Labuschagne in Plant Breeding during 2024.

STAFF MATTERS



Prof Botma Visser

Willem Boshoff and Botma Visser were both promoted from associate professor to full professors. Rudo Ngara, at the Qwaqwa Campus, was promoted to associate professor.

Two new appointments were made in the Department during 2024. Dr Chrisna Steyn was appointed as Lecturer and Diana Mngomezulu as professional officer in Plant Breeding.

RESEARCH OUTPUTS

Research Articles

Abdi, N., Van Biljon, A., Steyn, C. & Labuschagne, M. 2024. Effect of Arbuscular Mycorrhizal Fungi on yield attributes, and protein quantity and quality in bread wheat (*Triticum aestivum*) grown under drought stress. *Arid Land Research and Management* 38(4). DOI: 10.1080/15324982.2024.2331125.

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Books/Chapters in Books

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Conference Contributions

Conference Papers

Adams, L., Martin, G.D., Downs, C. & Steenhuisen, S. 2024. *Community perceptions of a fleshy-fruited invasive alien plant in the grassland biome of South Africa*. Paper delivered at the 49th Annual Conference of the South African Association of Botanists (SAAB), University of Zululand, Richard's Bay, South Africa. 7–11 January 2024.

Adams, L., Martin, G.D., Downs, C. & Steenhuisen, S. 2024. *Fleshy-fruited invasive alien shrubs population change over time along roadsides of South African grasslands*. Paper delivered at the National Symposium on Biological Invasions, Sol Plaatje University, Kimberley, South Africa. 9–12 September 2024.

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Adams, L., Martin G.D., Downs, C. & Steenhuisen, S. 2024. *Fleshy-fruited invasive alien shrubs population change over time along roadsides of South African grasslands*. Paper delivered at the 59th Annual Congress of the Grassland Society of Southern Africa, Gariiep Forever Resort, Gariiep Dam, South Africa. 22–26 July

Adams, L., Martin, G.D., Downs, C. & Steenhuisen, S. 2024. *The role of mammals in seed dispersal of fleshy-fruited invasive alien plants in the Grassland Biome of South Africa*. Paper delivered at the 8th Frugivores and Seed Dispersal Symposium, Ilhéus, Brazil. 4–8 August 2024.

Adams, L., Martin, G.D., Downs, C. & Steenhuisen, S. 2024. *The role of mammals in seed dispersal of fleshy-fruited invasive alien plants in the montane Grassland Biome of South Africa*. Paper delivered at the Southern African Wildlife Management Association Conference, Windhoek, Namibia. 6–11 October 2024.

Amegbor, I.K., Nelimor, C., Adu, G.B., Jamal-Deen, A., Agbesi, K., Ayim, R.K., Kusi, F., Amadu, M.K., Atosona, B., Aboyadana, P. & Labuschagne, M.T. 2024. *Insights on yield performance, farmer and consumer preferences for fall army worm tolerant maize hybrids in Ghana*. Paper delivered 15th Southern African Plant Breeding Symposium (SAPBA), Monte Bello Estate, Bloemfontein, South Africa. 11–13 March 2024.

Bender, C.M., Hlongwa, S.I., Meyer, W.B., Pretorius, Z.A. & Boshoff, W.H.P. 2024. *Macro- and microscopic phenotyping of Uromyces appendiculatus on beans*. Paper delivered at the 53rd Congress of the Southern African Society for Plant Pathologists (SASSP), Golden Gate Highlands Hotel, Golden Gate, South Africa. 22–25 January 2024.

Boshoff, W.H.P., Meyer, W.B., Maphobole, L., Coetzer, A., Bender, C.M., Terefe, T.G., Pretorius, Z.A. & Visser, B. 2024. *Mitigating the threat of rust pathogens of food and forage crops in South Africa*. Paper delivered 15th Southern African Plant Breeding Symposium (SAPBA), Monte Bello Estate, Bloemfontein, South Africa. 11–13 March 2024.

Boshoff, W.H.P., Visser, B., Bender, C.M. & Pretorius, Z.A. 2024. *The response of Allium species and varieties to Puccinia porri in South Africa*. Paper delivered at the 53rd Congress of the Southern African Society for Plant Pathologists (SASSP), Golden Gate Highlands Hotel, Golden Gate, South Africa. 22–25 January 2024.

Boshoff, W.H.P., Visser, B. & Pretorius, Z.A. 2024. *Thinopyrum distichum as a possible ancillary host for cereal rusts in South Africa*. Paper delivered at the 53rd congress of the Southern African Society for Plant Pathologists (SASSP), Golden Gate Highlands Hotel, Golden Gate, South Africa. 22–25 January 2024.

Buthelezi, T., Steenhuisen, S., Payne, S.L. & Thompson, D. 2024. *Pollination ecology of South African endemic Euphorbia clavarioides (Euphorbiaceae)*. Paper delivered at the 49th Annual Conference of the South African Association of Botanists (SAAB), University of Zululand, Richard's Bay, South Africa. 7–11 January 2024.

Canavan, K., Canavan, S., Clark V.C., Gwate, O., Mapuara, S., Richardson, D.M., Steenhuisen, S., Sutton, G.F. & Martin, G.D. 2024. *Elevation patterns of non-native invasions in South African mountains*. Paper delivered at the Policy and Practice Workshop: Woody range-expanding species in southern African mountains: Trends, predictions and Mitigations at the 59th Annual Congress of the Grassland Society of Southern Africa, Gariep Forever Resort, Gariep Dam, South Africa. 22–26 July 2024.

Canavan, K., Canavan, S., Clark, V.C., Gwate, O., Mapuara, A., Richardson, D.M., Steenhuisen, S., Sutton, G.F. & Martin, G.D. 2024. *Elevation patterns of non-native invasions in South African mountains*. Paper delivered at the 59th Annual Congress of the Grassland Society of Southern Africa, Gariep Forever Resort, Gariep Dam, South Africa. 22–26 July 2024.

Canavan, K. & Martin, G.D. 2024. *Managing wilding Pines in the Cape Floristic Region, South Africa: progress and prospects*. Paper delivered at the National Symposium on Biological Invasions, Sol Plaatje University, Kimberley, South Africa. 9–12 September 2024.

Coetzee, E., Achilonu, C.C., Rothmann, L.A. & Marais, G.J. 2024. *Airborne Cladosporium species associated with pecan orchards in South Africa*. Paper delivered at the 53rd Congress of the Southern African Society for Plant Pathologists (SASSP), Golden Gate Highlands Hotel, Golden Gate, South Africa. 22–25 January 2024.

Coetzee, M.P.A., Matodzi, L., Minnaar-Ontong, A., Steyn, C., Yilmaz, N. & Visagie, C.M. 2024. *Fusarium species causing Sudden Death Syndrome like symptom on soybean in South Africa*. Paper delivered at the 53rd Congress of the Southern African Society for Plant Pathologists (SASSP), Golden Gate Highlands Hotel, Golden Gate, South Africa. 22–25 January 2024.

Coetzer, A., Maré, A. & Boshoff, W.H.P. 2024. *First report of Puccinia striiformis f. sp. tritici race 142E30A+ on wheat in South Africa*. Paper delivered at the South African Academy for Science and Art, University of the Free State, Bloemfontein, South Africa. 30–31 October 2024.

Coetzer, A., Terefe, T.G., Maré, A., Mebalo, J., Gqola, B., Meyer, W.B., Pretorius, Z.A. & Boshoff, W.H.P. 2024. *Virulence of a new race of Puccinia striiformis f. sp. tritici detected on wheat in South Africa*. Paper delivered at the 53rd Congress of the Southern African Society for Plant Pathologists (SASSP), Golden Gate Highlands Hotel, Golden Gate, South Africa. 22–25 January 2024.

Du Plooy, J., Boshoff, W.H.P. & Visser, B. 2024. *Identification of putative virulence effector genes from Puccinia graminis f. sp. tritici*. Paper delivered at the Annual post-graduate symposium of the Department of Botany and Plant Biotechnology at University of Johannesburg, South Africa. 21 October 2024.

Du Toit, I., Boshoff, W.H.P., Rothmann, L.A. & Visser, B. 2024. *Monitoring of wheat rust in South-Africa with MARPLE-diagnostics*. Paper delivered at the South African Academy for Science and Art, University of the Free State, Bloemfontein, South Africa. 30–31 October 2024.

Du Toit, I., Rothmann, L.A., Boshoff, W.H.P. & Visser, B. 2024. *Triazole fungicide sensitivity among South African Puccinia graminis f. sp. tritici isolates*. Paper delivered at the 53rd Congress of the Southern African Society for Plant Pathologists (SASSP), Golden Gate Highlands Hotel, Golden Gate, South Africa. 22–25 January 2024.

Figueroa, M., Henningsen, E.C., Lewis, D., Hewitt, T., Outram, M., Arndell, T., Blundell, C., Chen, J., Mago, R., Nguyen, T.D., Hartwig, E., Spanner, R., Nazareno, E., Hickey, L., Huang, Y.-F., Visser, B., Pretorius, Z.A., Boshoff, W.H.P., Stone, E., Nienser, N., Moscou, M., Saunders, D., Silva, P., German, S., Campos, P., Steffenson, B., Kianian, S.F., Vanhercke, T., Sperschneider, J. & Dodds, P.N. 2024. *Securing crops against rust pathogens: Robigus in the modern times*. Paper delivered at the 32nd Fungal Genetics Conference, Pacific Grove, California, USA. 12–17 March 2024.

Fosa, H., Swart, W. J., Nyoni, M. & Muzhinji, N. 2024. *Biopriming of Glycine max (Soybean) seeds using Aureobasidium pullulans CBS584.75*. Paper delivered at the 53rd Congress of the Southern African Society for Plant Pathologists (SASSP), Golden Gate Highlands Hotel, Golden Gate, South Africa. 22–25 January 2024.

Grobler, H., Jackson, M. & Joubert, L. 2024. *Pollinator rewards in Nemesia (Scrophulariaceae)*. Paper delivered at the 58th Microscopy Society of South Africa (MSSA) Conference, Bloemfontein, South Africa. 2–5 December 2024.

Gwanya, H., Mohase, L. & Mafa, M. 2024. *Bioprospecting*

glycoside hydrolase influencing RWASA2 and RWASA5 virulence during wheat-aphid interaction. Paper delivered at the 49th Annual Conference of the South African Association of Botanists (SAAB), University of Zululand, Richard's Bay, South Africa. 7–11 January 2024.

Gwate, O., Payne, S., Steenhuisen, S.L., Martin, G.D., & Clark, V.R. 2024. *Exploring mechanisms underlying the success of range expanding plants in Maloti-Drakensberg Mountains*. Paper delivered at the Policy and Practice Workshop: Woody range-expanding species in southern African mountains: Trends, predictions and Mitigations at the 59th Annual Congress of the Grassland Society of Southern Africa, Gariep Forever Resort, Gariep Dam, South Africa. 22–26 July 2024.

Hlahla, J.M., Mafa, M.S., Van der Merwe, R. & Moloi, M.J. 2024. *Synergistic effects of drought and heat stress on the photosynthetic efficiency and osmolytes accumulation in edamame*. Paper delivered at the 49th Annual Conference of the South African Association of Botanists (SAAB), University of Zululand, Richard's Bay, South Africa. 7–11 January 2024.

Hlahla, J.M., Mafa, M.S., Van der Merwe, R. & Moloi, M.J. 2024. *The enzymatic and non-enzymatic antioxidant systems and cell wall modification enhanced edamame tolerance during combined drought and heat stress*. Paper delivered at the Annual post-graduate symposium of the Department of Botany and Plant Biotechnology at University of Johannesburg, South Africa. 21 October 2024.

Hlahla, J.M., Mafa, M.S., Van der Merwe, R. & Moloi, M.J. 2024. *The enzymatic and non-enzymatic antioxidant systems and cell wall modification enhanced edamame tolerance during combined drought and heat stress*. Paper delivered at the 11th International Plant Protection Symposium at University of Debrecen, Hungary (online session). 15 October 2024.

Hlakotsa, N.M.M.S. & Ngara, R. 2024. *Identification of drought-responsive small RNAs in sorghum roots*. Paper delivered at the Annual post-graduate symposium of the Department of Botany and Plant Biotechnology at University of Johannesburg, South Africa. 21 October 2024.

Hlakotsa, N.M.M.S. & Ngara, R. 2024. *Physiological and small RNA responses of sorghum seedlings under mild drought stress*. Paper delivered at the Qwaqwa Campus Research Conference. Science, Social Innovation and the Future of Local Societies: Keeping Pace in a Changing Knowledge and Political Landscape, Clarens, South Africa. 9–10 October 2024.

Labuschagne, M.T. 2024. *Crop biofortification for iron content in African food security crops: current status, progress and prospects*. Keynote address delivered at the 21st International Symposium on Iron Nutrition and Interactions in Plants (ISINIP), Düsseldorf, Germany. 8–11 July 2024.

Labuschagne, M.T., Reveglia, P., Cobos, M.J. & Rubiales, D. 2024. *Metabolomics as a tool in plant breeding: Pisum sativum as a case study*. Paper delivered 15th Southern African Plant Breeding Symposium (SAPBA), Monte Bello Estate, Bloemfontein, South Africa. 11–13 March 2024.

Lichakane, M., Labuschagne, M., Van Der Merwe, R. & Zhou, M. 2024. *The effect of photoperiod treatments on time to genotype flowering and implications for sugarcane breeding in South Africa*. Paper delivered 15th Southern African Plant Breeding Symposium (SAPBA), Monte Bello Estate, Bloemfontein, South

Africa. 11–13 March 2024.

Lichakane, M., Zhou, M., Labuschagne, M.T. & Van der Merwe, R. 2024. *The effect of photoperiod treatments on time to genotype flowering and implications for sugarcane breeding in South Africa*. Paper delivered 15th Southern African Plant Breeding Symposium (SAPBA), Monte Bello Estate, Bloemfontein, South Africa. 11–13 March 2024.

Mafa, M.S. & Mohotloane, M.M. 2024. *Elucidating holocellulolytic enzymes of commercial secretome sourced from Aspergillus Niger and its saccharification of alkaline-pretreated mango seed husk*. Paper delivered at the 20th International Conference on Polysaccharides-Glycoscience, Novotného lávka 5, Prague, Czech Republic. 13–15 November 2024.

Malekana, L., Clark, V.R., Steenhuisen, S., Martin, G.D. & Alexander, J. 2024. *Impact of invasive Rosaceae on plant diversity along elevation gradients in the Maloti-Drakensberg*. Paper delivered at the Policy and Practice Workshop: Woody range-expanding species in southern African mountains: Trends, predictions and Mitigations at the 59th Annual Congress of the Grassland Society of Southern Africa, Gariep Forever Resort, Gariep Dam, South Africa. 22–26 July 2024.

Marais, G.J. 2024. *Types of fungal diseases in pecans*. Paper delivered at the Annual General Meeting of the South African Pecan Nut Producer's Association NPC, Douglas, South Africa. 1 November 2024.

Martin, G.D., Canavan, K., Chikowore, G. & Hill, M. 2024. *Biological Control for Pinus pinaster seeds in the Cape Floristic Region*. Paper delivered at the Forestry Science Symposium, Hilton, KwaZulu Natal, South Africa. 26–27 November 2024.

Martin, G.D. & Clark, V.R. 2024. *Legal aspects around listing of and management of indigenous bush encroaching species in southern Africa*. Paper delivered at the Policy and Practice Workshop: Woody range-expanding species in southern African mountains: Trends, predictions and Mitigations at the 59th Annual Congress of the Grassland Society of Southern Africa, Gariep Forever Resort, Gariep Dam, South Africa. 22–26 July 2024.

Martin, G.D., Mashamba, T., Steenhuisen, S. & Payne, S. 2024. *Beauty and the Beast: A story of Salix species in South Africa's grassland biome*. Paper delivered at the National Symposium on Biological Invasions, Sol Plaatje University, Kimberley, South Africa. 9–12 September 2024.

Martin, G.D., Philip, I. & Chikowore, G. 2024. *Resolving conflict situations when using biological control against economically-useful invasive tree species*. Paper delivered at the 3rd International Congress of Biological Control (ICBC3), San José, Costa Rica. 24–27 June 2024.

Martin, G.D., Steenhuisen, S.L., Moloi, K.T., Adams, L.D., Payne, S., Gwate, O., Masole, P., Malekana, L., Downs, C. & Clark V.R. 2024. *Invasive temperate Rosaceae in southern African mountains and highlands*. Paper delivered at the Policy and Practice Workshop: Woody range-expanding species in southern African mountains: Trends, predictions and Mitigations at the 59th Annual Congress of the Grassland Society of Southern Africa, Gariep Forever Resort, Gariep Dam, South Africa. 22–26 July 2024.

Masisi, T.V., Jackson, M., Rose, L.J., Sabela, K.S. & Rothmann, L.A. 2024. *National grain sorghum disease surveillance: Detecting fungi threatening production and livelihoods*. Paper delivered

at the 53rd Congress of the Southern African Society for Plant Pathologists (SASSP), Golden Gate Highlands Hotel, Golden Gate, South Africa. 22-25 January 2024.

Masisi, T.V., Sabela, K.S. & Rothmann, L.A. 2024. *Sorghum disease surveillance to understand South African producer perceptions and inform disease management and industry needs*. Paper delivered at the 13th International Epidemiology Workshop, Foz do Iguaçu, Brazil. 9-12 April 2024.

Matjeke, B.M., Gerrano, A.S., Labuschagne, M., Minnaar-Ontong, A., Truter, M. & Mbuma, N.W. 2024. *Combining ability and heritability of cowpea (Vigna unguiculata L. Walp) for yield and yield components*. Paper delivered at the Combined Congress, George, South Africa. 22-25 January 2024.

Mbele, T., Steenhuisen, S. & Canavan, K. 2024. *Invasive status of pampas grass in South Africa*. Paper delivered at the Centre for Biological Control Research Day, Rhodes University, Makhanda, South Africa. 28 November 2024.

Mbele, T., Steenhuisen, S. & Canavan, K. 2024. *Invasive status of pampas grass in South Africa*. Paper delivered at the National Symposium on Biological Invasions, Sol Plaatje University, Kimberley, South Africa, 9-12 September 2024. (Best Student Presentation Award for Miss Mbele).

Mbele, T., Steenhuisen, S. & Canavan, K. 2024. *Seed germination of naturalized and floristically traded Cortaderia species in South Africa*. Paper delivered at the 49th Annual Conference of the South African Association of Botanists (SAAB), University of Zululand, Richard's Bay, South Africa. 7-11 January 2024.

Mekonnen, T.W., Matongera, N., Van Biljon, A. & Labuschagne, M.T. 2024. *Breeding of high iron and zinc and grain yield under abiotic stress conditions, supporting enhanced maize biofortification*. Paper delivered at the Applied Genetics Conference, Washington DC, USA. 6-10 March 2024.

Minnaar, J.J., Steenhuisen, S. & Cron, G.V. 2024. *Pollinators drive floral diversification and speciation in Galtonia (Hyacinthaceae): a Drakensberg near-endemic genus*. Paper delivered at the 49th Annual Conference of the South African Association of Botanists (SAAB), University of Zululand, Richard's Bay, South Africa. 7-11 January 2024.

Mohotloane, M.M., Alexander, O., Adoons, V.N., Pletschke, B.I. & Mafa, M.S. 2024. *Peroxidase application reduces microcrystalline cellulose recalcitrance towards cellulase hydrolysis in model cellulose substrates and rooibos biomass*. Paper delivered at the 20th International Conference on Polysaccharides-Glycoscience, Novotného lávka 5, Prague, Czech Republic. 13-15 November 2024.

Moloi, M.J. & Hafeez, A. 2024. *Effects of increasing temperature on the photosynthesis efficiency, biochemical and yield responses of edamame cultivars*. Paper delivered at the 49th Annual Conference of the South African Association of Botanists (SAAB), University of Zululand, Richard's Bay, South Africa. 7-11 January 2024.

Muzhinji, N. & Ntuli, V. 2024. *Soil microbial Profile as a bioindicator of soil health, biodiversity, functionality, and disease risk*. Paper delivered at the 32nd Soilborne Plant Diseases Interest Group of South Africa (SBPDG-SA), ARC-PHP Vredenburg, Stellenbosch, South Africa. 22-24 October 2024.

Nekundi, J. & Mafa, M.S. 2024. *Osmotic stress induced with sorbitol: a tool for selecting drought tolerant wheat cultivars at seed germination and seedling stages*. Paper delivered at the

Annual post-graduate symposium of the Department of Botany and Plant Biotechnology at University of Johannesburg, South Africa. 21 October 2024.

Ntswane, M., Labuschagne, M., Shandu S.F., Rantso, P. & Mbuma, N.W., 2024. *Phenotypic diversity among cowpea mutants and accessions for grain yield and yield components*. Paper delivered at the Combined Congress, George, South Africa. 22-25 January 2024.

Payne, S., Alison, J., Høye, T. & Steenhuisen, S. 2024 *Pollination interactions and wildlife camera by-catch across elevations in the northern Maloti-Drakensberg*. Paper delivered at the Policy and Practice Workshop: Woody range-expanding species in southern African mountains: Trends, predictions and Mitigations at the 59th Annual Congress of the Grassland Society of Southern Africa, Gariep Forever Resort, Gariep Dam, South Africa. 22-26 July 2024.

Ramovha, D., Bender, C.M., Boshoff, W.H.P. & Visser, B. 2024. *A study of Puccinia coronata isolates from oat and Phalaris aquatica in South Africa*. Paper delivered at the 53rd Congress of the Southern African Society for Plant Pathologists (SASSP), Golden Gate Highlands Hotel, Golden Gate, South Africa. 22-25 January 2024.

Rothmann, L.A. 2024. *Syllabus redesign: A quest to conquer a 'wee beastie' in plant health education*. Paper delivered at the American Phytopathological Society Plant Health Conference, Memphis, Tennessee, USA. 27-30 July 2024.

Shamuyarira, K.W., Labuschagne, M., Shimelis H., Botha, E. & Fourie, P. 2024. *Pre-breeding and breeding capacity of sorghum within South Africa*. Paper delivered at the European Association for Research on Plant Breeding (EUCARPIA) Conference, Leipzig, Germany. 18-23 August 2024.

Shamuyarira, K.W., Labuschagne, M., Shimelis, H., Botha, E. & Fourie, P. 2024. *Pre-breeding and breeding capacity of sorghum within South Africa*. Paper delivered at the South African Plant Breeders Association (SAPBA) Conference, Bloemfontein, South Africa. 11-13 March 2024.

Sithole, J.V., Dayaram, A. & Van Aardt, A.C. 2024. *Influence of Aspect on the Drakensberg Amathole-Afromontane Fynbos (Gd6) vegetation composition, Golden Gate Highlands National Park*. Paper delivered at the 49th Annual Conference of the South African Association of Botanists (SAAB), University of Zululand, Richard's Bay, South Africa. 7-11 January 2024.

Sithole, Z., Moloi, K.T., Steenhuisen, S. & Martin, G.D. 2024. *Role of mammals in the seed dispersal of the invasive plant species, Rosa rubiginosa, in the Free State rangelands*. Paper delivered at the 49th Annual Conference of the South African Association of Botanists (SAAB), University of Zululand, Richard's Bay, South Africa. 7-11 January 2024.

Sondela, L.C., Gokul, A. & Moloi, M.J. 2024. *Influence of Pseudomonas spp endophytes on the physiological and biochemical responses of drought-stressed edamame (Glycine max (L.)).* Paper delivered at the 49th Annual Conference of the South African Association of Botanists (SAAB), University of Zululand, Richard's Bay, South Africa. 7-11 January 2024.

Spanner, R.E., Henningsen, E.C., Li, F., Matny, O., Hodson, D., Virzi, N., Nguyen, K.-P., Moscou, M., Pretorius, Z.A., Boshoff, W.H.P., Sperschneider, J., Dodds, P., Steffenson, B. & Figueroa, M. 2024. *Understanding the role of somatic hybridisation in*

global wheat stem rust epidemics through the development of haplotype-phased reference genome assemblies. Paper delivered at the Fungal Genetics Conference, Pacific Grove, California, USA. 12-17 March 2024.

Steenhuisen, S.L., Martin, G.D., Moloi, K.T., Adams, L.D., Payne, S., Gwate, O., Masole, P., Malekana, L., Downs, C. & Clark V.R. 2024. *When roses go rogue: Expanding ranges of invasive Rosaceae in South Africa*. Paper delivered at the 20th International Botanical Congress (IBC), Madrid, Spain. 21-27 July 2024.

Terefe, T.G., Boshoff, W.H.P., Park, R.F., Pretorius, Z.A. & Visser, B. 2024. *Virulence diversity of Puccinia graminis f. sp. tritici on wheat and triticale in South Africa*. Paper delivered at the 53rd Congress of the Southern African Society for Plant Pathologists (SASSP), Golden Gate Highlands Hotel, Golden Gate, South Africa. 22-25 January 2024.

Terefe, T.G., Pretorius, Z.A. & Boshoff, W.H.P. 2024. *Virulence diversity of Puccinia triticina in South Africa and the response of wheat cultivars and breeding lines to new races*. Paper delivered at the 20th International Plant Protection Congress, Athens, Greece. 1-5 July 2024.

Terefe, T.G., Visser, B., Pretorius, Z.A. & Boshoff, W.H.P. 2024. *Variation in Puccinia graminis f. sp. tritici and P. triticina on wheat in South Africa and reaction of commercial cultivars and breeding lines to recently identified races*. Paper delivered at the ARC-DALRRD Conference, ARC-VIMP, Roodeplaat, Pretoria, South-Africa. 12-14 February 2024.

Tsotetsi, M.E., Boshoff, W.H.P. & Visser, B. 2024. *Sequence analysis of the AvrSr35 and AvrSr50 avirulence genes in South African Puccinia graminis f. sp. tritici isolates*. Paper delivered at the 53rd Congress of the Southern African Society for Plant Pathologists (SASSP), Golden Gate Highlands Hotel, Golden Gate, South Africa. 22-25 January 2024.

Van Aardt, A.C., De Jager, J.C.L. & Van Tol, J.J. 2024. *Effect of annual burning on diversity and vegetation composition of Golden Gate Highlands National Park*. Paper delivered at the 59th Annual Congress of the Grassland Society of Southern Africa, Gariep Forever Resort, Gariep Dam, South Africa. 22-26 July 2024.

Van Aardt, A.C., Scott, L., Grundling, P.-L., Grundling, A. & Woodborne, S. 2024. *Late-Holocene paleoenvironmental reconstruction of the Savanna-Grassland ecotone, Gauteng, South Africa*. Paper delivered at the XXIV SASQUA Conference, Cango Valley, South Africa. 19-24 May 2024.

Van der Merwe, R., Coetzee, E. & Moloi, M.J. 2024. *Combining ability of drought tolerance-related traits in vegetable-type soybean*. Paper delivered 15th Southern African Plant Breeding Symposium (SAPBA). Monte Bello Estate, Bloemfontein, South Africa. 11-13 March 2024.

Visser, B., Terefe, T.G., Bender, C.M., Pretorius, Z.A. & Boshoff, W.H.P. 2024. *Wheat rust surveillance in South Africa: past, present and future*. Paper delivered at the Annual post-graduate symposium of the Department of Botany and Plant Biotechnology at University of Johannesburg, South Africa. 21 October 2024.

Weaver, K., Hill, M.P., Martin, G.D., English, K., Ngxande-Koza, S., Ivey, P., Paterson, I. & Coetzee J. 2024. *Promoting biological control leads to improved implementation and long-term sustainability*. Paper delivered at the 3rd International Congress of Biological Control (ICBC3) in San José, Costa Rica. 24-27 June 2024.

Zondo, S.N.N., Mohase, L., Tolmay, V., & Mafa, M.S. 2024. *Functional characterisation of β -1,3-glucanase regulating callose accumulation upon wheat infestation by Diuraphis noxia*. Paper delivered at the 49th Annual Conference of the South African Association of Botanists (SAAB), University of Zululand, Richard's Bay, South Africa. 7-11 January 2024.

Conference Posters

Adams L, Martin G.D. Downs C, & Steenhuisen S. 2024. *The role of mammals in seed dispersal of fleshy-fruited invasive alien plants in the Grassland Biome of South Africa*. Poster presented at the 49th Annual Conference of the South African Association of Botanists (SAAB), University of Zululand, Richard's Bay, South Africa. 7-11 January 2024.

Delport, B., Marais, G.J., Castillo-Hernandez, J., McCarlie, S. & Bragg, R. 2024. *Metagenomic evaluation of the bacterial diversity in overall decline pecan trees*. Poster presented at the 53rd Congress of the Southern African Society for Plant Pathologists (SASSP), Golden Gate Highlands Hotel, Golden Gate, South Africa. 22-25 January 2024.

Edwards, G., Swart, V. & Marais, G.J. 2024. *Ecological aspects of soil-dwelling arthropods in pecan orchards*. Poster presented at the 53rd Congress of the Southern African Society for Plant Pathologists (SASSP), Golden Gate Highlands Hotel, Golden Gate, South Africa. 22-25 January 2024.

Engida, C., Van Biljon, A., Herselman, L., Nida, H. & Labuschagne, M.T. 2024. *Ethiopian sorghum landraces as a possible genetic diversity resource for breeding*. Poster presented at the 15th Southern African Plant Breeding Symposium, Bloemfontein, South Africa. 11-13 March 2024.

Gqola, B.N., Mebalo, J., Boshoff, W.H.P. & Terefe, T.G. 2024. *Virulence diversity of Puccinia triticina collected from wheat and triticale in South Africa from 2021 to 2022*. Poster presented at the Combined Crops, Soils, Horticulture and Weeds Congress, Wilderness Hotel, George, South Africa. 22-25 January 2024.

Hlatshwayo, K., Maré, A., Minnaar-Ontong, A., Zhang, Q. & Van der Merwe, R. 2024. *Family selection for pod-shattering resistance and seed yield of vegetable-type soybean*. Poster presented at the 15th Southern African Plant Breeders' Association (SAPBA) Symposium, Monte Bello Estate, Bloemfontein, South Africa. 11-13 March 2024.

Kruger, W., Achilonu, C.C. & Marais, G.J. 2024. *Post-harvest pathogens associated with pecan nuts in South Africa*. Poster presented at the 53rd Congress of the Southern African Society for Plant Pathologists (SASSP), Golden Gate Highlands Hotel, Golden Gate, South Africa. 22-25 January 2024.

Lichakane, M., Zhou, M., Labuschagne, M.T. & Van der Merwe, R. 2024. *The effect of photoperiod treatments on time to genotype flowering and implications for sugarcane breeding in South Africa*. Poster presented at the 15th Southern African Plant Breeders' Association (SAPBA) Symposium, Monte Bello Estate, Bloemfontein, South Africa. 11-13 March 2024.

Malekana, L., Clark, V.R., Steenhuisen, S., Martin, G.D. & Alexander, J. 2024. *Impact and Management of Range Expanding Rosaceae Species Along Elevational Gradients in the Maloti Drakensberg*. Poster presented at the 49th Annual Conference of the South African Association of Botanists (SAAB), University of

Zululand, Richard's Bay, South Africa. 7-11 January 2024.

Maphobole, L.A., Visser, B., Meyer, W.B., Pretorius, Z.A. & Boshoff, W.H.P. 2024. *Pathogenicity and microsatellite analysis of Puccinia sorghi isolates in South Africa*. Paper delivered at the 53rd Congress of the Southern African Society for Plant Pathologists (SASSP), Golden Gate Highlands Hotel, Golden Gate, South Africa. 22-25 January 2024.

