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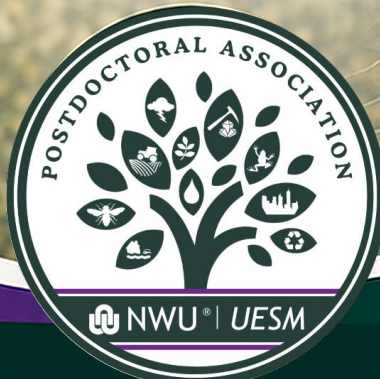
Unit for Environmental
Sciences and Management

Postgraduate Conference 2026

Abstract Book

*Navigating environmental
change across
systems and scales*

4 & 5 August 2026
The Roots, Potchefstroom





*3^d Unit for Environmental Sciences and Management Postgraduate Conference
4-5 August 2026*

Word of welcome: UESM Postdoctoral Association

The Organising Committee of the North-West University's (NWU) Unit for Environmental Sciences and Management (UESM) Postdoctoral Association is pleased to welcome all delegates, researchers, postgraduate students, supervisors, and guests to the **3rd UESM Postgraduate Conference: Navigating environmental change across systems and scales**. This gathering provides an important opportunity to showcase scholarly achievements, share emerging research, and foster meaningful academic engagement across disciplines. We extend our sincere appreciation to all delegates and supervisors for endorsing and encouraging future leaders in their respective fields in participating and engaging in this event. We also wish to express our special gratitude to student supervisors, whose mentorship, expertise, and commitment to academic excellence have played a pivotal role in guiding and supporting postgraduate research. Your dedication to developing research capacity and nurturing future scholars is invaluable. We thank all participants for their contributions and wish you a productive and rewarding conference.

UESM Postdoctoral Association & Organising Committee

Dr Marelize Marsay
Dr Marliese Truter
Dr Refilwe Kai-Sikhakhane
Dr Willie Cloete

Special mention of thanks to:

Professor Mark Maboeta
Professor Jonathan Taylor
Professor Carlos Bezuidenhout

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Foreword

It is a privilege to introduce this year's UESM Postgraduate Conference, themed Navigating environmental change across systems and scales. The title is not incidental. Environmental problems rarely announce themselves at a single system or scale: a contaminant in water/air/soil; a shift in a food web; a disease vector migrating due to climate change. The strength of the UESM has always been its expertise in working across these systems and scales. This year's programme reflects these strengths, with presentations ranging from groundwater interactions, antimicrobial resistance surveillance, and amphibian conservation to air quality and the food security of urban households, to name just a few. What connects these contributions is not a shared method or organism, but a shared discipline, i.e. careful observation, honest data, and a willingness to let evidence lead the argument.

To our postgraduate students and early-career researchers: this conference is yours. The skills you are honing now, precision in your data, clarity in your writing and oral presentation, and the courage to defend your findings, are the same habits that will define your careers long after this conference ends. Make use of the time spent at this conference to test your ideas against your peers, and not only yours and your supervisors'.

To our sponsors Inqaba Biotech, Lasec, Marang a Kitso, Separations, and SymbioLab, your support made this conference possible, and it is not taken for granted.

My thanks to the organising committee for the behind-the-scenes work that made this conference possible, and to every presenter for sharing their work.

Prof Mark Maboeta

Research Director: Unit for Environmental Sciences and Management



*3rd Unit for Environmental Sciences and Management Postgraduate Conference
4–5 August 2026*

Appreciation to our sponsors

The Organising Committee of the North-West University's (NWU) Unit for Environmental Sciences and Management (UESM) Postdoctoral Association wish to express their sincere appreciation to our sponsors for their generous support and valued partnership. Your contributions have been instrumental in the successful planning and execution of this conference and in facilitating the dissemination of high-quality scientific knowledge. Through your commitment to research, education, innovation, and professional development, you have helped create a platform that enables researchers, academics, and students to share findings, exchange perspectives, and foster interdisciplinary collaboration.

The support provided by our sponsors has contributed significantly to the delivery of the scientific programme, networking opportunities, educational initiatives, and the publication of this abstract book. Your investment in scholarly engagement and knowledge advancement reflects a shared dedication to excellence and the continued growth of our field.

We are deeply grateful for the confidence our sponsors have placed in this event and for their ongoing commitment to supporting and rewarding scientific and professional communities. On behalf of the North-West University, participants, presenters, adjudicators, and committee members, we extend our heartfelt thanks. Your support has played a vital role in ensuring the success and impact of this conference, and we look forward to continued collaboration in advancing research, innovation, and professional practice.

Sponsors

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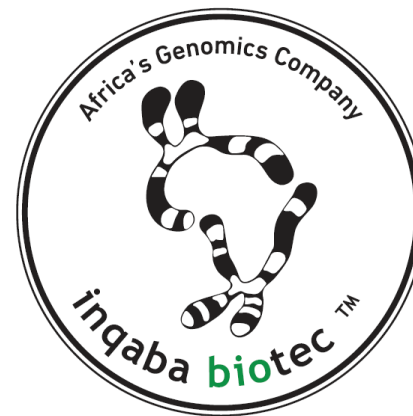
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SEPARATIONS
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*3rd Unit for Environmental Sciences and Management Postgraduate Conference
4–5 August 2026*

Program overview

Day 1 – Tuesday 4 August 2026	
7:30	Registration
8:30	Housekeeping
8:40	Welcoming – Director: Prof Mark Maboeta
9:00	Keynote – Prof Stuart Piketh
9:30	Full Talk
9:45	Short Talks
10:00 – 10:30	Tea
10:30	Sponsor talk – Separations
10:50	Full Talks
11:20	Short Talks
12:00 – 13:00	Lunch
13:00	Full Talk
13:15	Short Talks
14:00	Poster session
15:00	Tea
End of Day 1	

Day 2 – Wednesday 5 August 2026	
7:30	Registration
8:30	Housekeeping
8:40	Keynote – Prof Ché Weldon
9:10	Guest talk – DSTI
9:35	Full Talk
9:50	Short Talks
10:00 – 10:30	Tea
10:30	Sponsor talk – Ingaba
10:50	Full Talks
11:20	Short Talks
12:00 – 13:00	Lunch
13:00	Full Talk
13:15	Short Talks
14:00	Poster session
15:00	Tea
End of Day 2	
Gala Dinner @ The Roots – 17:30 for 18:00	

Program schedule by day

Tuesday 4 August 2026				
Time	Item	Speaker	Title	Sub-program
7:30	Registration			
8:30	Housekeeping			
8:40	Welcoming – Director: Prof Mark Maboeta			
9:00	Keynote – Prof Stuart Piketh			
9:30	Full Talk	F1 Raeesa Bhikhoo	A surveillance strategy for environmental antimicrobial resistance monitoring	Aquatic Ecosystem Health
9:45	Short Talk	S1 Thobeka Mpungose	Investigating groundwater and surface water interactions in the Eastern Karoo Basin, South Africa	Environmental Management
9:50	Short Talk	S2 Carla Fourie	The life history of three South African <i>Miomantis</i> species (Mantodea: Miomantidae)	Biodiversity and Conservation Ecology
9:55	Short Talk	S3 Kelebogile Phatlhaphatlha	Presence, prevalence, and characterization of <i>Klebsiella</i> species from wastewater and surrounding surface water systems in South Africa, North-West Province	Aquatic Ecosystem Health
Tea				
10:30	Sponsor talk– Separations			
10:50	Full Talk	F2 Pieter Wernich Bredenkamp	Innovating disaster risk reduction in SADC through AI and ML-enhanced data analysis and application	Disaster Risk Science
11:05	Full Talk	F3 Percy Moyaba	<i>Stomoxys</i> flies, their associated protozoan parasites and microbiota in KwaZulu-Natal Province, South Africa	Integrated Pest Management

Tuesday 4 August 2026				
Time	Item	Speaker	Title	Sub-program
11:20	Short Talk	S4 Karin Kooij	Harnessing environmental bacteriophages to combat multidrug-resistant <i>Pseudomonas aeruginosa</i> in wastewater-impacted ecosystems	Environmental Management
11:25	Short Talk	S5 Joos Theron	Monitoring photosynthetic performance during reproductive development of grain amaranth (<i>Amaranthus cruentus</i> L.) using chlorophyll fluorescence	Crop Production and Soil Management
11:30	Short Talk	S6 Kgothatso Malaka	Evaluating the quality of EIA reports for filling stations in Gauteng, South Africa	Environmental Management
11:35	Short Talk	S7 Palesa Ramodibe	Long-term sewage-related water quality trends and guideline compliance in the Vaal Barrage (2015–2024)	Aquatic Ecosystem Health
11:40	Short Talk	S8 Lebogang L Mosotho	Are current governance frameworks fit for purpose? assessing the institutional, policy, and legislative adequacy of drought relief funding in South Africa	Disaster Risk Science
11:45	Short Talk	S9 Yolanda Makgale	Tracking air quality and weather trends to uncover pollution and allergenic pollen patterns in Pietermaritzburg, KwaZulu-Natal (South Africa)	Climate Change, Air Quality and Impacts
11:50	Short Talk	S10 Ernest Seretse	The role of the informal sector in the food security of urban households: A case study of Mahikeng, South Africa	Environmental Management
Lunch				

Tuesday 4 August 2026				
Time	Item	Speaker	Title	Sub-program
13:00	Full Talk	F4 Lomarie Janse van Rensburg	Stable food webs in unstable waters: Subtle shifts in food webs of subtropical ephemeral pools	Ecological Interactions and Ecosystem Resilience
13:15	Short Talk	S11 Tshepang Motlhaping	Genomic insights into multidrug-resistant <i>Enterobacter asburiae</i> isolated from water sources in the North-West Province, South Africa	Biodiversity and Conservation Ecology
13:20	Short Talk	S12 Chandra le Roux	Unravelling the ecology of marine fish leeches in South Africa	Aquatic Ecosystem Health
13:25	Short Talk	S13 Duan van der Vyver	Management of <i>Eremnus cerealis</i> Marshall (Coleoptera: Curculionidae) with entomopathogenic fungi	Integrated Pest Management
13:30	Short Talk	S14 Lungile Mlangeni	Characterization of the gut microbiome of <i>Hemachatus haemachatus</i> and <i>Bitis arietans</i> . Implications for opportunistic pathogens associated with secondary infections following a snake bite	Biodiversity and Conservation Ecology
13:35	Short Talk	S15 Kgomotso Jamda	Investigating the presence and characteristics of carbapenem-and colistin-resistant <i>Klebsiella</i> species from wastewater and surrounding rivers	Aquatic Ecosystem Health
13:40	Short Talk	S16 Elelwani Rambauli	Climate change-induced agricultural shifts and amphibian biogeography in the Vhembe Biosphere Reserve, South Africa	Biodiversity and Conservation Ecology
13:45	Short Talk	S17 Thendo Sikhwari	Spatial-temporal variability and multiscale drivers of extreme rainfall in KwaZulu-Natal	Disaster Risk Science

Tuesday 4 August 2026				
Time	Item	Speaker	Title	Sub-program
13:50	Short Talk	S18 Jonathan Mark Birch	Assessing the impact of bush control methods on vegetation and soil in <i>Senegalia mellifera</i> -encroached areas at Tswalu Kalahari Reserve, Northern Cape Province	Ecological Interactions and Ecosystem Resilience
14:00	Poster session			
15:00	Tea			
End of Day 1				

*3rd Unit for Environmental Sciences and Management Postgraduate Conference
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Wednesday 5 August 2026				
Time	Item	Speaker	Title	Sub-program
7:30	Registration			
8:30	Housekeeping			
8:40	Keynote – Prof Ché Weldon			
9:10	Guest talk – DSTI			
9:35	Full Talk	F5 Mulalo Netsianda	A Miocene to Quaternary record of the northern Namibian continental slope	Earth System Sciences, Soils and Resources
9:50	Short Talk	S19 Karabo Kumalo	A land suitability assessment for environmentally compliant landfill site in Emfuleni Local Municipality, South Africa	Climate Change, Air Quality and Impacts
9:55	Short Talk	S20 Katiso Mgadi	Seasonal characterisation of Buchu (<i>Agathosma betulina</i> and <i>A. crenulata</i>) from wild and cultivated Western Cape populations	Environmental Management
Tea				
10:30	Sponsor talk – Inqaba			
10:50	Full Talk	F6 Nolwandle Khumalo	Dietary modulation of gut microbiota and functional enzymes in Savannah honeybees (<i>Apis mellifera scutellata</i> Lepeletier)	Ecological Interactions and Ecosystem Resilience
11:05	Full Talk	F7 Kailen Boodhia	A lung epithelial barrier – co-culture model – exposed to gold and silver nanomaterials at the air-liquid interface, investigating the cytotoxicity and intracellular uptake	Aquatic Ecosystem Health
11:20	Short Talk	S21 Ronan Diedericks	Spatial distribution patterns of potato tuber moth and tomato leafminer in potato fields in the Limpopo province of South Africa	Integrated Pest Management
11:25	Short Talk	S22 Makatu Casius Mashanyu	From waste to value: Rare earth element occurrence and mineralogical characterisation of carbonatite stringers	Earth System Sciences, Soils and Resources

Wednesday 5 August 2026				
Time	Item	Speaker	Title	Sub-program
11:30	Short Talk	S23 Tiaan Botha	Finding Bilbo: Automated acoustic monitoring and analysis on the near-extinct Bilbo's Rain Frog (<i>Breviceps bagginsi</i>) reveals key conservation action	Biodiversity and Conservation Ecology
11:35	Short Talk	S24 Roney Yssel	Assessment of anthelmintic resistance status of gastrointestinal nematodes infecting horses in the Potchefstroom	Environmental Management
11:40	Short Talk	S25 Phumelele Nkosi	Characterising ambient air quality in a low-income settlement in the South African Highveld Region: A case study of Embalenhle	Climate Change, Air Quality and Impacts
11:45	Short Talk	S26 Zander Arthur Coetzee	Distribution and characterization of <i>Klebsiella pneumoniae</i> and lytic bacteriophages in a South African wastewater treatment plant system	Environmental Management
11:50	Short Talk	S27 Charles Madiba	Spatial variability in the wildfire burn severity in the Mediterranean biome: A review	Disaster Risk Science
11:55	Short Talk	S28 Juan Crause Du Plessis	Evaluating the functionality of different kimberlite mine wastes as alternative to building material	Earth System Sciences, Soils and Resources
Lunch				
13:00	Full Talk	F8 Frans Labuschagne	Isolation, molecular identification, and biodegradation potential of pentolite-degrading fungi	Environmental Management
13:15	Short Talk	S29 Njabulo Luyanda Mahlobo	Assessing the perceived impacts of climate variability and change on maize farming in the Maize Triangle, South Africa	Climate Change, Air Quality and Impacts
13:20	Short Talk	S30 Thakhani Rambuda	Modelling groundwater flow/connection to surface waters in the upper Umgeni catchment, KwaZulu-Natal	Earth System Sciences, Soils and Resources