Masisi, T.V., Sabela, K.S., Rose, L., Jackson, M., Matebesi, S., Pelsler, A., & Rothmann, L.A. 2024. *A first look at farmer perceptions of sorghum production, disease constraints and future outlooks*. Poster presented at the 53rd Congress of the Southern African Society for Plant Pathologists (SASSP), Golden Gate Highlands Hotel, Golden Gate, South Africa. 22-25 January 2024.

Matjeke, B.M., Gerrano, A.S., Labuschagne, M., Minnaar-Ontong, A. & Mbuma, N.W. 2024. *Diallel analysis and heritability of cowpea for nutritional characteristics*. Poster presented at the 15th Southern African Plant Breeders' Association (SAPBA) Symposium, Monte Bello Estate, Bloemfontein, South Africa. 11-13 March 2024.

Matjeke, B.M., Gerrano, A.S., Labuschagne, M., Minnaar-Ontong, A., Truter M. & Mbuma, N.W. 2024. *Combining ability and heritability of cowpea (Vigna unguiculata L. Walp) for yield and yield components*. Poster presented at the Combined Congress, George, South Africa. 22-25 January 2024.

Mbuma, N.W., Steyn, P.J., Laurie, S.M., Labuschagne, M.T. & Bairu, M.W. 2024. *Phenotypic diversity of the South African-bred potato varieties for tuber yield and processing quality*. Poster presented at the Combined Congress, George, South Africa. 22-25 January 2024.

Mekonnen, T.W., Gerrano, A.S., Van Biljon, A. & Labuschagne, M.T. 2024. *Application of artificial intelligence (AI) in crop breeding, with a focus on teff, grass pea and cowpea*. Poster presented at the 15th Southern African Plant Breeding, (SAPBA) Symposium, Monte Bello Estate, Bloemfontein, South Africa. 11-13 March 2024

Mishasha, T., Zhou, M., Van der Merwe, R. & Labuschagne, M. 2024. *Genetic correlations among cane quality traits and implications on sugarcane breeding*. Poster presented at the 15th Southern African Plant Breeders' Association (SAPBA) Symposium, Monte Bello Estate, Bloemfontein, South Africa. 11-13 March 2024.

Moloi, K.T., Martin, G.D., & Steenhuisen, S. 2024. *Seed dispersal and germination of Cotoneaster pannosus on Afromontane grasslands of eastern Free State, South Africa*. Poster presented at the 49th Annual Conference of the South African Association of Botanists (SAAB), University of Zululand, Richard's Bay, South Africa. 7-11 January 2024.

Moloi, N., Masisi, T.V., Achilonu, C.C., Sabela, K.S. & Rothmann, L.A. 2024. *Occurrence and identification of fungi associated with sorghum grain from contrasting production systems*. Poster presented at the 53rd Congress of the Southern African Society for Plant Pathologists (SASSP), Golden Gate Highlands Hotel, Golden Gate, South Africa. 22-25 January 2024.

Motshagwa, G. & Moloi, M.J. 2024. *Frequency matters: The impact of multiple selenium foliar applications on the physio-biochemical responses of drought-stressed edamame*. Poster presented at the 49th Annual Conference of the South African Association of Botanists (SAAB), University of Zululand, Richard's

Bay, South Africa. 7-11 January 2024.

Muzhinji, N. & Nghalipo, N. 2024. *Decoding the soil microbiome to enhance Pearl Millet growth and drought resilience under varying soil amendments*. Poster presented at the International Society of Microbial Ecology (ISME), Cape Town Convention Centre, Port Elizabeth, South Africa. 18-23 August 2014

Ngara, R. & Steenhuisen, S-L. 2024. *Work Integrated Learning*. Poster presented at the Annual UFS Learning and teaching Conference: Enhancing the Quality of Blended Learning and Teaching within the UFS Context, University of the Free State, Bloemfontein, South Africa. 16-10 September 2024.

Niekerk, L-A., Gokul, A., Keyster, M. & Klein, A. 2024. *An Omics view of the alleviation of iron deficiency in common beans through the application of indole-3carboxyaldehyde*. Poster presented at the Next Generation of Emerging Researchers Symposium hosted by the National Research Foundation (NRF), Birchwood Hotel, Johannesburg, South Africa. 23-25 October 2024.

Ntjabane, N.A., Boshoff, W., Visser, B. & Mafa, M.S. 2024. *Unravelling functions of the modified cell wall in Thatcher and ThatcherLr9 wheat infected by Puccinia triticina*. Poster presented at 49th South African Association of Botany (SAAB) Annual Conference, University of Zululand, Richards Bay campus, South Africa. 7-11 January 2024.

Ntswane, M., Labuschagne, M.T., Shandu, S.F., Rantso, P. & Mbuma, N.W. 2024. *Variation in seed protein, selected minerals, phytic acid and potential mineral bioavailability of cowpea [Vigna unguiculata (L.) Walp] mutants and accessions*. Poster presented at the 15th Southern African Plant Breeders' Association (SAPBA) Symposium, Monte Bello Estate, Bloemfontein. 11-13 March 2024.

Nxumalo, P.D., Labuschagne, M., Van Der Merwe, R. & Zhou, M. 2024. *Quantifying the contribution of fibre content to indirect breeding for Eldana saccharina (Lepidoptera: Pyralidae) stalk borer resistance in sugarcane*. Poster presented at the 15th Southern African Plant Breeders' Association (SAPBA) Symposium, Monte Bello Estate, Bloemfontein. 11-13 March 2024.

Payne, S., Steenhuisen, S., Moloi, K., Masole, P., Carvalho, G., Sithole, Z., Chikowore, G., Westwood, T., Rahlao, M., Chatanga, P., Seleteng-Kose, L. & Martin, G.D. 2024. *Review of the invasive, yet economically beneficial, Rosa rubiginosa L. (Rosaceae) within southern Africa*. Poster presented at the 49th Annual Conference of the South African Association of Botanists (SAAB), University of Zululand, Richard's Bay, South Africa. 7-11 January 2024.

Rothmann, L.A., Del Ponte, E.M., Boshoff, W.H.P. & Pretorius, Z.A. 2024. *Plant rust research in South Africa: "A picture is worth a thousand words."* Poster presented at the American Phytopathological Society - Plant Health Conference, Memphis, Tennessee, USA. 27-30 July 2024.

Sabela, K.S., Masisi, T.V., Van der Walt, P.J. & Rothmann, L.A. 2024. *Seeds of knowledge: exploring fungi associated with uChokwane (teparay bean), a climate-smart landrace*. Poster presented at the 53rd congress of the Southern African Society for Plant Pathologists (SASSP), Golden Gate Highlands Hotel, Golden Gate, South Africa. 22-25 January 2024.

Sivhada, R.A., Van Biljon, A. & Labuschagne, M.T. 2024. *Going back to the wild for better bread*. Poster presented at the 15th Southern African Plant Breeders' Association (SAPBA)

Symposium, Monte Bello Estate, Bloemfontein, South Africa. 11-13 March 2024.

Tenesi, T., Jumbo, M., Jaba, J. & Labuschagne, M.T. 2024. *Genetic resistance to fall armyworm in sorghum*. Poster presented at the 15th Southern African Plant Breeders' Association (SAPBA) Symposium, Monte Bello Estate, Bloemfontein, South Africa. 11-13 March 2024.

Valombola, J.S., Labuschagne, M.T., Van Biljon, A. & Horn, L. 2024. *Radio sensitivity test of gamma-irradiated Bambara groundnut for lethal dose (LD₅₀) and growth reduction (GR₅₀)*. Poster presented at the 15th Southern African Plant Breeders' Association (SAPBA) Symposium, Monte Bello Estate, Bloemfontein, South Africa. 11-13 March 2024.

Research Reports

Boshoff, W.H.P. 2024. *Evaluation of wheat cultivars and lines for genetic resistance to rust diseases*. Report delivered to the South African Winter Cereal Industry Trust, Pretoria, South Africa.

Boshoff, W.H.P. 2024. *Explore new rust resistance sources in wheat*. Report delivered to the South African Winter Cereal Industry Trust, Pretoria, South Africa.

Figlan, S., Chaplot, V., Shimelis, H., Shamuyarira, K.W., Ngidi, A. & Mutanda, M. 2024. *Water use efficiency and soil carbon sequestration of selected indigenous and modern crop cultivars for sustainable agriculture intensification and climate change mitigation*. Report delivered to Water Research Council (WRC). ISBN 978-0-6392-0603-5.

Padacyachee, A. & Martin, G.D. 2024. Risk Analysis Report. Taxon: *Rosa rubiginosa* L. Area: South Africa. Approved by: South African Alien Species Risk Analysis Review Panel on 20 March 2024.

Visser, B. 2024. *Screening South African stem and stripe rust field isolates for fungicide insensitivity using MARPLE diagnostics*. Report delivered to the South African Winter Cereal Industry Trust, Pretoria, South Africa.

Weyl, P., Witt, A. & Martin G.D. 2024. *Silent invader: Hydrocharis laevigata in southern Africa*. Evidence Note. CABI Publishing.

Yilmaz, N., Visagie, C.M., Visser, B. & Boshoff W.H.P. 2024. *Survey of fungal pathogens affecting maize production in the Eastern Cape*. Report delivered to the Maize Trust, Pretoria, South Africa.



STAFF (2024)

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Prof A Minnaar-Ontong**

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Professors: Prof L Herselman and Prof MT Labuschagne

Associate Professors: Prof WHP Boshoff, Prof A Minnaar-Ontong, Prof R van der Merwe, and Prof B Visser

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Lecturers: Dr M Jackson, Dr MS Mafa, Dr L Rothmann, Dr KW Shamuyarira, Dr C Steyn, and Dr DA Veldkornet

Mentor: Prof L Scott

Research Fellows: Dr NW Mbuma, Dr GP Potgieter, Prof ZA Pretorius, Dr S Ramburan, Dr L Roussow, Prof WJ Swart, Dr AM Venter, and Prof HJT Venter

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Chief Officer – Professional Services: Dr CM Bender

Officer – Professional Services: DN Mngomezulu

Senior Officers: M Frylinck and HP Pretorius

Senior Assistant Officers: LP Mbingeleli and JM Vlotman

Assistant Officer: K Mbatha

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Lecturers: Dr PJ Mojau and TR Pitso

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DEPARTMENT OF
**ZOOLOGY AND
ENTOMOLOGY**

FACULTY OF NATURAL AND AGRICULTURAL SCIENCES



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OVERVIEW OF 2024

“**W**hat did we do in 2024?” We attended conferences, local and abroad, we went on numerous fieldtrips (all over South Africa and neighbouring Botswana and Namibia), some were privileged enough to travel to far-off countries on other continents, some academic and support staff participated in student excursions, and open days, not to mention NAS Flash Fact competition. Two new staff members were appointed on the Bloemfontein Campus, we hosted the first Short Leaning Programme (SLP) in the Department and were part of a biology education programme, collaborating with a non-profit organisation. Last, but not least, at the December 2024 graduation, three PhD degrees were awarded.

ACHIEVEMENTS

Staff Achievements

Prof Aliza le Roux was inaugurated in April 2024 as the first woman to achieve full professor status on the Qwaqwa Campus. In 2024, she also became a member of the international Belmont Forum Advancing Leadership programme and the inaugural cohort of the Public Engagement Exchange (PEX) between South Africa and Germany.

Prof Patrick Voua Otomo was appointed as the Director of the Centre for Global Change (formerly Risk and Vulnerability Science Centre). He will remain a staff member of the Department of Zoology and Entomology on the Qwaqwa Campus.



Prof Aliza le Roux's inaugural lecture in April 2024. Front, Prof Aliza le Roux; back, from the left, Prof Liesl van As, Prof Vasu Reddy, Prof Prince Ngobeni, and Prof Sam Adelabu

The UFS Exceptional Academic Achievers Awards celebrate excellence within the academic community. At the October 2024 ceremony, Lindi Heyns was recognised for her innovative contributions to learning and teaching, securing first place in the Assessment category.

Prof Peter Taylor was a nominated finalist for the 2023/2024 National Science & Technology Forum (NSTF)-South 32 Awards in the Lifetime category.



Prof Peter Taylor and Prof Sandy Steenhuisen (Plant Sciences) at the National Science and Technology Forum awards in Sandton

During the 53rd Annual Meeting of the Parasitological Society of Southern Africa, Prof Linda Basson received the Elsdon-Dew Medal for her contribution to parasitology in Africa, from the Parasitological Society of Southern Africa, during the 52nd Annual meeting. The medal was received on her behalf.

Dr Ntatisi Molefel-Nyembe received an honorary membership of the Golden Key International Honour



Elsdon Dew Medal awarded to Prof Linda Basson

Society through her nomination by recognised honours students (top 15% internationally) for her extraordinary mentorship in teaching and learning for the Qwaqwa students.

Student Achievements

Runé van der Merwe received the Junior Kaptein Scott medal from the South African Academy of Science and Art for the best MSc in Zoology at a South African university. The prize was awarded in September 2024 at a gala function in Pretoria.



Runé van der Merwe (second on left in back row) at the 2024 South African Academy Awards

Ruan Booysen win the prize for the best student paper at the 14th Colloquium of the African Arachnological Society, held at the ATKV Buffelspoort, North West, early in 2024, for his paper 'Scytodes (Araneae: Scytodidae) spitting spiders of Southern Africa'.

Thandeka Mahlobo attended the XIX International Colloquium on Soil Zoology (ICSZ) and the XVI International Colloquium of Apterygota (ICA) in Cape Town, during the week of 26 to 30 August where she gave an oral presentation, on the impact of the invasive alien *Gleditsia triacanthos* (Fabaceae) on ground-dwelling arthropod in South African grasslands and won second best prize for a student presentation.

Aneke Kruger received the Micrograph Nikon Prize (2nd place) at the 58th Annual Meeting of the Microscopy Society of southern Africa, that was hosted in December 2024 on the Bloemfontein Campus. This was for her scanning electron microscopy images used in her presentation on the left P5 of male *Metadiaptomus meridianus* used to firmly cling to the female's urosome. The left, pincer-like transformed P5 of the male then transfers a spermatophore to the female's urosome.



Left P5 of male Metadiaptomus meridianus used to firmly cling to the female's urosome

TEACHING AND LEARNING

During the 2024 autumn recess, Prof Daryl Codron and Dr Candice Jansen van Rensburg took the third-year Ecology students on the annual ecology excursion to Umgeni Nature Reserve in Howick and Treasure Beach on the Bluff, both facilities administered by the Wildlife and Environmental

Society of South Africa (WESSA). Several practical field experiments were carried out during the excursion, such as water quality testing at different sites along the Umgeni River, dispersal patterns of organisms within the Nature Reserve, and community zonation patterns, species associations, and species turnover of the Treasure Beach rocky shores. At the end of the week, students presented their results in the form of poster presentations, and a month later a written submission in the form of a journal article.

The annual third-year Entomology excursion was held concurrently at Bankfontein in the western Free State for the seventh year by Prof Charles Haddad and PhD student Ruan Booyesen. The group was joined by Prof Stano Pekar of Masaryk University in Brno and PhD candidate Jan Korba from Charles University in Prague, Czech Republic, who conducted predation trials on various spider families. The students conducted a comparative study of arthropod diversity in three biotopes using three sampling methods, delivering a presentation and submitting a written report on their results.



Third-year Entomology excursion to Bankfontein. From the left, Samkelo Ndlovu, Keamogetswe Nteo, JC Beukes, Buhle Zwane, Palesa Mothlabi, Ruan Booyesen, Dr Michael Vickers, Prof Charles Haddad, Ithabaleng Kalane, Prof Stano Pekar, and Jan Korba

In the first semester, Introduction to Behavioural Ecology students on the Qwaqwa Campus attended the joint field excursion in Golden Gate Highlands

National Park with the Vegetation Ecology students from Plant Sciences. As usual, this was a great success in which multidisciplinary, hands-on learning took place. Students base their capstone assignment on this weekend field trip.

The BIOL6814 students grappled with ChatGPT in their academic writing, learning how to use this AI tool as tutor and advisor – but not as the primary writer. They also learned how to use AI (Bing and co-pilot) to create brand new images.

During the second semester recess, the second- and third-year Entomology students from the Bloemfontein Campus, went on the bi-annual Industry Entomology excursion led by Dr Vaughn Swart, Dr De Villiers Fourie, and our Department's technician, Patrick Mohasi. The excursion began with a visit to the National Institute for Communicable Diseases (NICD) in Pretoria, where students learned about malaria control strategies, including the Sterile Insect Technique (SIT) used to manage mosquito populations. The second day featured a visit to Onderstepoort Veterinary Research Institute (OVI), where research on Tsetse fly control highlighted the role of entomology in veterinary science. Students also visited the Agricultural Research Council (ARC)-Vegetable, Industrial, and Medicinal Plants (VIMP), where biological control methods for crop pests were explored, and ARC-PHP (Plant Health and Protection) Biosystematics, home to one of the largest insect



Entomology students during Industry excursion to Pretoria, accompanied by Patrick Mohasi (front left), Dr Vaughn Swart (front right), and Dr De Villiers Fourie (back centre)

collections in the world. On the third day, the group visited ARC-PHP at Roodeplaat, where researchers focus on biological control of invasive plants using insects. The final stop was at Syngenta, a global agrochemical company specialising in targeted insecticides and herbicides. The excursion provided insight into real-world entomology applications, inspiring students to consider future careers in the field. Participants gained a deeper appreciation for the role of insects in environmental management, disease control, agricultural sustainability and global food security.

In the second semester (from 28 to 30 August), the third-year Biology students from the Qwaqwa Campus undertook their annual excursion to Maropeng Gradle of Humankind. The excursion was led by Dr Mpho Ramoejane with assistance from Maria Sithole, Nosipho Kheswa and Veli Mdluli. The students participated in a tour of the facility to learn more about human evolution as Africa is regarded as the place where humans originated. Unfortunately, the Sterkfontein caves were not open to the public for large part of 2024, due to the high rain falls. The excursion ended with the students presenting their assignments.



Qwaqwa third-year Zoology students at Maropeng with Dr Mpho Ramoejane (kneeling)

The second-year Biology Education students (a module lectured by Plant Sciences as well as Zoology and Entomology staff) from the Bloemfontein Campus, collaborated with a non-profit organisation on a live project to create educational posters for

local schools. Through this initiative students learned about planetary boundaries and participated in a poster design workshop led by Lindi Heyns (Zoology) and Jani van der Merwe (Centre for Teaching and Learning). The class of 200 students were introduced to new educational tools such as FeedbackFruits to encourage engagement and teamwork. The project culminated in the creation of a series of posters aimed at promoting environmental awareness. This authentic learning experience equipped students with the knowledge and skills to confidently teach these topics in future classrooms. (<https://sharescreenafrica.org/projects/conservation-for-non-conservation-students-f7079/designing-change-55c21-subproject>)



From the left, Olerato Sesenyamotse, Cidalia Sithole, Boitumelo Maqoacha, Khanysile Molotsi, and Mpoetseng Moloji with their planetary boundary poster



(Front) Bennie Jordaan (PhD) and Dr Edward Netherlands; (Back) James Kidd (PhD), Samantha Paterson, Hendriëte Stroebel, and Khomotso Mothibi at Bankfontein

The Bloemfontein Honours Biodiversity excursion, supervised by Dr Edward Netherlands, took place in early March 2024 at Bankfontein in the western Free State. This was a joint excursion with the Herpetology module, focusing on species identification techniques and data analysis.

In preparation for the trip, Dr Michael Bates and Dr Cora Stobie from the Department of Animal and Plant Systematics at the National Museum (both serving as Research Fellows at UFS), presented a one-day workshop to the students. In addition, Adriaan Jordaan and Christiaan Steenkamp, Principal Technicians of the Science Collections at the South African National Biodiversity Institute (SANBI), hosted a pre-excursion workshop on the Specify Database. They later joined the excursion for several days and actively participated in the field programme. Dr Marvin Schäfer, a postdoctoral fellow from the Natural History Museum in Berlin, Germany, also joined the field excursion, delivering sessions on various aspects of field-based research and safety.



Dr Marwin Schäfer at Bankfontein during night collection



RESEARCH, INNOVATION AND RESEARCH COLLABORATION

Bloemfontein Campus

Aquatic Parasitology

Dr Leon Barkhuizen (Research Fellow and Fisheries Scientist at Free State Department of Economic, Small Business Development, Tourism and Environmental Affairs) assisted us with fieldwork for the Honours students who were enrolled for Aquatic Parasitology in the first semester. Students undertook fish surveys in Krugersdrift Dam (Modder River) and visited the Aquaculture Technology Demonstration Centre (ATDC) at Gariiep. During the day visit at ATDC, staff presented lectures to the students, which was followed with a tour of the facility.

Prof Liesl van As and Prof Linda Basson (Emeritus Professor and Research Fellow) were joined by Dr Gerhard de Jager, on a visit to the Leseding Research camp in Botswana for a two-week survey. The 2024 trip was also a recce trip for upcoming fieldtrips with researchers from the University of Pisa This forms part of the NGtax programme that started in 2019 and were delayed due to COVID-19.

Applied Agriculture Entomology

The Applied Agricultural Entomology Group, led by Dr De Villiers, has been investigating pesticide



Dr De Villiers Fourie fogging a macadamia tree with pesticides to collect stinkbug pests

resistance in macadamia nuts for several years. The project culminated in 2024 with the completion of his PhD thesis titled 'Identification and Management of Pyrethroid Resistance in Two-Spotted Stink Bug, *Bathycoelia distincta* (Hemiptera: Pentatomidae), on Macadamia in South Africa'. The project provided invaluable insights, and additional research on pesticide resistance in other agricultural pests is being planned for the near future.

Recently, the group's focus has shifted toward addressing industry demand and expanding research in this area. Since 2024, the group has been conducting contract research for Bayer CropScience, focusing on maize and soybean crops in all primary growing regions of South Africa.



Spotted maize beetle feeding

Pieter van der Merwe is nearing the completion of his MSc dissertation which involves a comprehensive evaluation of armoured scale insect damage to walnut crops in the Free State. The study explores alternative management strategies, such as biological control, to provide practical recommendations for growers and contribute to a comprehensive pest management plan for this significant threat.

A collaborative study with Dr Fourie (Entomology) and Dr Gesine Coetzer (Soil, Crop and Climate Science), was conducted in 2024 to investigate resistance to cochineal and cactus moth damage and infestation across several new prickly pear cultivars. The study yielded excellent results, and an abstract has been submitted for review and presentation at the XI International Congress on Cacti as Food, Fodder, and other uses.

Arachnology

Prof Charles Haddad continued collaborative research with Prof Stano Pekar (Masaryk University, Czech Republic) on dietary specialisation in various spider families, with an emphasis on Zodariidae and Salticidae. As a result of his visit to the UFS in March 2024, he started collaboration with postdoctoral fellow Dr Michael Vickers on dietary specialisation in jumping spiders. This work has since continued, with Michael generating experimental dietary data on almost 150 individuals tested using four prey types.

Prof Haddad also continued collaboration with Prof Wanda Wesolowska (Wroclaw University) and Prof Konrad Wisniewski (Pomeranian University) on the taxonomy of African Salticidae, Cristian Grismado and Martin Ramirez (Museo Argentino de Ciencias Naturales) on Anyphaenidae, Corinnidae and Trachelidae, and Robin Lyle (Agricultural Research Council) on Trachelidae.

Prof Stano Pekar and Jan Korba (PhD student) from the Czech Republic visited the Arachnology research group during March 2024 as part of continued collaborative research on the predation biology and dietary evolution of various spider families on a global scale. The two visitors also delivered presentations to departmental staff and students on spider mimicry and the phylogeny of Mediterranean trapdoor spiders, respectively. Field work was conducted at the West Campus of the UFS and at Bankfontein to collect zodariid spiders for feeding trials and fresh material for a molecular phylogeny of the family. A paper on this latter study was submitted for publication at the end of 2024.

Prof Charles Haddad, Dr Michael Vickers, Hannelene Badenhorst, and Ruan Booysen (both PhD students) attended the 14th Colloquium of the African

Arachnological Society, held at the ATKV Buffelspoort in the Northwest Province.

Etho-Ecology

The etho-ecology research group, led by Dr Hennie Butler, focused on ecologically based animal behaviour. In collaboration with Prof Francois Deacon (Animal Science), various field excursions were undertaken related to giraffe research. A collaborative study on the behaviour of giraffes as part of their thermoregulation was initiated.



Johanco Viljoen and Dewald du Plessis assisting with Giraffe project

Johanco Viljoen (MSc student) continued to evaluate the biodiversity of inselbergs in the Free State. Hendriette Stroebel (Honours student) evaluated Muridae and invertebrate diversity as bioindicators of grassland integrity in the central Free State. In collaboration with the Zoological Garden of Mangaung Municipality, a study on the morphometrics of aardvark burrows at Kwaggafontein was initiated.

Environmental Entomology and Dipterology

The Environmental Entomology research group, led by Dr Vaughn Swart, focuses on studying insects and their interactions with the environment, covering areas such as ecology, pest management, and the impact of human activities on insect populations and ecosystems. Further research, including dipterology, explores the biology, behaviour,

classification, and evolution of this diverse group of insects, which plays a crucial role in revealing their ecological relationships and broader evolutionary patterns across various habitats and organisms.

Adriaan Stander (MSc student) registered as a part-time MSc student and focused on research on the management of the brown locust (*Locustana pardalina*). In early 2024, Adriaan was employed by Rovensa Next, a global company specialising in biological solutions for sustainable agriculture. As a field trial specialist, Adriaan plays a crucial role in conducting registration and screening trials. Through this work, Adriaan contributes to developing and validating innovative agricultural solutions that support environmentally friendly and effective farming practices.

Gary Edwards has started with his PhD focusing on the possibility of intercrop migration of false codling moth (*Thaumatotibia leucotreta*) and carob moth (*Ectomyelois ceratoniae*) between citrus and pecan orchards. Burgert Muller, a part-time PhD student, is making satisfactory progress in looking at the systematics of Afrotropical water snipe flies (Diptera: Athericidae).

De Villiers Fourie successfully obtained his PhD, which focused on the investigation of pyrethroid resistance in two-spotted stinkbug, *Bathycoelia distincta* (Hemiptera: Pentatomidae), on macadamia nuts in South Africa.



At the December 2024 graduation, from the left, Prof Charles Haddad, Hannelene Badenhorst, Dr De Villiers Fourie, and Dr Vaughn Swart

Herpetology

Dr Edward Netherlands and his research group continued to focus on the diversity of blood parasites in amphibians and reptiles across various regions of South Africa, the African continent, and globally. Their research aims to improve our understanding of the distribution, ecology, and evolutionary biology of these parasites, which can have important implications for both conservation and public health.

Dr Netherlands leads and contributes to a range of national and international collaborative research projects that advance biodiversity and parasite research, particularly in ectothermic vertebrates. His involvement in the Next Generation Taxonomy (NGTax) project, in collaboration with Dr Michele Castelli (University of Pavia, Italy), focuses on the genomic characterisation of frog trypanosomes, with PhD student Bernie Jordan leading genome sequencing efforts. He is also involved in a US NSF-funded project on the systematics and diversity of Haemosporida parasites in African lizards, working with Prof Aaron Bauer and Dr Amanda Picelli (Villanova University, USA), Dr Maria Pacheco and Prof Ananias Escalante (Temple University, USA), and Dr Johann van As (UFS Qwaqwa Campus), who serves as a co-investigator on this initiative. The collaboration aims to secure additional funding and expand postgraduate research and training opportunities.

Through an NCN-funded project with Prof Gemma Palomar and Prof Rodrigo Megia Palma (Complutense University of Madrid, Spain), Dr Netherlands investigates the role of blood parasites in amphibian disease dynamics, including their interactions with emerging pathogens.

In a regionally focused initiative, he collaborates with Dr Francois Jacobs (Namibian Ministry of Fisheries and Marine Resources), Prof Louis du Preez (North-West University), and Prof Stephen Bullard (Auburn University, USA) on an Oak Foundation-funded survey of blood parasite diversity in ectothermic vertebrates and birds within the Kavango-Zambezi Transfrontier Conservation Area (KAZA-TFCA), generating data that will support RAMSAR site designation and broader conservation goals. In collaboration with Prof Louis du Preez (North-West

University), the Bloemfontein team conducted a research expedition to Botswana and Namibia from 28 January to 20 February.



Francois Jacobs (Kamutjonga Inland Fisheries Institute, Namibia), Dr Edward Netherlands, and Prof Louis Du Preez with a new bull frog species

In addition, Dr Netherlands maintains long-term collaborations with Dr Marvin Schäfer and Prof Mark-Oliver Rödel (Natural History Museum, Berlin), contributing to joint studies on amphibian and reptile parasites and field-based experimental research.

Dr Netherlands and Bernie Jordaan attended the 10th World Congress of Herpetology held from 5 to 9 August 2024 in Kuching, Sarawak, Malaysia. He was also an invited plenary speaker at the VI



Students at the workshop on blood parasite sampling in local amphibians and reptiles, hosted by Dr Edward Netherlands in Colombia

International Conference on Malaria and Other Blood Parasites of Wildlife & III International Symposium of the Wildlife Diseases Research Network, held from 26 to 29 November 2024 in Medellín, Colombia. During his visit to Colombia, he conducted a student workshop on blood parasite sampling in local amphibians and reptiles.

Dr Netherlands also served on the organising committee for the 16th Conference of the Herpetological Association of Africa, held from 25 to 29 November 2024 in Wilderness. All postgraduate students from the UFS HERP Lab attended the conference and presented their research.

In March and April 2024, Dr Marvin Schäfer, a postdoctoral fellow from the Natural History Museum in Berlin, Germany, visited the UFS HERP Lab to collaborate on an experimental project on frog parasites.

As part of a collaborative research project on lizard malaria between Villanova University (USA) and the National Museum of Namibia (Windhoek), PhD student James Kidd and MSc student Monique Barnard were invited to join a research trip to Namibia from 31 October to 24 November 2024.

Tamson Foster, who was enrolled for her PhD under the supervision of Prof Neil Heideman (the previous herpetologist in the Department until his retirement in 2021), graduated in December 2024.

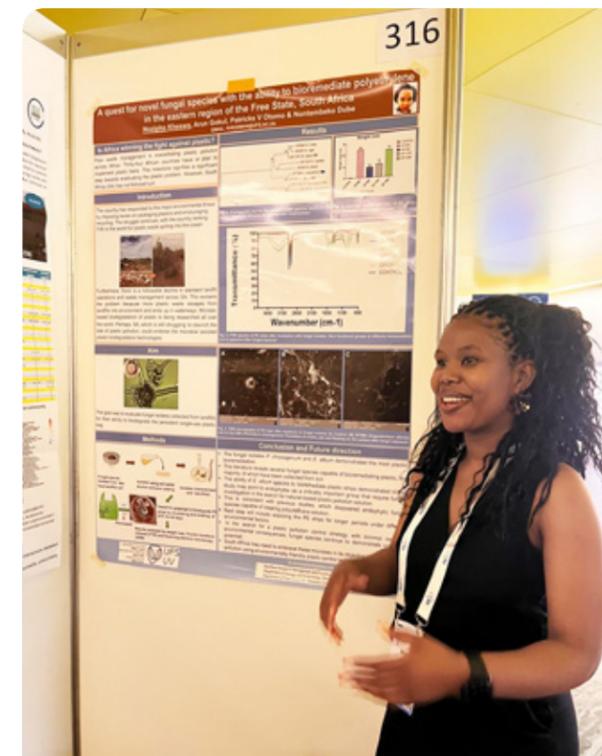


Tamson Foster and Prof Neil Heidemann at the December 2024 graduation ceremony

Integrated Biological Control and Ecosystem Management (IBEM)

In January 2024 Ntsoaki Sabisa enrolled for her MSc as the first candidate in the IBEM initiative to explore the efficacy of invasive alien plants for the management of agricultural insect pests in South Africa. This study, funded by the NRF and Maize Trust, aims to understand the response of ecosystem species on invasion to *Gleditsia triacanthos*.

Thandeka Mahlobo (PhD student) spent two months (January and February) at the Nematology section in the Agricultural Research Council under the guidance of Dr Chantelle Girgan and Dr Mariette Marais for her study section on nematodes. Thandeka attended the XIX International Colloquium on Soil Zoology (ICSZ) and the XVI International Colloquium of Apterygota (ICA) in Cape Town from 26 to 30 August where she gave oral presentations on the impact of the invasive alien *Gleditsia triacanthos* (Fabaceae) on ground-dwelling arthropod in South African grasslands. She also attended the 16th NRF-SAEON Student Network Indibano held on the 16-19 September in Gqeberha.



Nozipho Kheswa presenting her poster at the 34th Society of Environmental Toxicology and Chemistry conference in Spain

Keletso Makaota submitted her MSc dissertation on 'Ecological impacts of *Cylindropuntia pallida* (Cactaceae), herbicidal management, and efficacy of *Bacillus amyloliquefaciens* as a biopesticide in South Africa'.

Nozipho Kheswa (Qwaqwa staff member and PhD student) attended and presented a poster on 'A quest for novel fungal species with the ability to bioremediate polyethylene in the eastern region of the Free State, South Africa', at the 34th Society of Environmental Toxicology and Chemistry (SETAC), from 5 to 9 May in Seville, Spain. Her poster was among the Top 100 of 2 600 posters.

In November, Dr Nontembeko Dube visited the ZZZ offices in Mooketsi with three Microbiology colleagues (Prof Koos Albertyn, Dr Christopher Rothmann, and Dr Winschau van Zyl) during which the prospects of investing on biologicals for plant production and pest management were discussed. En route from Mooketsi, Dr Dube attended the national stakeholder consultation workshop on National Invasive Species Strategy and Action Plan in Pretoria where the urgency on the invasive alien species management was discussed as a matter of urgency.



UFS staff visiting ZZZ Mooketsi farm, from the left, Dr Winschau van Zyl, Dr Nontembeko Dube, Dr Christopher Rothman, Faan Smit (ZZZ), and Prof Koos Albertyn

Dr Dube and her students (Ntsoaki Sabisa and Thandeka Mahlobo) went on a field trip to Umkomaas, KwaZulu-Natal in May 2024. During this trip they visited the Weeds Division of the Agricultural Research Council where Dr Dube is collaborating with Dr Costas Zachariades, the Ants Laboratory in the University of KwaZulu-Natal (UKZN) of Dr Caswell Munyai, a collaborator on arthropod assemblages, as well as the natural products laboratory led by Dr Fanie

van Heerden (Dr Dube's mentor on phytochemistry) of the UKZN Chemistry Department.



Thandeka Mahlobo (PhD), Ntsoaki Sabis (MSc), Dr Costas Zachariades, and Dr Nontembeko Dube at the ARC Weeds Division

Nematology

The current research in the lab of Dr Candice Jansen van Rensburg remains focused on free-living nematodes from nature reserves in the Free State. These nematodes play important roles in maintaining soil health and contributing to the overall functioning of ecosystems. They are crucial members of soil food webs, and their activities help drive processes like nutrient cycling, decomposition, and soil structure maintenance. Free-living nematodes therefore offer significant benefits to agriculture by also contributing to pest control and serve as natural bioindicators of soil health. Dr Jansen van Rensburg continued collaboration with Prof Gerhard du Preez (NWU), counting and identifying free-living nematodes from soil samples for one of his research projects. Anke de Smidt is currently in the write-up stage of her PhD, focusing on the systematics of the superfamily Cephaloidea from the Free State, which are very important bacterivorous nematodes in the soil.

In December 2024, Dr Milad Rashidifard joined the nematology research group. His research centres on the identification and management of important plant-parasitic nematodes. By understanding these interactions, he tries to identify antagonistic bacteria and fungi that have nematode biocontrol potential. Another aspect of his research is to control plant-parasitic nematodes using sustainable management

strategies such as cover crop, crop rotation and soil microbiome.

Dr Rashidifard has a strong collaboration with Dr Samad Ashrafi, Dr Torsten Tonen and Dr Wolfgang Maier at Julius Kuhn Institute (JKI) in Germany, which has already resulted in the publication of several articles. Milad is also collaborating with Prof Majid Pedram from Tarbiat Modares University (Iran) and Prof Akbar Karegar from Shiraz University (Iran). In terms of national collaboration, Dr Rashidifard is working closely with Dr Mieke Daneel (ARC-TSC) and Prof Gerhard du Preez (NWU).

Terrestrial Ecology

The most significant discovery made by the Terrestrial Ecology group (led by Prof Daryl Codron) during 2024 was derived from a stable isotope study of fossil mammal fauna from the Late Pleistocene assemblage at Kathu Pan I, Northern Cape (published in *Quaternary International*). Based on serial carbon and oxygen stable isotope profiling of tooth enamel carbonates, we found that individual niche specialisation was not a definitive strategy of any of the sampled palaeopopulations, nor was individual generalism. Instead, individuals of each 'population' varied in their strategy. For the first time, a population characterised by discrete levels of niche variability amongst individuals was described. Typically, emphasis is placed on whether populations comprise individual generalists or specialists. Whether this type of phenotypic plasticity is a peculiar feature of the 'hyper-productive' mid-Late Pleistocene of the central interior of South Africa, a feature unique to mammalian herbivores, or a ubiquitous phenomenon, is still an outstanding question, but whatever the case these findings necessitate a re-formulation of our current thinking about individual niche variation.

Another finding of note was the uncovering of cyclic dynamics of population trajectories in approximately half of roughly 150 studied mammal herbivore populations living in free-range conditions in the Free State, and at an even greater rate amongst European captive zoo populations. Cycles occur at frequencies different to a) life history strategies, e.g. reproductive biology, and b) climate. Previously, cyclic – and even chaotic – dynamics have largely

been hypothesised for fast-reproducing species like cockroaches, locusts, and various pathogens, but modelling derived from our preliminary observations revealed that high growth rates can cause lags that effectively cancel out cyclic growth. This research is still nascent, but we expect key insights about population dynamics to emerge in the coming months/years.

Studies of South African palaeoenvironments (e.g. individual niche variation; see above) were undertaken in collaboration with Dr Liora Horwitz (Hebrew University of Jerusalem).

Prof Codron is also a co-investigator of an ERC-Stg project 'PEOPLE', led by Dr Michael Toffolo (University of Bordeaux, France) studying Paleolithic human palaeo-dispersal in relation to resources across the South African central interior. Several studies of life history evolution and adaptation were published in collaboration with Prof Marcus Clauss (University of Zurich, Switzerland).

Postdoctoral research fellow (Dr Aileen van der Mescht), two PhD students (Chanel Lewis and Runé van der Merwe), and MSc student (Jabulile Maseko) along with Monique Barnard, all either submitted papers or are preparing to submit to non-predatory peer-reviewed journals. Runé is co-supervised by Han Olf from the University of Groningen, as part of an international collaboration that opens new avenues to explore for future joint-degree students.

Aileen's work involved a macroecological study using a multi-decadal South African spider taxonomy database, demonstrating that completeness of biodiversity metrics increases with both spatial and taxonomic scale. These findings are critical for informing biodiversity studies as the vast majority published within our region do not address the issue of coverage explicitly or implicitly, and also for displaying the topical, present-day contribution of taxonomic datasets – such data remain invaluable, and their compilation needs to continue well into the future.

Chanel Lewis attended a Bone Identification course hosted by HeritageWorX at the Ditsong National Museum of Natural History, developing scarce skills not only in morphometric methods, but the novel

perspectives gleaned from studies of comparative anatomy (and, by extension, physiology). These advances were already displayed at the 2024 SAAWK, where Chanel's authoritative presentation was identified as one of the top eight PhD papers delivered. Prof Codron visited the University of Colorado (UC)



Chanel Lewis (left) with Karin Scott of HeritageWorX, an expert on archaeological explorations

at Boulder as part of his involvement in a Human Frontiers Science Foundation funded research project advancing novel approaches to isotopic analysis of early hominin diets. The project includes collaborators from UC (Dr Caj Neubauer, Prof Matt Sponheimer), the Max Planck Institute for Chemistry, Mainz, Germany (Dr Tina Lüdecke and colleagues), the University of Munich (Dr Rani Bakkour), and others.



Prof Daryl Codron and other Palaeodiet research workshop participants hiking in the Rocky Mountains of Colorado

Mammal Parasitology Laboratory

Dr Luther van der Mescht joined the Department of Zoology and Entomology in June 2024 as a replacement for Dr Ellie van Dalen who retired at the end of 2023. Since joining the Department, Dr Van der Mescht has been building and expanding on the research conducted by Dr Van Dalen, as well as fostering collaboration with other academics and industry partners.

The Pesticide Resistance Testing Facility (PRTF) continued to operate as part of the laboratory delivering a resistance testing service for producers and pharmaceutical companies based on good scientific practice, so that data generated can be used for research. Elizna Terblans (PhD) and Grethe Campher (MSc) joined the lab in 2024, studying tick diversity and developing a rat-endoparasite model, respectively.

Dr Van der Mescht initiated several new and continued existing national and international collaborations. Nationally, Luther started collaborating with Dr Zamantungwa Khumalo-Mnisi (University of Limpopo) and applied for NRF FBIP funding to start a two-year project on tick diversity in 2025 which was successful. He also continued working with Prof Sonja Matthee (Stellenbosch University), Prof Conrad Matthee (Stellenbosch University), Prof Adriaan Engelbrecht (University of the Western Cape), Dr Mamohale Chaisi (South African National Biodiversity Institute), Prof Eddie Ueckermann (North-West University), Dr Marcus Makgabo (University of South Africa), and Dr Leigh Richards (Durban Natural Science Museum), which resulted in NRF FBIP funding for a two-year project on the ectoparasites of small mammals, and industry (Clinvet and other animal health companies) collaborations.

Internationally, he started a collaboration with Dr Charles Ndawula (National Livestock Resources Research Institute, Uganda) to investigate a novel method to test acaricide resistance and continued collaborating with Prof Boris Krasnov (Ben-Gurion University of the Negev, Israel) and other international colleagues studying the evolutionary ecology, biogeography and community ecology of parasites.

Qwaqwa Campus

Afromontane Molecular Phylogenies Group

This research group focuses on the diversity and conservation of small mammals (rodents and shrews) in the Maluti-Drakensberg. Nkanyiso Sishange (MSc student) managed to undertake successful sampling exercises at Sterkfontein Dam (7 to 10 March), Qwaqwa Campus (5 to 9 August), and three localities on Clarens farms (12 to 15 March and 10 to 15 July) with the help of Zandile Dlalisa and Karabo Moloi (PhD in Plant Sciences). Zandile, in the first year of her MSc research, was mostly busy with ethics and permit applications. Both students went to the Bloemfontein Museum to deliver voucher specimens and to measure those housed in the museum.



Nkanyiso Sishange conducting a small mammal survey at Sterkfontein Dam

Dr Mpho Ramoejane visited Prof Paulette Bloomer at the Molecular Ecology and Evolution Programme (MEEP) laboratory at the University of Pretoria and Prof Albert Chakona at SAIAB/NRF to continue his collaboration with both institutes. He is currently establishing new collaborations with Dr Morena

Mampuru (SanParks), Dr Sifiso Xulu (UKZN,) and Dr Samuel Motitsoe (Wits).

Applied Entomology

Veli Mdluli, the last remaining student of the Kokonyana lab, successfully completed his PhD. Dr Emile Bredenhand has been taking a medically forced hiatus, and has focused on finding new funding opportunities, new students, and working on writing a book on Entomology teaching practices and study aids.

Behavioural Ecology Research Group (BERG)

There are multiple collaborative projects in the BERG, including collaborations with US colleagues on mountain reedbuck declines, plant-animal interactions, and community-based research combining social science with natural science approaches.

A new postdoctoral fellow, Dr Mpho Tawana, joined Prof Aliza le Roux's research group, bringing with him expertise in pathogen research, which can be linked to behavioural ecology in wild and disturbed habitats. Several students in this research group obtained funding from non-traditional sources, such as SANParks (Thembelihle Mofokeng) and EFTEON (Toka Mosikidi).

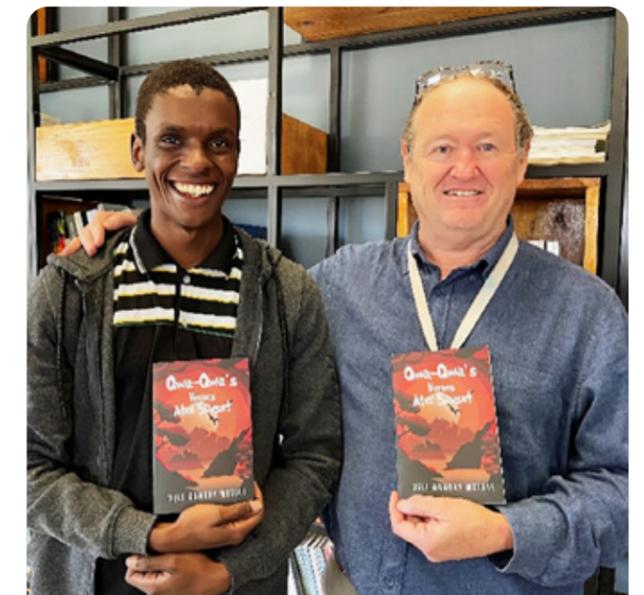
Prof Le Roux continued to collaborate with Dr Clara Grilo, who is a principal researcher at Rede de Investigação em Biodiversidade e Biologia Evolutiva in Lisbon, Portugal. She also leads projects in collaboration with Kyran Kunkel (University of Montana), colleagues at the University of Michigan (Gelada Research Group), the Extended Freshwater and Terrestrial Earth Observation Network (EFTEON), and members of the Plant Sciences Department. She started a new collaboration with Dr Emily Bennet from the University of Botswana. She has several other partnerships in the pipeline that are waiting for funding support to fully materialise.

Mountain Bat Laboratory

Khia van der Meulen registered for her MSc on social vocalisations and human-bat interactions of two house-roosting bat species. She has been using Passive Acoustic Monitoring to collect monthly samples of social calls of bats from roosting colonies

and foraging areas, and she has undertaken questionnaires in two urban communities (Phuthaditjhaba and Clarens) to investigate human perceptions of bats roosting in houses.

Veli Mdluli submitted his PhD on bat diversity along elevational and anthropogenic gradients, and the impacts of environmental education on children's perceptions of bats, in October, with graduation to follow in 2025. His children's book, *Qwaqwa's Heroes After Sunset*, was launched at the April 2024 graduation ceremony on Qwaqwa Campus.



Veli Mdluli and Prof Peter Taylor with the newly published book 'Qwaqwa's Heroes After Sunset'

Alexandra Howard, making steady progress with her PhD on bat diversity and ecosystem services in apple orchards, obtained a EUROSA award. This allowed her to travel to the University of Hohenheim in Germany and spend a month with Prof Ingo Grass (a collaborator of her supervisor, Prof Peter Taylor), who assisted with her data analysis and provided valuable networking with the agroecology group.

Prof Peter Taylor has been appointed as the Southern African Regional Hub Coordinator of the Global Mountain Biodiversity Assessment (GMBA). Peter attended a workshop of the GMBA in Davos, Switzerland in June 2024, after which he presented a paper at the World Biodiversity Forum.



Prof Peter Taylor presenting at the Global Mountain Biodiversity Assessment workshop in Davos, Switzerland

Peter Taylor, his students, and collaborators published a synthesis of the importance of the Southern African Escarpment in the biogeography of mountain bats in the journal *Global Change Biology*. This paper drew attention to and added important new information on the newly discovered Drakensberg-endemic horseshoe bat. The bat, discovered by P Benda and colleagues in 2024, had previously been confused with another common species.

Prof Taylor continued to collaborate actively with Prof Ara Monadjem from the University of Eswatini, and Prof Ingo Grass from the University of Hohenheim in Germany. Through the ongoing Witsieshoek BioBlitz Project, he collaborates with several researchers from UFS, UKZN, Wits University, ARC, Ezemvelo KZN Wildlife, the National Museum in Bloemfontein, and the Albany Museum.

Prof Taylor and Dr Mpho Ramoeljane, with jointly supervised MSc students, have uncovered a distinctly small-sized and genetically divergent new species of vlei rat (*Otomys*) from Golden Gate Highlands National Park. In collaboration also with Prof Josef Bryja from Czechia, who has additional data on the same species from elsewhere on the Free State, and colleagues from the National Museum in Bloemfontein, the new species will soon be formally described.

Parasitology

Dr Nthatsi Molefe-Nyembe and her group have successfully established a collaboration with the King of Makgolokwe in Tseseng, which will enable them

visit and collect animal samples from various livestock kept in this area. She continued her collaborative work with Prof Oriël Thekisoë (North-West University, Potchefstroom Campus) and established a new collaboration with Dr Zamantungwa Khumalo-Mnisi (University of Limpopo) and Dr Morutse-Mphahlele (Scientia Institute).

The postdoctoral fellowship of Dr Lehlohonolo Mofokeng was extended by a year based on his exceptional performance and postgraduate mentorship. Two Honours students successfully submitted their mini-dissertations and will graduate with distinction in 2025.

Vertebrate Haemoparasite Biology

Dr Johann van As and Dr Michelle van As continued to work through blood smears and blood samples of carnivores sampled during 2024, to obtain more information on morphological characteristics and presence/absence of blood parasites and to gather haematological data. They worked on a paper on the life cycle of the *Hepatozoon ingwe* together with Dr Netherlands which was submitted in December 2024.

Ecotoxicology Research Laboratory

In May 2024, Ngitheni Nyoka and Sanele Mnkandla (both PhD candidates) presented at the 34th Annual Meeting of the Society of Environmental Toxicology and Chemistry (European Chapter) in Sevilla, Spain. In October, Sanele Mnkandla and Nonhlanhla Radebe (MSc candidate) presented papers at the Qwaqwa Campus Research Conference, held in Clarens. Two students submitted their dissertations, i.e. Blessing Hlongwana and Nonhlanhla Radebe, whilst Nkabeleng Lechesa graduated with Honours *cum laude*. For the first time in the laboratory's history a total of nine papers were published in 2024.

NatuRA and OHRatSA collaborative projects

Prof Peter Taylor was a co-applicant in obtaining funding from the NRF-Norway partnership for a project involving collaboration between the UFS, University of Venda and Norwegian partners, titled NatuRA (Sustainable use of Natural Resources in Alpine and mountain grassland ecosystems under global change). About R1.6. million will come directly

to UFS for operational expenses related to monitoring biodiversity, restoring rangelands, and enhancing livelihood in the Qwaqwa Maloti Mountains.

Prof Taylor is the lead South African partner in a collaborative project on One Health Research on Pest Rodents in South African Townships (OHRatSA) that secured funding in 2024 from the South African and UK Medical Research Councils of about R14 million in total (including R4.38 million to UFS Department of Zoology and Entomology). The project which is expected to last from March 2025 to March 2028, involves collaborators from the University of Venda (Prof Lourens Swanepoel) and the University of Greenwich (Prof Steve Belmain)

ACADEMIC CITIZENSHIP AND COMMUNITY ENGAGEMENT

Dr Luther van der Mescht published a popular article in *The Conversation* and was interviewed live on television (*eNCA* and *Newzroom Afrika*) and radio (*Radio 786* and *Cape Talk*) to discuss research on the development of acaricide resistance in ticks of livestock in South Africa and the way forward. This effort aligns with the Vision 130 strategy of being a regionally engaged university and supports one of the key pillars of research development at the UFS, which is to make research visible, impactful, and relevant to society.

Lindi Heyns and Prof Liesl van As partnered with Leadership for Conservation in Africa (LCA) on the 'Designing Change' project, one of 15 pilot projects funded through the LCA's Conservation for Non-Conservation Students (CNCS) programme. This initiative helps students recognise the relevance of conservation within their academic disciplines and future career paths. Over 200 education students at the University of the Free State participated, gaining hands-on experience in environmental education. All 15 CNCS projects can be viewed on <https://sharescreenafrica.org/projects/conservation-for-non-conservation-students-f7079>. Lindi Heyns

also designed a series of planetary boundaries posters donated to more than 20 schools across South Africa.



St Bernards Secondary School receiving posters developed in the CNCS project

Schools in the Heidedal area received donations of indigenous tree donations creating a meaningful link between environmental education and grassroots action. This project was led by Lindi Heyns, with support from Prof Liesl van As, Dr Makoena Moloi (Department of Plant Sciences), and Jani van der Merwe (Centre for Teaching and Learning).



Planting indigenous trees at Petunia Secondary School

Dr Candice Jansen van Rensburg (UFS) and Dr Chantelle Girgan (Agricultural Research Council - Plant Health and Protection Research Nematology Unit) developed the first Free-living nematode identification for ecologists and taxonomists Short Learning Programme (SLP) in South Africa to service industry and institutes for the training of nematologists in free-living nematode identification.

The blended learning SLP was successfully presented both face to face (30 October to 4 November 2024) and online (13 and 14 November 2024).



First Free-Living Nematode Identification Short Learning Programme held in November 2024. Front, from the left, Rachel Mohala (ARC – Tropical & Subtropical Crops), Dr Candice Jansen van Rensburg, (UFS), Dr Chantelle Girgan (ARC – Plant Health and Protection Research, Biosystematics Division). Back, from the left, Dr Akhona Mbatyoti, Prof Mieke Daneel (ARC – Tropical and Subtropical Crops), Raymond Collett (ARC – Plant Health & Protection Research Biosystematics Division), Guga Itani, and Dr Grace Tefu (ARC – Tropical and Subtropical Crops)

Dr Mpho Ramoejane was elected as the chairperson of the Golden Gate Highlands National Park Forum and heads the portfolio for Research and Monitoring. This automatically makes him a member of Free State Provincial People and Parks.

Prof Aliza le Roux was invited to speak as panellist on Oppenheimer Generations Research & Conservation webinar Episode 23, on 'Making young blood run green'. In August 2024, she was interviewed on *Radio Islam International*, with Annita Essack, focusing on the Flipped Classroom approach. Aliza's PhD student, Sphindile Dlamini, presented on wattle invasions to the tribal chiefs of Qwaqwa (Tsheseng, Thaba Bosiu, Mabolela, and Monontsha).

Prof Daryl Codron attended a human palaeodiet research workshop at the University of Colorado at Boulder, USA, and delivered a campus-wide guest lecture on pitfalls of quantitative analysis of isotope data. He also guest lectured for the stable isotope course at the University of Cape Town and included a 'stable isotope analysis in R' workshop for postgraduate students, post-docs, and other researchers attending the course.



Prof Daryl Codron in front of a Triceratops skeleton during his visit to the University of Colorado at Boulder

On 26 January, the Free State National Botanical Garden hosted an engaging event focused on the fascinating world of frogs and toads. Dr Edward Netherlands was invited to assist with the event, a fun-filled 'Frog Night' designed to spark curiosity and learning about amphibians. In addition to his involvement in this public outreach initiative, Dr Netherlands also contributed to the filming of a Netflix documentary on the life history of the Giant Bullfrog (*Pyxicephalus adspersus*). The documentary, titled *Rising Waters*, is scheduled for release in 2025.



Participants in the Botanical Garden Frog Night

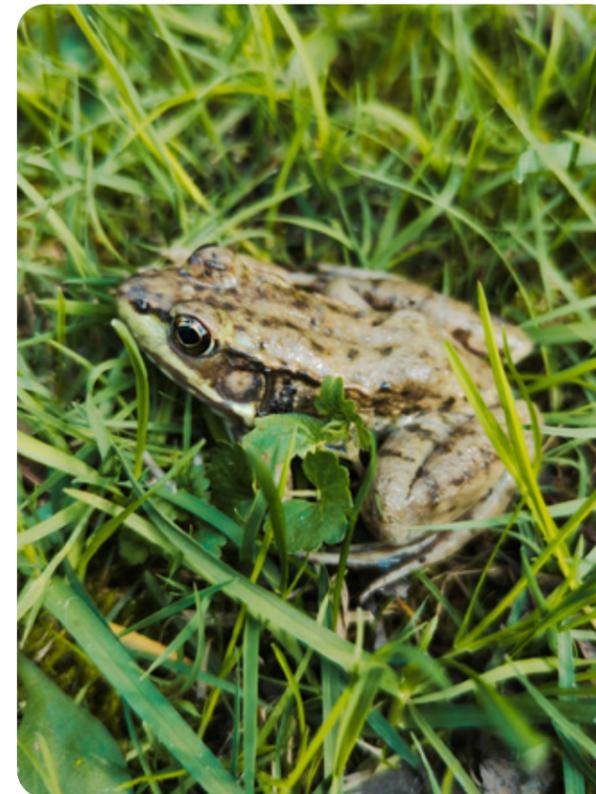
Dr Nontembeko Dube has served as an advisory committee member of the Prince Edward Islands since 2021.

POSTGRADUATE STUDENTS

In 2024, the following numbers of postgraduate students were enrolled in the Department of Zoology and Entomology:

- Honours: three in Zoology on the Bloemfontein Campus, and three in Zoology on the Qwaqwa Campus (Total: 6).
- MSc: seven in Zoology and four in Entomology on the Bloemfontein Campus, with a further six in Zoology on the Qwaqwa Campus (Total: 17).
- PhD: Eleven in Zoology and five in Entomology on the Bloemfontein Campus, and six in Zoology on the Qwaqwa Campus (Total: 21).

Seven students on the Bloemfontein Campus and five students on the Qwaqwa Campus graduated with an Honours degree. Three of the Qwaqwa students graduated *cum laude*.



At MSc level, Jade Hasting (*cum laude*), James Kidd (*cum laude*), and Elizna Terblans (all from the Bloemfontein Campus), graduated with Zoology specialisation during the April and December graduations:

Three candidates graduated with the PhD:

Hannelene Badenhorst (Entomology)

Thesis: Ecology and diversity of springtails and spiders in three biomes in central South Africa

Supervisor: Prof CR Haddad

Co-supervisors: Dr C Janion-Scheepers and Dr M Gryzenhout

De Villiers Fourie (Entomology)

Thesis: Identification and management of pyrethroid resistance in two-spotted stink bug, *Bathycolia distincta* (Hemiptera: Pentatomidae) on macadamia in South Africa

Supervisor: Dr VR Swart

Co-supervisors: Dr PS Schoeman and Prof JP Grobler

Tamson Foster (Zoology)

Thesis: Phylogeography, morphology, reproduction and activity patterns of the Greater Padloper, *Homopus femoralis* (Reptilia: Testudinidae)

Supervisor: Prof NJL Heideman

Co-supervisor: Prof JP Grobler

POSTDOCTORAL RESEARCH FELLOWS

The Department of Zoology and Entomology hosted five Postdoctoral Fellows in 2024:

- Dr Aileen van der Mescht, from South Africa, supervised by Prof Codron (ongoing Bloemfontein Campus).

- Dr Michael Vickers, from USA, supervised by Prof Haddad (ongoing Bloemfontein Campus).
- Dr Michel Kamden, from Cameroon, supervised by Prof Patrick Voua Otomo (ongoing Qwaqwa Campus).
- Dr Lehlohonolo Mofokeng, supervised by Dr Nthatsi Molefe-Nyembe and Prof Peter Taylor (ongoing Qwaqwa Campus).
- Dr Mpho Tawana, supervised by Prof Aliza le Roux (ongoing Qwaqwa Campus).

STAFF MATTERS

De Villiers Fourie graduated with his PhD during the December 2024 graduation.

Two senior lecturers, Dr Luther van der Mescht and Dr Milad Rashidifard, were appointed on the Bloemfontein Campus. Dr Van der Mescht follows in the footsteps of Dr Ellie van Dalen, from the Tick resistance lab and has immediately initiated new projects. Dr Rashidifard joined Dr Candice Jansen van Rensburg as part of the Nematology Research Group and will expand the existing soil nematode fauna to the broader plant parasitic worms.

RESEARCH OUTPUTS

Research Articles

- Ali, A., Khan, M., Numan, M., Alouffi, A., Almutairi, M.M., Pienaar, R., De Castro, M.H., Chitimia-Dobler, L., Muñoz-Leal, S. & Mans, B.J.** 2024. Description of a new *Ornithodoros* (*Pavlovskyella*) Ixodidae: Argasidae tick species from Pakistan. *Parasitology* 151: 919–932.
- Anders, M., Westphal, C., Linden, V.M.G., Weier, S., Taylor, P.J. & Grass, I.** 2024. Complementary effects of pollination and pest control services enable ecological intensification in macadamia orchards. *Ecological Applications* 34(8): e3049. DOI: 10.1002/eap.3049.
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Chitimia-Dobler, L., Barboutis, C., Bounas, A., Kassara, C., Mans, B.J. & Saratsisi, A. 2024. Discovery of a novel Mediterranean *Haemaphysalis* (*Ornithophysalis*) *doenitzi* group tick species infesting *Falco eleonora* on Antikythira Island, Greece. *Parasitology* 151: 933–945.

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Chitimia-Dobler, L., Handschuhu, S., Dunlop, J.A., Pienaar, R. & Mans, B.J. 2024. Nuttalliellidae in Burmese amber: Implications for tick evolution. *Parasitology* 151: 891–907.

Clements, H.S., Do Linh San, E., Hempson, G. et al [including Taylor, P.J., Le Roux, A.] 2024. The bio4africa dataset of faunal and floral population intactness estimates across Africa's major land uses. *Scientific Data* 11: 191. DOI: 10.1038/s41597-023-02832-6.

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Conference Contributions

Conference papers

Badenhorst, H., Haddad, C.R. & Janion-Scheepers, C. 2024. *Springtails and spiders from the “cosy homes” of termites*. Paper delivered at the 14th Colloquium of the African Arachnological Society, ATKV Buffelspoort Resort, South Africa. 28 January–1 February 2024.

Barnard, M., Dutton, H.R., Bullard, S.A., Du Preez, L.H. & Netherlands, E.C. 2024. *Life In Cold Blood: Exploring*

haemogregarine species diversity in Southern Africa’s terrapins. Paper delivered at the 16th Conference of the Herpetological Association of Africa, Wilderness, South Africa. 25–29 November 2024.

Booyesen, R. & Haddad, C.R. 2024. *Scytodes (Araneae: Scytodidae) spitting spiders of Southern Africa*. Paper delivered at the 14th Colloquium of the African Arachnological Society, ATKV Buffelspoort Resort, South Africa. 28 January–1 February 2024.

Butler, H.J.B. & Codron, D. 2024. *Geophagy, a remedy for internal parasite infestations?* Paper delivered at the Southern African Wildlife Management Association Conference, Windhoek, Namibia. 6–11 October 2024.

De Jager, G.P., Basson, L., Van As, L.L., Serra, C. & Petroni, G. 2024. *Symbiotic peritrichs (Ciliophora: Oligohymenophorea) of the Okavango Panhandle, Botswana*. Paper delivered at the 83rd Congress of the Italian Zoological Union – 34th Congress of the Italian Society of Protistology (Joint Congress), Pisa (Italy). 11–14 September 2024.

Dippenaar-Schoeman, A.S., Foord, S.H., Haddad, C.R., Lotz, L.N. & Lyle, R. 2024. *SANSA after 27 years: The present status of spiders in South Africa*. Paper delivered at the 14th Colloquium of the African Arachnological Society, ATKV Buffelspoort Resort, South Africa. 28 January –1 February 2024.