Wednesday 5 August 2026				
Time	Item	Speaker	Title	Sub-program
13:25	Short Talk	S31 Gerald Motale Bokwe	Depositional environments and stratigraphy of the outer continental shelf of western South Africa	Earth System Sciences, Soils and Resources
13:30	Short Talk	S32 Karabo Makgaretse	Exploring the relationship between pollen fluctuations and vegetation-land cover: A case study from Potchefstroom, North West Province, South Africa	Climate Change, Air Quality and Impacts
13:35	Short Talk	S33 Khwezi Ndinga	Assessment of the biodurability of graphene-family materials and their potential interference with standard toxicity assays	Biodiversity and Conservation Ecology
13:40	Short Talk	S34 Eyona Ndawana	Evaluating the accessibility and use of climate services by small-scale farmers in the North-West Province, South Africa	Disaster Risk Science
14:00	Poster session			
15:00	Tea			
End of Day 2				



*3rd Unit for Environmental Sciences and Management Postgraduate Conference
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Poster session	
MSc Poster	
M1	<i>Masego Medupe</i> Characterisation and agricultural suitability assessment of treated wastewater sludge, Mmabatho, South Africa
M2	<i>Takalani Mudau</i> Wildfire burn severity in the Grassland biome: A systematic review
M3	<i>Kruger Ferreira</i> Towards a refined model for early warning messaging in South Africa
M4	<i>Bonolo Mofokeng</i> Water quality dynamics across treatment stages at Midvaal drinking water plant
M5	<i>Tebogo Mafiri</i> Integrating geospatial analysis and local perceptions to enhance climate resilience of Ramsar wetlands in iSimangaliso Wetland Park
M6	<i>Anele Ndwandwe</i> Creating a soil-water sensitivity map to support urban planning
M7	<i>Dillon Croshaw</i> Ecology, health, and anthropogenic pressures on African Tigerfish (<i>Hydrocynus vittatus</i>): A systematic review and future research directions
M8	<i>Phophi Tshidzumba</i> Analysing temperature and rainfall trends as hazard determinants on the ecosystem services provided by the Ramsar wetland within the iSimangaliso Wetland Park
M9	<i>Sanmari Barlow</i> Uneven risks in a changing environment: Mapping disaster risk in the North West Province, South Africa
M10	<i>Khomotso Mathsa</i> Assessing the impacts of urbanisation on land use and land cover (LULC) in Polokwane Local Municipality
M11	<i>Marlien Potgieter</i> Signal vs Noise in OJIP curves: A semi-automated outlier detection for chlorophyll fluorescence data
M12	<i>Simthandile Brandon Ponti</i> Investigating the best practices to control molluscs in Brassicaceae and Solanaceae crops among smallholder farmers in the Hessequa Municipality

M13	<i>Asanda Tshakubi</i> The response of floodplain wetlands to human utilisation: Implications for conservation and management (uMfolozi Floodplain System)
M14	<i>Siya Tokwane</i> Complex urban risk systems and future resilience: Navigating compounding climate vulnerabilities across South African municipalities
M15	<i>Abraham Ryke</i> Diversity and composition of epiphytic corticolous lichens along an urban–rural gradient of three cities
M16	<i>Mohamedi Alley</i> A systematic review on community and stakeholder perceptions of fire occurrences and management in the Grassland biomes
M17	<i>Dominique Straub</i> Mapping agro-climatic suitability for sunflowers across the North West Province
M18	<i>Sinqobile Nokuphila Ntshalintshali</i> Population dynamics and agroecological distribution of lepidopteran pests of sorghum in South Africa
M19	<i>Anika Botha</i> Climatic and edaphic filtering of plant functional traits (PFTs) along a semi-arid mountain gradient
M20	<i>Sean Tshabalala</i> Estimating particulate matter (PM) 10-2.5 exposure through LUR model for unmonitored sites in South Africa
M21	<i>Brilliant Ntshangule</i> Strengthening climate governance for sub-national climate action: Case study of the North West Province, South Africa
M22	<i>Tarren Harrison</i> Efficacy of selected South African entomopathogenic fungal isolates against <i>Phthorimaea operculella</i> (Zeller) (Lepidoptera: Gelechiidae)
M23	<i>Samantha van Aarde</i> Effects of copper-oxide nanoparticles on host–parasite interactions in a freshwater system
M24	<i>Liam Webster</i> Assessing the potential of cosmic-ray neutron sensing to estimate yield potential in grain crops
M25	<i>Anelisa Leve</i> The taxonomy and systematics of fossil Scarabaeidae in Orapa Diamond Mine, Botswana

M26	<i>Kayla Kritzinger</i> Assessment of agrochemical compatibility and efficacy of entomopathogenic fungi targeting <i>Phthorimaea operculella</i> (Zeller) (Lepidoptera: Gelechiidae) under laboratory conditions
M27	<i>Adanna Soko</i> Institutional and stakeholder perspectives on plastic waste reduction in JB Marks Local Municipality
M28	<i>Thato Phala</i> Spatial accessibility patterns and transport mode choice among university students in Potchefstroom, South Africa
PhD Poster	
P1	<i>Tshenolo Masilo</i> Integrating Indigenous Ecological Knowledge (IEK) into fish parasite taxonomy to support inclusive biodiversity research
P2	<i>Jody Howard</i> Phage therapy targeting multidrug-resistant <i>Aeromonas</i> species in wastewater treatment plants
P3	<i>Aimée Dumont</i> A non-invasive approach to soil moisture monitoring in South African drylands
P4	<i>Zikhona Menze</i> Application of a Safe and Sustainable by Design (SSbD) framework to determine the ecotoxicological responses of <i>Daphnia magna</i> to graphene family materials
P5	<i>Ntebaleng Mokotla</i> Optimising cowpea productivity through integrated climate-smart strategies in South Africa's summer rainfall regions
P6	<i>Desiree Moela</i> Science-Policy interface and collaborative governance in wildfire management
P7	<i>Marcel Kruger</i> Freshwater fish biodiversity in the Limpopo River Basin: Current knowledge, gaps, and conservation implications
P8	<i>Nokwanda Nkabinde</i> Assessing farmers' perceptions of wetland use, governance dynamics and geospatial sustainability patterns in the uMfolozi Floodplain System, KwaZulu-Natal

Keynote speakers

Prof Stuart Piketh

*Deputy Dean: Research and Innovation, Community
Engagement and Internationalisation
North-West University*



Biography

Professor Stuart Piketh is the Deputy Dean for Research and Innovation, Community Engagement and Internationalisation in the Faculty of Natural and Agricultural Sciences at North-West University. He obtained his PhD in Geography and Environmental Studies from the University of the Witwatersrand and is an NRF B-rated scientist and member of the Academy of Science of South Africa (ASSAf). A leading atmospheric scientist, his research focuses on air pollution emissions, atmospheric transport, aerosols, and their environmental and human health impacts across southern Africa. He is a former President of the National Association for Clean Air (NACA) (2017–2020), contributing to global atmospheric science initiatives. Professor Piketh has supervised more than 70 postgraduate students, many of whom now hold influential positions in academia, government, and industry. Prof. Piketh has established an extensive network of international research collaborations through his work using ground-based and satellite observations, aircraft campaigns, research vessels, and remote sensing technologies.

Prof Ché Weldon

*Professor: School of Biological Sciences
North-West University*



Biography

Prof Ché's research mainly focusses on the terrestrial ectothermic vertebrate health (specifically amphibians and reptiles) in sub-Saharan Africa and Madagascar. The African landscape provides a fitting opportunity to study the ecological and health interactions between ectothermic vertebrates and their pathogens because of a high species diversity and wide range of ecosystems. He incorporates the growing collection of knowledge on the emerging infectious disease of amphibians, chytridiomycosis, to serve as theoretical framework for testing hypotheses related to amphibian and reptile health in the environment and even the public health sector where zoonosis is involved. His research program on herpetofauna health in Africa is the only one of its kind based at an African research institution. Through the network of collaborations his research has yielded records from Bénin, Burkina Faso, Côte d'Ivoire, Ghana, Guinea, Liberia, Sierra Leone, Cameroon, Nigeria, Tanzania, Niger, Botswana, South Africa, Lesotho, Swaziland and Madagascar. One of his prerogatives is to keep expanding the existing network of institutions across the continent in a concerted effort to understand and mitigate the impact of infectious disease on amphibian and reptile conservation.

Guest speaker

Tebogo Mokoma

Director: Americas and Asia

Department of Science, Technology and Innovation



Biography

Tebogo Mokoma is the Director responsible for bilateral cooperation with countries in the Americas and Asia, as well as BRICS, at the Department of Science, Technology and Innovation. A key part of his role is to position South Africa's National System of Innovation as a preferred destination for science, technology and innovation partnerships and R&D investment. Mr Mokoma is also a founding committee member of the Science Diplomacy Capital for Africa initiative, a DS&I initiative hosted at the Council for Scientific and Industrial Research. His 17 years of experience span teaching, research and science diplomacy, with previous roles at institutions including the Human Sciences Research Council and the National Research Foundation. He holds a BSc in Education, a Postgraduate Diploma, a Master of Philosophy and a Master of Business Administration (MBA).

Full presentations

F1 – A surveillance strategy for environmental antimicrobial resistance monitoring

Raeesa Bhikhoo

PhD candidate

Sub-programme: Aquatic Ecosystem Health

Supervisors: CC Bezuidenhout, LGM Molale-Tom

Abstract

Antimicrobial resistance (AMR) has proven to be a long-lasting threat, with bacterial resistance escalating at an alarming rate. This study focuses on the standardization of how AMR is tracked in wastewater, the investigation of biofilms on plastics as hidden reservoirs of resistant bacteria and then designing a standardized ARG biomarker profile for consistent global surveillance. Samples were collected from a wastewater treatment plant and a site-specific point in the ocean. A microplastic instrument was used to study biofilm formation on different plastic types using an in-situ technique in the marine environment. DNA was extracted and sequenced to identify resistance genes, allowing us to develop an ARG biomarker profile for standardization. Results thus far have shown that specific ARGs within different communities in the influent and effluent remain stable which may serve as a possible ARG biomarker indicator. Scanning Electron Microscopy (SEM) images also indicate that microplastics are potential carriers of opportunistic pathogens in the ocean as they attach and lodge themselves onto its surface to increase their survival rate in the environment. Data generation and analysis are currently ongoing. The findings from this study would assist in the preliminary design an ARG biomarker profile for the surveillance of AMR in wastewater. The findings would also allow the assessment of the linkage between biofilms forming on microplastics (MPs) and the spread of antimicrobial resistance genes (AMRGs) in biofilms in a marine environment. This approach helps us connect what's happening in wastewater and on plastics with real-world resistance trends.

Keywords: Antimicrobial resistance, Wastewater-based Epidemiology, Microplastics, Surveillance

F2 – Innovating disaster risk reduction in SADC through AI and ML-enhanced data analysis and application

Pieter Wernich Bredenkamp

PhD candidate

Sub-programme: Disaster Risk Science

Supervisor: D van Niekerk

Abstract

Disaster risk governance in Southern Africa is constrained by fragmented, uneven, and often incomplete disaster loss data. This PhD research addresses this gap through the development of REM-DAT, a Regional Emergency and Disaster Database for the Southern African Development Community (SADC), designed to complement national reporting systems and global repositories such as EM-DAT. Covering disaster events from 1990 to 2024, REM-DAT consolidates multi-source records using harmonised hazard classifications, subnational location metadata, date-precision indicators, and source-reliability ratings. Beyond event population and analysis, the research extends REM-DAT through the development of economic loss and gender-disaggregated disaster impact data models. The addition of these two models supports a more detailed analysis of how disasters affect livelihoods, sectors, households, and vulnerable population groups across different spatial scales. The PhD further explores the incorporation of artificial intelligence and machine learning to strengthen disaster data analysis, including automated source extraction, entity resolution, classification, validation, trend detection, and predictive modelling. Together, these components position REM-DAT not only as a regional disaster inventory, but as an analytical platform for evidence-based disaster risk reduction, resilience planning, and policy support. The research demonstrates how regional data systems can improve completeness, comparability, and equity in disaster risk governance across Southern Africa.

Keywords: REM-DAT, SADC, Disaster loss data, Gender-disaggregated impacts, Economic loss modelling

F3 – *Stomoxys* flies, their associated protozoan parasites and microbiota in KwaZulu-Natal Province, South Africa

Percy Moyaba

PhD candidate

Sub-programme: Integrated Pest Management

Supervisors: J Esterhuizen, OMM Thekiso, MO Taioe

Abstract

Stomoxys flies have a cosmopolitan distribution and both sexes are hematophagous. They feed on numerous domesticated, wild animals and occasionally bite humans. They act as biological or mechanical vectors of several pathogens including bacteria, viruses and protozoan diseases to their hosts, negatively affecting the agricultural production to billions in losses. This study investigated the diversity of *Stomoxys* flies, their associated protozoan parasites and microbiota in the northeastern KwaZulu-Natal province of South Africa. Thirty H-traps were deployed across three different land use setups across the uMkhanyakude District known to be infested with tsetse flies. Total of 1 328 *Stomoxys* flies were collected and identified microscopically and by molecular techniques. Six species namely: *S. boueti*, *S. calcitrans*, *S. niger bilineatus*, *S. n. niger*, *S. sitiens* and *S. taeniatus* were identified. Using universal PCR assays, three protozoan parasites were identified from these flies composed of *Trypanosoma* spp., *Babesia* spp. and *Theileria* spp. The prevalence of *Trypanosoma* spp. were 15.79%, 1.41% and 17.01% from commercial farms, communal areas and game reserves, respectively. Prevalence of piroplasmids (*Babesia* and *Theileria*) was 10.53%, 3.76% and 8.25% in the same respective land use setups. Additionally, 16S rRNA metabarcoding revealed Proteobacteria as the most abundant phylum across all species, followed by Firmicutes. It was observed that land-use setups have an influence on the *Stomoxys* spp. diversity and abundance as well as on the prevalence of protozoan parasites and their bacterial composition. These results highlight the ecological significance of land management in relation to vector diversity, ecology and disease transmission.

Keywords: *Babesia*, Microbiota, *Stomoxys* spp., *Theileria*, *Trypanosoma*

F4 – Stable food webs in unstable waters: Subtle shifts in food webs of subtropical ephemeral pools

Lomarie Janse van Rensburg

PhD candidate

Sub-programme: Ecological Interactions and Ecosystem Resilience

Supervisors: V Wepener, NJ Smit

Abstract

Temporary pool ecosystems are globally understudied yet increasingly threatened. In subtropical regions with unpredictable rainfall, endorheic pools fill irregularly and sustain communities adapted to extreme hydrological variability. Southern Mozambique's pools are distinctive in supporting fish with exceptional life-history strategies, including the endemic turquoise killifish *Nothobranchius furzeri*. Despite its prominence as a laboratory model, its natural trophic interactions remain poorly characterised. During austral autumn 2024, five temporary pools were sampled at four points across a hydroperiod. Biodiversity collections (fish, macroinvertebrates, zooplankton, biofilm, primary producers) were analysed using stable isotopes, alongside measurements of water quality and habitat variables. Isotopic niches stabilised within four days of inundation and remained consistent until desiccation. $\delta^{13}\text{C}$ variability indicated stochastic allochthonous inputs at initial inundation, shifting to autochthonous production after day four. Trophic positions of all taxa remained stable, with observed changes reflecting ontogenetic growth-related shifts in body size rather than altered trophic roles. This study provides the first integrative assessment of food-web processes in isolated temporary pool ecosystems of southern Mozambique. It establishes a foundation for understanding nutrient pathways and trophic interactions in these sensitive systems, thereby informing future conservation and management strategies.

Keywords: Aquatic invertebrates, Baseline shift, *Nothobranchius*, *Protopterus annectens*, Vegetation

F5 – A Miocene to Quaternary record of the northern Namibian continental slope

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Sub-programme: Earth System Sciences, Soils and Resources

Supervisor: E Bergh

Abstract

The Benguela Upwelling System is an important oceanographic feature along the margin of northern Namibia. The system is important in maintaining high productivity in the region. The intensity and variations of this system have closely been linked to marine productivity, regional ocean circulation and climate change. However, an account of how this system has changed since the Miocene is not well documented. This study aims to address this gap by analysing a marine sediment core (ODP 1081) recovered from the continental margin off northern Namibia. Samples obtained from this core were analysed for its foraminiferal micropaleontological content. This was done to determine how the system varies across certain time periods along the margin. Results indicated a moderate level of oxygenation and productivity in the area, characterised by the presence of benthic foraminifera such as *Cibicidoides wuellerstofi*, *Cibicidoides pachyderma*, *Bulimina marginata*, *Bulimina aculeata* and *Oridorsalis umbonatus*. The presence of *Globigerina bulloides* and *Globoconella inflata* in relatively high abundances and minor abundances of *Neogloboquadrina incompta* indicate the influence of upwelled, high-nutrient surface waters during the Pliocene to Pleistocene. From these results, the position and strength of the Angola-Benguela Front is shown to have varied throughout the Miocene to Pleistocene due to varying abundances of warmer water and colder water foraminifera species. This research has indicated the usefulness of utilising foraminifera to determine past ocean conditions along the northern Namibian margin during the late Cenozoic.

Keywords: Angola-Benguela Front (ABF), *Bulimina aculeata*, *Cibicidoides pachyderma*, *Cibicidoides wuellerstofi*, *Globigerina bulloides*, *Globoconella inflata*, *Neogloboquadrina incompta*, *Oridorsalis umbonatus*

F6 – Dietary modulation of gut microbiota and functional enzymes in savannah honey bees (*Apis mellifera scutellata* Lepeletier)

Nolwandle Khumalo

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Sub-programme: Ecological Interactions and Ecosystem Resilience

Supervisors: R Adeleke, Y Abdullahi

Abstract

Honey bees gather pollen from flowering plants, using it as a vital protein source and, in turn, acquire pollen-associated microbes that interact with their existing gut microbiota. Despite their ecological importance, limited information exists regarding the gut microbiota of African savannah honey bees (*Apis mellifera scutellata* Lepeletier) and how diet and its associated microbial community influence this crucial internal ecosystem. This study aimed to investigate the differences in gut microbiota between wild honey bees collected during the flowering season and microbially depleted honey bees reared under semi-sterile conditions and fed various protein diets. To achieve this, freshly hatched worker bees were maintained in hoarding cages and assigned one of four protein diets: fresh sunflower pollen, casein, sterilised casein, or sterilised pollen. High-throughput DNA metabarcoding was then employed to compare the microbial composition of the honey bee gut across these groups. Our findings revealed that the gut of microbially depleted honey bees exhibited higher species diversity and richness. Conversely, the non-core gut microbial community predominated in wild bees and those fed the different protein diets. Specifically, *Commensalibacter*, *Bartonella*, and *Bifidobacterium* were the most dominant bacterial genera across all treatments. Interestingly, *Gilliamella*, a common core gut bacterium, was undetected, whereas *Apibacter* was found exclusively in wild honey bees. Furthermore, pollen-associated microbes such as *Devosia* and *Pedobacter* were identified solely in the gut of honey bees fed a pollen diet. Functional predictions of the gut microbial community also indicated the presence of key enzymes, including β -glucosidase, β -galactosidase, pyruvate dehydrogenase, and phosphoglycerate mutase, which are crucial for nutrient absorption, digestion, and carbohydrate metabolism. These results underscore the intricate relationships among honey bees, microbes, and plants, offering valuable insights into how diet and its associated microbial communities can shape the gut microbiota of African honey bees.

Keywords: *Apis mellifera scutellata*, Diet, Gut microbiome, Honey bees, Pollen

F7 – A lung epithelial barrier – co-culture model – exposed to gold and silver nanomaterials at the Air-Liquid Interface, investigating the cytotoxicity and intracellular uptake

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Sub-programme: Aquatic Ecosystem Health

Supervisors: V Wepener, M Gulumian, C Andraos

Abstract

Most studies assess the potential adverse effects of exposure to airborne nanomaterials (NMs) using submerged culture systems; however, air-liquid interface (ALI) exposure systems are far better suited for assessing in vitro pulmonary effects of NMs, as they more closely mimic the in vivo respiratory system. In addition to the exposure system, other factors to consider during exposure studies include NM composition and exposure dose (bolus vs fractionated), as these will influence the delivered dose and, consequently, the NM's toxicity. This study aimed to determine the deposition, cytotoxicity, and cellular uptake of 20 nm citrate-stabilized gold nanoparticles (AuNPs) and silver nanoparticles (AgNPs) exposed as a bolus and a fractionated dose. The NM were exposed to the Lung Epithelial Barrier model composed of human alveolar basal epithelial (A549) cells and differentiated human monocytic (THP-1) cells at the ALI, using the VITROCELL® Cloud 12 in vitro exposure system. Cytotoxicity of the lung model was monitored using the LDH assay, and deposition and intracellular uptake were assessed using the CytoViva Darkfield Imaging System. The AuNPs and AgNPs were shown to be relatively non-toxic under ALI conditions when exposed as a bolus and fractionated dose. Both NMs were uniformly distributed over the exposure area of the transwell insert, indicating successful deposition of the NM dose. Intracellular uptake of the NPs was shown to be greater when exposed as a bolus dose, compared to the fractionated dose. This may indicate that a fractionated-dose exposure approach allows the model to clear NM more effectively, despite both exposure scenarios delivering the same dose. In conclusion, we can see that the NM composition may not affect the delivered dose, but rather the exposure scenario, as is apparent by the difference in intracellular uptake.

Keywords: Air-Liquid Interface, AgNPs, AuNPs, Deposition, Dose, Toxicity

F8 – Isolation, molecular identification, and biodegradation potential of pentolite-degrading fungi

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Sub-programme: Environmental Management

Supervisor: R Adeleke

Abstract

Expanded mining and infrastructure activities have increased the environmental release of pentolite residues. Pentolite, comprising trinitrotoluene (TNT) and pentaerythritol tetranitrate (PETN), poses ecotoxicological risks owing to its toxicity, persistence, and hazardous transformation products. Conventional remediation methods are often costly, complex, and may generate secondary pollution. Bioremediation therefore represents a sustainable alternative, with fungi regarded as promising agents because of their capacity to transform recalcitrant nitroaromatic and nitrate ester compounds. Therefore, this study aimed to isolate and identify fungi from a pentolite-contaminated site and evaluate their tolerance, degradation potential, and associated enzymatic mechanisms. Fungi were isolated from a pentolite-contaminated site on pentolite-amended media and identified by ITS and 28S rRNA sequencing with phylogenetic analysis. Isolates were screened for growth at pentolite concentrations up to 1000 mg/L. Representative genera were assessed for degradation of 100 mg/L pentolite using HPLC and GC–MS, while enzyme activities were examined using indicator media and selective inhibitors. Eight fungal isolates representing *Trichoderma*, *Fusarium*, *Purpureocillium*, and *Bjerkandera* were recovered. Five site-derived isolates tolerated up to 1000 mg/L pentolite, whereas controls failed at 100 mg/L. Six strains degraded 20–99% of 100 mg/L pentolite within six days. *Fusarium solani* fkm1 showed increased biomass, suggesting possible metabolic utilisation. Pentolite transformation yielded amino-nitrotoluenes and PETriN, indicating nitro-reductase as the principal initial enzyme, with cytochrome P450 contributing secondarily. These findings support the use of *F. solani* fkm1, *T. harzianum* fkm4 and *B. adusta* fkm10 fungi for further pentolite bioremediation application development.

Keywords: 2,4,6-trinitrotoluene, Bioremediation, Fungi, Pentaerythritol tetranitrate, Pentolite, PETN, TNT

Short talks

S1 – Investigating groundwater and surface water interactions in the Eastern Karoo Basin, South Africa

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Sub-programme: Environmental Management

Supervisor: S Kebede

Abstract

Groundwater plays a critical role in sustaining river flows and water security in South Africa's fractured-rock environments, yet the mechanisms controlling recharge, flow, and groundwater–surface water interactions remain poorly understood. This study investigates groundwater–surface water connectivity across multiple spatial scales within the eastern Karoo Basin, South Africa, using an integrated framework of environmental isotope tracers, hydrometric observations, and numerical modelling. Field investigations were conducted across the uMngeni and uThukela catchments, spanning elevations from the Drakensberg Mountains to the Indian Ocean. Environmental isotope tracers such oxygen-18 ($\delta^{18}\text{O}$) deuterium ($\delta^2\text{H}$) and radon (^{222}Rn), electrical conductivity (EC), groundwater-level monitoring, and baseflow separation were used to characterise recharge processes, identify groundwater discharge zones, and conceptualise groundwater flow systems. Results indicate compartmentalised groundwater flow controlled by lithology, fracture networks, and dolerite intrusions. Groundwater contributions to streamflow are spatially restricted, originating mainly from fractured upland zones, while downstream reaches show limited sustained baseflow. A coupled groundwater–surface water model is being developed using MODFLOW 6 with FloPy to simulate groundwater flow, streamflow routing, and river–aquifer exchange. The model enables quantification of spatial flow continuity, identification of gaining and losing reaches, and assessment of seasonal hydrological responses under variable recharge conditions. This integrated approach improves representation of fractured-rock catchment behaviour and provides a transferable framework for coupled hydrogeological modelling in data-scarce African fractured rock environments.

Keywords: Conceptual model, Environmental isotope tracers, Fractured-rock aquifers, Groundwater-surface water interactions, MODFLOW 6-FloPy.

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S2 – The life history of three South African *Miomantis* species (Mantodea: Miomantidae)

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Sub-programme: Biodiversity and Conservation Ecology

Supervisors: B Greyvenstein, J van den Berg, A Vermaak, P Janse van Rensburg

Abstract

The *Miomantis* genus (Mantodea: Miomantidae) consists of 73 species worldwide of which 21 are estimated to occur in South Africa, including the native Springbok mantis, *Miomantis caffra* Saussure. The latter species is known for its invasive tendencies and is currently outcompeting the only native New Zealand mantid species (*Orthodera novaezealandiae* [Colenso]). Furthermore, the springbok mantis has also been declared an environmental threat on Saint Helena Island (South Atlantic Ocean). Despite this, little is known about the biology, ecology and behaviour of, not only the South African *M. caffra* population, but the entire *Miomantis* genus. This study aimed to address this gap by breeding field-collected specimens and rearing their offspring to establish a baseline of the life history for three different *Miomantis* species (including *M. caffra*) in both a controlled laboratory and ambient environment. Preliminary results show all three species lived longer in an ambient environment (approx. 220 days) compared to a controlled environment (approx. 177 days). Similarly, the survival rates in ambient environments are also higher (37% compared to 20.57%). These differences may be due to seasonal variability influencing metabolic rates in the ambient environment and species-specific tolerances that are not met in the controlled environment. Additionally, the three species differed in terms of their incubation period and reproductive output. Notably, *M. caffra* exhibited asynchronous hatching, while the other two species did not. These findings highlight interspecific variation in developmental strategies and provide essential baseline data for understanding the ecological adaptability and invasive potential of *Miomantis* species.