Du Bussion, J., Du Preez, L.H. & Netherlands, E.C. 2024. *Diversity and distribution of anuran blood parasites within the Vhembe Biosphere*. Paper delivered at the 10th World Congress of Herpetology, Kuching, Sarawak, Malaysia. 5–9 August 2024.

Haddad, C.R., Foord, S.H., Booyesen, R., Christiaan, R., Stander, A. & Dippenaar-Schoeman, A.S. 2024. *One time only: spider diversity determined along a latitudinal transect in the Succulent Karoo Biome using a rapid sampling protocol*. Paper delivered at the 14th Colloquium of the African Arachnological Society, ATKV Buffelspoort Resort, South Africa. 28 January–1 February 2024.

Haddad, C.R., Foord, S.H., Dippenaar-Schoeman, A.S., Booyesen, R., Vickers, M.E., Christiaan, R. & Stander, A. 2024. *Spiders of the Richtersveld National Park: contribution of a rapid sampling protocol repeated seasonally in adding biodiversity data*. Paper delivered at the 14th Colloquium of the African Arachnological Society, ATKV Buffelspoort Resort, South Africa. 28 January–1 February 2024.

Heyns, L. & Nell, A. 2024. *Measuring what matters: A creative take on authentic assessment*. Paper delivered at the Annual UFS Learning and Teaching Conference, University of the Free State, Bloemfontein. South Africa. 16–19 September 2024.

Jordaan, B.J., Du Preez, L.H., Van As, J. & Netherlands, E.C. 2024. *Investigating trypanosomes of herpetofauna in Southern Africa*. Paper delivered at the 10th World Congress of Herpetology, Kuching, Sarawak, Malaysia. 5–9 August 2024.

Jordaan, B.J., Dutton, H.R., Bullard, S.A., Du Preez, L.H. & Netherlands, E.C. 2024. *The first molecular and morphological characterisation of a trypanosome infecting wild African snakes*. Paper delivered at the 16th Conference of the Herpetological Association of Africa, Wilderness, South Africa. 25–29 November 2024.

Kheswa, N., Gokul, A., Voua Otomo, P. & Dube, N. 2024. *A quest for novel fungal species with the ability to bioremediate*

polyethylene in the eastern region of the Free State, South Africa: an eco-friendly solution to eliminate plastic pollution. Paper delivered at the 34th Annual Meeting of Society of Environmental Toxicology and Chemistry (SETAC), Seville, Spain. 5–9 May 2024.

Kidd, J.M., Mashinini, L., Heyns, L. & Heideman, N.J.L. 2024. *Body size dimensions, predation and reproductive ecology of Agama aculeata aculeata (Lacertilia, Agamidae) throughout its distribution range in southern Africa*. Paper delivered at the 16th Conference of the Herpetological Association of Africa, Wilderness, South Africa. 25–29 November 2024.

Kruger, A.X., Jansen van Rensburg, C & Van As, L.L. 2024. *Taxonomic analysis of calanoid copepods in South African lentic ecosystems using scanning electron microscopy*. Paper presented at the Paper delivered at 58th Annual Conference of the Microscopy Society of Southern Africa, University of the Free State, Bloemfontein. South Africa. 2–5 December 2024.

Kruger, A.X., Jansen van Rensburg, C. & Van As, L.L. 2024. *Verkenning van harpaktikoïede kopepode in Suider-Afrika: Nuwe ontdekkings*. Paper delivered at 23rd Studentesimposium in Natuurwetenskappe, Suid Afrikaanse Akademie vir Wetenskap en Kuns, University of the Free State, Bloemfontein. South Africa. 30–31 October 2024.

Le Roux, A. 2024. *One Health and zoonotic disease in a changing South Africa*. Keynote Address delivered at the Qwaqwa Campus Research Conference, Clarens. South Africa. 10–11 October 2024.

Le Roux, A. 2024. *Right is might? Some fitness correlates of behavioural laterality in bat-eared foxes (Otocyon megalotis)*. Paper delivered at the 19th International Society for Behavioural Ecology (ISBE) conference. Melbourne, Australia. 29 September–4 October 2024.

Lewis, C. & Codron, D. 2024. *Herkouerrebelle: Uitdaging van die lineêre verhouding tussen morfofisiologiese eienskappe en dieetnisie*. Paper delivered at 23rd Studentesimposium in Natuurwetenskappe, Suid Afrikaanse Akademie vir Wetenskap en Kuns. University of the Free State, Bloemfontein. South Africa. 30–31 October 2024.

Mahlobo, T., Martin, G., Munyai, C. & Dube, N. 2024. *Impact of the invasive alien Gleditsia triacanthos (Fabaceae) on ground-dwelling arthropod in South African grasslands*. Paper delivered at the XIX International Colloquium on Soil Zoology (ICSZ) and the XVI International Colloquium of Apterygota (ICA). Cape Town, South Africa. 26–30 August 2024.

Mahlobo, T., Martin, G., Munyai, C., Zondo, S. & Dube, N. 2024. *Impact of the invasive alien Gleditsia triacanthos (Fabaceae) on soil characteristics and ground-dwelling arthropod communities in South African grasslands*. Paper delivered at the 16th NRF-SAEON Student Network Indibano. Port Elizabeth, South Africa. 16–19 September 2024.

Mnkandla, S., Basopo, N. & Voua Otomo, P. 2024. *Assessment of Iron (III) Removal in Aqueous Solution by Mycofiltration, Through a Fixed-Bed Column Biosorption Approach*. Paper delivered at the 34th Annual Meeting of Society of Environmental Toxicology and Chemistry (SETAC), Seville, Spain. 5–9 May 2024.

Mnkandla, S., Basopo, N. & Voua Otomo, P. 2024. *Mycofiltration and water management: Insight on the removal of select metals by mycofiltration and the potential application of mycofilters*

for bio-augmentation of wastewater. Paper delivered at the Qwaqwa Campus Research Conference, Clarens. South Africa. 10–11 October 2024.

Mofokeng, L.S., Taylor, P.J. & Melefe-Nyembe, N.I. 2024. *Ectoparasite diversity of small terrestrial mammals*. Paper delivered at the 52nd Parasitological Society of Southern Africa, Hartbeespoortdam. South Africa. 6–8 October 2024.

Molefe-Nyembe, N.I., Sefojane, T. & Mofokeng, L.S. 2024. *The identification of parasitic gastrointestinal nematodes of naturally infected sheep in the Maluti-A-Phofung Municipality, Free State*. Paper delivered at the 52nd Parasitological Society of Southern Africa, Hartbeespoortdam, South Africa. 6–8 October 2024.

Mosikidi, T., Smart, K. & Le Roux, A. 2024. *Understanding soundscape dynamics of the northern Drakensberg*. Paper delivered at the African Bioacoustics Community Conference, Cape Town. South Africa. 1–6 September 2024.

Netherlands, E.C. 2024. *The biology of blood parasites in amphibians and reptiles: Insights into host-parasite interactions and ecology*. Keynote Address delivered at the 6th International Conference on Malaria and Other Blood Parasites of Wildlife & 3rd International Symposium of the Wildlife Diseases Research Network, Medellín, Colombia. 26–29 November 2024.

Netherlands, E.C., Jordaan, B.J., Du Preez, L.H. & Van As, J. 2024. *Exploring the diversity of haemoparasites in Smaug depressus (flat dragon lizard), an endemic from the Soutpansberg mountain range in South Africa*. Paper delivered at the 10th World Congress of Herpetology, Kuching, Sarawak, Malaysia. 5–9 August 2024.

Nyoka, N., Ogbeide, O., Jungman, D., Opeolu, B. & Voua Otomo, P. 2024. *Human health risk assessments of selected metals in the Qwaqwa region river waters*. Paper delivered at the 34th Annual Meeting of Society of Environmental Toxicology and Chemistry (SETAC), Seville, Spain. 5–9 May 2024.

Picelli, A.M., Ceriaco, L.M., Pacheco, A.M., Netherlands, E.C., Heinicke, M., Escalante, A.A. & Bauer, A.M. 2024. *Hemoparasites in Herpetofauna: revealing hidden components of Southern Africa biodiversity*. Paper delivered at the 10th World Congress of Herpetology, Kuching, Sarawak, Malaysia. 5–9 August 2024.

Radebe, N., Voua Otomo, P., Mnkandla, M. & Obame-Nkoghe, J.C. 2024. *Mortality and behaviour changes of Culex sp. after exposure to carbaryl and pymetrozine*. Paper delivered at the Qwaqwa Campus Research Conference, Clarens. South Africa. 10–11 October 2024.

Sefojane, T., Mofokeng, L.S., Thekiso, O.M.M. & Molefe-Nyembe, N.I. 2024. *Species diversity and attachment preference site of hard ticks infesting equines from the Free State and KwaZulu-Natal, South Africa*. Paper delivered at the 52nd Parasitological Society of Southern Africa, Hartbeespoortdam. 6–8 October 2024.

Serage, N., Taioe, M., Esterhuizen, J., Mofokeng, L., Ramatla, T. & Thekiso, O.M.M. 2024. *Molecular detection of animal trypanosomes infecting cattle in the northeastern. KwaZulu-Natal Province, South Africa*. Paper delivered at the 52nd Parasitological Society of Southern Africa, Hartbeespoortdam. 6–8 October 2024.

Taylor, P.J. 2024. *Documenting the elevator to extinction in an imperilled Afrotropical alpine hotspot*. Paper delivered at the

World Biodiversity Forum, Davos, Switzerland, 16–21 June 2024.

Terblans, E., Van Dalen, E.M.S., Kruger, L. & Van der Mescht, L. 2024. *Ondersoek na die potensiaal van ouderdomsverwante weerstand van beeste teen bosluis vir bosluisbeheer*. Paper delivered at 23rd Studentesimposium in Natuurwetenskappe, Suid Afrikaanse Akademie vir Wetenskap en Kuns, University of the Free State, Bloemfontein. South Africa. 30–31 October 2024.

Terblans, E., Van Dalen, E.M.S., Kruger, L. & Van der Mescht, L. 2024. *Investigating the potential of age-related resistance of cattle to hard ticks for tick control*. Paper delivered at the 52nd Parasitological Society of Southern Africa, Hartbeespoortdam, South Africa. 6–8 October 2024.

Van der Merwe, R., Codron, D. & Olf, H. 2024. *Hulpbronbenuttingpatrone van groot soogdierherbivore in klein reservate*. Paper delivered at 23rd Studentesimposium in Natuurwetenskappe, Suid Afrikaanse Akademie vir Wetenskap en Kuns, University of the Free State, Bloemfontein. South Africa. 30–31 October 2024.

Van der Mescht, L. 2024. *Acaricide resistance status of ticks on cattle in South Africa and the way forward*. Paper delivered at the 52nd Parasitological Society of Southern Africa, Hartbeespoortdam, South Africa. 6–8 October 2024.

Van der Mescht, A.C. & Corona, D. 2024. *Hurry up and sing: early onset of diel calling behaviour and ecological drivers of calling behaviour of *Acanthoplius discoidalis**. Paper delivered at the 5th World Ecoacoustics Congress, Autonomous University of Madrid, Madrid, Spain. 8–12 July 2024.

Vickers, M., Pekár, S. & Haddad, C.R. 2024. *The evolution of predation in spiders: Proposed jumping spider edition*. Paper delivered at the 14th Colloquium of the African Arachnological Society, ATKV Buffelspoort Resort, South Africa. 28 January–1 February 2024.

Viljoen, J., Codron, D. & Butler, H.J.B. 2024. *Die invloed van koppies op die biodiversiteit van die graslande in Suider-Afrika*. Paper delivered at 23rd Studentesimposium in Natuurwetenskappe, Suid Afrikaanse Akademie vir Wetenskap en Kuns, University of the Free State, Bloemfontein. South Africa. 30–31 October 2024.

Voua Otomo, P., Nyoka, N. & Boernick, H. 2024. *Pharmaceuticals in rivers of the QwaQwa region*. Paper delivered at the Qwaqwa Campus Research Conference, Clarens, South Africa. 10–11 October 2024.

Conference Posters

Kheswa, N., Gokul, A., Voua Otomo, P. & Dube, N. 2024. *A quest for novel fungal species with the ability to bioremediate polyethylene in the eastern region of the Free State, South Africa*. Poster presented at 34th Annual Meeting of Society of Environmental Toxicology and Chemistry (SETAC), Seville, Spain. 5–9 May 2024.

Lewis, C. & Codron, D. 2024. *Nonlinear form-function relationships in ruminants highlight the need for evolutionary adaptation in wildlife conservation*. Poster presented at the 13th Oppenheimer De Beers Group Research Conference, Midrand, South Africa. 9–11 October 2024.

Mosikidi, T., Smart, K. & Le Roux, A. 2024. *Understanding soundscape dynamics of the northern Drakensberg*. Poster

presented at the World Eco-acoustics Congress, Madrid Spain, 08–12 July 2024

Van As, L.L. & Christison KW. 2024. *Back to basics when molecular sequences are not in place yet*. Poster presented at 58th Annual Conference of the Microscopy Society of Southern Africa, University of the Free State, Bloemfontein. South Africa. 2–5 December 2024.

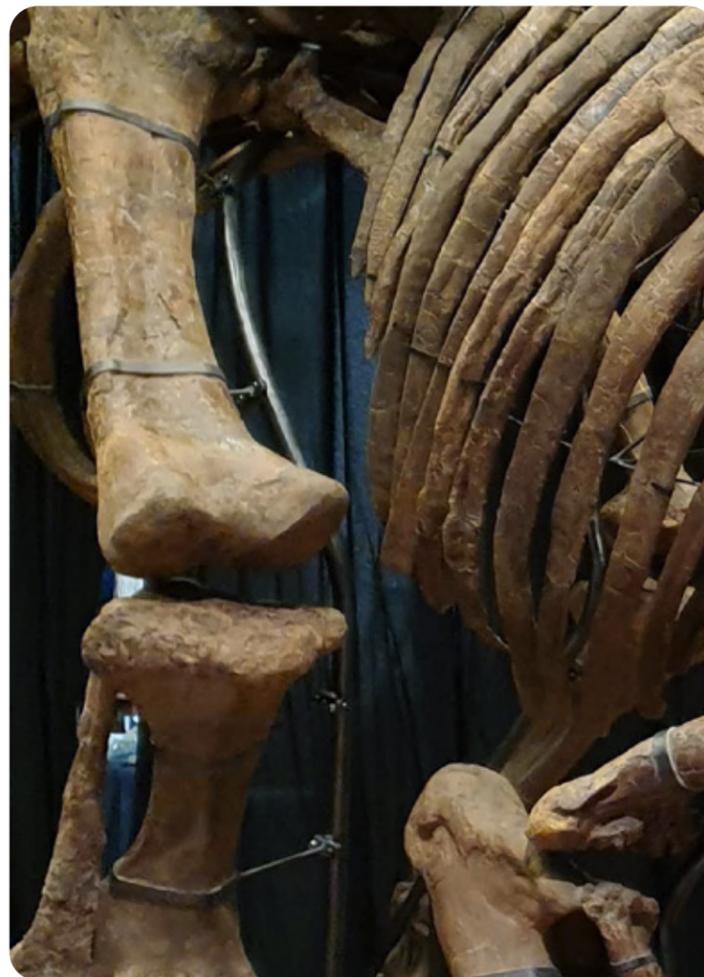
Conference Proceedings

Kruger, A.X., Jansen van Rensburg, C & Van As, L.L. 2024. Taxonomic analysis of calanoid copepods in South African lentic ecosystems using scanning electron microscopy. In: *Proceedings of the Microscopy Society of Southern Africa, vol 50*. Bloemfontein, South Africa. 2–5 December 2024. p 14.

Van As, L.L. & Christison KW. 2024. Back to basics when molecular sequences are not in place yet. In: *Proceedings of the Microscopy Society of Southern Africa, vol 50*. Bloemfontein, South Africa. 2–5 December 2024. p 20.

Other Outputs

Mosikidi, T. 2024. *The basics of bioacoustics*. Guest lecture at the University of the Western Cape, 9 October 2024.



STAFF (2024)

Head of Department:
Prof LL van As

BLOEMFONTEIN CAMPUS:

| | |
|-----------------------------------|---|
| Professors: | Prof D Codron and Prof LL van As |
| Associate Professor: | Prof CR Haddad |
| Senior Lecturers: | Dr N Dube, Dr C Jansen van Rensburg, Dr EC Netherlands, Dr M Rashidifard, Dr VR Swart, and Dr L van der Mescht |
| Lecturers: | Dr HJB Butler and L Heyns |
| Junior Lecturer: | Dr DV Fourie |
| Research Associate (Affiliated): | Dr Y Marusik |
| Research Fellows (Affiliated): | Dr LM Barkhuizen, Prof L Basson, Dr M Bates, Dr J Botha, Dr F Chidawanyika, Prof N Heideman, Dr D Harms, Dr EA Hugo-Coetzee, Prof B Mans, Dr Z Mnisi, Dr R Pienaar, Dr C Stobie, and Dr O Uyi |
| Programme Director: | Dr C Jansen van Rensburg |
| Officers – Professional Services: | L Bopheka, Dr S Mahlobo-Shwabede, and NW Mokhethi, |
| Technicians: | TW Lesaona and PK Mohasi |

QWAQWA CAMPUS:

Subject Head:
Prof P Voua Otomo

| | |
|-----------------------------------|---|
| Professors: | Prof A le Roux and Prof P Taylor |
| Associate Professor: | Prof P Voua Otomo |
| Senior Lecturer: | Dr E Bredenhand |
| Lecturers: | Dr N Molefe-Nyembe, Dr M Ramoeljane, Dr J van As, and Dr M van As |
| Research Fellows (Affiliated): | Dr K Lloyd, Dr J Obame-Nkoghe, and Dr AR Rakotoarivelo |
| Officers – Professional Services: | N Kheswa and MP Sithole |





ACADEMIC
CENTRES



CENTRE FOR

ENVIRONMENTAL MANAGEMENT

FACULTY OF NATURAL AND AGRICULTURAL SCIENCES



CONTACT DETAILS

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OVERVIEW OF 2024

The Centre for Environmental Management (CEM) achieved substantial success during 2024. Research outputs have continued to grow steadily over the decades – the eight research reports and two accredited articles produced in 2005 increased to 128 research reports, 13 books/book chapters and 80 articles in accredited journals by the end of 2014, and to 161 research reports, 82 books/book chapters and 529 articles in accredited journals by the end of 2024, of which two books/book chapters and 23 accredited articles were produced during 2024. Continued collaboration contributed to the success of our research endeavours during 2024. Even though the CEM's initial mandate was to coordinate the Master of Environmental Management programme, it was important to develop our own research profile – not only to serve the wider community of environmental managers, but also to support and ensure quality postgraduate training. By continuing to develop our research profile alongside our postgraduate degree programmes, the CEM aims to establish itself as the thought-leader in southern African environmental and water management. This will create a hub where the best and brightest postgraduate students can come together to begin solving tomorrow's environmental problems.

The CEM is currently presenting the following programmes:

Environmental Management:

- Master of Science majoring in Environmental Management (structured and full dissertation)
- PhD in Environmental Management

Integrated Water Management:

- Postgraduate Diploma in Integrated Water Management

- Master of Science majoring in Integrated Water Management (structured and full dissertation)
- PhD in Integrated Water Management

The CEM hosted visitors from various institutes in other countries, including Dr Dirk Jungmann and Dr Hilmar Börnick from the Technical University of Dresden (TU Dresden) in Germany, delegates from Denmark collaborating on the Management of aquifer recharge in South Africa (MARSAs) project, and representatives from San Diego State University (SDSU) in the USA.

The CEM staff also visited various institutes/towns in other countries for research, which included the University of Namibia, Harare in Zimbabwe, University of San Diego (USD) in the USA, Hanken School of Economics in Helsinki in Finland, and TU Dresden in Germany.

The Centre's highlight was celebrating its 30th Anniversary (11 and 12 October 2024) with a commemorative conference, titled 'Sustainable Horizons – Navigating the Future with Environmental Innovation'.



Delegates at the CEM 30th Anniversary Conference

The Centre was also one of the minor sponsors of the Kimberley Biodiversity Research Symposium on 18 September 2024.

ACHIEVEMENTS

Staff Achievements

Prof Shola Ololade was appointed as Acting Director for the Centre for Environmental Management after the previous Director (Prof Paul Oberholster)

was appointed as Dean of the Faculty of Natural and Agricultural Science. She was also invited as a keynote speaker at the Seventh International Workshop on Environment and Geoscience in November 2024 (virtual).



Prof Shola Ololade, Acting Director of the Centre for Environmental Management

Dr Marinda Avenant was invited by the German Limnological Society to deliver a keynote address, titled 'Non-perennial rivers in southern Africa: Unpredictable, highly variable and often misunderstood', at their 39th Annual Meeting (16 to 20 September 2024) in Dresden, Germany. Dr Avenant was accepted on the Women Influencing Scholarship and Education (WISE) programme.



Dr Marinda Avenant delivering a keynote address at the German Limnological Society in Dresden, Germany

Dr Bimo Nkhata was rated as an NRF C2 researcher in July 2024. He was also nominated and subsequently short-listed as a finalist for the 2023/2024 National Science and Technology Forum (NSTF)-South32 Awards (Science Oscars): categories Green Economy Award and NSTF-Water Research Commission (WRC) Award (May 2024). He also received special recognition from the University of the Free State (UFS) as an Exceptional Academic Achiever for 2024.

Marthie Niemand was accepted into the Research Excellence Accelerator Programme (REAP) at UFS and was also elected as the student representative for the Executive Committee for Tree-Ring Research (TRR) 2024-2026 in October 2023, at the 1st International Wood Identification Training course at the Ștefan cel Mare University of Suceava in Romania.

Dr Ernestine Atangana was accepted and enrolled in the Emerging Scholars Programme (ESAP) in December 2024.

Prof Anthony Turton was nominated for the 2023/2024 NSTF-South32 Awards (Science Oscars): categories Green Economy Award, NSTF-WRC Award and the Innovation Award: Small, Medium and Micro Enterprise (SMME) category (May 2024).

Student Achievements

During the Natural and Agricultural Sciences (NAS) Faculty Prize-giving ceremony (16 April 2024), the Maitland Seaman Prize for the best MSc student (2023) was awarded to Mariette Jansen van Vuuren



Mariette Jansen van Vuuren (left) and Thendo Mathiva with Prof Ololade at the NAS Faculty's Prize-giving ceremony

(majoring in Integrated Water Management). Thendo Mathiva was awarded the Centre for Environmental Management prize for best mini-dissertation in MSc majoring in Integrated Water Management for 2023. The winner of the Centre for Environmental Management Prize for the best student in the Postgraduate Diploma in Integrated Water Management (2023) was Dr Mmanthupi Amanda Mahuma.

PhD student Kabelo Mathabatha's research project, co-supervised by Prof Ololade, was nominated in the category 'Best environmental research, dissertation, thesis, or project by a young professional/student' at the 3rd Environmental Assessment Practitioners Association of South Africa (EAPSA) Regional Conference held in Durban, KwaZulu-Natal from 23 to 25 October 2024. Her topic was 'Evaluating the readiness and willingness of the energy value chain in implementing a closed-loop system for sustainable waste management'.



Kabelo Mathabatha at the 3rd Environmental Assessment Practitioners Association of South Africa (EAPSA) Regional Conference in Durban

RESEARCH, INNOVATION AND RESEARCH COLLABORATION

The Centre has a long and proud history of 30 years of research, and this was celebrated on 11 and 12 October 2024 at a commemorative conference, titled 'Sustainable Horizons – Navigating the Future

with Environmental Innovation'. The Centre hosted over 100 delegates, of whom one was a keynote speaker and four were invited speakers. Thirty oral presentations were delivered, and 11 posters presented over the two days. While the conference started with a Reflection of 30 Years of Excellence by Prof Maitland Seaman (former director of CEM and research associate), it ended on a high note with a panel discussion looking towards the next 30 years.



The CEM staff at the CEM 30th Anniversary Conference. Front: Dr Marinda Avenant; Back, from the left: Dr Bimo Nkhata, Dr Ernestine Atangana, Dr Gladys Belle, Donné Kolesky, Prof Shola Ololade, Marthie Niemand, Dr Surina Esterhuyse, and Dr Tascha Vos

Prof Olusola Ololade continued her research for the University of San Diego (USD) Innovation Research Fund project 'Salton Crisis through the Water-Energy-Food lens' in collaboration with Dr



Prof Olusola Ololade (right) with Prof (Dr) Suzanne Walther (left), and Prof (Dr) Bethany O'Shea (centre) from the Department of Ocean and Environmental Science, University of San Diego, California

Bethany O'Shea and Dr Suzanne Walther, from the Department of Environmental and Ocean Sciences at USD, and Dr Amy Quandt from the Department of Geography at San Diego State University (SDSU). Dr Mihaela Sima from the Romanian Academy also collaborates on the project. Prof Ololade visited the Department of Environmental and Ocean Sciences from 15 to 19 December 2024.

Prof Ololade also collaborated with researchers from the University of California Davis on a research project on metal contaminants at active floating photovoltaic sites. At a national level she collaborated with Dr Funzani Asnath Melato from the Department of Chemistry, Tshwane University of Technology, on the use of *Pelargonium* species for agricultural run-off remediation, and Dr Maleke Maleke from the Central University of Technology on 'Life cycle assessment of rare earth element leaching from alkaline mine waste using methanesulfonic acid'.

Prof Ololade and Dr Ernestine Atangana were co-PI recipients of the NAS Research Award for Early and Mid-Career Researchers, for the project 'Sustainable agricultural waste for agricultural runoff wastewater and groundwater resource and development of a framework among farms located within the same vicinity'.



Dr Ernestine Atangana sampling winery wastewater at a winery near Stellenbosch, Western Cape

Dr Marinda Avenant (PI) and Prof Ololade are collaborating with the Hanken School of Economics, Helsinki, Finland, on an ERASMUS+ funded project titled 'Co-Producing Knowledge on Sustainable Growth through Service Learning Pedagogy between African and European HEIs (COPAFEU)'. The project

kicked-off in Helsinki in March 2024 and involves researchers from the University of Peloponnese (Greece), Federal University of Agriculture (Nigeria), University of Ibadan (Nigeria), Mettu University (Ethiopia), Haramaya University (Ethiopia), University of Dar es Salaam ((Tanzania), Ruaha Catholic University (Tanzania), and the Cape Peninsula University of Technology (CPUT -South Africa).



Dr Marinda Avenant (seated, second from left) with other partners of the COPAFEU project at the Hanken School of Economics in Helsinki, Finland

Dr Marinda Avenant continued her collaborative research with Dr Dirk Jungmann and Dr Hilmar Börnick (TU Dresden in Germany), conducting field sampling in the Vaalharts area in the Northern Cape and North West in July 2024. Dr Tascha Vos worked with Dr Avenant on this project.



Alexander Becker (TU Dresden) with Dr Tascha Vos preparing water samples to be transported to the various laboratories

Dr Surina Esterhuyse researched the impacts of oil and gas drilling in Namibia and Botswana on the Okavango River basin groundwater resources and delta with

colleagues from the University of Edinburgh, the University of Stirling, and the Institute for Groundwater Studies. This research, that was reported in *National Geographic*, led to UNESCO recommending expanding the Okavango Delta protection zone to include the entire watershed to protect the Delta against upstream oil and gas drilling.

Dr Esterhuyse collaborated with the UFS Interdisciplinary Centre for Digital Futures, Engineering Sciences, Social Sciences and researchers from the Qwaqwa Campus on base research and developing a proposal for 'Modelling and Simulating Complex Systems by Utilising Social-Energy Network Dynamics'. This interdisciplinary project aims to interface social and resource network dynamics using NetworkDynamics.jl. The complexity of a just and sustainable energy transition demands an understanding of various social-environmental and social-technological interactions, both on a global and local scale. As energy systems do not develop or operate in isolation but are deeply intertwined with social, economic, political, and cultural systems, an interdisciplinary approach involving experts from the social and natural sciences is required to better understand and contribute to future energy planning. By employing systems thinking, network analysis, scenario planning, and modelling techniques, the dynamic relationships and feedback loops between the energy system and social actors can be modelled and the interactions between key variables can be simulated over time.

Dr Bimo Nkhata worked with the World Bank, African Development Bank, and Climate Investment Funds Programme to develop climate investment plans for countries in southern Africa, with a focus on nature-based solutions for the Zambezi River Basin. Dr Nkhata also worked with partners from the University of Venda and World Wildlife Fund (WWF) in developing a Reversing Environmental Damage in Africa and Asia (REDAA) Programme funding proposal focusing on ecological restoration.

Dr Nkhata actively engaged with the international Programme on Ecosystem Change and Society (PECS), established by the International Council for Science (ICSU) and United Nations Educational, Scientific and Cultural Organization (UNESCO). He participated in

the annual management committee meeting of the INSAKA University Consortium (UFS, University of Botswana, Clemson University, Copperbelt University, University of Montana, University of Namibia, and the Independent Institute of Education [IIE]) held in Kasane, Namibia in May 2024.



Dr Bimo Nkhata (right) and Dintle Korie (CEM PhD student) at the INSAKA summit in Zambia

Dr Ernestine Atangana received an NRF-Thuthuka grant in December 2024. She is involved with several projects that include various collaborators from the UFS, the Pasteur Institute of Iran (Tehran, Iran), and the Nelson Mandela University. She collaborated with Prof Johan van Niekerk from the Department of Sustainable Food Systems and Development on a project 'The effect of Natural Polymer Composites and its Application in Food Packaging'. This project



MSc student Ntaoleng Qobolo (left) and Dr Ernestine Atangana on a sampling trip near Stellenbosch, Western Cape

has a few sub-projects which involve a group of other researchers. Dr Atangana also collaborated with Prof Hendrik Swart (Department of Physics) and Dr Marieka Gryzenhout (Department of Genetics) on a project titled 'Antimicrobial and Antifungal Assay of Polymer Composite Blended'.

Together with Prof Paul Oberholster, Dr Nicolette Vermaak continued research on the MARSA project funded by the Danish International Development Agency (DANIDA) Fellowship Centre. This is a collaboration between the Geological Survey of Denmark and Greenland (GEUS), University of the Western Cape, the South African Department of Weather and Sanitation, and Ramboll, Denmark. Study sites are at Atlantis and Langebaan Road, near Saldanha.

Dr Nico Avenant's work on the caracal, in collaboration with Roberto Isotti and Alberto Cambone from the University of Rome, appeared on the *Camera Service Roma Eventi* YouTube channel on 22 January 2024. He collaborated on a project on a South African-produced anti-predator protection collars which he developed in collaboration with a Karoo sheep farmer. The collars have been tested at a scale not possible in South Africa, on lambs and adult sheep, against damage-causing coyotes, which were previously placed in the same genus as our black-backed jackal. Independent of this project, a request has also recently been received from a group of senior scientists in Australia who want to test the effect of these collars against damage-causing dingoes. From work done in South Africa we know that these collars are successful against caracal, and the news that it may also be an asset against canids is encouraging in the South African context.

Another new collaborative research project of Dr Nico Avenant is with WildTrack (USA). The project 'Delivering a proof of concept for a novel biodiversity metric: Small mammal track analysis using AI, morphometrics and Traditional and Local Ecological Knowledge' is nearing the end of phase one. This work combines the long-term research of Dr Avenant on using small mammals as indicators of habitat integrity, with the footprint information technology (FIT) of WildTrack to investigate the use of small mammal tracks to sample or monitor the integrity of ecosystems, making use of a faster, more affordable, accurate, and non-invasive sampling

technique. His long-term collaborative work with Dr Guila Ganem's group from the University of Montpellier, on 'African striped mouse (*Rhabdomys* spp.) contact zones - windows on adaptability and climate change', continues.