Keywords: Biology, Invasive species, Reproductive strategy, Thermal plasticity, Springbok mantis

S3 – Presence, prevalence, and characterization of *Klebsiella* species from wastewater and surrounding surface water systems in South Africa, North West Province

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Sub-programme: Aquatic Ecosystem Health

Supervisors: L Molale-Tom, CC Bezuidenhout, K Tsholo, OS Olanrewaju

Abstract

Klebsiella species are opportunistic pathogens responsible for significant percentage of hospital acquired infections, with multidrug resistant hypervirulent *Klebsiella* clones posing a major public health concern. This study aimed to investigate the presence, prevalence and characterization of *Klebsiella* species in wastewater and surrounding surface water systems. In a water-scarce country such as South Africa, surface water and groundwater are crucial resources for irrigation and livestock making the presence of pathogenic and antibiotic-resistant bacteria a potential risk to both human and animal health. Water samples were collected from wastewater treatment plants and surrounding surface water systems, filtered, cultured on chromo-select agar and purified using streak plate method. Preliminary identification was performed using biochemical assays, PCR amplification of housekeeping genes, and Sanger sequencing. Confirmed *Klebsiella* isolates were subsequently characterized for antibiotic resistance and virulence associated traits using both phenotypic and molecular approaches. Analysis of physicochemical parameters showed that influent and effluent sites generally had higher variability and elevated levels of key parameters, especially conductivity, salinity, and TDS, while upstream and downstream sites are more stable water quality. Temperature and pH remained relatively consistent across all sampling sites, with a high proportion of isolates being multidrug resistant and able to lyse red blood cells. As the study is ongoing, further analyses will provide additional insight into the distribution, resistance profiles, and virulence potential of environmental *Klebsiella* species. The findings of this study will contribute to better understanding of the environmental dissemination of *Klebsiella* species and their potential role as reservoirs of antimicrobial resistance and virulence determinants, thereby informing public health and water quality management strategies.

Keywords: Antimicrobial resistance, Hypervirulence, *Klebsiella*, Multidrug resistance, Surface water, Wastewater

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S4 – Harnessing environmental bacteriophages to combat multidrug-resistant *Pseudomonas aeruginosa* in wastewater-impacted ecosystems

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Sub-programme: Environmental Management

Supervisors: KE Lekota, JJ Bezuidenhout, E Bergh

Abstract

Antimicrobial resistance is recognized by the World Health Organization as a major global health threat. Among priority pathogens, *Pseudomonas aeruginosa* is classified as a high-priority bacterium due to its increasing multidrug resistance, virulence, and association with poor clinical outcomes. Wastewater treatment plants (WWTPs) and polluted aquatic environments serve as important reservoirs for the persistence and dissemination of antibiotic-resistant bacteria and antibiotic resistance genes, highlighting the need for alternative antimicrobial strategies. Bacteriophages, also known as phages, are viruses that infect bacteria and represents a promising biocontrol approach due to their host specificity and ability to co-evolve with bacterial populations. Over a 12-month period, bimonthly water samples were collected from five selected sites within the Mooi River system to investigate bacteriophages targeting *P. aeruginosa*. Physicochemical parameters were measured concurrently, while environmental bacterial isolates and phages were characterized. A total of 214 *P. aeruginosa* bacteriophages and 42 environmental *P. aeruginosa* isolates were recovered, the latter confirmed by PCR and Sensititre identification. Host interaction assays identified 58 phages capable of infecting $\geq 70\%$ of environmental isolates, indicating broad host ranges and biocontrol potential. Broad-host-range phages were most prevalent during March and May; however, no highly effective phages were detected during November and January, corresponding with periods of severely depleted dissolved oxygen concentrations. Wastewater-associated sites exhibited elevated nutrient and metal concentrations and harboured the highest prevalence of phage-resistant isolates, with 84% of effluent-derived isolates resistant to phage activity. These findings suggest that environmental contamination and seasonal physicochemical fluctuations influence phage-host dynamics and support the potential application of bacteriophages for the control of environmentally relevant multidrug-resistant *P. aeruginosa*.

Keywords: Antimicrobial resistance, Bacteriophages, Biocontrol, Physicochemical parameters, *Pseudomonas aeruginosa*, Wastewater treatment plants

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S5 – Monitoring photosynthetic performance during reproductive development of grain amaranth (*Amaranthus cruentus* L.) using chlorophyll fluorescence

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Sub-programme: Crop Production and Soil Management

Supervisor: JM Berner

Abstract

Grain amaranth (*Amaranthus cruentus* L.) is a climate-resilient pseudo-cereal with considerable potential to contribute to sustainable agriculture and food security in South Africa. Understanding the photosynthetic changes that occur during reproductive development is important for improving crop management and identifying factors associated with plant senescence. Chlorophyll a fluorescence analysis provides a rapid, non-destructive method for evaluating photosynthetic performance and photosystem II (PSII) function. Changes in chlorophyll a fluorescence parameters were investigated over seven consecutive weeks, from the onset of bolting through progressive plant ageing and senescence. Measurements were obtained using a Hansatech M-PEA chlorophyll fluorometer, and fluorescence parameters, including FO, FJ, FI, FM, FV, FV/FM, and OJIP fluorescence transients, were analysed. In addition, the total performance index (PITotal) and its individual components were calculated to assess changes in photosynthetic performance throughout plant development. As plants moved from bolting through later development into senescence, photosynthetic performance declined. Both the maximum quantum efficiency of PSII (FV/FM) and the total performance index (PITotal) dropped significantly over this period, and OJIP fluorescence transients tracked this decline with progressive shifts in induction kinetics throughout the measurement window. Breaking the performance index down further, three of its four components, $\gamma_{RC}/(1-\gamma_{RC})$, $\phi_{Po}/(1-\phi_{Po})$, and $\psi_{Eo}/(1-\psi_{Eo})$, changed significantly with measurement week (all $P < 0.001$). The fourth, $\delta Ro/(1-\delta Ro)$, did not ($P = 0.967$). By identifying the onset of photochemical decline, this approach could provide a non-destructive tool to inform crop management decisions, such as harvest timing, in grain amaranth production.

Keywords: *Amaranthus cruentus*, Chlorophyll fluorescence, Grain amaranth, OJIP transients, photosystem II, Performance index, Senescence

S6 – Evaluating the quality of EIA reports for filling stations in Gauteng, South Africa

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Sub-programme: Environmental Management

Supervisors: L Kruger

Abstract

Environmental Impact Assessment (EIA) is the most recognised and widely utilised tool for identifying and assessing the possible impacts of proposed developments on the environment. Through the compilation of Environmental Impact Reports (EIRs), the EIA process encourages informed decision-making and promotes sustainable development by integrating the three pillars of sustainability (social, economic, and environment). Filling station developments are an essential part of the growing South African economy, which accounts for close to 40% of the country's retail fuel demand, and hosts more than 1,700 filling stations. Despite their economic significance, filling stations are associated with potential environmental impacts, particularly water and soil contamination. These impacts can lead to increased healthcare costs, and extensive socio-economic consequences. Therefore, the EIA process is essential to ensure that such impacts are identified and mitigated. Hence, the quality of EIRs conducted for filling station developments is critical for ensuring sustainable development. This study aimed to review the quality of EIA reports conducted for filling stations in the Gauteng Province. A qualitative research approach was followed, applying a modified Lee and Colley review package and document analysis to a sample of 30 EIA reports. Review Area 1 (Description of the development) achieved the highest performance (100%), followed by Review Area 4 (Communication of results) (97%), while Review Area 3 (Alternatives and mitigation of impacts) was the weakest performing area. The overall findings on the quality of the reports were that 97% were satisfactory (A-C), while 3% were deemed unsatisfactory (D-F). This study contributes new perceptions into the quality of EIA reports for filling stations in Gauteng and emphasises areas requiring improvement to strengthen environmental decision-making.

Keywords: EIA reports, Environmental Impact Assessment (EIA), Environmental Impact Statements (EIS), Filling Stations, Lee and Colley review package, Report Quality

S7 – Long-term sewage-related water quality trends and guideline compliance in the Vaal Barrage (2015–2024)

Palesa Ramodibe

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Sub-programme: Aquatic Ecosystem Health

Supervisors: M Dlamini, D Boshoff

Abstract

Persistent sewage discharge from failing wastewater treatment plants within the Emfuleni catchment continue to enter the Vaal River system and pollute downstream to the Vaal Barrage. These spillages intermittently elevate microbial contamination and nutrient loads, generating a combination of acute pollution events and chronic water quality degradation. Such conditions pose risks to public health, undermine regulatory compliance and threaten the reliability of water-based recreational activities along the Barrage. This study assesses sewage-related water quality conditions in the Vaal Barrage using long term secondary monitoring data obtained from Rand Water for the period 2015-2024. The analysis focuses on key indicators commonly associated with sewage contamination, including *Escherichia coli*, Nitrogen, Phosphorus, turbidity and biochemical oxygen demand. Descriptive statistics and non-parametric trend analysis were applied to examine temporal variability and long-term changes in these indicators, while measured values were evaluated against relevant national and international guidelines thresholds, including South African water quality standards and World Health Organisation recommendations. The study is designed to investigate potential exceedances of guideline limits and temporal variability, which may reflect the combined influence of sewage inflows and fluctuating hydrological dilution. While the research does not directly assess tourism performance or economic losses, the anticipated water quality patterns are expected to hold important implications for recreational suitability and risk exposure in water based tourism operations. By adopting a systematic, guideline-based framework for assessing water quality in the Vaal Barrage, this work aims to establish an empirical foundation that can enhance monitoring, accountability and management of an economically and socially significant freshwater system

Keywords: Economic vulnerability exposure, Microbial contamination risk, Nutrient enrichment, Recreational water sustainability, Wastewater infrastructure

S8 – Are current governance frameworks fit for purpose? Assessing the institutional, policy, and legislative adequacy of drought relief funding in South Africa

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Sub-programme: Disaster Risk Science

Supervisor: L Nema-konde

Abstract

This study critically assesses whether current governance frameworks for drought relief funding in South Africa are fit for purpose by examining their adequacy in institutional, policy, legislative, and collaborative terms, as well as their capacity to support effective and resilient drought response systems. A qualitative, phenomenological design was employed. The study purposely engaged 19 participants involved in disaster risk governance and finance across national, provincial, and municipal spheres, alongside an analysis of 22 selected legislative frameworks. Key findings reveal several critical limitations, including persistent capacity constraints, weak stakeholder coordination, inadequate data systems, and limited integration of frameworks into local planning processes. Additionally, public-private collaboration remains underutilised, thereby limiting the overall effectiveness and potential impacts of interventions. This study offers original insights into disaster risk governance by critically assessing the effectiveness and coherence of South Africa's drought-relief frameworks amid increasing climate variability. It adopts an integrated governance approach that examines institutional capacity, legislative alignment, coordination, stakeholder collaboration, and monitoring systems, while also highlighting the underutilised role of public-private partnerships and resilience-oriented financing in strengthening drought governance.

Keywords: Climate Change, Disaster Risk Reduction (DRR), Drought Relief Funding, Governance, Monitoring and Evaluation, Public-Private Partnerships, South Africa

S9 – Tracking air quality and weather trends to uncover pollution and allergenic pollen patterns in Pietermaritzburg, KwaZulu-Natal (South Africa)

Yolanda Makgale

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Sub-programme: Climate Change, Air Quality and Impacts

Supervisors: F Neumann

Abstract

Air quality in Pietermaritzburg is deteriorating due to biogenic particles (pollen and fungal spores) and anthropogenic air pollutants (NO₂, SO₂, PM_{2.5}, PM₁₀), posing risks to residential health. This study aims to assess how seasonal weather patterns interact with air pollution parameters and aerosol concentrations over 12 months. Pollen and fungal spore samples were collected using a Hirst-type 7-day volumetric spore trap placed 1.6 m above ground at St. Charles College, alongside meteorological data (temperature, rainfall, relative humidity, wind speed/direction) from an adjacent automated weather station. Pietermaritzburg's undulating topography and winter thermal inversions contribute to localised pollution hotspots, warranting this seasonal investigation. Preliminary analysis of two months of peak monitoring data has identified 36 distinct pollen types, with *Plantago* emerging as the most abundant taxon during this period. Among the fungal spores, *Cladosporium* was the dominant genus, alongside significant contributions from basidiospores and ascospores. However, the air pollution and meteorological datasets are currently pending statistical analysis. Once integrated, these datasets will be used to examine interlinkages among aerosols, weather variables, and pollutant concentrations using Spearman's rank correlation. Seasonal spatial maps of pollution variables will be generated using ArcGIS Pro, while time-series graphs will be created in RStudio to visualise temporal variations.

Keywords: Aerospora, Air pollution, Fungal spores, GIS, Meteorology, Pollen

S10 – The role of the informal sector in the food security of urban households: A case study of Mahikeng, South Africa

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Sub-programme: Environmental Management

Supervisors: D Ah Goo

Abstract

Food insecurity remains a serious concern in Mahikeng, like many other urban areas. Although informal food markets are widely used, their contribution to household food access from the consumer perspective has not been examined sufficiently. The aim of this study was to investigate the role of informal food markets in food security in Mahikeng, with a specific focus on the accessibility dimension. A quantitative cross-sectional design was used. Primary data were collected from 150 consumers between September 2025 and February 2026 at informal trading sites within the Mahikeng Central Business District, through face-to-face structured questionnaires that included a small number of open-ended questions. A convenience non-probability sampling technique was used to select consumers who were 18 years or older and had purchased food from informal markets. The data were analysed using descriptive statistics, while open-ended responses were analysed thematically to support findings. The findings showed that consumers used these markets mainly because they were affordable and easy to access. The most frequently purchased foods included vegetables, fruits, staple foods, snacks, cooked food and meat. The vast majority of the consumers who participated in the study indicated that informal markets contributed to household food security because they offered lower prices, small affordable quantities and nearby trading stalls. However, informal food access was affected by changing prices, seasonal variations and travel distance for consumers living far from the CBD. The study concluded that informal food markets play an important role in improving food accessibility and supporting household food security in Mahikeng.