ACADEMIC CITIZENSHIP AND COMMUNITY ENGAGEMENT

Prof Ololade was selected as one of the mentors in the mentoring scheme of the African Academy of Science in February 2024. She also appeared in two feature articles – 'Olusola Ololade – The lifeline of the future: The role of women scientists in water resource management' on *Science News* by Frontiers Media, Switzerland, on 8 March 2024, and 'Prof Shola Ololade – all about innovative and practical solutions for water conservation' on the UFS News Archive, on 26 March 2024.

Prof Ololade serves as an Associate Editor for *Frontiers in Sustainable Resource Management* and invited Editor for *Frontiers in Water*, *Frontiers in Environmental Science* and *Frontiers in Earth Science*. She is the lead topic editor on a special issue titled 'Innovations in the Water-Energy-Food Nexus for Sustainable Management' in *Frontiers in Sustainable Resource Management* and was invited as a handling editor by *Frontiers in Environmental Science*, *Frontiers in Water* and *Frontiers in Earth Science*. Prof Ololade is also the lead editor on a book titled *Environmental and Disaster Management: Remote Sensing and GIS Case Studies for Sustainable Solutions* to be published by Taylor and Francis.

Prof Ololade reviewed for 10 international journals on the topics of her research expertise and was invited to review for three international conferences (6th Euro-Mediterranean Conference for Environmental Integration [EMCEI] 2024, the International Conference on Logistics and Industrial Engineering 2024 [ICLIE], and the 2nd Southern African Mountain Conference (SAMC2025)). During 2024, she served as external examiner for one PhD thesis at the University of the Witwatersrand

and two MSc dissertations at the University of Johannesburg and Tshwane University of Technology. She was also invited as a reviewer on several NRF specialist review panels and as a WRC Reference Group Member and served as a volunteer reviewer for students' presentations at the American Geophysical Union (AGU24) conference in Washington DC from 9 to December 2024.

In addition, Prof Ololade was invited and developed curricula for three new undergraduate modules for the Department of Environmental Science of IIE MSA in Johannesburg.

Dr Marinda Avenant serves on the Free State Integrated Provincial Water Monitoring Committee. She and Dr Tascha Vos initiated a short training session and visit for a school group (St Andrews School) to the Modder River in June 2024 as part of the Citizen Science Programme coordinated by GroundTruth. Dr Avenant was invited to present this initiative at the Department of Water and Sanitation Free State Integrated Provincial Water Monitoring Committee on 28 June 2024.



St Andrew's School students at Sannaspos, Modder River, and Sepane Spruit as part of the Citizen Science project

Dr Marinda Avenant was invited to present on the conservation of non-perennial streams and rivers at the Northern Cape Provincial Planning meeting on 7 March 2024.

Dr Surina Esterhuyse, with Dr Nola Redelinghuys, presented talks during a Fracking webinar to Free State Agriculture on 'Unconventional oil and gas extraction and fracking, and its water-related and socio-economic impacts'. Dr Esterhuyse also

provided information on several queries made by members of Free State Agriculture on fracking water-related impacts, the public participation processes during fracking regulation development in South Africa, and how to manage and minimize negative water resources impacts.

Dr Esterhuyse reviewed postgraduate scholarship and research fellowship applications in the field of Natural Science for the Oppenheimer Memorial Trust. She also served as a reviewer in the 2024 NRF rating panel review for applicants applying for NRF-rating in the UFS Faculty of Natural and Agricultural Science and continues to serve as one of four Associate Editors for *Water International*.

Dr Bimo Nkhata continued to work with the Council on Higher Education (CHE) as a member of the Working Group drafting the Environmental Assessment Practice Qualification Standard for the higher education sector. He is leading one of the Sub-working Groups composed of academic experts in quality assurance in the field of environmental management. Dr Nkhata was also involved in advising the governments of Angola, Botswana, Namibia, Malawi, Mozambique, Tanzania, Zambia, and Zimbabwe on the development of climate investment plans.

Dr Nkhata was invited to give a keynote presentation at the Harmony in Wildlife Conservation and Tourism 2024 (WMTC24) conference, held at the University of Namibia.



Dr Nkhata at the newly built Katima Mulilo campus of the University of Namibia



Dr Surina Esterhuyse

Marthie Niemand is the Student Representative on the Executive Committee for Tree-Ring Research for the period 2024 to 2026, having been elected in October 2023.

Dr Tascha Vos and Dr Marinda Avenant were mentioned in an article 'State of water addressed', in the *Bloemfontein Courant* on 15 February 2024. Since April 2017, Dr Vos has acted as the Vice-Chair of the Modder-Riet Catchment Management Forum, coordinated by the Free State Department of Water and Sanitation (DWS). She also represents the CEM on various DWS forums and committees, e.g. the Free State Integrated Provincial Water Monitoring Committee. Dr Vos served as a reviewer for the 2nd Southern African Mountain Conference (SAMC2025).

Dr Ernestine Atangana acted as a reviewer for various academic journals.

Prof Anthony Turton appeared on various news programmes as a guest speaker on water related issues in South Africa; he also wrote multiple pieces on this topic in the news media.

Dr Nico Avenant has been invited to serve on the International Union for Conservation of Nature (IUCN) Species Survival Commission Cat Specialist Group, for which he is currently coordinating the international IUCN caracal Red List Assessment.

Dr Piet-Louis Grundling and Dr Althea Grundling took 60 pupils of Eastside Primary School, Glenstantia



Dr Piet-Louis Grundling (left) at the Moreleta-Nature Reserve

Primary School, and Constantiapark Primary School to Mhangele nature area in Moreleta Nature Reserve on 2 February 2024 for World Wetland Day. They also accompanied students to Colbyn Wetland Nature Reserve for Wetlands Day on 3 February 2024 and were part of Friends of Moreleta Kloof Nature Reserve's Eco Day on 24 February 2024.

Dr Daan Toerien has been an Honorary Member of the Stilbaai Chamber of Commerce, since May 2020.

Many of our staff served as external examiners for other Universities and higher education institutions.

The Centre was also one of the minor sponsors of the Kimberley Biodiversity Research Symposium on 18 September 2024.



Kimberley Biodiversity Research Symposium delegates

POSTGRADUATE STUDENTS

During 2024, a total of 36 students were registered for the Postgraduate Diploma in Integrated Water Management. Ten candidates were registered for the PhD in Environmental Management and five for the PhD in Integrated Water Management.

Twenty-five (25) students were registered (first time registration) for the two structured MSc degrees – 10 for the MSc majoring in Environmental Management and 25 for the MSc majoring in Integrated Water Management. A further 33 students were registered

to continue their structured MSc degrees – 15 for the MSc majoring in Environmental Management and 18 for the MSc majoring in Integrated Water Management. Another 11 students were registered for the full MSc – four majoring in Environmental Management and seven majoring in Integrated Water Management.



Ts'epo Sekaleli sampling Peatlands in the Khalong-la-Lithunya area, Lesotho

During the April and December graduation ceremonies, 20 students received their Postgraduate Diploma in Integrated Water Management (three with distinctions). In the structured Master's,



Dr Piet-Louis Grundling (left) with Jason le Roux (PhD candidate) at the December 2024 graduation ceremony

three students graduated with the MSc majoring in Environmental Management, while 13 students graduated with the MSc majoring in Integrated Water Management, with two distinctions (M Jansen van Vuuren and T Mathiva). Two students (MS Moloji and SE Addo) obtained their PhD degrees in Environmental Management, while one student (JP Le Roux) obtained his PhD degree in Integrated Water Management.

Thuto Ramosoeu (MSc student) participated in the International Postdoctoral Day, representing Lesotho.



Thuto Ramosoeu (MSc student; 3rd from left) at the International Postdoctoral Day representing Lesotho

POSTDOCTORAL RESEARCH FELLOWS

The CEM hosted three postdoctoral research fellows during 2024 – Dr Gladys Belle (from Cameroon), Dr Yolande Schoeman (from South Africa), and Dr Nicolette Vermaak (from South Africa; till February 2024).

Dr Gladys Belle appeared in a feature article 'Dr

Gladys Belle's research dedicated to reducing impact of COVID drugs on water resources' on the UFS News Archive, on 11 February 2024. She also participated as a departmental finalist in the UFS Flash Fact competition for the CEM in the PostDoc category with a presentation titled 'Pharmaceuticals of emerging concern in water and implications to health' on 12 June 2024. Dr Belle was involved in two projects: 2023-2024 – DST-NRF Innovation Postdoctoral Fellowship award for 2023 and 2023-2026 – Water Research Commission Research, Development, and Innovation grant.



Dr Gladys Belle on a field sampling trip

Dr Yolandi Schoeman was nominated for the 2023/2024 NSTF-South32 Awards (Science Oscars): categories TW Kambule-NSTF Award: Emerging Researcher (May 2024).

Dr Nicolette Vermaak continued to collaborate on the MARSA project which continued to August 2024 funded by the Danish International Development Agency (DANIDA) Fellowship Centre.

STAFF MATTERS

Prof Ololade stepped in as acting Director of the Centre for Environmental Management at the start of 2024.

Dr HH Pienaar was appointed as a Research Fellow from May 2024.

RESEARCH OUTPUTS

Research Articles

Araya, N., Rebelo, A., Grundling, A., Grundling, P.L., Le Roux, J., Masekwana, N., Maboja, L. & Zuma, K. 2024. Raising awareness of the existence, importance, and need for conservation of South African wetlands. *Water Wheel* 23(2): 28–30.

Avenant, M., Börnick, H., Graumnitz, S., Nyoka, N., Opeolu, B., Voua Otomo, P., Schubert, A., Schubert, S., Vos, T. & Jungmann, D. 2024. Investigating a surface water quality monitoring approach for QwaQwa, South Africa, by combining biological *in vitro* tests and chemical analyses. *Frontiers in Water* 6: 1–25 (Article #1408856). DOI: 10.3389/frwa.2024.1408856.

Baloyi, L., Kanyerere, T., Muchingami, I. & Pienaar, H. 2024. Application of hydrogeophysical techniques in delineating aquifers for estimating groundwater recharge potential to enhance water allocation in groundwater-dependent systems, Northern Cape, South Africa. *Water* 16(18): 1–17 (Article #2652). DOI: 10.3390/w16182652

Belle, G.N., Schoeman, Y. & Oberholster, P.J. 2024. Source to receptor: assessing health risks from heavy metal exposure in mining soils. *Minerals* 14(9): 1–20 (Article #858). DOI: 10.3390/min14090858.

Benda, P., Uvizi, M., Eiseb, S.J. & Avenant, N. 2024. On the systematic position of horseshoe bats (Mammalia: Chiroptera) from Lesotho. *Mammalia* 88(3): 239–258. DOI: 10.1515/mammalia-2023-0119.

Cebekhulu, S., Gómez-Arias, A., Matu, A., Alom, J., Valverde, A., Caraballo, M.A., Ololade, O., Schneider, P. & Castillo, J.C. 2024. Role of indigenous microbial communities in the mobilization of potentially toxic elements and rare-earth elements from alkaline mine waste. *Journal of Hazardous Materials* 466: 1–10 (Article #133504). DOI: 10.1016/j.jhazmat.2024.133504.

Clements, H.S., Do Linh San, E., Hempson, G., ..., Avenant, N.L., ..., Winterbach, C.W. & Woodhouse, G.M. 2024. The bii4africa dataset of faunal and floral population intactness estimates across Africa's major land uses. *Scientific data* 11: 1–17 (Article #191). DOI: 10.1038/s41597-023-02832-6.

Deboelpaep, E., Pint, S., Koedam, N., Van der Stocken, T. & Vanschoenwinkel, B. 2024. Horizontal prey distribution determines the foraging performance of short- and long-billed waders in virtual resource landscapes. *Ibis* 166(3): 1041–1058. DOI: 10.1111/ibi.13274

Dzhang, T.R. & Atangana, E. 2024. Evaluation of the impact of coal mining on surface water in the Boesmanspruit, Mpumalanga, South Africa. *Environmental Earth Sciences* 83(6), 1–21 (Article #159). DOI: 10.1007/s12665-024-11431-6.

Green, A., Avenant, N.L. & Melville, H.I.A.S. 2023. Getting a grip on jackals: Net-gunning as an efficient and cost-effective approach to capturing Black-backed jackals (Canidae: *Lupulella mesomelas*). *Indago* 39: 1–14. DOI: 10.5281/zenodo.10093347.

Jansen van Vuuren, M., Schoeman, Y., Botha, A.-M. & Oberholster, P.J. 2024. Revealing the Protective Dynamics of an Ecologically Engineered Wetland against Acid Mine Drainage: A Case Study in South Africa. *Applied Science* 14: 1–25 (Article # 7441). DOI: 10.3390/app14177441.

Kafula, Y.A., Mataba, G.R., Mwaijengo, G.N., Moyo, F., Munishi, L.K., Vanschoenwinkel, B., Brendonck, L. & Thoré, E.S. 2024. Fish predation affects invertebrate community structure of tropical temporary ponds, with downstream effects on phytoplankton that are obscured by pesticide pollution. *Environmental Pollution* 346: 1–9 (Article #123592). DOI: 10.1016/j.envpol.2024.123592.

Magagula, M., Atangana, E. & Oberholster, P. 2024. Assessment of the impact of coal mining on water resources in Middelburg, Mpumalanga Province, South Africa: Using different water quality indices. *Hydrology* 11(8): 1–33 (Article #113). DOI: 10.3390/hydrology11080113.

Maremane, S., Belle, G. & Oberholster, P. 2024. Assessment of effluent wastewater quality and the application of an integrated wastewater resource recovery model: The Burgersfort wastewater resource recovery case study. *Water* 16(4): 1–20 (Article #608). DOI: 10.3390/w16040608.

Mataba, G.R., Munishi, L., Brendonck, L. & Vanschoenwinkel, B. 2024. *Culex quinquefasciatus* mosquito avoids ovipositing in habitats with the annual fish (*Nothobranchius neumanni*) in Tanzania. *Aquatic Ecology* 58:775–787. DOI: 10.1007/s10452-024-10104-7.

Mataba, G.R., Munishi, L., Brendonck, L. & Vanschoenwinkel, B. 2024. Influence of land use on the abundance and spatial distribution of mosquito larvae of the *Anopheles gambiae* complex in a malaria expansion area in northern Tanzania. *Hydrobiologia* 851: 1743–1760. DOI: 10.1007/s10750-023-05414-0.

Nkhata, B.A. 2024. The role of accountability in the emergence of adaptive water governance. *Ecology and Society* 19(2): 1–9 (Article #14). DOI: 10.5751/ES-14940-290214.

Nsiband, L.R., Lehutso, R.F., Thwala, M., Mzimela, H.M. M., Seopela, M. & Masikane, N.F. 2024. Occurrence of contaminants of emerging concern in the uMhlathuze and uThukela River systems, KwaZulu-Natal, South Africa. *African Journal of Aquatic Science* 49(3), 262–274. DOI: 10.2989/16085914.2024.2388557.

Nyirenda, V.R., Nkhata, B.A., Phiri, D., Nyirenda, W., Phiri, D.N., Malasa, M., Becker, M.S., Tembo, E.M., Nyirenda, M.A., Simpamba, T., Mwitwa, J. & Chomba, C. 2024. Vulture poisoning in Sub-Saharan Africa and its implications for conservation planning: A systematic review. *Heliyon* 10(3): 1–15 (Article e25126). DOI: 10.1016/j.heliyon.2024.e25126.

Oberholster, P.J., Schoeman, Y. & Botha, A.M. 2024. Is Africa ready to use phycoremediation to treat domestic wastewater as an alternative natural base solution? A case study. *Phycology* 4(1): 153–167. DOI: 10.3390/phycology4010009.

Redelinghuys, N., Esterhuys, S. & Goodrick, W. 2024. Fractured perceptions: Unconventional oil and gas development and the social construction of perceptions of risk in South Africa. *The Extractive Industries and Society* 19: 1–10 (Article #101519). DOI: 10.1016/j.exis.2024.101519.

Toerien, D.F. 2024. Community prosperity/poverty (Prosopv) maps: development and usefulness. *Journal of Poverty* 28(7): 622–642. DOI: 10.1080/10875549.2023.2259884.

Van Aardt, A.C., Scott, L., Grundling, P. L., Grundling, A.T. & Woodborne, S. 2024. Revisiting past savanna environments: Pollen analysis of the Colbyn wetland on the southern African central plateau. *Review of Palaeobotany and Palynology* 331:1–8 (Article #05198). DOI: 10.1016/j.revpalbo.2024.105198.

Books/Chapters in Books

Hohne, D., Fourie, F., Esterhuys, S., Gericke, H. & Butler, M. 2024. Managed Aquifer Recharge Projects in the Western Karoo, South Africa: Progress and Challenges. In: Dipankar, S, Villholth, K.G., Shamrukh, M. (Eds). *Managed Groundwater Recharge and Rainwater Harvesting. Water Resources Development and Management*. Springer, Singapore. pp. 207–245 (426).

Schoeman, Y. & Oberholster, P.J. 2024. Advancing mining sustainability metrics: The Ecological Engineering Nexus Accounting Framework (EENAF). In: Das, A.P., Van Hullebusch, E.D. & Akcil, A. (Eds). *Sustainable management of mining waste and tailings: A circular economy approach*. CRC Press, Boca Raton. pp. 203–232 (358).

Conference Contributions

Conference Papers

Atangana, E. 2024. *Assessment of Abattoir Wastewater Purification Potential of Chitosan Crosslinked Biopolymer from Shrimp Shell Waste for Domestic and Commercial Use*. Paper delivered at the 5th International Conference on the African Society for Industrial Mathematics Conference, Cape Town, South Africa. 30 September– 05 October 2024.

Atangana, E. 2024. *An indices-based water quality model to evaluate surface water quality: A case study in Vaalwaterspruit, Mpumalanga, South Africa*. Paper delivered at the 5th Edition of World Congress on Geology & Earth Science, Lisbon, Portugal. 17–20 June 2024.

Atangana, E. 2024. *Effectiveness of biopolymer adsorbent treatment method for small medium winery industry in South Africa*. Paper delivered at the 18th Edition of International Conference on Catalysis, Chemical Engineering and Technology & 4th Edition of International Conference on Green Chemistry and Renewable Energy, Paris, France. 17–19 June 2024.

Avenant, M.F. 2024. *Non-perennial rivers in southern Africa: Unpredictable, highly variable and often misunderstood*. Keynote address at the 39th Annual Meeting of the German Limnological Society, Dresden, Germany. 16–20 September 2024.

Baloyi, L., Kanyerere, T., Pienaar, H. & Muchingami, I. 2024. *Application of hydrogeophysical techniques in delineating aquifers to enhancing recharge potential areas in groundwater-dependent systems, Northern Cape, South Africa*. Paper delivered at the Centre for Environmental Management 30th Anniversary Conference: Sustainable horizons – Navigating the future with environmental innovation, Bloemfontein, South Africa. 11–12 October 2024.

Belle, G., Oberholster, P., Omotola, E., Moodley, B. & Olatunji, O. 2024. *Occurrence of selected Covid-19 drugs in water and sediment in the Upper Orange River Basin*. Paper delivered at the Centre for Environmental Management 30th Anniversary Conference: Sustainable horizons – Navigating the future with environmental innovation, Bloemfontein, South Africa. 11–12 October 2024.

Chaffin, B., Nkhata, B. & Meredith, G. 2024. *Resilience and Social-Ecological Systems*. Paper delivered at the INSAKA International Symposium on Resilience and Sustainability of Social-Ecological Systems, Kasane, Botswana. 27–31 May 2024.

Chokoe, C., Ololade, O. & Ramusiya, F. 2024. *The impact of water allocation control measures on overallocation of groundwater resource in karst aquifers: A case study of the Wonderfontein Catchment in the Vaal Water Management Area*. Paper delivered at the Centre for Environmental Management 30th Anniversary Conference: Sustainable horizons – Navigating the future with environmental innovation, Bloemfontein, South Africa. 11–12 October 2024.

Grundling, A., Verschoor, A.-J., Du Plooy, I., Araya, H. & Mapumulo, C. 2024. *Agricultural waste management using bio-based technologies approach*. Paper delivered at the Centre for Environmental Management 30th Anniversary Conference: Sustainable horizons – Navigating the future with environmental innovation, Bloemfontein, South Africa. 11–12 October 2024.

Grundling, P.-L., Hanekom, C. & Grundling, A. 2024. *The value of ecohydrology in wetland management planning: Nyamithi Pan rehabilitation, Ndumo Game Reserve Ramsar Site*. Paper delivered at the National Wetland Indaba, Cape St Francis Bay, South Africa. 21–25 October 2024.

Grundling, P.-L., Sekaleli, T. & Le Roux, J. 2024. *The application of ecohydrology techniques in defining wetland functioning planning: where science meets regulations*. Paper delivered at the Centre for Environmental Management 30th Anniversary Conference: Sustainable horizons – Navigating the future with environmental innovation, Bloemfontein, South Africa. 11–12 October 2024.

Henschel, J., Chatterjee, S., Palumbo, J., Jafari Gukeh, M., Morrisette, J, Xi Li, L, Ganguly, R., Wassenaar, T., Duncan, F., Mitchell, D. & Megaridis, C.M. 2024. *How do Fog-basking Beetles take up Fog?* Paper delivered at the Arid Zone Ecology Forum (hybrid conference), Calvinia, South Africa & online. 08–10 October 2024

Korie, D. 2024. *South Africa's Contaminated Abandoned Mines: Assessing Potential Impacts on Water Quality and Accountability for Remediation of Contaminated Sites*. Paper delivered at the INSAKA International Symposium on Resilience and Sustainability of Social-Ecological Systems, Kasane, Botswana. 27–31 May 2024.

Kruger, E., Massey, R. & Avenant, M.F. 2024. *What makes the ideal Environmental Assessment Practitioner? An empirical approach to identifying key knowledge areas and employability skills*. South African Geographical Society Biennial Conference, Potchefstroom, South Africa. 19–20 September 2024.

Le Roux, J.P., Grundling, P.-L., Grundling, A.T. & Whittington, P. 2024. *The influence of degradation and burning on surface topography, water table dynamics and hydraulic properties on peatlands in the Maputaland Coastal Plain of South Africa*. Paper delivered at the National Wetland Indaba, Cape St Francis Bay, South Africa. 21–25 October 2024.

Mabitsela, K.D., Schoeman, Y. & Oberholster, P. 2024. *Assessing the feasibility of using phytoremediation technologies: a case study of two wastewater treatment plants in Mpumalanga Province, South Africa*. Paper delivered at the Centre for Environmental Management 30th Anniversary Conference: Sustainable horizons – Navigating the future with environmental innovation, Bloemfontein, South Africa. 11–12 October 2024.

Mahlangani, C. 2024. *Measuring the performance of fat, oil, and grease removal from wastewater by pre-treatment*

facilities of food outlet services in Rustenburg. Paper delivered at the Centre for Environmental Management 30th Anniversary Conference: Sustainable horizons – Navigating the future with environmental innovation, Bloemfontein, South Africa. 11-12 October 2024.

Malise, T., Grundling, A., Brown, L. & Le Roux, J. 2024. *Soil organic carbon and water level of different plant communities of the hydrogeomorphic wetland types in the Kgaswane Mountain Reserve.* Paper delivered at the National Wetland Indaba, Cape St Francis Bay, South Africa. 21-25 October 2024.

Mathabatha, K. Ololade, O.O. & Rampedi, I. 2024. *Evaluating the readiness and willingness of the energy value chain in implementing a closed-loop system for sustainable waste management.* Paper delivered at the 3rd Environmental Assessment Practitioners Association of South Africa (EAPSA) Regional Conference, Durban, South Africa. 22-25 October 2024.

Nemathaga, L. 2024 *The Slow Pace of Rehabilitation of Unrehabilitated Mined Lands in South Africa: The case of Gauteng Province.* Paper delivered at the Centre for Environmental Management 30th Anniversary Conference: Sustainable horizons – Navigating the future with environmental innovation, Bloemfontein, South Africa. 11-12 October 2024.

Niemand, M. 2024. *Cleared trees: Potential climate records or firewood?* Paper delivered at the 19th Kimberley Biodiversity Symposium, Kimberley, South Africa. 18 September 2024.

Niemand, M.E., Neumann, F.H. & Woodborne, S.M. 2024. *Rules for stable isotope dendroclimatology in tropical and sub-tropical trees.* Paper delivered at the 1st African Tree Ring Network (ATRN) workshop: Building Resilience to Climate Change Using Tree-Based Data in Africa, Addis Ababa, Ethiopia. 28-29 November 2024.

Nkhata, B. 2024. *Nature, People and Climate Interventions for the Zambezi River Basin.* Invited Guest Speaker at the Second Zambezi Watercourse Commission NPC/MDBs Regional Workshop, Harare, Zimbabwe. 30 September-4 October 2024.

Nkhata, B. 2024. *Wildlife Management and Tourism: A Social-Ecological Systems Perspective.* Invited Guest Speaker at the Harmony in Wildlife Conservation and Tourism 2024 Conference, Katima Mulilo, Namibia. 21-22 October 2024.

Ololade, O.O., Sikhosana, M.L. & Melato, F.A. 2024. *A review of possible influencing factors affecting the efficiency of Pelargonium species as a potential phytoremediation buffer.* Paper delivered at the International Conference on Environment and Natural Resources (ICENR-24), Chicago, IL, USA. 27-28 May 2024.

Schoeman, Y., Oberholster, P.J. & Somerset, V. 2024. *A multi-criteria decision-making framework towards achieving zero waste in the iron and steel industry of developing nations in southern Africa: A case study.* Paper delivered at the 2nd International Conference on Environmental Sustainability through Waste and Recycling, Boston, MA, USA. 11-14 March 2024.

Conference Posters

Atangana, E. 2024. *Assessment of abattoir wastewater purification potential of chitosan crosslinked biopolymer from shrimp shell waste for domestic and commercial use.* Poster presented at the Centre for Environmental Management 30th Anniversary Conference: Sustainable horizons – Navigating the

future with environmental innovation, Bloemfontein, South Africa. 11-12 October 2024.

Grundling, A.T., Araya, H., Du Plooy, I., Araya, N. & Le Roux, J.P. 2024. *Multifunctional Constructed Wetland Experiment: from design to application.* Poster presented at the National Wetland Indaba, Cape St Francis Bay, South Africa. 21-25 October 2024.

Grundling, A.T., Van der Laan, M., Araya, N.A. & Grundling, P. 2024. *Poorly treated wastewater: an opportunity for irrigation but not without risks.* Poster presented at the ARC/DALRRD Conference and Exhibition, Roodeplaat, South Africa. 12-14 February 2024

Maremane, S., Belle, G. & Oberholster, P. 2024. *Application of the integrated wastewater resource recovery model: A case at the Burgersfort WWTF.* Poster presented at the Centre for Environmental Management 30th Anniversary Conference: Sustainable horizons – Navigating the future with environmental innovation, Bloemfontein, South Africa. 11-12 October 2024.

Ololade O.O., Themba J. & Ntsonda, N.J. 2024. *Comparative evaluation of the sustainability of two mining communities post mining in the platinum belt sector of Rustenburg area, South Africa.* Poster presented at the AGU24 meeting, Washington, D.C, USA. 09-13 December 2024.

Van de Sande, E., Van Malderen, A., Partoens, L., Deboelpaep, E. & Vanschoenwinkel, B. 2024. *Simulating the potential effects of cocoa-related deforestation on landscape connectivity in a West African biodiversity hotspot.* Poster presented at the European Conference of Tropical Ecology 2024, Lisbon, Portugal. 12-16 Feb 2024.

Van de Sande, E. & Vanschoenwinkel, B. 2024. *Global variation in the flowering phenology of cacao trees (Theobroma cacao).* Poster presented at the European Conference of Tropical Ecology 2024, Lisbon, Portugal. 12-16 Feb 2024.

Conference Proceedings

Mudau, R., Oke, S. & Ololade, O. 2024. Impacts of nickel mine tailings storage facility on surface and groundwater quality at Onverwacht Farm, Mpumalanga Province, South Africa. In: Ksibi, M., Negm, A., Hentati, O., Ghorbal, A., Sousa, A., Rodrigo-Comino, J., Panda, S., Lopes Velho, J., El-Kenawy, A.M. & Perilli, N. (Eds). *Recent Advances in Environmental Science from the Euro-Mediterranean and Surrounding Regions (3rd Edition).* EMCEI 2021. *Advances in Science, Technology & Innovation.* Springer, Cham. pp. 271-273 (815). ISBN: 978-3-031-43921-6

Orimoloye, I.R. & Ololade, O.O. 2024. Drought disaster risk reduction and its environmental benefits. In: Ksibi, M., Negm, A., Hentati, O., Ghorbal, A., Sousa, A., Rodrigo-Comino, J., Panda, S., Lopes Velho, J., El-Kenawy, A.M. & Perilli, N. (Eds). *Recent Advances in Environmental Science from the Euro-Mediterranean and Surrounding Regions (3rd Edition).* EMCEI 2021. *Advances in Science, Technology & Innovation.* Springer, Cham. pp. 545-547 (815). ISBN: 978-3-031-43921-6.

Research Reports

Belle, G.N., Oberholster, P.J., Omotola, E.O., Moodley, B. & Olatunji, O.S. 2024. *Report on Liquid Chromatography-Mass Spectrometric and Solid-Phase Extraction method*

development. WRC Report 2. No 2023/2024-01308.

Belle, G.N., Oberholster, P.J., Omotola, E.O., Moodley, B. & Olatunji, O.S. 2024. *Report on the Occurrence of selected Covid-19 Drugs in Water and Sediment in the Upper Orange River Basin.* WRC Report 3. No 2023/2024-01308.

Belle, G.N., Oberholster, P.J., Trutter, J.C., Archer, D., Ramosoou, T.A. 2024. *Report on the Ecotoxicology of Covid-19 Drugs on Aquatic Organisms and Human Health.* WRC Report 4. No 2023/2024-01308.

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STAFF (2024)

**Director (Acting):
Prof OO Ololade**

| | |
|--|---|
| Associate Professor: | Prof OO Ololade |
| Affiliated Professor: | Prof AR Turton |
| Adjunct Professor: | Prof MH Solomon |
| Senior Lecturers: | Dr MF Avenant, Dr S Esterhuysen, and Dr BA Nkhata |
| Researcher: | Dr E Atangana |
| Research Fellows: | Dr NL Avenant, Dr NB Collins, Dr AT Grundling, Dr PL Grundling, Dr JR Henschel, Dr D Jungmann, Dr E Milne, Dr HH Pienaar, Dr TWD Pincheel, Dr NA Rivers-Moore, Dr M Thwala, Dr DF Toerien, Prof BJ Vanschoenwinkel, and Dr PC Zietsman |
| Senior Officer (Professional Services): | ME Niemand |
| Officer (Professional Services): | Dr AT Vos |
| Course Administrator: | RI Mariti |
| Senior Assistant Officer: | DM Kolesky |
| Messenger: | PS Thibiri |

CENTRE FOR MICROSCOPY

FACULTY OF NATURAL AND AGRICULTURAL SCIENCES



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OVERVIEW OF 2024

During 2024, the Centre for Microscopy witnessed remarkable achievements and a noticeable sense of enthusiasm. The Centre for Microscopy and the Department of Physics hosted the 58th Microscopy Society of Southern Africa (MSSA) conference along with pre-conference microscopy workshops, which took place from 30 November to 5 December 2024 at the University of the Free State. In 2024, equipment utilisation and the total number of clients increased significantly, which included a welcome increase in outside institutions that made use of the Centre's facilities.