Keywords: Consumers, Food security, Household food access, Informal food markets, Mahikeng, Urban areas

S11 – Genomic insights into multidrug-resistant *Enterobacter asburiae* isolated from water sources in the North West Province, South Africa

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Sub-programme: Biodiversity and Conservation Ecology

Supervisors: K Lekota, OMM Thekiso, T Ramatla

Abstract

Enterobacter spp. are increasingly recognized as a global concern due to their involvement in diverse infections and their rising antibiotic resistance. This study investigated resistance patterns and genomic features of *Enterobacter asburiae* isolated from tap and windmill water in the North West Province, South Africa. Whole genome sequencing (WGS) was performed on eight strains, followed by comparative genomics including average nucleotide identity (ANI), plasmid typing, antibiotic resistance genes (ARGs), virulence determinants, and phylogenomic placement. ANI revealed 95-100% similarity among isolates, confirming species classification. Strains 9A, 9B, 10A, 10B, 12A, and 12B corresponded to sequence type 3481 (ST3481), while 14A and 14B matched ST3095. All genomes carried ARGs for efflux pumps (*mdf(A)*), fosfomycin (*fosA*), and nalidixic acid (*oqxA*, *oqxB*). The β lactamase gene *blaACT 4* was present in all but 14A and 14B. Virulence factors included chemotaxis proteins (*cheW*, *cheY*, *cheZ*), curli fimbriae (*csgD*, *csgG*), enterobactin biosynthesis/export (*entA*, *entB*, *entE*, *entS*), ferric enterobactin transport (*fepA-fepG*), flagellar assembly proteins (*flgH*, *flhA*, *fliA*, *fliG*, *fliI*, *fliM*, *fliP*), type VI secretion components (*hslB1/vipA*, *hslC1/vipB*), long polar fimbriae (*lpfA-lpfC*), autoinducer 2 synthase (*luxS*), and the *ompA* adhesin. Plasmid analysis identified AC530 in 10B and 14B, and AD092 in 14B, both lacking ARGs. Novel plasmids were detected in 9A (pKP0155 5, 97% identity) and 14B (pKSB1_9A_2, 100% identity). Replicon typing revealed Col440I and IncFII_1_pKP91 in 9A, 10B, and 14B, highlighting plasmid diversity. Phylogenetic analysis showed multiple sub lineages, underscoring genetic heterogeneity. Overall, *E. asburiae* from communal farming environments exhibited diverse resistance and virulence profiles, emphasizing the importance of genomic surveillance at the human–animal–environment interface to anticipate emerging resistance threats.

Keywords: AMR, ARGs, *E. asburiae*, Virulence genes, WGS

S12 – Unravelling the Ecology of Marine Fish Leeches in South Africa

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Sub-programme: Aquatic Ecosystem Health

Supervisors: NJ Smit, S Lawton

Abstract

Hirudinea are segmented annelids characterised by anterior and posterior suckers and the absence of bristles, with many species functioning as ectoparasitic blood feeders of teleost fish. Fish leeches are highly diverse globally, with new species described annually; however, key regions remain underexplored. Along the South African coastline, only two piscicolid leech species have been formally recorded, despite the country's exceptional marine biodiversity, highlighting a knowledge gap. This study integrates morphological, histological, and molecular approaches to investigate marine and estuarine fish leech diversity and examines genetic population structure to infer ecological dynamics such as host use and blood parasite transmission. Leeches were collected from a range of teleost hosts, including the mullet species *Chelon dumerili*, *Chelon richardsonii*, *Chelon tricuspidens*, *Mugil cephalus*, the klipfish *Clinus superciliosus*, the blacktail *Diplodus capensis*, the steenbra *Lithognathus lithognathus*, and stumpnose *Rhabdosargus holubi*, sampled across multiple estuarine and near shore sites along the South African South Coast. Specimens were identified to the lowest possible taxonomic level based on morphological characteristics. Genetic analyses using multiple molecular markers (COI, 12S rRNA, ITS2, and ND1) were conducted to evaluate genetic diversity, population connectivity, and host–parasite associations. Genetic results revealed that a single leech species parasitises multiple fish species in estuaries, demonstrating low host specificity and evidence of host switching. Population genetic patterns further indicated connectivity between geographically distinct sites, suggesting dispersal ability and tolerance to varying environmental conditions. Differences in associated blood parasite assemblages were observed between hosts, indicating that these leeches may transmit distinct blood parasite taxa according to the identity of their fish hosts. Overall, the findings highlight that host switching and environmental adaptability are key ecological traits shaping the population structure of marine and estuarine fish leeches. This flexibility enhances their role as vectors within marine systems, with implications for parasite transmission and host–parasite interactions.

Keywords: Blood parasites, Fish leeches, Hirudinea, Host switching, Population genetics

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S13 – Management of *Eremnus cerealis* Marshall (Coleoptera: Curculionidae) with entomopathogenic fungi

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Sub-programme: Integrated Pest Management

Supervisor: H du Plessis

Abstract

Eremnus cerealis Marshall (Coleoptera: Curculionidae) is a destructive pest of crops in the Western Cape province of South Africa, causing economic losses. Two native entomopathogenic fungi, NWU-Bb-1 (*Beauveria* sp.) and NWU-Mt-1 (*Metarhizium* sp.), were isolated from mycosed larvae. Laboratory bioassays were conducted to evaluate their pathogenicity against larvae and adults using the soil drench method. The native EPFs were compared to commercially available EPF bio-insecticides *Metarhizium anisopliae* strain ICIPE 69, *Metarhizium anisopliae* strain ICIPE 78, *Beauveria bassiana* strain PPRI5339, *Beauveria bassiana* strain BB01. Soil drench application of the EPFs was done using fungal suspensions (1×10^8 cfu/ml, 1 ml per 10 g of soil). The four commercial bio-insecticides were applied at their maximum recommended label rates. The inoculated soil was equally divided among the wells of a bioassay tray for the larvae and in plastic containers for weevils, prior to the introduction of the insects. Treatment efficacy was determined by the relative speed of kill by the respective EPF and cumulative mortality 7 days post-treatment for larvae and 10 days post-treatment for adults. Larval mortality (>80%) was achieved with two commercial strains (*Metarhizium anisopliae* ICIPE 69 and *Metarhizium anisopliae* ICIPE 78) and both native strains (NWU-Mt-1(LT50; 4.96 (4.9-5.02)), NWU-Bb-1, with similar LT50 values ranging between 4.85 - 5.02 days. Both these native strains also achieved 90% mortality of weevils. The high pathogenicity of EPFs against *E. cerealis* under laboratory conditions in this study warrants further investigation for their use as a biocontrol option in an integrated pest management program.

Keywords: Bio-control, Entomopathogenic Fungi, *Eremnus cerealis*, Pest management

S14 – Characterization of the gut microbiome of *Hemachatus haemachatus* and *Bitis arietans*. Implications for opportunistic pathogens associated with secondary infections following a snake bite

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Sub-programme: Biodiversity and Conservation Ecology

Supervisors: C Weldon, R Adeleke

Abstract

This study aims to characterize the gut and oral bacteriome of two venomous snake species, the Rinkhals (*Hemachatus haemachatus*) and Puff adder (*Bitis arietans*), in South Africa's North-West Province, and to assess the associated public health risks. Snakebite envenomation is a critical health issue, and secondary bacterial infections from a snake's oral bacteria can significantly complicate patient recovery, leading to severe morbidity. Despite this, the bacterial diversity in wild snake populations, their antibiotic resistance, and virulence potential remain largely unexplored. Our research will use a multi-faceted approach. First, a systematic review and meta-analysis of existing literature on reptile bacteria will be conducted. Subsequently, the study will use next-generation sequencing (16S rRNA metabarcoding) and culture-dependent methods to grow and analyze ESKAPE bacteria in oral and cloacal swabs from wild-caught snakes. There will be 10 snakes collected for each species and an additional 20 snake samples for each species which were collected and stored in previous years. This will allow for a detailed comparison of bacterial communities between the two species and different anatomical sites. Bacterial isolates will be further tested for antibiotic resistance (using the Kirby-Bauer method and PCR for resistance genes) and virulence factors. Finally, the project will develop a spatial risk assessment model, correlating snake distribution data with environmental variables and human demographics to predict areas with a high risk of bacterial transmission from snakebites. The findings will provide crucial baseline data on snake-associated microbiota, inform clinical treatment protocols for snakebite victims by identifying potential pathogens, and contribute to a broader understanding of the ecological and public health implications of reptile bacteriomes.

Keywords: Antibiotic resistance, *Bitis arietans*, *Hemachatus haemachatus*, Gut microbiome, Oral bacteria, Virulence genes

S15 – Investigating the presence and characteristics of carbapenem- and colistin-resistant *Klebsiella* species from wastewater and surrounding rivers

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Sub-programme: Aquatic Ecosystem Health

Supervisors: LGM Molale-Tom, CC Bezuidenhout

Abstract

Wastewater treatment plants (WWTP) are environmental reservoirs for the release of antimicrobial-resistant bacteria into aquatic ecosystems, contributing to the dissemination of antimicrobial resistance (AMR). This study investigates the presence and characteristics of carbapenem- and colistin-resistant *Klebsiella* spp. from wastewater and receiving rivers. Water samples were collected from two wastewater treatment plants and upstream and downstream river sites. Physicochemical parameters were measured, and carbapenem- and colistin-resistant *Klebsiella* isolates were isolated using selective media. Identification of *Klebsiella* spp. was performed by biochemical testing and Sanger sequencing. Antimicrobial susceptibility testing followed CLSI guidelines. Virulence characteristics were assessed phenotypically and by PCR, while selected isolates underwent whole-genome sequencing for antimicrobial resistance gene detection, virulence profiling, and multilocus sequence typing. Preliminary results indicate that water quality improved with respect to dissolved oxygen; however, nitrate/nitrite concentrations remained elevated, while conductivity and total dissolved solids indicated a persistent dissolved pollutant load, and pH shifted towards slightly alkaline conditions. Antimicrobial susceptibility testing of 37 *Klebsiella* isolates demonstrated widespread multidrug resistance. Resistance was highest to meropenem (97.3%), ceftriaxone (100%), ceftazidime (97.3%), cefotaxime (94.6%), trimethoprim (94.6%), gentamicin (8/37; 21.6%), and ampicillin (91.9%). Colistin remained the most active antimicrobial tested *in vitro*, with 21/37 isolates (56.8%) remaining susceptible, although 16/37 (43.2%) were resistant. Colistin resistance was detected in 16/37 (43.2%) isolates. Whole-genome sequencing and molecular characterization are ongoing to identify resistance determinants, virulence factors, and sequence types. These preliminary findings suggest that wastewater treatment plants and receiving rivers act as reservoirs of multidrug-resistant *Klebsiella* spp.,

supporting continued genomic surveillance within a One Health framework to monitor the environmental dissemination of antimicrobial resistance determinants.

Keywords: Antimicrobial resistance, Carbapenem resistance, Colistin resistance, *Klebsiella* spp., Environmental surveillance, One Health, Wastewater treatment plant



S16 – Climate Change-induced agricultural shifts and amphibian biogeography in the Vhembe Biosphere Reserve, South Africa

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Sub-programme: Biodiversity and Conservation Ecology

Supervisor: FM Phaka

Abstract

Climate change is altering agricultural practices globally, resulting in implications for biodiversity and ecosystem integrity. In Vhembe Biosphere Reserve (VBR), South Africa, a region known for its high amphibian diversity, these shifts may influence habitat availability and species distributions. Amphibians with their sensitivity to environmental changes makes their biogeography a useful indicator for understanding ecological responses to combined climate and land-use pressures. This study investigates climate change-induced agricultural shifts and amphibian biogeography within the VBR, with emphasis on establishing a baseline understanding of amphibian distribution and diversity across the landscape. The study integrates historical occurrence records with field surveys using visual encounter methods and DNA barcoding to confirm species identity. Geographic Information Systems (GIS) is applied to map species distributions and assess spatial patterns of amphibian diversity across environmental and elevational gradients. The resulting biogeographical baseline provides an overview of amphibian diversity and distribution within VBR and reveals spatial structuring across the landscape. These baseline data is essential for interpreting amphibian responses to environmental variability and form a foundation for assessing potential impacts of future agricultural expansion and climate change. This work provides important baseline information for conservation planning within Vhembe Biosphere Reserve.

Keywords: Agricultural expansion, Amphibian biogeography, Biodiversity conservation, Climate change, GIS, Species distribution, Vhembe Biosphere Reserve

S17 – Spatial-temporal variability and multiscale drivers of extreme rainfall in KwaZulu-Natal

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Sub-programme: Disaster Risk Science

Supervisors: D van Niekerk, R Burger, H Havenga

Abstract

Extreme rainfall events are a major driver of flooding and associated socio-economic impacts in eastern South Africa, where interactions between tropical and mid-latitude circulation systems strongly influence rainfall variability. This study investigated atmospheric drivers of extreme rainfall over KwaZulu-Natal during the 1990-2020 period. Daily and monthly rainfall data from the South African Weather Service were analyzed using spatial-temporal statistical techniques, while atmospheric circulation patterns were examined using NCEP/NCAR and ERA5 reanalysis datasets. The spatio-temporal statistical analysis in this study was implemented using a combination of grid-based extreme rainfall indices, anomaly analysis, composite analysis, and correlation techniques to explicitly quantify spatial patterns and temporal variability. In the context of this study, short duration refers to extreme rainfall events occurring over synoptic timescales, typically lasting from approximately 1 to 3 days (24-72 hours). Extreme rainfall events were defined using a ≥ 50 mm/day threshold and evaluated alongside seasonal percentile distributions. Composite analysis, anomaly diagnostics, and case studies were applied using outgoing longwave radiation, sea-level pressure, geopotential height, wind vectors, and relative humidity fields. Tropical-temperate troughs (TTTs) are also shown to play a significant role, contributing to widespread high-intensity rainfall events. These systems enhance moisture transport and convergence, creating favourable conditions for persistent and spatially extensive precipitation. The results reveal a pronounced west-east rainfall gradient, with enhanced extremes along the eastern escarpment, and show that extreme rainfall is primarily associated with short-duration, high-intensity events. Short duration events included 17 cut-off low systems that were identified, with 41% occurring during spring (SON). Interannual variability is modulated by ENSO, with increased extreme rainfall during La Niña phases, although neutral years also exhibited high-rainfall events. These findings demonstrate that extreme rainfall in KwaZulu-Natal is driven predominantly by synoptic-scale disturbances

embedded within favorable large-scale moisture environments, providing a basis for improved impact-based forecasting and flood risk management.

Keywords: Cutt off lows, Extreme rainfall, Spatial-temporal variability, Tropical Temperate Trough (TTT)



S18 – Assessing the impact of bush control methods on vegetation and soil in *Senegalia mellifera*-encroached areas at Tswalu Kalahari Reserve, Northern Cape Province

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Sub-programme: Ecological Interactions and Ecosystem Resilience

Supervisors: P Malan, C Harmse, K Kellner

Abstract

Senegalia mellifera (Black-thorn) bush encroachment is a major driver of rangeland degradation in semi-arid savannas. It reduces herbaceous productivity, biodiversity, and grazing capacity, while altering vegetation structure and ecosystem functioning. This study evaluated the effectiveness of manual, chemical, and integrated bush control methods at Tswalu Kalahari Reserve (TKR), Northern Cape over a three year period, to determine which methods most effectively promoted herbaceous recovery while limiting woody regrowth (coppicing) and improving grazing capacity. A randomised block design was used to compare seven treatments across permanent monitoring plots, with biannual assessments of herbaceous biomass, species composition, diversity, density, woody structure, and soil-surface condition, supplemented by soil and microbial analyses, before and after treatment application. The results showed that 100% manual felling, combined with a cut stump chemical treatment produced the best short-term herbaceous responses, reflecting a higher biomass production and estimated grazing capacity compared to the other treatments and the untreated control. However, these responses are interpreted as the first phase of post-treatment recovery, likely amplified by exceptionally favourable rainfall seasons following treatment implementation. At the same time, increasing trends in tree equivalents per hectare and woody species diversity indicate ongoing woody re-establishment (especially coppicing), suggesting that the observed gains in herbaceous productivity may be temporary. The findings therefore indicate that, although intensive bush control can stimulate rapid short-term recovery, long-term restoration success will depend on sustained follow-up management to prevent re-encroachment in this rainfall driven ecosystem. This study provides applied guidance for adaptive bush-control planning and sustainable rangeland restoration in semi-arid southern African savannas.

Keywords: Adaptive bush control, Bush encroachment, Coppicing, Grazing capacity, Herbaceous vegetation recovery, Rangeland rehabilitation, Semi-arid savanna, *Senegalia mellifera*

*3rd Unit for Environmental Sciences and Management Postgraduate Conference
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S19 – A land suitability assessment for environmentally compliant landfill site in Emfuleni Local Municipality, South Africa

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Sub-programme: Climate Change, Air Quality and Impacts

Supervisor: A Ngie

Abstract

Municipal solid waste management is one of the major global concerns driven by rapid urbanization, and increased generation rates of waste per capita. In growing municipalities such as Emfuleni Local Municipality (ELM), South Africa, declining standards of essential public services have led to uncontrolled dumping, illegal landfill sites, and environmental degradation. Although several national policies are enacted to address this issue, landfill siting in ELM has historically been unplanned and reactive, thus leading to disputes about land use, potential pollution of water resources, and decreased landfill capacity. This research addresses the absence of scientific studies on landfill site selection in ELM by implementing an integrated Geographical Information System (GIS)-Analytical Hierarchy Process (AHP) based analysis. Criteria drawn from the National Environmental Management: Waste Act and Minimum Requirements for Waste Disposal by Landfill are used to identify and eliminate non-conformable zones, including regions prone to 1-in-50-years floods, and conservation zones. AHP is then used to assign weights based on meta-analysis (consistency ratio lower than 0.1) to the selected environmental, socio-economic, and financial criteria, including proximity to waterbodies (Vaal River catchment), wetlands, flood-prone zones, settlements, highways, slope, elevation, and land use type. By applying weighted overlay analysis, the study classified the municipality into various suitability zones: very suitable (>0.7), moderately suitable (0.4-0.6), marginally suitable (0.3-0.4), and unsuitable (<0.3). Validation is then performed by overlaying the results of the model with the current landfills (Waldrift, Boitshepi, Palm Springs) and the proposed Yakani landfill site. Consequently, the developed suitability map offers a useful tool for city officials to guide the development of acceptable landfill infrastructure. This study demonstrates the applicability of GIS-AHP approaches in resource-constrained South African municipalities and underscores the need for localized, science-based decision-making in landfill site selection.

Keywords: Emfuleni, Geographic Information Systems (GIS), Landfill, Municipal Solid Waste, Suitability Assessment



S20 – Seasonal characterisation of buchu (*Agathosma betulina* and *A. crenulata*) from wild and cultivated Western Cape populations

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Sub-programme: Environmental Management

Supervisors: R Adeleke

Abstract

The Western Cape is a biodiversity-rich region that supports a diverse range of indigenous aromatic plant species, including the endemic genus *Agathosma*. *Agathosma betulina* and *A. crenulata* (buchu) are commercially important species valued for their essential oil-rich leaves, which have long been used in traditional medicine and remain important to the flavour, fragrance, and perfumery industries. This study investigates the seasonal variation in soil nutrient status, plant metabolite profiles, essential oil composition, and plant-associated microbial communities in wild and cultivated buchu populations across the Western Cape over four seasons. Data collection and analysis are currently underway. The findings will provide insights into the environmental and biological factors influencing buchu productivity and phytochemical composition. Furthermore, the results will inform subsequent controlled greenhouse experiments aimed at evaluating the effects of selected endophytic microbial treatments on buchu growth, essential oil yield, and essential oil quality.

Keywords: *Agathosma*, Aromatic, Buchu, Essential oil, Seasonal

S21 – Spatial distribution patterns of potato tuber moth and tomato leafminer in potato fields in the Limpopo Province of South Africa

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Sub-programme: Integrated Pest Management

Supervisor: H du Plessis

Abstract

The Potato tuber moth (PTM), *Phthorimaea operculella* (Gelechiidae) and tomato leafminer, *Phthorimaea absoluta* (Gelechiidae) are important pests of tomato and potato crops in South Africa. The recent shift in the composition of *Phthorimaea* spp. in potato fields has raised concern among producers, particularly in regions where both crops are cultivated. The aim of this study was to investigate the spatial distribution patterns of both moth species within and adjacent to potato fields in three South African production areas. Weekly monitoring was conducted using four delta traps per field per species, each baited with a species-specific pheromone lure and placed within potato fields. In addition, larval presence of *Phthorimaea* spp. in potato foliage was assessed in two cropping regions. To further understand moth dispersal, trap catches were recorded monthly over a 48-hour period along transects extending from 5 m inside the field to 100 m into surrounding natural vegetation, in all four cardinal directions. Weekly trap catches indicated that both species followed corresponding trends in occurrence throughout the sampling period, although *P. absoluta* was consistently more abundant than *P. operculella*. Almost all larvae collected from potato leaves were *P. absoluta*. Moths of both *Phthorimaea* spp. were caught in fields before planting, and individuals were captured throughout the potato production season, including up to 100 m from the fields into natural veld. These findings offer critical insights for guiding integrated pest management strategies targeting both *Phthorimaea* species in South African potato production systems.

Keywords: IPM, Pheromone, Potato, PTM, Tuta

S22 – From waste to value: Rare earth element occurrence and mineralogical characterisation of carbonatite stringers

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Sub-programme: Earth System Sciences, Soils and Resources

Supervisor: F Waanders

Abstract

Rare earth elements (REE) are classified as critical raw materials and plays a pivotal role in modern technologies (Amato et al., 2019), renewable energy systems (Habib and Wenzel, 2014; Golroudbary., 2022), advanced electronics and electric vehicles (Zhao et al., 2022). The primary economically significant sources of REEs are carbonatite-hosted deposits associated with alkaline igneous complexes. This study aims to determine geochemical, deportment and mineralogical characteristics of rare earth minerals (REM) from the under explored carbonatite stringers waste rocks from Phalaborwa Igneous Complex to better understand the occurrence, distribution, and association of REE-bearing phases. The study aims at utilising integrated characterisation approach which involves petrography, X-ray diffraction (XRD), X-ray fluorescence (XRF), Inductively Coupled Plasma Mass Spectrometry (ICP-MS) and Scanning Electron Microscopy (SEM) coupled with energy-dispersive X-ray spectrometry (EDS). These techniques will be used to identify REE-bearing minerals, determine their elemental composition, evaluate grain associations and liberation characteristics, and assess factors that may influence downstream beneficiation and extraction processes. The study is expected to generate foundational mineralogical data that will contribute toward evaluating the economic potential of carbonatite-hosted REE mineralisation. Furthermore, the findings are anticipated to support the development of future beneficiation strategies and provide insights into the recovery potential of REEs from South African carbonatite deposits. While contributing to SGG goal 13, which calls for urgent combat action to combat climate change.

Keywords: Carbonatite, Mineral characterisation, Rare Earth Elements

S23 – Finding Bilbo: Automated acoustic monitoring and analysis on the near-extinct Bilbo's Rain Frog (*Breviceps bagginsi*) reveals key conservation action

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Sub-programme: Biodiversity and Conservation Ecology

Supervisor: L du Preez

Abstract

Unsustainable silviculture practice has pushed Bilbo's Rain Frog (*Breviceps bagginsi*) to the brink of extinction as a result of irreversible forestation practices in the eMtonjaneni region of KwaZulu-Natal. After it's divergence from the Boston's Rain Frog (*Breviceps batrachophiliourum*) in 2025, it became evident that this species can only be found in an area much less than 400km² within remaining natural grassland habitat that exist as green-belts and five-meter-wide road-side verges between timber plantations and roadways along a single 60km stretch of road. Passive Acoustic Monitoring (PAM) devices (SM4) recorded the circadian calling cycle (10 minutes each hour) of *B. bagginsi* between September 2025 and February 2026. BirdNet (Version 2.4.0) was trained to detect the calls of *B. bagginsi* males at an accuracy of 83% while spectrographic parameters like average daily energy were analyzed using SeeWave and TuneR. Results indicate a clear rise in calling activity of *B. bagginsi* late November and early December during early morning hours, specifically between 03:00 and 08:00. Call detections showed a strong positive correlation to Precipitation (mm) and Humidity (%), a moderate positive correlation to Air Pressure (hPa), and a strong negative correlation to Temperature (°C). BirdNet proved very useful with regard to time-efficiency and accuracy in reliable monitoring of a cryptic, near-extinct super-endemic. This study confirmed the presence of novel populations - possibly due to migration of mature adults - while some historical sites show unexpected absence of *B. bagginsi*. Although remaining populations of *B. bagginsi* demonstrates resilience, unmitigated forestry threats and stresses will drive the global population of *B. bagginsi* to extinction within the next 10-15 years.

Keywords: BirdNet, *Breviceps*, Critically Endangered, Forestry, Stakeholder-based conservation

S24 – Assessment of anthelmintic resistance status of gastrointestinal nematodes infecting horses in the Potchefstroom

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Sub-programme: Environmental Management

Supervisor: OMM Thekiso

Abstract

Gastrointestinal nematodes (GINs), particularly cyathostomins, remain among the most important parasitic infections affecting horse health and performance worldwide. The widespread use of anthelmintics has contributed to concerns regarding reduced drug efficacy and the development of anthelmintic resistance. This study evaluated the efficacy of three commonly used anthelmintic classes against GINs infecting horses in the Potchefstroom, North West Province, South Africa, using faecal egg count reduction tests (FECRT). A total of 40 horses from a managed equine breeding facility were randomly allocated to four groups ($n = 10$ per group), comprising benzimidazoles, macrocyclic lactones, tetrahydropyrimidines, and an untreated control. Faecal samples were collected on Day 0 prior to treatment and Day 21 post-treatment. Faecal egg counts (FEC) were determined using the modified McMaster technique, and treatment efficacy was assessed using percentage faecal egg count reduction (FECR). Data were analysed using generalised linear models with a negative binomial distribution to account for overdispersion and non-normality. All treated groups demonstrated reductions in eggs per gram (EPG) values following treatment. Macrocyclic lactones exhibited the highest numerical FECR (94.58%), followed by tetrahydropyrimidines (80.99%) and benzimidazoles (77.40%). The untreated control group showed a reduction of 27.45%. Pairwise comparisons demonstrated that all treated groups had significantly lower FEC values than the untreated control group ($p < 0.0001$). However, no statistically significant differences were detected between the three anthelmintic classes ($p > 0.05$), indicating comparable treatment efficacy under the conditions of this study. The FECR data were highly variable and exhibited a non-normal, right-skewed distribution. The findings indicate that benzimidazoles, macrocyclic lactones, and tetrahydropyrimidines remain effective against gastrointestinal nematodes infecting horses in the Potchefstroom. Continued monitoring of anthelmintic efficacy through FECRT, together with integrated parasite management strategies, is

recommended to support sustainable parasite control in equine populations.

Keywords: Anthelmintic efficacy, Anthelmintic resistance, Equine parasite control, Faecal egg count reduction test (FECRT), Gastrointestinal nematodes, Horses



S25 – Characterising ambient air quality in a low-income settlement in the South African highveld region: a case study of Embalenhle

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Sub-programme: Climate Change, Air Quality and Impacts

Supervisor: S Piketh

Abstract

This study evaluates the status of ambient air quality in the low-income settlement of Embalenhle, situated within the Highveld Priority Area (HPA) of South Africa. While the Highveld is a well-documented industrial hub dominated by coal-fired power stations and petrochemical operations, this research focuses on the localised pollution challenges that are often overlooked at the settlement scale. Using direct ground-based in-situ measurements of fine and coarse particulate matter ($PM_{2.5}$ and PM_{10}) sulphur dioxide (SO_2) and nitrogen oxides (NO_x) from January 2023 to February 2024 the study characterizes pollutant variability and assesses compliance with National Ambient Air Quality Standards (NAAQS). The results demonstrate a significant "Township Effect" where localised sources such as domestic coal burning and dust from unpaved roads create a much heavier pollution burden than is captured by the regional SAAQIS monitoring network. Statistical analysis using paired t-tests and regression diagnostics revealed that the regional SAAQIS station underestimated particulate matter concentrations by approximately 44-46% while overestimating gaseous pollutants by over 250%. $PM_{2.5}$ concentrations exceeded the daily NAAQS threshold on 41.36% of the monitored days with extreme peaks reaching above $700\mu g/m^3$ during the winter months. Diurnal profiles revealed distinct morning and evening peaks in particulate matter which confirms that residential fuel burning for cooking and heating remains the primary driver of local exposure. In contrast gaseous pollutants like SO_2 displayed an "industrial signature" with midday peaks driven by the fumigation of high-altitude industrial plumes as the planetary boundary layer develops. Meteorological analysis further confirms that stable atmospheric conditions and frequent temperature inversions during the winter and autumn months trap these local emissions near the ground, worsening the health risks for the community. The study concludes that the existing regional monitoring network is "blind" to the intense localized smoke in low-income areas. These findings suggest that air quality management strategies in the Highveld must shift from a purely

industrial focus to include aggressive interventions in domestic energy use and township infrastructure to protect vulnerable populations.