ACHIEVEMENTS

Staff Achievements

Edward Lee was awarded the DPCMM BUSCH Vacuum PhD student presentation award in the field of Condensed Matter Physics and Material Science at the South African Institute of Physics conference.

Hanlie Grobler was awarded the Wirsam Scientific Prize for best student paper in Life Science at the 58th Microscopy Society of Southern Africa conference.

TEACHING AND LEARNING

Staff at the Centre for Microscopy engage in delivering informative sessions tailored to meet the needs of various departments within the Faculty of Natural and Agricultural Sciences upon request. These interactive sessions typically entail a comprehensive tour of the Centre, during which our staff guide researchers and students through

the variety of equipment available. Additionally, the tour includes practical demonstrations, illustrating the functionality of each piece of equipment, the kind of data one can expect to obtain, as well as the required sample preparation procedures involved.

Examples of such practical sessions are the annual scanning electron microscopy (SEM) training for the Honours students from the Department of Zoology and Entomology, as well as those from the Department of Microbiology and Biochemistry, at the request of Prof Liesl van As and Prof Olihile Sebolai, respectively.

Students from the Department of Zoology and Entomology collect and prepare their own specimens for SEM. They are then assisted on how to operate the SEM and provided the opportunity to examine and image their specimens. This approach provides students with practical and hands-on experience in electron microscopy, which may serve as the introduction and first of many future SEM sessions as they progress in their academic journey.



Students from the Department of Microbiology and Biochemistry at the JEOL F200 HR-TEM



Students from the Department of Microbiology and Biochemistry at the JEOL JSM7800F SEM

In October 2024, Centre for Microscopy staff attended an International Workshop on Topics of Transmission Electron Microscopy, hosted by the Centre for HR-TEM at Nelson Mandela University. This workshop covered the fundamentals of TEM, such as TEM construction, alignments, image formation, theory of electron diffraction, as well as HR-STEM and spectrum imaging.

ACTIVITIES

User Support

The Centre for Microscopy specialises in obtaining detailed structural data on a scale ranging from micro- to nanometres, employing advanced microscopy techniques such as scanning electron microscopy (SEM), transmission electron microscopy (TEM), and confocal laser scanning microscopy (CLSM). In addition, the Centre is equipped with specialised specimen preparation equipment, including critical point dryers, sputter coaters, an ultramicrotome and a focused ion beam (FIB). This range of equipment ensures that specimens are appropriately prepared for SEM and TEM. Clients of the Centre include researchers affiliated with the University of the Free State (UFS), as well as external domestic and international institutions.

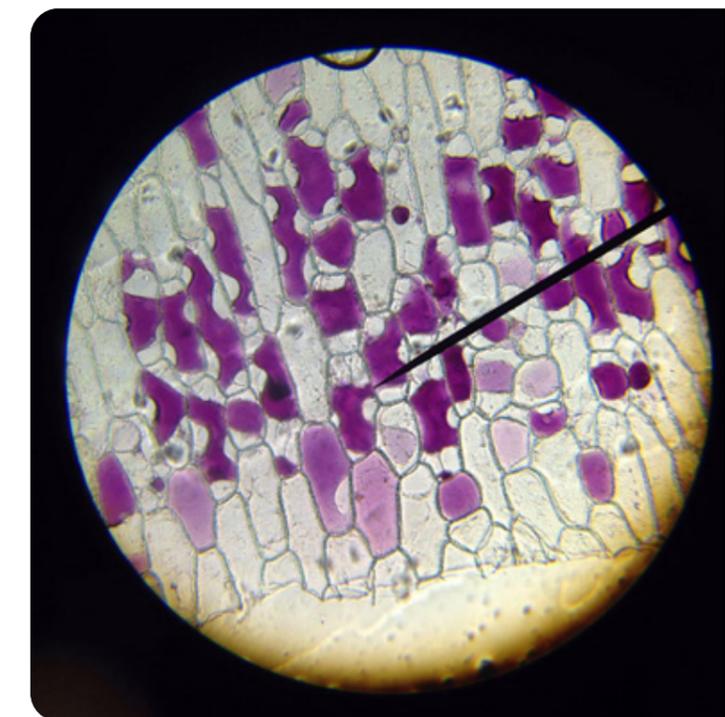


Table 1: Microscope usage per department (2024)

| | USAGE HOURS | | | | | Total |
|--|-------------|------------|------------|-----------|-----------|-------------|
| | HRSEM | SEM | HRTEM | TEM | CLSM | |
| UFS Departments / Centres | | | | | | |
| Cardiothoracic Surgery | 2 | 2 | - | - | - | 4 |
| Centre for Environmental Sciences | 6 | - | - | - | - | 6 |
| Centre For Mineral Biogeochemistry | 21 | - | - | - | - | 21 |
| Centre for Microscopy | - | - | 30 | - | - | 30 |
| Chemistry | 170 | 3 | 12 | 4 | - | 189 |
| Engineering Sciences | 10 | 14 | - | - | - | 24 |
| Fine Arts | 51 | - | - | - | - | 51 |
| Genetics | 4 | - | - | 9 | - | 13 |
| Geology | 11 | - | - | - | - | 11 |
| Microbiology and Biochemistry | 59 | 4 | 18 | 13 | 10 | 104 |
| Pharmacology | 15 | - | 4 | 13 | - | 32 |
| Physics | 392 | 15 | 136 | 14 | 7 | 564 |
| Plants Sciences | 6 | 22 | - | - | - | 28 |
| Soil, Crop & Climate Sciences | 3 | - | - | - | - | 3 |
| Sustainable Food Systems and Development | 25 | 36 | - | - | - | 61 |
| Zoology and Entomology | 15 | 34 | - | - | - | 49 |
| External researchers/projects | | | | | | |
| CUT | 125 | 61 | - | 9 | - | 195 |
| CSIR | - | - | 20 | - | - | 20 |
| Nelson Mandela University | - | - | 26 | - | - | 26 |
| Sol Plaatje University | 9 | - | - | - | - | 9 |
| University of Johannesburg | 12 | - | - | - | - | 12 |
| University of the Western Cape | 8 | - | 19 | - | - | 27 |
| TOTAL USAGE | 944 | 191 | 265 | 62 | 17 | 1479 |

The HR-SEM (High-resolution scanning electron microscope) is still the most utilised microscope at the Centre, due to its versatility and capability in providing morphological and elemental information on various types of specimens, with sizes ranging from a few microns to several hundred nanometres. The HR-TEM (High-resolution transmission electron microscope) has also seen a significant increase in utilisation for research endeavours compared to the previous year, when most of the time was spent on staff development. While the HR-TEM is versatile, the types of specimens it can handle are more limited, and to fully utilise the capabilities of the system, specimens should ideally be smaller than a hundred nanometres.

In 2024, our team provided support to at least 124 researchers and students across various disciplines who utilised microscopy in their research projects, an increase of 57% from 2023.

The collective utilisation of all microscopes amounted to 1479 hours, marking a significant rise compared to the preceding four years.



Figure 1: Total number of user hours (2020 – 2024)

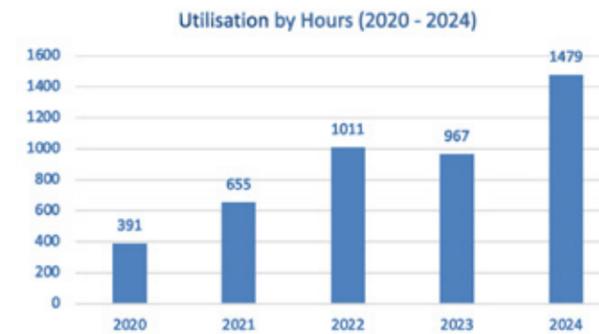
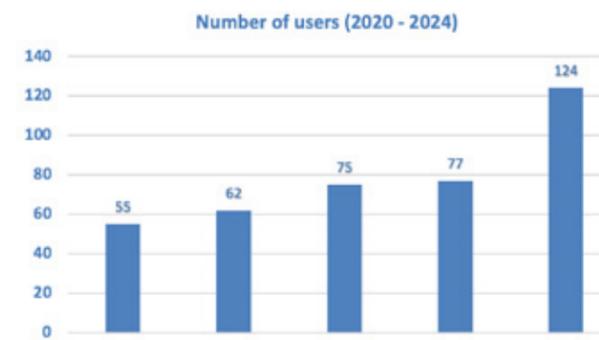


Figure 2: Total number of users (2020 – 2024)



Conferences and Workshops

The Centre for Microscopy and the Department of Physics hosted the 58th Microscopy Society of Southern Africa (MSSA) conference from 2 to 5 December 2024 on the UFS Bloemfontein Campus of the University of the Free State.

The pre-conference workshops, focusing on confocal microscopy, SEM and HR-TEM, took place on 30 November and 1 December 2024 at the Centre for Microscopy, utilising the microscopy facilities during the hands-on training.

The confocal microscopy workshop was presented by Ania Henning, a research microscopy specialist from ZEISS Africa. The course offered an introduction to microscopy and covered fundamental concepts such as light and optics, contrast techniques, and imaging methods. The confocal microscopy segment demonstrated on the ZEISS LSM 900, delved into multicolour, 3D, and time-lapse imaging, as well as spectral imaging.

Dr James Wesley-Smith, from EMPOWER Microscopy, presented the workshop on SEM basics, which was aimed at beginner and intermediate users

who wished to advance their knowledge of SEM sample preparation and imaging. The course covered electron beam-matter interactions, the types of signals generated, and the information each produces. The theory behind key operational conditions (e.g. kV, signal optimisation and working distance) was demonstrated on the JEOL IT200 SEM at the Centre for Microscopy, and participants were left with a greater understanding of how to optimise SEM conditions to get the most out of any sample.



An advanced HR-TEM workshop was presented by Dr Damien McGruther with the assistance of Dr Eudri Venter, both application specialists from JEOL UK. This workshop focused on how to obtain high-quality data from the JEOL F200 HR-TEM and covered a range of topics, including specimen preparation, optimising alignments for TEM and STEM (Scanning Transmission Electron Microscopy) imaging, Lorentz imaging of magnetic specimens, and automating some processes with Python PyJEM scripting.

The Microscopy Society of Southern Africa brings students, microscopists, researchers, and industrial partners together to demonstrate and share experiences and expertise. Approximately 120 local and international delegates attended the MSSA 2024 conference. This is the place to interact and build networks across all science and engineering disciplines through microscopy, and to see the latest advancements and developments in light-, electron- and laser microscopy. Two international speakers delivered the plenary lectures, namely, Prof Jörg Lindner from the Physics Department of Paderborn University, Germany, with a lecture on 'STEM-DPC imaging of what is in between

the atomic nuclei, and Prof Lydia-Marie Joubert, from the SLAC National Accelerator Laboratory at Stanford University, USA, who presented on 'Microscopy meanders: highways and backroads to high-resolution imaging in life sciences'.



From the left, Prof Jaco Olivier (MSSA president,) Prof Lydia-Marie Joubert, Prof Jörg Lindner, and Prof Koos Terblans



MSSA 2024 conference delegates at the Boyden Observatory and the Naval Hill Planetarium, Bloemfontein

RESEARCH OUTPUTS

Research Articles

Khanyile, B.S., Numan, N., Simo, A., Nkosi, M., Mtshali, C.B., Khumalo, Z., Madiba, I.G., Mabakachaba, B., Swart, H., CoetseeHugo, E., Duvenhage, Mart-Mari., Lee, E., Henini, M., Gibaud, A., Chaker, M., Rezaee, P., Lethole, N., Akbari, M., Morad, R. & Maaza, M. 2024. Towards Room Temperature Thermochromic Coatings with controllable NIR-IR modulation for solar heat management & smart windows applications. *Scientific Reports* 14(1). DOI: 10.1038/s41598-024-52021-7.

Lee, E., Harris, R.A., Terblans, J.J., Coetsee, E., Kumar, V. & Swart, H.C. 2024. Preparation of SrVO₃ by annealing of Sr₂V₂O₇ in a reducing atmosphere. *Chemical Physics Impact* 9 100715. DOI: 10.1016/j.chphi.2024.100715.

Conference Contributions

Conference Papers

Grobler H., Jackson M. & Joubert L. 2024. Pollinator rewards in *Nemesia* (Scrophulariaceae). Paper delivered at the 58th Microscopy Society of Southern Africa Conference, UFS, Bloemfontein, South Africa. 2-5 December 2024.

Lee, E. & Terblans, J.J. 2024. Nano-Imaging: UFS Explores with HRTEM. Paper delivered at the 68th Annual Conference of the South African Institute of Physics, Rhodes University, South Africa. 1-5 July 2024.

Conference Posters

Lee, E., Harris, R.A., Terblans, J.J. & Swart, H.C. 2024. Preparation of SrVO₃ thin films using spin coating. Poster presented at the 58th Microscopy Society of Southern Africa Conference, University of the Free State, South Africa. 2-5 December 2024.

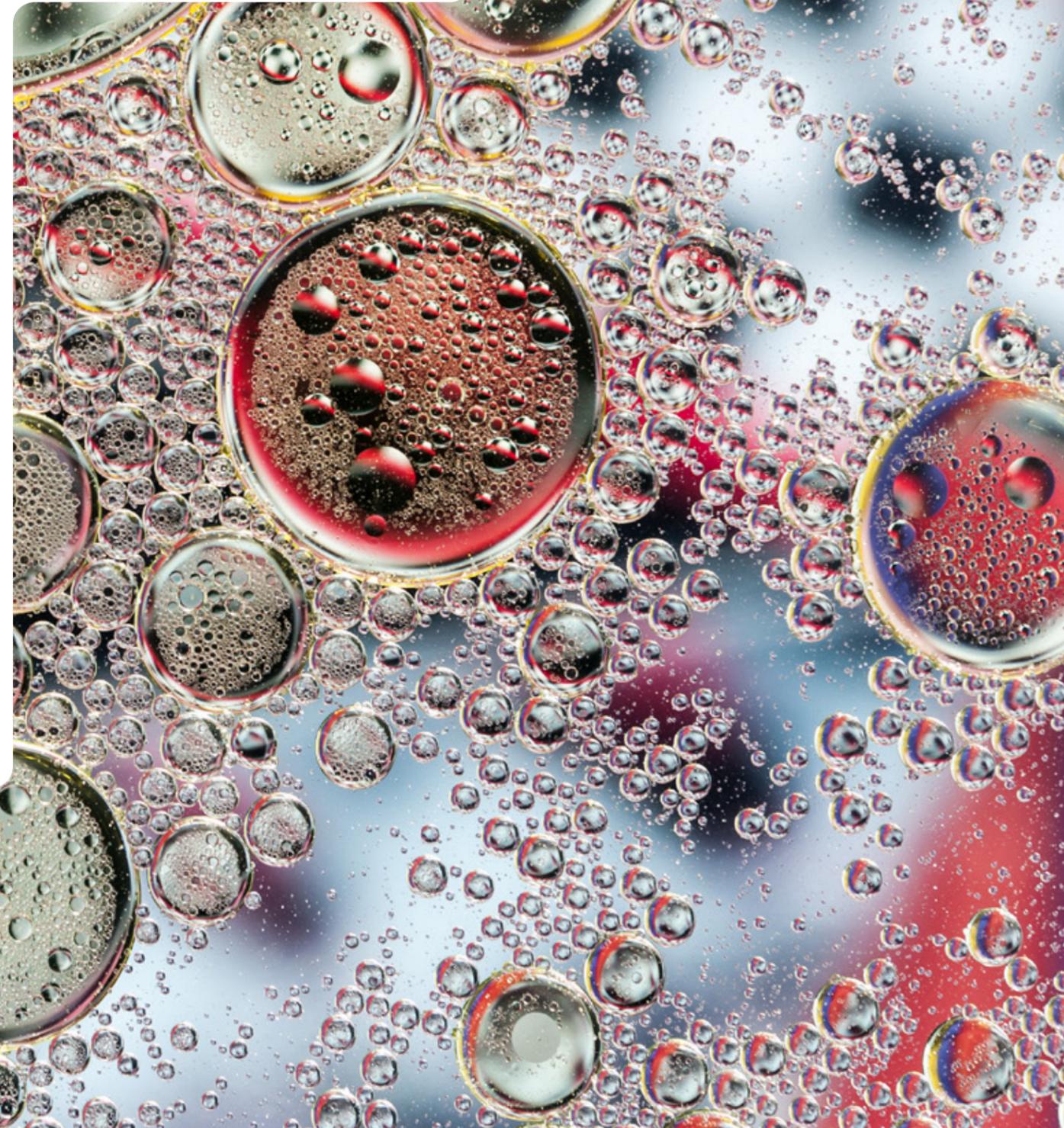
Lee, E., Harris, R.A., Terblans, J.J. & Swart, H.C. 2024. SrVO₃ thin films prepared using spin coating. Poster presented at the 68th Annual Conference of the South African Institute of Physics, Rhodes University, South Africa. 1-5 July 2024.

STAFF (2024)

Director:
Prof JJ Terblans

Junior Lecturer /
Researcher: E Lee

Senior Officer: H Grobler



DISASTER MANAGEMENT TRAINING AND EDUCATION CENTRE FOR AFRICA (DiMTEC)

FACULTY OF NATURAL AND AGRICULTURAL SCIENCES



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OVERVIEW OF 2024

The year 2024 was another prolific year for the Disaster Management Training and Education Centre for Africa (DiMTEC), in which we achieved significant milestones, affirming that the successes of 2023 were not merely incidental. Research output increased in 2024, with DiMTEC staff and affiliated researchers delivering numerous presentations at international and local conferences. Reflecting on 2024, DiMTEC confidently asserts that it was an even more fruitful academic year.

In 2024, DiMTEC became a member of the Africa Network of Centre's of Excellence for Disaster Risk Reduction, a collaborative framework, aimed at enhancing African institutions' capacity in disaster risk reduction, early warning, and anticipatory action, fostering joint development and delivery of customised services, tools, and training. Throughout 2024, we initiated various training programmes and community service activities in collaboration with our partners. We disseminated the message to diverse stakeholders of our paradigm shift from vulnerability to preparedness and reinforced this through the many training sessions we conducted. This paradigm shift entails transitioning from a reactive stance, primarily addressing vulnerabilities after an event, to a proactive approach focused on preparedness. While acknowledging the existence of vulnerabilities, adopting a proactive and prepared mindset is crucial for enhancing resilience and mitigating the impact of disasters. Achieving this

necessitates a blend of community engagement, capacity building, technological innovation, and policy integration to foster a more resilient and adaptive society.

At the beginning of year, the Centre welcomed Tsepo Fonane as Finance Officer and Ronel Smith as Senior Assistant Officer.

ACHIEVEMENTS

Staff Achievements

Prof Johanes Belle was appointed by the United Nations Office for Disaster Risk Reduction (UNDRR) to be part of the organising team for the Eighth Session of the Global Platform for Disaster Risk Reduction (GP2025), to be held from 2 to 6 June 2025 in Geneva, Switzerland. This is the highest-level dialogue platform on disaster issues in the world. In addition, Prof Belle is a member of the G20 Working Group on Disaster Risk Reduction that facilitated and produced the final Declaration on DRR by the G20 Head of States in Brazil, in November 2024.

Prof Abiodun Ogundeji was recognised as one of the World's Top 2% of Scientists for 2024 in his field, according to the recently released list by Stanford University. This list, created in collaboration with Elsevier and utilising data from Scopus, highlights researchers who make significant contributions in their fields and are considered world-class. The ranking identifies the most distinguished and influential scientists globally based on standardised citation parameters, h-index, co-author corrected hm-index, article citations according to author positions, and a composite indicator.



Dr Tlou Raphela-Masuku was awarded a full scholarship to attend the World Policy Conference 2024 held at Fountains Hotel, Cape Town, South Africa from 24 to 27 November 2024. The World Policy Conference is a prestigious global event that brings together parliamentarians, policymakers, and thought leaders worldwide to discuss and address key global issues. The event aims to foster international cooperation, share best practices, and promote legislative innovations.

In this spirit, Dr Raphela-Masuku presented the preliminary results from her National Research Foundation-Black Academic Advancement Programme (NRF-BAAP) funded research project on, 'The Preparedness and Resilience of Healthcare Systems across the Free State Province on Pandemics: Lessons learned from the COVID-19'.



Dr Tlou Raphela-Masuku at the World Policy Conference

Prof Alice Ncube serves on the board of the Africa Science and Technology Advisory Group (AfSTAG) for Disaster Risk Reduction (DRR). In this capacity,

she attended the Africa Youth Advisory Board (AYAB) and African Science and Technology Advisory Group (Af-STAG) on Disaster Risk Reduction (DRR) meeting held in Mombasa, Kenya from 19 to 22 March 2024.

Student Achievements

Anele Mthembu, who is pursuing her Master's degree in Disaster Management at DiMTEC, was honoured with the DSI-Esther Mahlangu Master's Fellowship at the 2024 Women in Science Awards (SAWiSA) hosted by the Department of Science and Innovation (DSI). This fellowship is presented to women scientists and researchers undertaking their master's or doctoral studies and already have scholarships from the National Research Foundation (NRF) or other DSI agencies. Anele is working on her Master's dissertation, focusing on integrating risk-informed development (RID) and nature-based solutions (NbS) into sustainable human settlements in eThekweni Municipality, KwaZulu-Natal.

Paulina Brago was awarded the prize for the best Master's student at the 61st Annual Agricultural



Anele Mthembu (right) with her award



Prof Abiodun Ogundeji (second from left) receiving the award on behalf of Paulina Brago

Economics Association of South Africa (AEASA) Conference held in Gqeberha from 9 to 11 September. Her dissertation was titled 'The role of women empowerment in adoption of climate change adaptation strategies in Northern Ghana'. Prof Ogundeji received the award on her behalf.

RESEARCH, INNOVATION AND RESEARCH COLLABORATION

DiMTEC is one of the partners in a project titled 'A Pan-African DRR Action-Research-Network of Excellence (Pan-African-DRR-NoE) to support Multi-Hazard Early Warning and Anticipatory Action'. A number of events were held under this banner in the course of 2024.

Prof Alice Ncube and Prof Johannes Belle were part of the meeting held in Kampala, Uganda from 15 to 19 April 2024.



Prof Johannes Belle and Prof Alice Ncube with other attendees at the Network of Excellence on DRR in Africa Programme Multi-Hazard Early Warning Systems and Anticipatory Action in Uganda

Prof Abiodun Ogundeji and Prof Alice Ncube had the privilege of participating in the annual partners meeting of the Africa Network of Excellence (NoE), hosted by United Nations Office for Disaster Risk Reduction (UNDRR), together with ten NoE member institutions and five observers to establish the annual work plan with partner contributions, coordinate collaboration among NoE partners and

grantees, and review the strategic roadmap of the NoE. The meeting was held in Stellenbosch on 17 and 18 January 2024. In addition, Prof Ncube and Prof Jörg Szarszinski attended a stakeholder consultative meeting in Mozambique as part of the preparations for the Network of Centres of Excellence for Disaster-Risk Reduction in Africa (NoE) Training Programme on Multi-Hazard Early Warning Systems and Anticipatory Action that was held in Maputo, Mozambique, from 26 to 29 June 2024.



Attendees at the NoE Training Programme on Multi-Hazard Early Warning Systems and Anticipatory Action, held in Maputo, Mozambique

Prof Ncube attended the Forum of the Africa Network of Centres of Excellence for Disaster Risk Reduction (NoE) in Nairobi from 22 to 23 July 2024, funded by the Italian Government and the UNDRR. The forum aimed to foster collaboration and technical exchange between African DRR centres by sharing resources, assets, and expertise regarding related activities, visions and goals. At the forum, approximately fifty stakeholders and members from across Africa agreed to prioritise the network's working groups and to develop regional action plans that set out concrete steps to apply risk knowledge to disaster risk reduction and management. The forum created awareness of the expertise, research, and various ongoing initiatives of NoE institutions in the area of DRR and DRM, to bridge the gap between science and policy.

Dr Tlou Raphaela-Masuku presented a paper entitled, 'The Impacts of Floods in South Africa' at the 8th International Symposium on Flash Floods in Wadi Systems organised by the National Water and Energy Centre of the United Arab Emirates University in Partnership with the DPRI, Kyoto University. The

symposium included was held on the campus of the UAE University in Al Ain City from 4 to 7 November 2024. The theme of the symposium focused on 'Flash Floods, Water Harvesting, and Groundwater Recharge Potentials'.



Dr Tlou Raphaela-Msuku and other attendees at the 8th International Symposium on Flash Floods in Wadi Systems

Dr Raphaela-Masuku also participated in the Potsdam Summer School 2024 with the theme 'Ecosystems change and resilience in the Anthropocene', held from 15 September to 4 October. The Summer School was organised in partnership with the City of Potsdam, the Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research (AWI), the Leibniz Institute for Agricultural Engineering and Bioeconomy (ATB), the Research Institute for Sustainability (RIFS), and the University of Potsdam in Germany. Forty participants attended the Summer School which was held at different Potsdam University campuses and research institutes in Potsdam, to discuss the interactions between biodiversity, bioeconomy, digitalisation and sustainable development. The goal of the Summer School was to develop a holistic view of selected topics, their interactions and interdependencies and delve into the following topics: The Role of Nature in the Anthropocene; Biodiversity and Resilience of Ecosystem Functions; Interactions of Biodiversity and Bioeconomy; Landscape Ecology; Sustainable Land Use and Digitalisation of Agriculture.

Dr Raphaela-Masuku was invited to participate in the third (and last) SADC Regional Workshop | 3rd Live Event of the Learning Process on 'Flood Management for Risk-Informed Urban Development' in Tlokweng District, Gaborone, from 10 to 14 June 2024. The SADC and GIZ connective cities organised the workshop that resulted in a collaborative published paper in *Jamba* titled, 'Lessons learned from the Risk-

Informed Urban Development (RIUD) initiatives in the SADC region'. Dr Raphela-Masuku and Prof Belle were co-authors of this paper.



From the left, Lebogang Mosotho DMISA (Deputy President of DMISA), Owen Baker (DMISA President), Dr Tlou Raphela-Masuku, William Samwel (Environmental Advisor at Tanzanian Need and Trees Organisation), and Grace Matseba (SALGA, Limpopo) at the 3rd Live Event Learning Process on Flood Management for Risk Informed Urban Development

Dr Raphela-Masuku was invited to participate at the Adaptation Network Colloquium, where she presented on 'Environment, Ecosystems, and Ecosystem-Based Disaster Risk Reduction'. The colloquium, held in Cape Town, South Africa, was organised by the Adaptation Network in collaboration with the Flanders State of the Art, the African Climate and Development Initiative (ACDI), MYCELIUM Media COLAB, and SANBI, on 15 and 16 July 2024.

Maureen Kudzai Maisiri, a PhD candidate with DiMTEC, applied and received a grant to participate in the Climate Adaptation Research Programme (CARP). This programme focuses on implementing climate change solutions across Africa to improve livelihoods and eradicate hunger by 2030. It also aims to nurture a new generation of researchers in Africa, Latin America, the Caribbean, and the Pacific Islands, who will study the impacts of climate change on disaster risk reduction (DRR) policies and strategies. Maureen attended the CARP Workshop held in Stellenbosch, South Africa, which brought together 30 scholars from across Africa. The PERI PERI U, the University of Arizona, and USAID supported the workshop. Maureen presented her project titled 'Gender Responsive Climate Change

Adaptation: The Case of Flood-Induced Food Insecurity among Smallholder Farmers in KwaZulu-Natal, South Africa'. Prof Alice Ncube and Collins Okollie also attended the event.



Maureen Maisiri

Various stakeholders, including DiMTEC students and graduates, attended the first Research Agenda Seminar at the National Disaster Management Centre. The seminar centred on presentations and discussions that contributed to strengthening research in disaster management service delivery and development. Zukiswa Poto, a DiMTEC PhD candidate and recipient of the NDMC bursary, presented her research titled, 'Mainstreaming business continuity into disaster risk reduction', which focuses on disaster management practitioners who want to invest in service delivery during disasters. Koketso Mpishane, one of our Master's candidates, did an excellent job driving the initiative.



Zukiswa Poto

The Centre hosted its first-ever PhD Colloquium on Disaster Risk Management and Climate Change Adaptation. Dr Olivia Kunguma spearheaded the initiative with the vision of supporting PhD candidates in their research journeys. The colloquium was held from 17 to 19 April at the Protea by Marriott Hotel in Bloemfontein, South Africa, under the theme 'Higher Education Innovations in Sustainable Risk Reduction: Bridging the Gap between Theory and Practice'.



Dr Olivia Kunguma at the 1st PhD Colloquium on Disaster Risk Management and Climate Change Adaptation

The Old Mutual Foundation, the Gauteng Provincial Disaster Management Centre, and the National Disaster Management Centre sponsored the colloquium. Having the Old Mutual Foundation as the primary sponsor was a significant development for the disaster management community, as it indicates a growing interest from insurance companies in disaster risk management, resilience building, and climate change adaptation. The event attracted over 80 attendees from various faculties



Participants in the 1st PhD Colloquium on Disaster Risk Reduction and Climate Change Adaptation

at the University, as well as participants from other universities across South Africa and Africa. The colloquium will take place biennially and will be hosted in different cities.

Prof Abiodun Ogundeji and Prof Johannes Belle spent two weeks at the National University of Public Service (NUPS) in Budapest-Hungary on the European Union sponsored Erasmus Mobility for the North-South Staff Mobility from 29 April to 15 May. While there, Prof Belle and Prof Ogundeji taught some courses to postgraduate students at NUPS. They also visited the National Agriculture Show, the University of Szegged, and the Faculty of Water Science of NUPS. The visit enabled them to initiate possible further collaborations between different universities in Hungary and different departments at the UFS.



Prof Johannes Belle (second from left), and Prof Abiodun Ogundeji (second from right) in Hungary

Prof Ogundeji Abiodun, Prof Johannes Belle, Prof Alice Ncube, and Dr Tlou Raphela-Masuku contributed to the 9th Africa Regional Platform for Disaster Risk Reduction, held in Namibia, at which more than 1,000 participants gathered from almost every African country, representing civil society, academia, international organisations, and member states. Prof Ogundeji had the opportunity to set the scene and make submissions for a panel session on 'The Role of Private Business and Investment in Creating or Reducing Risk'. Prof Belle was a member of the organising committee on thematic group 2 and acted as a rapporteur during one of the sessions. At the conference booth documenting DiMTEC's efforts to consolidate further the UNDRR-funded 'Africa Network of Centres of Excellence for Disaster Risk Reduction', the NoE team informed conference participants daily about the initiative's current state and future activities. Prospective postgraduate

students also had the opportunity to enquire about the various programmes offered by DiMTEC.



From the left, Prof Abiodun Ogundeji, Prof Alice Ncube, Dr Tlou Raphela-Masuku, and Prof Johannes Belle at the 9th Africa Regional Platform for DRR

The DiMTEC team attended the Disaster Risk Reduction Conference, held in Cape Town on 21 and 22 November, and hosted annually by the Disaster Management Institute of Southern Africa (DMISA). The team presented various topics based on their research:

- Nontobeko Mpumieh Nxumalo on 'Investigating the Role and Impacts of Insurance Companies in Disaster Management: A Case Study of eThekweni Municipality'.
- Zukiswa Vallery Poto on 'Integrating Business Continuity into Disaster Management: Enhancing Resilience in South African Municipalities'.
- Dr Zachariah Mshelia on 'Geospatial Analysis of the Shoreline Dynamics and its Environmental Effects on the eThekweni Coastline from 1990 – 2023 using Digital Shoreline Analysis Systems'.
- Prof Alice Ncube on 'Use of Indigenous Knowledge in Floods and Droughts Early Warning for Improved resilience in Namibia, Malawi and South Africa'.