Keywords: Embalenhle Township, Domestic Fuel Burning, Highveld Priority Area (HPA), *In situ* Monitoring, Kruskal-Wallis H-test, Township Effect, Particulate matter ($PM_{2.5}$ and PM_{10}), Planetary Boundary Layer (PBL)



S26 – Distribution and characterization of *Klebsiella pneumoniae* and lytic bacteriophages in a South African wastewater treatment plant system

Zander Arthur Coetzee

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Sub-programme: Environmental Management

Supervisors: K Lekota, CC Bezuidenhout

Abstract

Wastewater treatment plants (WWTPs) are important environmental reservoirs of multidrug-resistant (MDR) *Klebsiella pneumoniae* and represent a rich yet underexplored source of lytic bacteriophages with therapeutic potential. In South Africa, *K. pneumoniae* remains poorly characterized, particularly in the WWTPs, North-West Province and lytic bacteriophages represent an untapped, ecologically relevant therapeutic resource. This study investigated the occurrence, distribution, and genomic diversity of MDR *K. pneumoniae* and characterized lytic *Klebsiella* bacteriophages for potential therapeutic applications. Bimonthly water samples were collected over a twelve-month period from WWTP influent, WWTP effluent and an upstream reference site. *Klebsiella pneumoniae* isolates were identified using phenotypic Sensititre ARIS system and confirmed using *rpoB* gene amplification by PCR assay. Bacteriophages were isolated and purified, while physiochemical parameters and heavy metal concentrations (ICP-MS) were recorded at each site. *K. pneumoniae* was consistently recovered across all sites, with influent yielding (n=27) and effluent (n=18) indicating incomplete pathogen removal through treatment. Fifty lytic *Klebsiella* phages were isolated, exhibiting broad host ranges and infecting up to 70% of the tested isolates, suggesting their potential utility as environmentally derived biocontrol agents. This study demonstrates that WWTPs represent both a reservoir of *K. pneumoniae* and a rich source of environmentally adapted lytic bacteriophages with therapeutic potential. The identification of broad-host-range phages provides a foundation for the development of phage-based interventions against multidrug-resistant *K. pneumoniae*, while strengthening environmental surveillance efforts aimed at addressing antimicrobial resistance.

Keywords: Antimicrobial resistance, Bacteriophage, Environmental reservoir, *Klebsiella pneumoniae*, South Africa, Wastewater treatment plant

S27 – Spatial variability in the wildfire burn severity in the Mediterranean biome: A review

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Sub-programme: Disaster Risk Science

Supervisors: D Boshoff, M Dlamini

Abstract

The Drakenstein Local Municipality, a critical agricultural hub in South Africa's Western Cape, is facing unprecedented pressure from both natural disturbances and rapid urbanisation. This study aimed to quantify LULCC from 2017 to 2024, specifically focusing on the impacts of potential drivers, such as wildfire events and the expansion of built areas. Using the Google Earth Engine (GEE) platform, the research processed multi-temporal Sentinel-2 imagery using a Random Forest (RF) classifier, achieving overall accuracies of 78%-84% between 2017 and 2024. The Semi-Automatic Classification Plugin (SCP) via QGIS was used to generate a change matrix and change map. The analysis reveals a pronounced transformation in the land-use dynamics between 2017 and 2024. Cultivated land exhibited a substantial net decline 26.61%, contracting from 43% of total landscape coverage in 2017 to just 16% in 2024. There was spatial overlap between the decline in cultivated land and the 2021 wildfire surge, which temporarily increased the burned area class to 22%. In the subsequent recovery period, the municipality experienced a 15.58% net increase in vegetation, driven by post-fire secondary succession, alongside significant gains in built-up areas (4.95%) and exposed bedrock (6.12%) and bare soil (6.12%). These findings suggest that the region is transitioning from an agricultural base toward a landscape defined by disturbance and development. Such dynamics highlight the imperative for more stringent spatial planning through robust land-use zoning, coupled with comprehensive fire-mitigation strategies, to safeguard ecosystem integrity and ensure sustainable development pathways.

Keywords: Geographic Information Systems, Land Use Land Cover Change (LULCC), Mediterranean, Random Forest, Sentinel-2

S28 – Evaluating the functionality of different kimberlite mine wastes as alternative to building material

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Sub-programme: Earth System Sciences, Soils and Resources

Supervisor: J Koch

Abstract

Kimberlite diamond mines tend to produce vast amounts of rock-derived waste that are ultimately stored and rehabilitated at high cost to the mining company. Diamond mine rock waste does not always contain the same cocktail of hazardous elements typically associated with other mining commodities' rock waste. Repurposing this material in a creative, optimised way could lead to value creation. Instead of rehabilitation, this project suggests that using various types of rock waste could replace aggregate or other components in the manufacture of building-related products. This could allow mine companies, building material manufacturers and the local community to work together to produce an environmentally friendly and economically viable product. Previous studies have found that kimberlite waste could be used in a range of products, from aggregates to cement to clinker bricks and more. The few studies that have been done have mostly concerned themselves with local bureau of standards requirements, using various testing methodologies. This project investigates mine rock waste from five Southern African sites, examining 25 geological materials. The tests conducted followed the South African Board of Standards (SABS) and other key quality bureau methods to assess compliance for a safety-critical product, with a focus on aggregate compliance tests due to time constraints. Information from different textural tests, aggregate impact value (AIV), chemistry (XRF), and mineralogy (XRD) helps assess the potential usage of 25 different materials. It was found that kimberlite material might have favourable properties for some characteristics, especially when fresh. Still, issues related to its weatherability and high clay content play a role, making it unsuitable for aggregate use in concrete. Some of the mine waste rock indicated greater potential for aggregates in concrete than others, where most had unsatisfactory results. The materials that didn't comply with building aggregate standards did, in some cases, indicate minerals used in other building materials, which have strong marketability and prospects.

Keywords: Aggregate, Clay, Concrete, Kimberlite, Tailings, SABS, Sustainable mining

S29 – Assessing the perceived impacts of climate variability and change on maize farming in the Maize Triangle, South Africa

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MSc candidate (Final year)

Sub-programme: Climate Change, Air Quality and Impacts

Supervisors: CC Bezuidenhout, LGM Molale-Tom

Abstract

Climate variability and change pose a growing threat to multiple sectors globally, with agriculture being most vulnerable. In South Africa, agriculture is a key pillar of the economy and is highly sensitive to fluctuations in temperature, rainfall patterns, and the increasing frequency of extreme weather events. This mixed-methods study investigates the perceived impacts of climate variability and change on maize farming in the Maize Triangle, focusing on the daily realities of farmers, the challenges they face, and the adaptation strategies they use. Trend analyses revealed statistically significant changes ($p < 0.05$) during the September-October-November season, characterised by declining rainfall and increasing air temperatures over the study period. These trends present substantial risks to maize production, which relies on consistent rainfall and is sensitive to extreme heat and frost. Results indicate also that 100% of the farmers plant between October and December, guided by soil moisture conditions and various sources of climate information from on-farm rain gauges to nature signs, as opposed to modern technology.

Keywords: Climate information, Forecasting Tools, Interviews, Perceptions, Seasonal Trends

S30 – Modelling groundwater flow/connection to surface waters in the upper Umgeni catchment, Kwazulu-Natal

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Sub-programme: Earth System Sciences, Soils and Resources

Supervisor: S Kebede

Abstract

Understanding groundwater-surface interactions is important for sustainable water resources management, particularly in fractured-rock aquifer systems where flow processes are complex and poorly understood. In South Africa, limited knowledge of deep and regional groundwater flow systems limits their integration into water management strategies. This study investigates groundwater flow dynamics and discharge processes in the upper Umgeni catchment, Kwazulu-Natal, a key water supply region dominated by karoo fractured -rock aquifers. A conceptual hydrogeological model is developed to represent recharge, flow and discharge processes, emphasizing regional groundwater contributions to rivers, wetlands, and groundwater-dependent ecosystems. This framework will be implemented using a numerical groundwater flow model (MODFLOW via Flopy), applying a two-dimensional approach justified by dominant lateral flow conditions and data limitations. Model calibration and sensitivity analysis will be conducted to evaluate system behaviour and reduce uncertainty. Scenario analysis will be performed to assess the impacts of groundwater abstraction on surface water connectivity. The study aims to quantify regional groundwater discharge and improve understanding of multi-scale flow systems in fractured-rock environments, contributing to improved groundwater representation in catchment-scale water resources management in South Africa.

Keywords: Flopy, Groundwater discharge, Groundwater-surface water interactions, MODFLOW, Regional groundwater

S31 – Depositional environments and stratigraphy of the outer continental shelf of western South Africa

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Sub-programme: Earth System Sciences, Soils and Resources

Supervisors: E Bergh

Abstract

The Benguela Upwelling System (BUS) exerts a major control on the sedimentation along the western margin of South Africa. Understanding the stratigraphy of this margin is important in exploration geology and understanding how past environments evolved. Core 129, retrieved from the western continental shelf of South Africa, presents an opportunity to investigate how the marine environment has changed during the late Cenozoic under the influence of the BUS. Determining the lithology, mineralogy and foraminiferal content can also provide information on how the BUS evolved over time. Strontium isotope stratigraphy was used to determine the ages of the stratigraphic layers. Binocular microscopy was used to determine the sedimentary mineralogical components and foraminifera was used to provide additional support for the age determination as well as past environmental change. Initial results for this study indicate that the core represents sedimentation spanning the late Oligocene/early Miocene to the Holocene. The basal unit is composed of calcareous mud, overlain by Pliocene-aged glauconitic sand. The upper Quaternary sequence is composed of calcareous and glauconitic components. Foraminiferal content indicates a gradual increase in eutrophic conditions, with less oxygenated bottom water conditions during the Pleistocene, consistent with the intensification of the Benguela Upwelling System. This research has provided a critical foundation in understanding the interplay between the prevailing oceanographic system, sedimentation and past marine environmental conditions along the western margin of South Africa.

Keywords: Benguela Upwelling System, Core stratigraphy, Foraminifera, Glauconitic sediments, Late Cenozoic evolution

S32 – Exploring the relationship between pollen fluctuations and vegetation-land cover: A case study from Potchefstroom, North West Province, South Africa

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Sub-programme: Climate Change, Air Quality and Impacts

Supervisors: F Neumann, J Finch, NS Wesch, D Gharbi

Abstract

Airborne pollen is a significant trigger for respiratory allergies, affecting a considerable 20% of the population, and it is anticipated to increase exponentially due to climate change, urbanisation, and industrialisation. Understanding the types of pollen present in the atmosphere and accurately interpreting their distribution is therefore critical for both public health and environmental management. Land cover directly affects the biodiversity, composition, and functioning of an ecosystem, and is an important factor influencing airborne pollen composition. However, the link between land cover and pollen distribution is poorly explored in South Africa. The city of Potchefstroom, in the North West Province of South Africa, is no exception. The city is surrounded by a diverse ecosystem characterised by Grassland and patches of the Savanna biomes. This study will investigate the relationship between daily pollen counts and the dominant land cover types around Potchefstroom over two years (August 2025 to July 2027) to identify and locate potential pollen sources for allergy sufferers. Additionally, the study will explore the relationship between pollen and meteorology, which will help determine the meteorological variables influencing the emission and dispersal of airborne pollen types throughout the pollen season. Airborne pollen data will be collected using a seven-day Hirst-type volumetric spore trap. Secondary data will include land cover and meteorological parameters data from a local weather station. This research will identify and map potential pollen sources, pollen allergy risk maps to support allergy prevention efforts, and provide an updated pollen calendar. The findings will inform policymakers in designing sustainable, local-scale landscapes that help minimise human pollen exposure while maintaining essential ecosystem services.

Keywords: Airborne pollen, Meteorological conditions, Pollen calendar, Pollen monitoring

S33 – Assessment of the biodurability of graphene-family materials and their potential interference with standard toxicity assays

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Sub-programme: Biodiversity and Conservation Ecology

Supervisors: C Andraos, V Wepener, M Gulumian

Abstract

Graphene-family materials (GFMs) are being used in products, but their biodurability and potential to interfere with toxicological assays remain poorly understood. As biopersistent materials may interfere with assays used to test them, this study first assessed degradation, then assay interference. Two industrial GFMs, graphene oxide and disordered graphene, were tested for degradation in biological and environmental fluids and for interference with in vitro toxicity assay read-outs. Both materials were characterized by the supplier using X-ray diffraction, X-ray photoelectron spectroscopy, Raman spectroscopy and TEM, with additional ICP-MS metal impurity analysis. Biodurability was then tested using a flow-through dissolution system exposing each material to synthetic lung, lysosomal and gastric fluids and freshwater for five days, with degradation tracked from released metal impurities by ICP-MS and confirmed by microscopy. Assay interference was tested by exposing both materials, without cells, to MTT, resazurin and DQ Red. Both samples were disordered structures containing defects rather than pure graphene, and both proved highly biodurable, with limited fragmentation across all fluids. Relative to other fluids, degradation was faster in acidic media, and graphene oxide released more impurities than disordered graphene. Microscopy confirmed substantial residue above the membranes throughout. Both GFMs adsorbed assay substrates, products and co-factors across all three systems, producing signal reductions that falsely indicate reduced cellular activity, with graphene oxide showing greater interference. These findings suggest that GFMs are biopersistent in biological and environmental media and significantly interfere with toxicity assay read-outs, highlighting a need for interference controls in cytotoxicity testing and biodurability-informed safety guidelines.