Prof Alice Ncube visited the Institute for Development Studies at the National University of Science and Technology in Bulawayo, Zimbabwe from 10 to 16 December 2024. She held a meeting with the incoming Director of the institute and visited a DiMTEC PhD student who had completed data collection and was preparing to proceed with his research. The Institute has a long relationship with our Centre, as most of the staff are our alumni.



The DiMTEC team at the DMISA Disaster Risk Reduction Conference, front from the left, Dr Tlou Raphela-Masuku, Prof Alice Ncube and Prof Johannes Belle. Back from the left, Dr Zacharia Mshelia, Tsepo Fonane, Akani Baloyi, Nontobeko Nxumalo, Dr Olivia Kunguma, and Moegamat Isaacs

DiMTEC is in the process of signing an MoU with NUST, an issue that is being handled through the UFS Office for International Affairs.



ACADEMIC CITIZENSHIP AND COMMUNITY ENGAGEMENT

Short Learning Programme: Introduction to Disaster Management

DiMTEC conducted a training programme on 'Introduction to Disaster Risk Management', for the staff at Enhlanzeni TVET College from 22 to 26 January 2024, in Nelspruit, Mpumalanga, South

Africa. The participants were eager to learn how to contribute to disaster risk reduction in TVET colleges and surrounding communities.



Participants from the Enhlanzeni TVET College at the SLP held in January 2024

15th Annual Block Course from Vulnerability to Resilience

The theme for the block course was 'Building Resilience in a Changing World: Innovative Approaches to Disaster Risk Reduction'. Participants from South Africa, Mozambique, Namibia, and Zambia attended the course. We want to thank the Disaster Management officials for their assistance in engaging with the Jagersfontein community. Xolani Tseletsele, the Mayor of Kopanong Local Municipality, and MA Jafta, the Acting City Manager of Gariiep District Municipality, participated in the block course, who, together with Dr Kunguma, address the issue of the Jagersfontein disaster and the community's rehabilitation.



Participants of the 15th Annual Block Course

Fire Safety & Prevention Seminar

Dr Olivia Kunguma was invited to participate in a panel discussion at the Fire Safety & Prevention Seminar at the Birchwood Hotel in Gauteng, South Africa, from 22 to 23 February 2024. She presented on 'The Institutional Arrangements for Disaster

Management', emphasising the importance of addressing challenges in policy implementation and the need for active stakeholder engagement. She also highlighted the significance of resource availability and effective utilisation.

Free State Province Fire Awareness Day - Xhariep District Municipality

The Free State Provincial Disaster Management Centre hosted the Free State Province Awareness Day on 25 April 2024. The Department of Agriculture, Land Reform and Rural Development, and Department of Forestry, Fisheries and Environment sponsored the event. Zukiswa Poto, a PhD candidate at DiMTEC, and Mbulelo Kelly, an alumnus of DiMTEC working for the Department of Agriculture, Land Reform and Rural Development, were invited to present papers. Dr Olivia Kunguma, Collins Okolie, and Nontobeko Nxumalo attended the event. The event took place in Trompsburg in the Xhariep District Municipality. Zukiswa Poto presented on fire awareness and DiMTEC's fire mitigation strategies. Mbulelo discussed the challenges and interventions surrounding state land, emphasising land lease agreements such as lessees' responsibilities regarding firebreaks and veldfire management. He also spoke about the training of farmers on veld firefighting, community projects, and creating awareness about the issue. The MMC of Planning and Social Development spoke positively about the involvement of higher academic institutions like the UFS in training firefighters for effective response. He also emphasised the importance of implementing by-laws to maintain law and order in communities.



Zukiswa Poto at the Free State Province Fire Awareness Day in Trompsburg

Africa Satellite Event of Sustainability Research Innovation (SRI)

Dr Raphela-Masuku was invited to speak at the YSI workshop during the Africa Satellite Event of Sustainability Research Innovation (SRI) 2024 that took place from 21 to 24 May 2024 in Durban, South Africa. Dr Raphela-Masuku presented virtually on 'Green Transition in Africa: A Regional Perspective on Biofuels and Land Grabbing'.

Mangaung Metropolitan Municipality

On 12 July 2024, staff from DiMTEC comprising Prof Ogundeji, Dr Kunguma, and Zukiswa Poto, were invited to the Office of the Deputy Mayor of Mangaung for a meeting. They discussed collaborative initiatives such as training for councillors and developing and implementing public awareness campaigns in the Mangaung region. The Deputy Mayor, Lulama Titi-Odili, and Vumeli Nikelo, attended the meeting.



Prof Abiodun Ogundeji (fourth from left), Dr Olivia Kunguma (first from left), and Zukiswa Poto (third from left) with representatives of the Mangaung Metropolitan Municipality

AUC validation workshop

Prof Alice Ncube attended the AUC validation workshop from 31 July to 2 August 2024 in Addis Ababa, Ethiopia. The workshop reviewed the draft report developed after data collection workshops with Regional Economic Communities and AU Member States, consolidated the data, and validated the third Africa Biennial Report on Disaster Risk Reduction. The third day of the workshop was dedicated to an orientation on Post Disaster Assessment of Economic Losses.

International Day for Disaster Risk Reduction 2024

Dr Olivia Kunguma and Zukiswa Poto attended the International Day for Disaster Risk Reduction (IDRR) in Polokwane, Limpopo, which highlighted education's role in protecting and empowering youth. Students in Limpopo joined in the celebration, reflecting the province's disaster management efforts.



Dr Olivia Kunguma and Zukiswa Poto at IDRR 2024 in Polokwane

University of Buea-Cameroon

Prof Johanes Belle attended a workshop at the University of Buea (UB)-Cameroon Disaster Management Unit from 13 to 19 December 2024. Prof Belle's visit came after one of the staff from UB (Dr Wantime Mabel) spent two months at DiMTEC via a staff mobility programme under the FRAME. During his visit, Prof Belle gave a lecture to Master's students studying Disaster Risk Management at UB and, together with the students, discussed and analysed both the Master's Programme at UB and the postgraduate programmes offered by DiMTEC. Funding for both programmes was highlighted as a major drawback, which also affected the placement of students at various DRM institutions for experiential learning and possible employment. They suggested and encouraged staff and student exchange programmes. The UB students also face serious infrastructural challenges, including non-availability of internet services. Both institutions explored avenues for further collaboration.



POSTGRADUATE STUDENTS

A three-day writing workshop was held from 16 to 18 September 2024, which enabled DiMTEC academic staff to focus on academic writing with registered Master's and PhD students. The workshop contributed to advancing and finalising the research work of students who are at the final stage of their research projects.

At the April and December graduation ceremonies, the DiMTEC awarded Postgraduate Diplomas, Masters's Degrees, and PhD qualifications. Forty-three (43) students graduated with the Postgraduate Diploma in Disaster Management. A special congratulation to the *cum laude* students for their excellence in their academic work – Marlin Shaun Abrams, Mthulisi Tshuma, and Anneska van der Spoel.

Sixteen (16) students graduated with the Master of Disaster Management. They were:

- Bapela, Mamatee Beauty
- Cheeli, Fukuthu Isdorina
- Gaene, Peggy Tlou
- Korie, Nkopane
- Le Roux, Jacob Johanes
- Lesenyeho, Mathe Helekia
- Manqele, Nelisiwe
- Masha-Matsemela, Makgwale Consolation
- Matsaba, Lethukubonga Inertia
- Mente, Alvina Milk
- Monare, Dithuso Confidence
- Munyai, Ndinanyi Sedwell
- Nake, Ntshalle Stella
- Ndaba, Ndivhuwo Gladstone
- Nkuna, Shivasa Richard
- Petersen, Ilona

Three candidates completed and graduated with the PhD in Disaster Management:

Deolfa Rute Joao Jose Moises

Thesis: Analysis of the operational flood early warning system in the Kabbe Constituency, Zambezi Region, Namibia

Supervisor: Dr O Kunguma

Sonita Awah Lum

Thesis: Developing an integrated flood management framework for community resilience through systems thinking in Limbe, Cameroon

Supervisor: Prof JA Belle

Co-supervisors: Dr YS Nyam and Dr IR Orimoloye

Fumiso Muyambo

Thesis: Developing a resilience model using a comprehensive multi-hazard risk analysis and disaster risk reduction strategies for extreme weather events in Qwaqwa, South Africa

Supervisor: Prof JA Belle

Co-supervisors: Dr YS Nyam and Dr IR Orimoloye

STAFF MATTERS

Ronel Smith joined the DiMTEC team as the Senior Assistant Officer Administration, and Tsepo Fonane joined as a Senior Assistant Officer Finance on 1 May 2024. Akani Baloyi joined the team in September 2024 on contract basis.



Prof Belle, Dr Raphela-Masuku, Dr Lum, Dr Muyambo, and Prof Ogundeji at the December 2024 graduation ceremony

RESEARCH OUTPUTS

Research Articles

Afuye, G.A., Kalumba, A.M., Owolabi, S.T., Thamaga, K.H., Ndou, N., Sibande, P. & Orimoloye, I.R. 2024. Analyzing spatiotemporal variations and dynamics of vegetation over Amathole district municipality in South Africa. *Environment, Development and Sustainability*. DOI: 10.1007/s10668-024-05221-0.

Belle, J.A., Mapingure, T. & Owolabi, S.T. 2024. Factors Influencing Rural Women's Adoption of Climate Change Adaptation Strategies: Evidence from the Chivi District of Zimbabwe. *Climate* 12 (191).

Bostani, M., Tavousi, T., Mahmoudi, P., Jordaan, A. & Jahanshahi, S.M.A. 2024. Drought risk assessment based on hazard, vulnerability, and coping capacity concepts for hot and dry climate regions of Iran. *Environmental Development* 52: 101077.

Danso-Abbeam, G., Ogundeji, A.A., Asale, M.A. & Baiyegunhi, J.S. 2024. Effects of livestock ownership typology on household food security in rural Lesotho. *GeoJournal* 89:63.

Danso-Abbeam, G., Ogundeji, A.A. & Fosu, S. 2024. Cashew contract farming in Ghana: implications on farm performance and household welfare. *Journal of Agribusiness in Developing and Emerging Economies* 14(2).

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Geffersa, A.G. & Tabe-Ojong, M.P Jr. 2024. Smallholder commercialisation and rural household welfare: panel data evidence from Ethiopia. *European Review of Agricultural Economics* 51(1).

José Moisés, D., Nnnesi, A.K. & Kunguma, O. 2024. Policy implementation: Assessing institutional coordination and communication for flood warning in Namibia. *Journal of Disaster Risk Studies* 16(1).

Kehinde, A.D., Ojo, T.O. & Ogundeji, A. 2024. Impact of participation in social capital networks on the technical efficiency of maize producers in Southwest Nigeria. *Agriculture & Food Security* 13:12.

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Letebele, K.E., Araujo, M.A.A.L., Belle, J.A., Shigwedha, F.A., Bakajika, L.N., Ochieng, G., Johann, G., Raphela, T.D., Yoedsel, J.P., Samuel, G. & Sada, K.H.G. 2024. Lessons learned from the risk-informed urban development initiative in the SADC region. *Journal of Disaster Risk Studies* 16(2).

Lum, S.A., Belle, J.A., Nyam, Y.S. & Orimoloye, I.R. 2024. A participatory systems dynamic modelling approach to understanding flood systems in a coastal community in Cameroon. *International Journal of Disaster Risk Reduction* 101: 104236.

Lum, S.A., Belle, J.A., Nyam, Y.S. & Orimoloye, I.R. 2024. A Systematic Analysis of Systems Approach and Flood Risk Management Research: Trends, Gaps, and Opportunities.

International Journal of Disaster Risk Science 15.

Lum, S.A., Nyam, Y.S., Belle, J.A. & Orimoloye, I.R. 2024. A system archetype approach to identify behavioural patterns in flood risk management: Case study of Cameroon. *Environmental Development* 51.

Mbatyoti, S., Summer, P., Kalumba, A.M., Owolabi, S.T. & Belle, J.A. 2024. Investigating soil erosion vulnerable zones based on clustered geoinformatics approach: a case study of Tyume River Catchment, Eastern Cape, South Africa *Cuaternalio y Geomorfología* 38(3-4): 47-74.

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Muyambo, F., Belle, J.A., Nyam, Y.S. & Orimoloye, I.R. 2024. Building resilience to multiple climate change-related risks in QwaQwa using the community capitals approach. *Journal of Water & Climate Change* 00 (1).

Muyambo, F., Belle, J.A., Nyam, Y.S. & Orimoloye, I.R. 2024. Climate change extreme events and exposure of local communities to water scarcity: a case study of QwaQwa in South Africa. *Environmental Hazards* 23 (5).

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Nyam, Y.S., Modiba, N.T.S., Ojo, T.O., Ogundeji, A.A., Okolie, C.C. & Selelo, O.T. 2024. Analysis of the perceptions of flood and effect of adoption of adaptation strategies on income of informal settlements of Mamelodi in South Africa. *Climate Services* 34: 100468.

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Raphela, T.D. 2024. Resilience and preparedness of hospitals for pandemics: Lessons learned from COVID-19. *Journal of Disaster Risk Studies* 16(2).

Raphela, T.D. 2024. Was It About COVID-19 Vaccine Acceptance or Societal Culture and Livelihoods? A Case of The Kruger National Park Employees, South Africa. *Journal of Ecohumanism* 3(8).

Raphela, T.D., Manqele, N. & Erasmus, M. 2024. The impact of improper waste disposal on human health and the environment:

a case of Umgungundlovu District in KwaZulu Natal Province, South Africa. *Frontiers in Sustainability* 5.

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Raphela, T.D. & Ndaba, N. 2024. The fire hazard preparedness of special needs schools in the North West Province, South Africa. *Journal of Disaster Risk Studies* 16(1).

Selelo, O.T., Danso-Abbeam, G., Ogundeji, A.A. 2024. Impact of agroecological practices on farm performance in Botswana. *Renewable Agriculture and Food Systems* 39: e13.

Tabé-Ojong, M.P Jr. & Geffersa, A.G. 2024. Complementary technology adoption and smallholder commercialization: Panel data evidence from Ethiopia. *Agricultural & Applied Economics Association* 13439.

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Torsu, D.A., Danso-Abbeam, G., Ogundeji, A.A., Owusu-Sekyere, E. & Owusu, V. 2024. Heterogeneous impacts of greenhouse farming technology as climate-smart agriculture on household welfare in Ghana. *Journal of Cleaner Production* 434: 139785.

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Datta, R. & Lunga, W. 2024. Foresight Visions: Embracing Community-led and Indigenous Perspectives? In: *A guide to anticipation: Working Paper on Tools and Methods of Horizon Scanning and Foresight*. Paris: International Science Council. pp. 25-31.

Heunis, C., Joubert, M. & Ncube, A. 2024. Social Worker Role-Taking During Communicable Disease Outbreaks in South Africa: The Need for Disaster Management Training. *Routledge Handbook of African Social Work Education*. S. Levy, U.). Okoye, P.T. Tanga & R. Ingram (Eds). Routledge. pp. 152-164.

Simelane, T., Mutanga, S., Hongoro, ..., Lunga, W., Lunga, W. et al. 2024. *National Food and Nutrition Security Survey: national report*. Human Sciences Research Council.

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Management Challenges Towards Integrated Disaster Risk Management at the South African Municipalities: What Is Left Untouched? In: *Challenges, Strategies, and Resiliency in Disaster and Risk Management*. Z. Mbandlwa (Ed). IGI Global Publisher of Timely Knowledge. pp. 242-276.

Owusu-Sekyere, E., Nyam, Y. S., Selelo, O. T. & Torsu, D.A. 2024. Sustainable Development Goal 13: Urgent action to combat climate change and its impacts. *Handbook on Public Policy and Food Security*. S.L. Hendriks & S. Baby (Eds). Edward Elgar Publishing. pp. 311-321.

Conference Contributions

Conference Papers / Posters

Kunguma, O. 2024. *The Institutional Arrangements for Disaster Management*. Paper delivered at Fire Safety & Prevention Seminar. Birchwood Hotel, Ekurhuleni, South Africa. 22-23 February 2024.

Maisiri, M.K. 2024. *Gender Responsive Climate Change Adaptation: The Case of Flood-Induced Food Insecurity among Smallholder Farmers in KwaZulu-Natal, South Africa*. Paper delivered at Climate Adaptation Research Programme (CARP). Stellenbosch, Cape Town, South Africa. 7-11 October 2024.

Mshelia, Z.H., Amatebelle, E.C. & Belle, J.A. 2024. *Geospatial analysis of shoreline change of Ethekeeni coastline from 1990 – 2023*. Paper delivered at the DMISA Disaster Risk Reduction Conference. Cape Town, South Africa. 21-22 November 2024.

Ncube, A. 2024. *Use of Indigenous Knowledge in Floods and Droughts Early Warning for Improved resilience in Namibia, Malawi and South Africa*. Paper delivered at the DMISA Disaster Risk Reduction Conference. Cape Town, South Africa. 21-22 November 2024.

Nxumalo, N.N.P. 2024. *Investigating the Role and Impacts of Insurance Companies in Disaster Management: A Case Study of eThekweni Municipality*. Paper delivered at the DMISA Disaster Risk Reduction Conference. Cape Town, South Africa. 21-22 November 2024.

Poto, Z.V. 2024. *Integrating Business Continuity into Disaster Management: Enhancing Resilience in South African Municipalities*. Paper delivered at the DMISA Disaster Risk Reduction Conference. Cape Town, South Africa. 21-22 November 2024.

Poto, Z.V. 2024. *Mainstreaming business continuity into disaster risk reduction*. Paper delivered at the Research Agenda Seminar. National Disaster Management Centre, Pretoria, South Africa. 3-4 September 2024.

Raphela T.D. 2024. *Environment, Ecosystems, and Ecosystem-Based Disaster Risk Reduction*. Paper delivered at the Biannual Adaptation Network Colloquium on Climate Change, University of Cape Town, Cape Town, South Africa. 14-18 July 2024.

Raphela T.D. 2024. *Green Transition in Africa: A Regional Perspective on Biofuels and Land Grabbing*. Paper delivered at the Africa Satellite Event of Sustainability Research Innovation (SRI), Durban, South Africa. 21-24 May 2024.

Raphela, T.D. 2024. *Resilience and preparedness of hospitals for pandemics: Lessons learned from COVID-19*. Paper delivered at

the 1st World Policy Conference, Cape Town, South Africa. 24-27 November 2024.

Raphela, T.D. & Matsididi, M. 2024. *The causes and impacts of flood risks in South Africa*. Paper delivered at the 8th International Symposium on Flash Floods in Wadi Systems, UAE University, Al Ain City, United Arab Emirates. 4-7 November 2024.

STAFF (2024)

Director:
Prof AA Ogundeji

| | |
|------------------------------------|---|
| Professor: | Prof AA Ogundeji |
| Associate Professors: | Prof JA Belle, Prof AJ Jordaan (Part-time), and Prof A Ncube |
| Affiliated Professors: | Prof R Bragg, Prof B Grove, Prof A Ozunu, and Prof J Szarzynski |
| Lecturers: | Dr O Kunguma and Dr TD Raphela-Masuku |
| Research Fellows: | Dr K Ayodeji, Dr G Danso-Abbeam, Dr C Ferguson, Dr W Lunga, Dr Z Mshelia, Dr Y Nyam, Dr T Ojo, Dr I Orimoloye, Dr S Owolabi, and Dr M Tabe-Ojong |
| Affiliated Lecturers: | L de Wet and W Ellis |
| Junior Lecturers: | D Banyane, M van Straaten, ZV Poto and A Baloyi |
| Affiliated Junior Lecturer: | L Nogabe |
| Programme Director: | Prof A Ncube |
| Senior Assistant Officer: | R Smith |
| Finance Officer: | T Fonane |
| Research Assistant: | C Okolie |
| Interns: | N Nxumalo, C Goshupelwang, and M Tshangana |



INSTITUTE FOR
GROUNDWATER STUDIES
 FACULTY OF NATURAL AND AGRICULTURAL SCIENCES



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OVERVIEW OF 2024

The Institute for Groundwater Studies (IGS) continues to live up to its vision and mission, striving to be the preeminent groundwater institution in Africa for academic training and research. Our main task is to educate world-class postgraduate students who can apply their knowledge and skills to ensure sustainable utilisation and management of groundwater resources. We aim to produce high quality research that is relevant and practically applicable. The IGS serves the community through their students, research, and actions that will empower stakeholders to manage groundwater sustainably.

ACHIEVEMENTS

Staff Achievements

Prof Modreck Gomo was appointed as Associate Editor for *Sustainable Water Resources Management* (SWAM), Editorial Board Member at *Discover Water* journals, and Subject Editor for *Water SA*.

Student Achievements

The IGS Dux Prize for the MSc student with the highest mark in Geohydrology was awarded to Bomkazi Vava at the Annual Faculty Prize-giving in April 2024. Bomkazi achieved a final mark of 87%. The title of her dissertation was 'The investigation of groundwater transport in a geological formation: West Park Cemetery, Johannesburg, South Africa'.



RESEARCH, INNOVATION AND RESEARCH COLLABORATION

The IGS is the only institute in South Africa dedicated to geohydrology. The Institute conducts contract research on a wide variety of water-related topics of special interest to the mining and industrial sectors in terms of water management, minimisation of pollution, as well as understanding the nature and behaviour of South Africa's aquifers. The Institute provides a complete service to these industries through field investigations, the development of specialised field equipment, a well-equipped commercial and water research laboratory, and a number of computer models for the management and operation of the aquifers, protecting them from pollution. The Institute also takes part in research projects for the Water Research Commission (WRC), Coaltech, and the government. We are proud of the fact that technologies developed through these projects are now in use worldwide.

The IGS has expertise in the following fields of geohydrology: Groundwater research, Laboratory services, Groundwater in a mining environment, Development of groundwater monitoring programmes, Hydrogeological and contaminant investigations, Geochemical assessments, Groundwater software development, Acid-mine drainage prediction and management, Assessment of groundwater pollution, Groundwater risk assessments, Groundwater resource development and management etc.

Dr Anton Lukas (postdoctoral fellow) investigates mining activities that threaten transboundary aquifer systems in the water poor areas in the SADC region. He attended the Centre for Environmental Management 30th Anniversary Conference with the theme Sustainable Horizons – Navigating the future with environmental innovation', during October 2024 at which he delivered a paper on 'The threat of mining to transboundary water resources'.

Researchers Prof Modreck Gomo, Dr Eelco Lukas, Dr Anton Lukas, and MSc Geohydrology students

(Mmakoena Rammutla and Tlotliso Ellius Nape) attended and presented at the SADC Groundwater Conference under the theme 'Promoting Peace Across Borders through Conjunctive Water Management' held in Maseru, Lesotho, from 13 to 15 November 2024.



Mmakoena Rammutla (left) and Tlotliso Ellius Nape at the SADC Groundwater Conference 2024

Prof Francois Fourie and his (then) PhD student Kobus Haumann undertook research focusing on the use of a geophysical technique (two-dimensional electrical resistivity tomography) to map groundwater-bearing zones in the subsurface. In October 2024, they attended the 18th Biennial Conference & Exhibition of the Southern African Geophysical Association (SAGA) in Windhoek, Namibia, at which they delivered a paper on the results of the research. Kobus Haumann has since completed his PhD degree in Geohydrology and will graduate in 2025.



Kobus Haumann (left) and Prof Francois Fourie

ACADEMIC CITIZENSHIP AND COMMUNITY ENGAGEMENT

Drilling Supervision Course – Practical Field Demonstration

The IGS, in collaboration with the Groundwater Division (GWD) of the Geological Society of South Africa (GSSA), successfully hosted the annual Drilling Supervision Course from 4 to 6 July 2024 on the Bloemfontein Campus of the University of the Free State (UFS). This practical field demonstration is a key component of the Honours student class curriculum and attracts professionals within the groundwater industry. The course provides participants with hands-on experience and a solid theoretical background in site selection, drilling operations, drilling supervision, borehole construction, and development. By bridging the gap between theory and practice, the course equips attendees with the essential skills and knowledge required to effectively supervise drilling operations and construct boreholes.

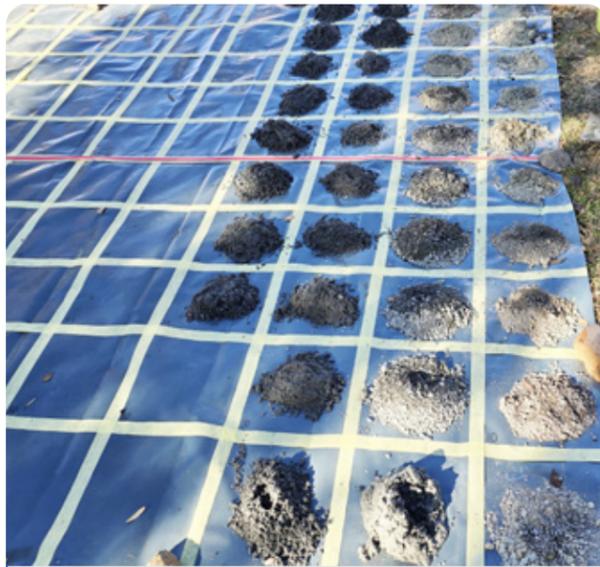


Delegates at the drilling supervision course

This annual event continues to play a vital role in capacity building and skills development within the groundwater sector, and the IGS is committed to maintaining this collaborative initiative with the GWD and GSSA. The course instructors included industry specialists, such as Dr Fanie de Lange, Dr Paul Lourens, Prof Francois Fourie, Dr Eelco Lukas, Dr Anton Lukas, and an experienced drilling contractor.



Drilling Operations



Drill chip samples laid out for geological logging during borehole drilling. The rock fragments provide valuable geological information, allowing the geohydrologist to monitor the subsurface stratigraphy and adjust the operations accordingly



MSc student, Leor Bester and Dr Paul Lourens demonstrating the down-the-hole camera into the bore hole

Establishing a formal accreditation curriculum for the drilling industry in South Africa

Dr Fanie de Lange was part of a delegation in November 2024, invited by the Department of Water and Sanitation (DWS), to visit to Denmark. This strategic initiative aimed to lay the groundwork for establishing a formal accreditation curriculum for the drilling industry in South Africa.

The main aim of this process was to establish a world-class drilling industry in South Africa, characterised by professionalism, safety, efficiency, and sustainability, through the development and implementation of a comprehensive accreditation curriculum. The objectives to reach this aim were to improve industry standards and safety, support economic growth and development, address regulatory and compliance requirements, and provide a framework for continuous improvement.



From the left, Fanus Fourie (DWS), Frederikke Storm Hansen (Denmark, EPA), Sakhile Mndaweni (DWS), and Derek Whitfield (EDRS)

Service to the scientific community

Prof Modreck Gomo examined one external international PhD thesis and three local MSc dissertations.

Dr Paul Lourens has served as the Chair for the Central Branch of the Groundwater Division (GWD) of the GSSA since the beginning of 2024. During 2024, the GWD Central Branch hosted online webinars on

World Wetlands Day titled 'An overview of South African Wetlands' with a focus on their social-ecological importance, presented by Steven Ellery from GroundTruth, and on World Environmental Day another titled 'Managed Aquifer Recharge', presented by Kes Murray (an IGS alumnus and now a senior hydrologist with WGA in Australia).

Managed Aquifer Recharge (MAR) with the focus on Drought Resilience
5 June 2024

Inviting all Young Professionals & Professionals in Celebration of World Environment Day

Presenter:
Kes Murray

10:30 – 11:30

Venue
Online Webinar

Webinar Overview:

- What is Managed Aquifer Recharge (MAR)?
- How does MAR help against drought resilience?
- MAR as a sustainable management practice in South Africa

For more information
Email: kes@murraywater.com
Registration available at
<https://uafwebinars.com/academic/managed-aquifer-recharge-2024>

WGA GROUND WATER DIVISION

World Environmental Day webinar

Dr Paul Lourens participated in the Free State Investment Conference 2024 held on the 27 February 2024 at the UFS. Dr Lourens moderated and participated in the panel discussion on 'The Future of Mining – The role and opportunities presented by technology and the 4th Industrial Revolution (4IR)'.



POSTGRADUATE STUDENTS

The IGS is a postgraduate institute which offers Honours, Master's, and Doctoral degrees in Geohydrology. Each year we receive more than 180 applications. With our lecture room that can only accommodate 38 students, we have a difficult task with the selection process, which is undertaken by an Academic Panel. In 2024, we hosted 20 Honours, 29 MSc, and 14 PhD students.

Eleven students graduated with the MSc degree at the April and December 2024 graduations, five passing with distinction. They were:

- Dumakude, Sbusiso Kwanda (with distinction)
- Fischer, Christian Erling (with distinction)
- Kolobe, Libuseng Theresia
- Maake, Katlego France
- Maluleke, Ntsako Victor
- Mbonambi, Lihlithemba Siphokazi
- Nape, Tlotliso Ellius (with distinction)
- Phikiso, Zininzi (with distinction)
- Theko, Thato Isabella
- Van Dyk, George Pieter
- Vava, Bomkazi (with distinction)

Three PhD degrees was conferred at the April 2024 graduations:

Patrick Cudjoe Adadzi

Thesis: Groundwater quality assessment with coupled soil and groundwater modelling of flow and transport at waste rock dump and tailings storage site

Supervisor: Dr AJ Allwright

Co-supervisor: Prof FD Fourie

Anton Lukas

Thesis: Machine learning applied to aquifer test analysis: Drawdown log-derivative classification with convolutional neural networks

Supervisor: Dr SS de Lange

Co-supervisor: Dr AJ Allwright

Hans Mbah

Thesis: Mathematical Modelling of Pressure Build-up Due to Geological Carbon Dioxide Storage in Deep Saline Aquifers, Using Non-local Operators: The Context of Groundwater Protection in the Climate Change Mitigation Era

Supervisor: Prof A Atangana

A key component of this postgraduate academic journey is the hands-on fieldwork opportunities designed to enhance practical understanding and application of geohydrological principles. The field trip remains an invaluable experience, consistently praised by students for its capacity to bridge academic learning with real-world application. This cornerstone event continues to play a pivotal role in the holistic development of our postgraduate geohydrology scholars. The 2024 field trip (1 to 3 July) was organised and facilitated by Dr Paul Lourens, Dr Fanie de Lange, Dr Anton Lukas, and Marius Smit, and offered participating students a comprehensive exploration of surface water-groundwater interactions. The trip also emphasised the practical aspects of groundwater systems, enriching the theoretical foundation provided through coursework.



Annual field trip of postgraduate students 2024

At IGS, it is important to equip our students with the necessary knowledge and skills. Many of our students are already employed when they enrol for the degrees at IGS. In 2024, it was a privilege for us to have three students from the same company enrolled for the BSc Honours and MSc Degrees. This

is not only a sign of students who are passionate about furthering their postgraduate education in Geohydrology, but also the industry that places their trust in IGS.



From left, Chris Miller (BSc Honours student), Arno van Vuuren (MSc student), and Arno Combrinck (MSc student)

STAFF MATTERS

Sadly, our messenger/cleaner, Priscilla Mosala passed away in January 2024.

In 2024 we bade farewell to two of our lab colleagues. Dr Trevor Chiweshe resigned as Senior Analyst and Wanda Geyer as Accreditation Officer. Both colleagues had been invaluable members of IGS's lab.

Dr Paul Lourens was appointed as the IGS Programme Director, Dr Tania Hill as Analyst in the IGS lab, and Agnes Maphathe as cleaner and messenger. Congratulations to all these well-deserved appointments.

RESEARCH OUTPUTS

Research Articles

Abro, K.A. & Atangana, A. 2024. Mathematical modeling of neuron model through fractal-fractional differentiation based on Maxwell electromagnetic induction: application to neurodynamics. *Neural Computing & Applications* 36: 18377-18383. DOI: 10.1007/s00521-024-10047-y.

Araz, S.I. & Atangana, A. 2024. Existence, uniqueness and numerical solution of stochastic fractional differential equations with integer and non-integer orders. *Electronic Research Archive* 32 (2) 733-761. DOI: 10.3934/era.2024035.

Atangana, A. 2024. 3-Dimensional computational analysis of ϕ -contraction in GV-fuzzy metric spaces with Applications. *Chaos Solitons & Fractals* 179: 114390_1-114390_11. DOI: 10.1016/j.chaos.2023.114390.

Atangana, A. 2024. Existence and uniqueness of nonlinear fractional differential equations with the Caputo and the Atangana-Baleanu derivatives: Maximal, minimal and Chaplygin approaches. *AIMS Mathematics* 9 (10) 26307-26338. DOI: 10.3934/math.20241282.

Atangana, A. & Araz, S.I. 2024. Extension of Chaplygin's existence and uniqueness method for fractal-fractional nonlinear differential equations. *AIMS Mathematics* 9(3): 5763-5793. DOI: 10.3934/math.2024280.

Atangana, A. & Koca I. 2024. Witte's conditions for uniqueness of solutions to a class of Fractal-Fractional ordinary differential Equations. *An International Journal of Optimization and Control: Theories & Applications / IJOCTA*: 14 (4) 322-335. DOI: 10.1121/ijocta.1639.

Egenasi, C., Benedict, M., Adefuye, A. & Madu, L. 2024. Epidemiological pattern of rape cases managed at a regional hospital in South Africa. *Health SA Gesondheid* 29 a2434:1-a2434:8. DOI: 10.4102/hsag.v29i0.2434.

Ghari, H., Parnow, S., Varfinezhad, R., Milano, M., Fourie, F.D. & Tosti, F. 2024. Cross-Gradient Joint Inversion of DC Resistivity and Gravity Gradient Data: A Multi-Disciplinary Approach for Geoscience, Heritage, and the Built Environment. *Remote Sensing* 16: 4468_1 - 4468_22. DOI:10.3390/rs16234468.

Gomo, M. 2024. Exploring deeper groundwater in a dolomite aquifer using telluric electric frequency selection method geophysical approach. DOI: 10.1016/j.gsd.2024.101265.

Gomo, M. 2024. On the Flow Characteristics (FC) method for estimating sustainable borehole yield. *Water SA* 50(1): 131-136. DOI: 10.17159/wsa/2024.v50.i1.4073.

Gomo, M. & Ngobe, T.F. 2024. Groundwater exploration in a granite aquifer using the telluric electric frequency selection method (TEFSM) in Eswatini, Southern Africa. *Sustainable Water Resources Management* 10 (22) 1-17. DOI: 10.1007/s40899-023-01009-8.

Gomo, M. & Ngobe, T.F. 2024. Interaction of pans and groundwater: A case study in the Khakhea-Bray Transboundary aquifer portion in South Africa. *Physics and Chemistry of the Earth* 136 1-10. DOI: 10.1016/j.pce.2024.103753.

Izadi, M. & Atangana, A. 2024. Computational analysis of a class of singular nonlinear fractional multiorder heat conduction model of the human head. *Scientific Reports* 14: 3466_1-3466_19. DOI: 10.1038/s41598-024-53822-6

Morakaladi, M.I.C. & Atangana, A. & 2024. Model of conversion of flow from confined to unconfined aquifers with stochastic approach. *Open Physics*: 22 1-13. DOI: 10.1515/phys-2023-0153.

Rehman, A.U., Chen, C., Riaz, M.B., Atangana, A. & Xiang, S. 2024. A comparative analysis of fractional model of second grade fluid subject to exponential heating: application of novel hybrid

fractional derivative operator. *Arab Journal of Basic and Applied Sciences* 31: 1-17. DOI: 10.1080/25765299.2023.2289237.

Vava, B. & Atangana, A. 2024. Investigation of possible effect of cemeteries on groundwater. *Journal of Taibah University for Science*. 18(1): 1-12. DOI: 10.1080/16583655.2024.2362425.

Welman-Purchase, M., Mokhahlane, L.S. & Chiweshe, T.T. 2024. Kinetic study of reaction formation of phosphate products from thermal dissolution of wolframite using fusion technique. *Journal of the Southern African Institute of Mining and Metallurgy* 22: 339-348. DOI: 10.17159/2411- 9717/3215/2024.

Conference Contributions

Conference Papers

Haumann, K. & Fourie, F.D. 2024. *Revisiting Equivalence in 2D ERT Surveys of Horizontal Aquifers*. Paper delivered as the 18th Biennial Conference & Exhibition of the Southern African Geophysical Association (SAGA), Windhoek, Namibia. 1-4 October 2024.



STAFF (2024)

Director:
Dr E Lukas

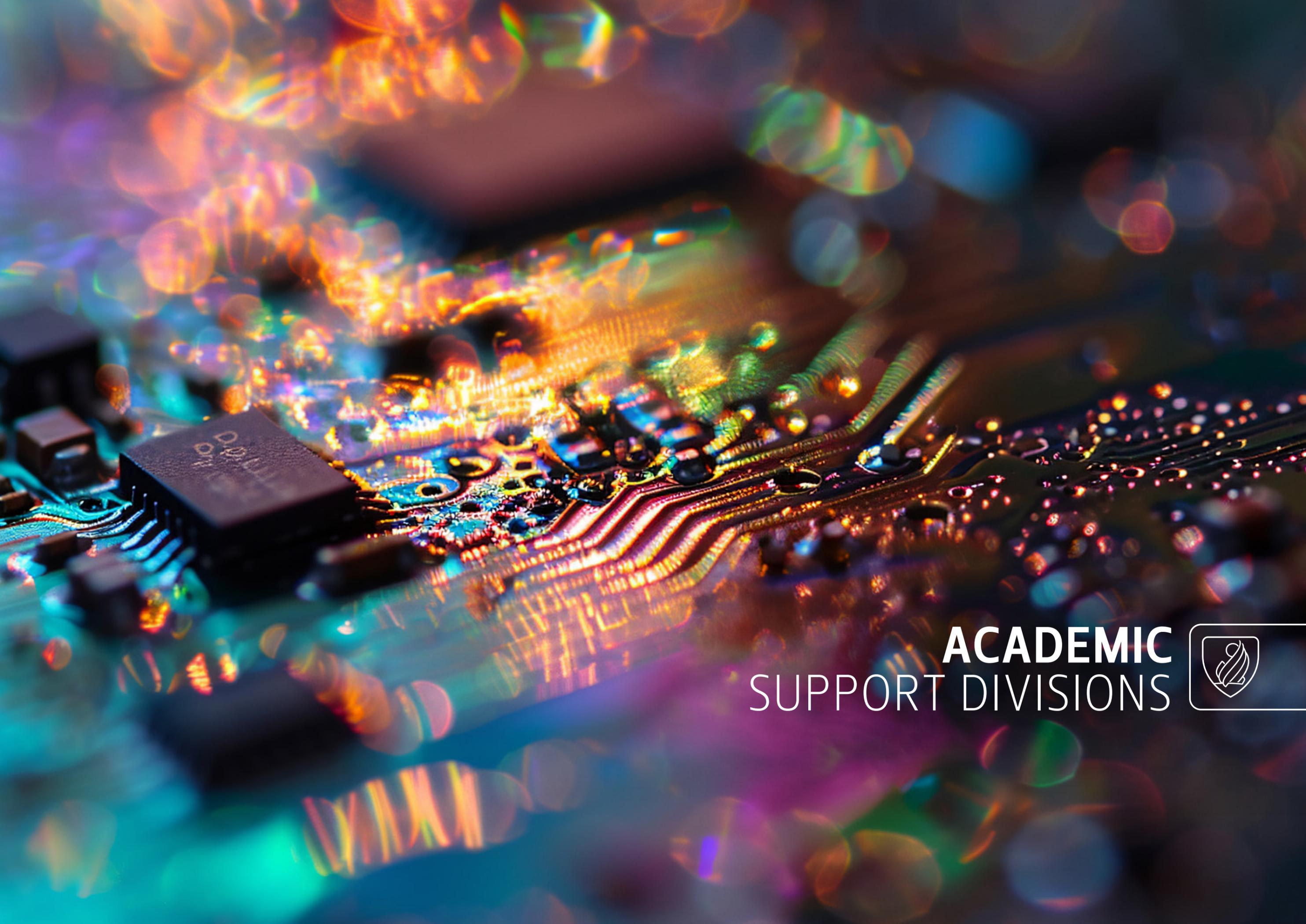
| | |
|---|-----------------------------------|
| Professor: | Prof A Atangana |
| Associate Professors: | Prof FD Fourie and Prof M Gomo |
| Affiliated Associate Professor: | Prof KT Witthüser |
| Senior Lecturer: | Dr SS de Lange |
| Lecturer and Programme Director: | Dr PJH Lourens |
| Chief Officer: | L Rust |
| Officer – Professional Services: | AB Rossouw |
| Assistant Officer: | M Smit (Contract) |
| Messenger/Cleaner: | A Maphathe |

IGS LABORATORY:

Deputy Director:
Dr L-M Deysel

| | |
|--------------------------------|-----------------------------|
| Quality Manager: | B Marumo |
| Analyst: | Dr T Chiweshe (resigned) |
| Analyst: | Dr T Hill |
| Junior Quality Analyst: | B Moruristian |
| Accreditation Officer: | W Geyer (resigned) |
| Officer: | T Letebele |
| Cleaner: | X Adoons |



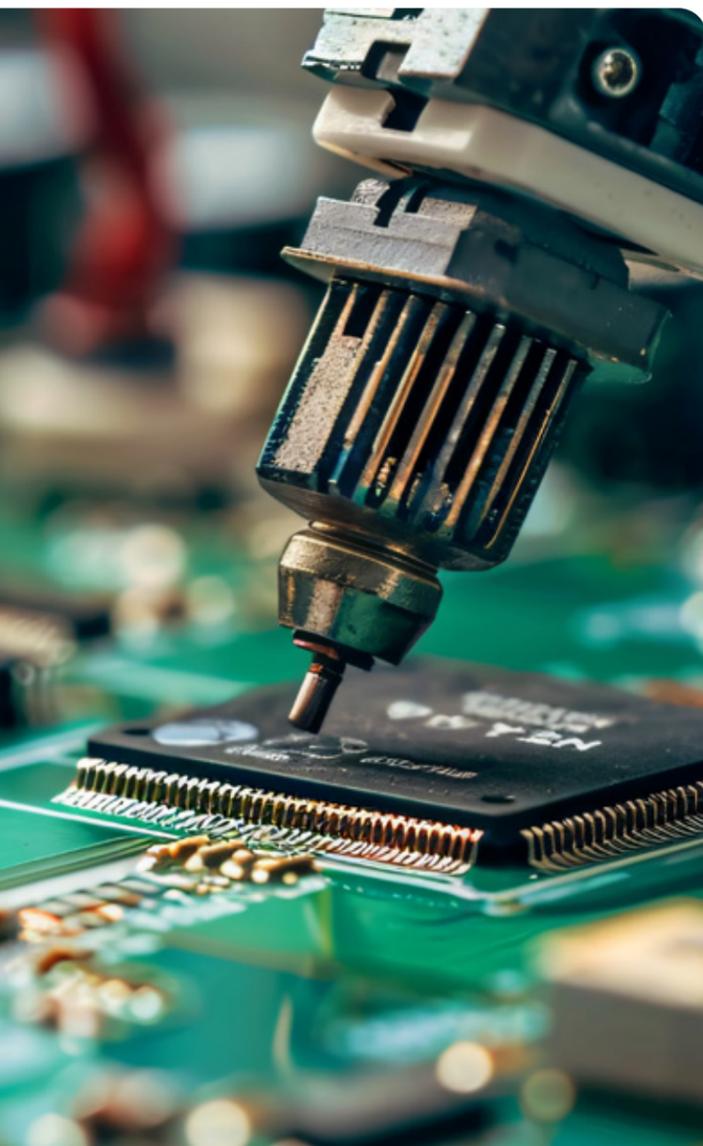


ACADEMIC
SUPPORT DIVISIONS



ELECTRONICS DIVISION

FACULTY OF NATURAL AND AGRICULTURAL SCIENCES



OVERVIEW OF 2024

2024 started on a worrisome note. The Faculty of Natural and Agricultural Sciences (NAS) was greeted with huge budget cuts and spending was curbed. Despite this the Division of Electronics had a very good year with only a slight decrease in work requests. This shows that, despite the budget cuts, research and the maintenance of research equipment plays a vital role within NAS. In the end we had a very busy and fruitful year that saw a few big projects being completed.

Our finances are in good health, and we managed to save enough money over the past couple of years to buy a new CNC PCB cutting machine. We purchased a LPKF 64 S to replace the LPKF 33 that served us well over the past 14 years, without any major breakdowns. We expect delivery in March 2025. By investing in our equipment we can deliver a good service and stay abreast of technology.

WORK ACTIVITIES

A total of 548 work requisitions were received in 2024, representing 624 pieces of apparatus. Twenty-three (23) were for development and installation projects. Some were new and others were extensions of existing systems, as well as the upgrading of older systems.

Of a possible 8967 working hours (based on 7.5 hours per day per person present), 7852 were actively used (i.e. 87.57%). Table 1 illustrates the time spent on work for the 48 departments, divisions and others that made use of the services of the Electronics Division in 2024.



CONTACT DETAILS

Innes Basson

Workshop: Electronics Division

Faculty of Natural and Agricultural Sciences

University of the Free State

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E: BassonI@ufs.ac.za

Table 1: Use made of the Electronics Division by departments and divisions (2024)

| CLIENT | | TOTAL TIME SPENT (HOURS) | % TIME SPENT | |
|--------------|--|--------------------------|--------------|----------------|
| 1. | Chemistry | 1226 | 15,61% | |
| 2. | University Estates | 1164 | 14,82% | |
| 3. | Physics | 1085 | 13,82% | |
| 4. | Protection Services | 776 | 9,88% | |
| 5. | Microbiology and Biochemistry | 693 | 8,83% | |
| 6. | Electronics | 438 | 5,58% | |
| 7. | Soil, Crop and Climate Sciences | 411 | 5,23% | |
| 8. | Animal Sciences | 369 | 4,70% | |
| 9. | Geology | 262 | 3,34% | |
| 10. | Plant Sciences | 239 | 3,04% | |
| 11. | Outside Firms | 218 | 2,78% | |
| 12. | Office of the Dean of NAS | 110 | 1,40% | |
| 13. | Institute for Groundwater Studies | 85 | 1,08% | |
| 14. | Brewery | 80 | 1,02% | |
| 15. | Architecture | 70 | 0,89% | |
| 16. | SADoCol | 62 | 0,79% | |
| 17. | Virology | 61 | 0,78% | |
| 18. | Centre for Microscopy | 58 | 0,74% | |
| 19. | Computer Science and Informatics | 51 | 0,65% | |
| 20. | Internal Administration | 50 | 0,64% | |
| 21. | Technical | 41 | 0,52% | |
| 22. | Mathematics & Applied Mathematics | 30 | 0,38% | |
| 23. | Engineering Sciences | 24 | 0,31% | |
| 24. | Zoology and Entomology | 22 | 0,28% | |
| 25. | Student Academic Services | 21 | 0,27% | |
| 26. | Centre for Environmental Management | 20 | 0,25% | |
| 27. | Agricultural Economics | 18 | 0,23% | |
| 28. | Instrumentation | 18 | 0,23% | |
| 29. | Sustainable Food Systems and Development | 16 | 0,20% | |
| 30. | Drama and Theatre Arts | 15 | 0,19% | |
| 31. | Pharmacology | 15 | 0,19% | |
| 32. | Teaching Practice Directorate | 13 | 0,17% | |
| 33. | Genetics | 13 | 0,17% | |
| 34. | Economic and Management Sciences | 10 | 0,13% | |
| 35. | Office of the Dean of Law | 9 | 0,11% | |
| 36. | Science-for-the-Future (SF4) | 9 | 0,11% | |
| 37. | Industrial Psychology | 6 | 0,08% | |
| 38. | Directorate for Research Development | 6 | 0,08% | |
| 39. | Centre for Mineral Biogeochemistry | 6 | 0,08% | |
| 40. | UVPERSU | 5 | 0,06% | |
| 41. | ICT Services | 5 | 0,06% | |
| 42. | Medical Physics | 4 | 0,05% | |
| 43. | Oncology | 4 | 0,05% | |
| 44. | Kovsie Sport | 4 | 0,05% | |
| 45. | Animal Research Centre | 3 | 0,04% | |
| 46. | Urban and Regional Planning | 3 | 0,04% | |
| 47. | Basic Medical Sciences | 2 | 0,03% | |
| 48. | Kovsie Gear | 2 | 0,03% | |
| TOTAL | | | 7 852 | 100,00% |

A total of 6078 hours were spent on maintenance (77.4%), 1724 hours on development projects and installations (21.96%), and 50 hours on administration (0.64%).

Work for the Faculty of Natural and Agricultural Sciences amounted to 5347 hours (68.1%), while 2505 (31.9%) hours were spent on work for departments/divisions outside the faculty.



Virgil Afrikaner – Servicing boom



The table below provides information on the projects completed in 2024 per department/division.

Table 2: Completed projects (2024)

| CLIENT | APPARATUS |
|--|--|
| Chemistry | 2 x upgrade to Algae growth container |
| | 1 x smoke detector alarm |
| | 4 x access control on fridges |
| | 1 x plant growing light |
| Engineering Sciences | 1 x upgrade to security system |
| Geology | 1 x upgrade to access control system |
| Institute for Groundwater Studies | 1 x upgrade to access control system |
| Office of the Dean of NAS | 1 x new intercom system |
| Oncology | 1 x fridge alarm system |
| Physics | 1 x complete security system consisting of access control cameras at the Planetarium |
| | 1 x upgrade to access control at Qwaqwa Campus |
| | 1 x upgrade to camera system in old building |
| SADoCoL | 4 x access control on walk in fridges |
| | 2 x standalone readers on fridges |
| Soil, Crop and Climate Sciences | 4 x temperature and humidity controls for tunnels |
| Sustainable Food Systems and Development | 1 x electronic control on new felt machine |
| University Estates | 1x camera system at new CSI lab |
| | 1x access control system at new CSI lab |
| | 2 x new boom gates at Frik Scott Library |
| | 2 x Sliding gate motor installations |
| | 9 x new boom gates at Qwaqwa Campus parking areas |



Elias Liew working on an access control installation

By the end of 2024, there were three unfinished projects, namely, an upgrade to the camera system and the access control system at the Centre for Mineral Biogeochemistry, and the building and commissioning of the Algae Plant for the Directorate for Research Development.



Mark Jackson – Repairing PCB

STAFF MATTERS

We advertised the position for an administrative officer after Alicia Kasper left us in 2023. Despite all the support staff positions being frozen due to the budget cuts, we managed to convince Human Resources that this position is crucial, and welcomed Alicia Kasper back to the Division.



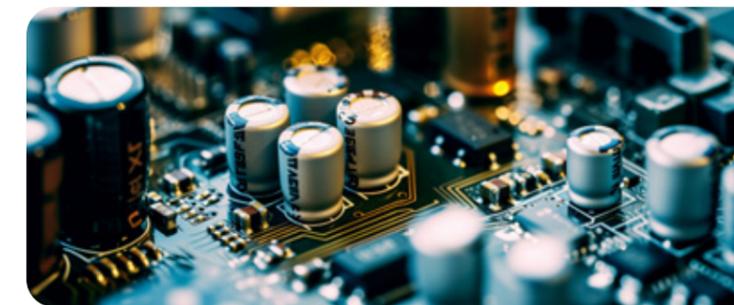
Alicia Kasper

All the other staff members are in good health and looking forward to 2025.

STAFF (2024)

Head of Division:
I Basson

Assistant Head: MH Jackson
Control Technician: HJ Roodt
Technicians: V Afrikaner and E Liew
Technical Assistant: D de Koker
Administrative Officer: A Kasper (shared with the Instrumentation Division)



INSTRUMENTATION DIVISION

FACULTY OF NATURAL AND AGRICULTURAL SCIENCES



CONTACT DETAILS

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Workshop: Instrumentation Division

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E: BassonI@ufs.ac.za

OVERVIEW OF 2024

The year began on a worrisome note due to budget cuts by the University and in the Faculty of Natural and Agricultural Sciences (NAS). A decrease in work requisitions was expected and we experienced a decrease of 41%. However, some large projects made up for the shortfall in work requisitions, and in the end the income matched that of 2023. The decline in work requisitions made time available for much-needed maintenance on the machines in the workshop, with all receiving a thorough cleaning, service, and repairs. In March we took delivery of the new CNC High-Definition Plasma Cutter that had been purchased at the end of 2023. I would like to thank all the departments that contributed financially towards the new machine. The saving in running costs will be a great advantage to all the departments and will bring about a good return on investment. The new machine will be used extensively in 2025, as a number of big projects that will carry over to 2025 will involve steel cutting work.

We welcomed Alicia Kasper back in 2024 after a short absence.

WORK ACTIVITIES

A total of 374 work requisitions were received in 2024, of which 23 were projects. Some were new projects and others were upgrades to older instruments and apparatus.

Of a possible 7508 working hours (based on 7.5 hours per day per person present), 5604 were actively used (i.e. 76.64%). Table 1 illustrates the time spent on work for the 39 departments, divisions and others that made use of the services of the Instrumentation Division in 2024.



Kobus Kruger

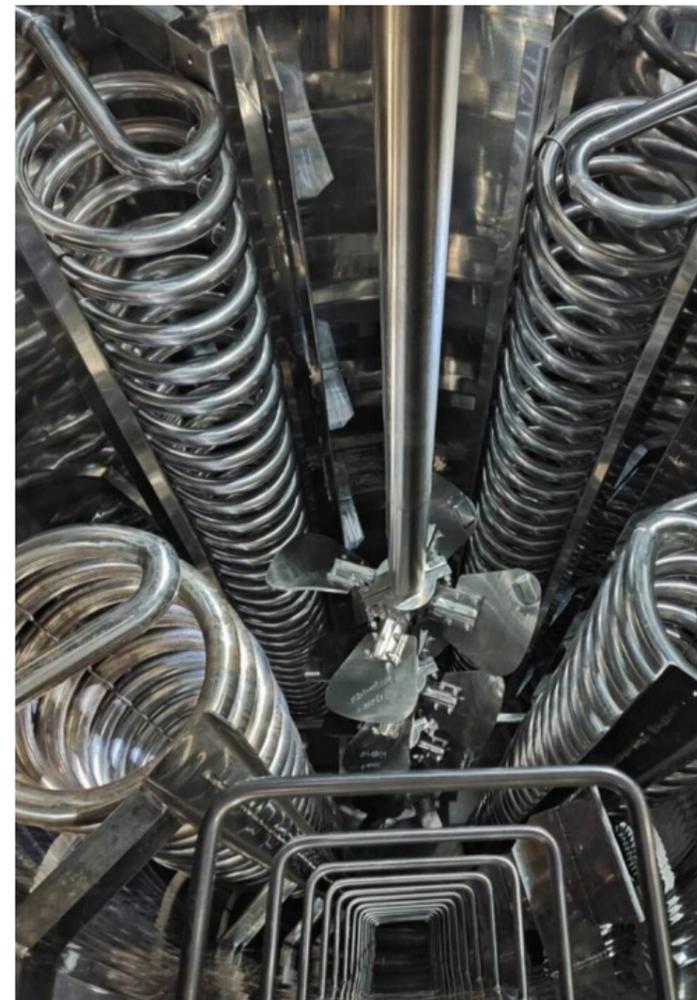


Table 1: Use made of the Instrumentation Division by departments and divisions (2024)

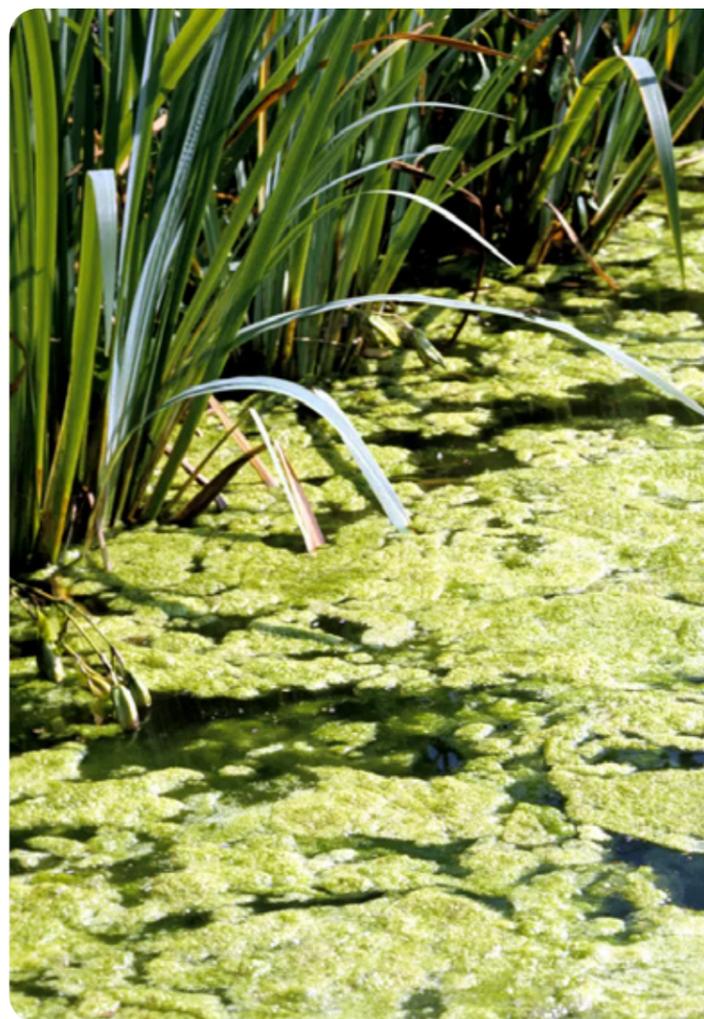
| | CLIENT | TOTAL TIME SPENT (HOURS) | % TIME SPENT |
|-----|--|--------------------------|--------------|
| 1. | Instrumentation | 734 | 13,10% |
| 2. | Physics | 719 | 12,83% |
| 3. | Animal Science | 552 | 9,85% |
| 4. | Chemistry | 530 | 9,46% |
| 5. | Brewery | 241 | 4,30% |
| 6. | University Estates | 232 | 4,14% |
| 7. | Office of the Dean of NAS | 222 | 3,96% |
| 8. | Sustainable Food Systems and Development | 198 | 3,53% |
| 9. | Outside Firms | 188 | 3,35% |
| 10. | ICT Services | 181 | 3,23% |
| 11. | Microbiology and Biochemistry | 180 | 3,21% |
| 12. | Exercise and Sport Sciences | 175 | 3,12% |
| 13. | Electronics | 172 | 3,07% |
| 14. | Soil, Crop and Climate Sciences | 171 | 3,05% |
| 15. | Institute for Groundwater Studies | 171 | 3,05% |
| 16. | Virology | 144 | 2,57% |
| 17. | Plant Science | 112 | 2,00% |
| 18. | SADoCoL | 101 | 1,80% |
| 19. | Centre for Mineral Biogeochemistry | 92 | 1,64% |
| 20. | Pharmacology | 76 | 1,36% |
| 21. | Brewery | 70 | 1,25% |
| 22. | Medical Physics | 58 | 1,03% |
| 23. | Kovsie ACT | 41 | 0,73% |
| 24. | Finance | 37 | 0,66% |
| 25. | Geology | 35 | 0,62% |

| CLIENT | | TOTAL TIME SPENT (HOURS) | % TIME SPENT |
|--------------|---|--------------------------|----------------|
| 26. | Centre for Environmental Studies | 32 | 0,57% |
| 27. | Genetics | 27 | 0,48% |
| 28. | Health Sciences | 25 | 0,45% |
| 29. | Directorate for Research Development | 23 | 0,41% |
| 30. | Zoology and Entomology | 11 | 0,20% |
| 31. | Engineering Sciences | 8 | 0,14% |
| 32. | Internal Administration | 8 | 0,14% |
| 33. | Centre for Microscopy | 8 | 0,14% |
| 34. | Office of the Deans of Economic and Management Sciences, and the Humanities | 7 | 0,12% |
| 35. | Kovsie Gear | 6 | 0,11% |
| 36. | Human Molecular Biology | 5 | 0,09% |
| 37. | Economic and Management Sciences, Qwaqwa Campus | 5 | 0,09% |
| 38. | Afrikaans, Dutch, German & French | 4 | 0,07% |
| 39. | Economic and Management Sciences | 3 | 0,05% |
| TOTAL | | 5 604 | 100,00% |

Work for the Faculty of Natural and Agricultural Sciences amounted to 4285 hours (76.46%). A total of 1311 (23.39%) hours were spent on work for departments/divisions outside the faculty. 8 Hours (0.14%) was spent on internal administration.



Lucas Odendaal using the new Plasma cutter



The table below provides a list of the completed projects in 2024 per department/division.

Table 2: Completed projects (2024)

| CLIENT | APPARATUS |
|---|---|
| Centre of Environmental Management | 4 x manufacturing of acrylic cylinders |
| Chemistry | 3 x pipette stands |
| | 2 x bioplastic moulds |
| Finance | 2 x exhibition trolleys |
| Genetics | 12 x mesh cages |
| ICT Services | 1 x overhead boardroom screen rack |
| Institute for Groundwater Studies | 1 x gas stripper |
| Microbiology and Biochemistry | 2 x vacuum pump trolleys |
| Medical Physics | 1 x MRI Phantom |
| Office of the Dean of NAS | 1 x built in braai |
| Physics | 1 x microscope light ring |
| | 1 x Lamont - Hussey 3D model |
| Sustainable Food System and Development | 1 x felt making machine |
| Paradys Experimental Farm | 2 x cultivator rebuild |
| | 10 x cattle scratch posts |
| | 8 x upgrade to Grow safe stations |
| Plant Sciences | 2 x milking parlour shade ports |
| | 1 x Greenhouse irrigation system |
| Soil, Crop & Climate Sciences | 4 x moisture/temperature probes |
| | 1 x sediment filter system |
| University Estates | 1 x screen bracket with shield for Thakaneng Bridge |
| Virology | 1 x rebuild EDS System |
| Zoology and Entomology | 13 x 3m extended bug catchers |



Wicus Storm

At the end of 2024, there were two unfinished projects – eight fermenters with agitation for the Centre for Mineral Biogeochemistry, and the building and commissioning of the Algae Plant for the Directorate for Research Development.

STAFF (2024)

Head of Division:
I Basson

Assistant Head: BJ Crous

Control Technicians: NJ Kruger, S Luthuli, and L Odendaal

Technical Assistants: P Matlwane and WJR Storm

Technical Aide: L Mokoena

Secretary: A Kasper (shared with the Electronics Division)

ACKNOWLEDGEMENTS

We are very grateful for the contribution of the Heads of Departments, Directors of Centres, and other academic and administrative staff who were responsible for the compilation of the contents of the departmental and other reports.

ISSUED BY

Faculty of Natural and
Agricultural Sciences
University of the Free State

EDITORIAL COMPILATION

Elfrieda van den Berg and
Cheryl Lombard

DESIGN AND LAYOUT

Andreas Viljoen Design

PHOTOGRAPHS AND IMAGES

Individual contributions and
UFS Communication and
Marketing. Additional images
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