Keywords: Assay interference, Biodurability, Dissolution, Graphene-family materials, Graphene oxide, ICP-MS, Nanotoxicology

S34 – Evaluating the accessibility and use of climate services by small-scale farmers in the North-West province, South Africa

Eyona Ndawana

MSc candidate (Final year)

Sub-programme: Disaster Risk Science

Supervisors: L Nemaikonde, N Sibiya, C Tshwene

Abstract

Climate variability and extreme weather events continue to pose significant challenges to small-scale farmers in South Africa, particularly in rural provinces such as the North-West. Although climate services, including seasonal forecasts, early warnings, and agro-advisories, are designed to support climate-resilient agricultural decision-making, their accessibility and effective use by smallholder farmers remain limited. This study investigates the extent to which climate services are accessible, trusted, and applied by small-scale farmers in the North-West Province. It further explores the barriers that hinder access, the perceptions surrounding the reliability and relevance of climate information, and the influence of these services on day-to-day farming decisions. The study follows a case study design underpinned by a pragmatic research philosophy and employs a mixed-methods approach. Quantitative data will be gathered through structured surveys of 120 small-scale farmers, while qualitative insights will be obtained via focus group discussions and in-depth interviews with farmers, agricultural extension officers, and climate service providers. A multi-stage sampling strategy ensures representation across the province's districts. The study will also analyse meteorological data to assess the alignment between climate forecasts and observed weather conditions. Findings will contribute toward enhancing the inclusivity, relevance, and usability of climate services for rural farming communities. Ultimately, the research aims to inform more responsive policy and service design, improving adaptive capacity and resilience among small-scale farmers in the face of climate change.

Keywords: Accessibility, Climate adaptation, Climate services, Early warning systems, North-West Province, Small-scale farmers, South Africa

MSc Posters

M1 – Characterisation and agricultural suitability assessment of treated wastewater sludge, Mmabatho, South Africa

Masego Medupe

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Sub-programme: Environmental Management

Supervisor: L Palamuleni

Abstract

Increasing population growth has placed an increasing pressure on Wastewater Treatment Works (WWTWs) resulting in operational overcapacity that comprises the removal of pollutants from wastewater. While previous studies have documented the deterioration of effluent quality from Mmabatho WWTW and its adverse impacts on Setumo Dam, the quality and characteristics of sludge generated at the facility remain insufficiently investigated despite the potential environmental and public health associated with its disposal and reuse. This study aims to evaluate the quality of sludge from Mmabatho WWTW by determining the physico-chemical and microbial properties. Sludge samples will be collected during the wet and dry seasons from sludge lagoons and analysed using statistical techniques in SPSS. The study will apply South African sludge guidelines to classify sludge for its beneficial use. Additionally, the fertilizing and clean index will be adopted to examine the potential of the sludge as a fertilizer. The findings are expected to provide evidence-based insights into the quality and resource recovery potential of sludge from the Mmabatho WWTW, thereby contributing to informed decision-making on sustainable sludge management, agricultural reuse, and environmentally safe disposal practices.

Keywords: Agricultural suitability, Microbial properties, Physico-chemical parameters, Sewage sludge, Wastewater treatment work

M2 – Wildfire burn severity in the Grassland biome: A systematic review

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Sub-programme: Disaster Risk Science

Supervisor: D Boshoff

Abstract

Wildfires are becoming increasingly severe across a number of biomes worldwide, increasing the risk of disruption to ecosystem services under changing wildfire regimes. Although wildfires, according to different studies, are beneficial to the ecosystem, some wildfires increase burn severity, leading to the loss of ecosystem services and the regrowth of vegetation. The increasing frequency and severity of fires may leave a number of biomes, such as the grassland biome, unable to recover and continue functioning over time. Wildfires in the grassland biome occur mostly during the dry season, increasing the risk of severe wildfires. It is important to measure burn severity to get a clear view and understanding of what happens post-fire event. Several studies use remote sensing to assess fire severity and examine how burn severity affects grassland recovery after a fire event. Some studies find Sentinel-2 to be the most reliable for determining burned severity, while others find Moderate Resolution Imaging Spectroradiometer (MODIS) to be more reliable for active fire detection and burned areas. This research aims to examine wildfire burn severity in the grassland biome using the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) method. The study will use ScienceDirect, Web of Science, and Scopus to conduct the reviews.

Keywords: Burned severity, Grassland Biome, MODIS, Sentinel-2, Remote sensing, Wildfires

M3 – Towards a refined model for early warning messaging in South Africa

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Sub-programme: Disaster Risk Science

Supervisors: D van Niekerk, G Wentink

Abstract

Continuous environmental change demands adaptive early warning systems (EWS) that are regularly updated and capable of translating scientific forecasts into clear, intelligible and actionable information for diverse communities. Communication has now become a critical link between hazard detection and protective action in the global Early Warnings for All (EW4All) initiative and the Southern African Development Community's (SADC) commitment to enhance disaster preparedness. Yet research on EWS in South Africa indicates ongoing challenges around the dissemination, accessibility and understanding of early warning messages (EWMs) across varied communities, particularly rural communities. Language barriers, socio-economic gaps, communication infrastructure and fragmented channels of information also have a part to play in how warnings are understood. These challenges highlight the importance of working across interconnected systems – from the South African Weather Service (SAWS) and government news outlets to local communities and individual decision-making – to navigate environmental change. This study investigates the clarity, understanding and effectiveness of impact-based forecasting (IBF) EWMs in South Africa. This study will use a mixed-methods Q methodology, which will include a national quantitative survey (around N=400 participants) to determine trends, perceptions and challenges faced by South African EWMs as well as qualitative semi-structured interviews (around N=17 participants) with disaster management practitioners, SAWS staff and communication experts to investigate possible solutions. The findings are expected to identify barriers to effective communication of EWMs and provide recommendations on how to improve their accessibility, inclusiveness and capacity to foster timely protective action.

Keywords: Communication, Disaster Management, Early Warning Messages, Early Warning Systems, EW4ALL, Protective action, South Africa

M4 – Water quality dynamics across treatment stages at Midvaal drinking water plant

Bonolo Mofokeng

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Sub-programme: Aquatic Ecosystem Health

Supervisors: S Barnard, A Levanets

Abstract

South Africa's surface water resources are under increasing pressure from farming, mining, and urban activities, which negatively affect water quality. The Vaal River, an important water source for the region, is affected by these activities, making it challenging for drinking water treatment plants to consistently produce safe water. The Midvaal Drinking Water Treatment Plant (DWTP) draws water from the Vaal River and treats it through coagulation, dissolved air flotation, sedimentation, filtration, and chlorination. Turbidity and chlorophyll concentrations have been identified as key factors contributing to non-compliance with SANS 241 drinking water standards, highlighting the need to better understand how water quality changes across the treatment process. This study monitored key water quality parameters at four treatment stages: source water, post-DAF, post-sedimentation, and final treated water. Parameters included turbidity, colour, pH, electrical conductivity, total chlorophyll, total organic carbon, dissolved organic carbon, *Escherichia coli*, and total coliforms. Data from 2021 to 2025 were analysed using descriptive statistics, Spearman rank correlations, Principal Component Analysis, Mann-Kendall trend tests with Sen's slope estimator, and Kruskal-Wallis tests. Significant differences were found across all treatment stages for every parameter. Microbiological indicators showed the greatest removal, with *Escherichia coli* and total coliforms reducing progressively at each stage, reaching near-complete clearance in the final water. Turbidity, dissolved organic carbon, and total organic carbon declined sharply during flotation and settling, reaching their lowest levels in the final treated water. Trend analysis revealed a significant increase in raw water algal biomass over the study period, yet the final treatment stage successfully neutralised this load. pH varied across stages due to process chemical dosing, while electrical conductivity remained largely stable, confirming that conventional treatment minimally alters dissolved ion composition.

Keywords: Algal biomass, Dissolved air flotation, Drinking water treatment, Eutrophication, Organic carbon, Turbidity, Vaal River, Water quality monitoring

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M5 – Integrating geospatial analysis and local perceptions to enhance climate resilience of Ramsar wetlands in iSimangaliso Wetland Park

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Sub-programme: Environmental Management

Supervisors: N Sibiya, M Dlamini

Abstract

Globally, wetlands provide essential ecological services, such as carbon sequestration, water purification, and habitat for wetland-dependent species. The iSimangaliso Wetland Park is South Africa's first designated Ramsar site and UNESCO World Heritage Site. Despite the designation, the extent of the wetland decreased from 655.416 km² in 1987 to 429.489 km² in 2017 due to climate change and land-use pressures. This decline emphasises the need for updated spatial information to guide conservation planning and sustainable management. The aim of this study is to generate a comprehensive and high-resolution land-use map of Ramsar sites within iSimangaliso Wetland Park. The objectives are to (i) map and classify land uses using geospatial technology, and (ii) quantify the spatial extent and distribution of these land uses over time. Sentinel-2 satellite imagery will be processed and analysed in ArcGIS Pro, employing supervised classification techniques, specifically the Support Vector Machine (SVM), to delineate land-use categories within and around the Ramsar site. The expected outcomes include an updated land-use dataset and map that will serve as a baseline for monitoring ecological change, assessing anthropogenic impacts, and informing adaptive management strategies. By integrating remote sensing and GIS-based analysis, this study helps fill a knowledge gap in wetland conservation. The results will not only enhance local management of iSimangaliso Wetland Park but also align with broader international frameworks such as the Ramsar Convention, National Biodiversity Assessment (NBA) 2025, and the AU Agenda 2063, which emphasise sustainable ecosystem management and biodiversity protection.

Keywords: iSimangaliso Wetland Park, Land-use, Ramsar site, Sentinel-2, Wetlands

M6 – Creating a soil-water sensitivity map to support urban planning

Anele Ndwandwe

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Sub-programme: Earth System Sciences, Soils and Resources

Supervisors: IE Smit, NS Wesch, RP Roelof

Abstract

The study was conducted in the Greater Potchefstroom, a semi-arid area in the North-West Province. The assessment and mapping of distribution of hydropedological soils; refining of landcover and assessment of risks associated with soil-water interactions in the Greater Potchefstroom were the objectives of this study. To assess the distribution of hydropedological soils, soil observations using an auger took place in the unbuilt areas. The soil observations and the environmental covariates were merged in randomForest package in R to predict the soil in unvisited sites using the multiple linear regression (MLR) predictors. The kappa coefficient with a scale between 0-1 was calculated with results close to 0 showing poor presentation of reality and close to 1 showing a greater representation of reality. The point accuracy was produced and represented as a percentage greater than 50% showing a greater presentation of reality while less than 50% showing less representation of reality. To refine the landcover map, the classification was manual and based on the effects on soil-water interaction and the final landcover map was produced from GEE. Then the hydropedology and landcover maps were combined and analyzed to assess the risks that result from water and soil interactions. To assess vulnerability of the soil-water risks, the following were assessed: (i) exposure, (ii) sensitivity, and (iii) adaptive capacity. The risks mapped include, shrink and swell of clay soils, soil erosion, sink holes and floods. The implication of this study is that the final product maps will help the Potchefstroom Municipality for future urban planning.

Keywords: Hydropedology, Kappa coefficient, Landcover, MLR, Urban planning, Vulnerability

M7 – Ecology, health, and anthropogenic pressures on African tigerfish (*Hydrocynus vittatus*): A systematic review and future research directions

Dillon Croshaw

MSc candidate

Sub-programme: Aquatic Ecosystem Health

Supervisors: W Malherbe, NJ Smit, O'Brien

Abstract

Understanding the ecology and conservation status of apex freshwater predators is critical in increasingly stressed river systems. The African tigerfish (*Hydrocynus vittatus* Castelnau, 1861) is a socially, economic and ecological important species widely distributed in sub-Saharan Africa rivers, yet knowledge of its biology, health, and responses to anthropogenic pressures remains fragmented. This study presents a systematic review of available literature to synthesise current knowledge and identify research gaps. A structured literature search was conducted using the Web of Science database, supplemented by additional peer-reviewed articles provided directly by collaborators. Studies were screened and categorised into major thematic areas, including ecology, life history, health and parasites, ecotoxicology, and anthropogenic impacts. A total of 132 studies were analysed. Results indicate a strong bias toward ecological research, particularly movement and trophic dynamics, with recent increases in telemetry-based studies. In contrast, critical gaps remain in reproductive biology, population dynamics, and fish health. Research effort is also geographically skewed, with most studies concentrated in Lake Kariba and South African systems, while other regions within the species' distribution remain underrepresented. Notably, emerging work in ecotoxicology and parasite ecology highlights increasing environmental pressures, including pollution and fishing impacts. This review demonstrates that while knowledge of *H. vittatus* has expanded in recent years, significant gaps persist that limit effective conservation and management. Future research should prioritise underrepresented regions and integrate multidisciplinary approaches to better understand population resilience in the face of environmental change.

Keywords: African tigerfish, Conservation, Ecotoxicology, Freshwater ecology, *Hydrocynus vittatus*, Research gaps, Systematic review, Telemetry

M8 – Analysing temperature and rainfall trends as hazard determinants on the ecosystem services provided by the Ramsar wetland within the iSimangaliso Wetland Park

Phophi Tshidzumba

MSc candidate

Sub-programme: Disaster Risk Science

Supervisors: D Boshoff, N Sibiya, N Ayob

Abstract

The wetlands that are Ramsar Convention approved provide essential cultural, regulating, provisioning, and supporting ecosystem services; these ecosystem services are constantly threatened by changes in land use, hydrological changes, pollution, and climate change. Geospatial analysis has shown significant wetland reduction between 1987 and 2017, with wetland coverage decreasing from about 655 km² to 429 km², while other land uses continue to expand, threatening ecosystem health and biodiversity. Moreover, these key hazards reduce the ability of ecosystems to provide essential services such as climate regulation, clean water, flood control, and food security. The purpose of this study is to analyse temperature and rainfall trends as hazards on the ecosystem services provided by the Ramsar wetland within the iSimangaliso Wetland Park. The goal is to examine the occurrence and impacts of key climatic hazards on the ecosystem services provided by the Ramsar wetlands within the iSimangaliso Wetland Park. The research will employ a quantitative method whereby historical temperature and rainfall data will be obtained from ERA5, using this will aid to identify the extreme weather events for 1986-2025. Data will be analysed using linear trend analysis, whereby Mann-Kendall test will be used to detect trends and Sen's slope to estimate the magnitude of the trend. Within the KwaZulu Natal province, these integrated findings will help in reducing risks, implementing climate change adaptation measures, and improving decision-making processes that aim to protect wetland ecosystem services and improve community living conditions.

Keywords: Climate change, Ecosystem services, Hazards, iSimangaliso Wetland Park, Ramsar wetlands, Remote sensing

M9 – Uneven risks in a changing environment: Mapping disaster risk in the North West Province, South Africa

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Sub-programme: Climate Change, Air Quality and Impacts

Supervisor: R Burger

Abstract

As weather-related hazards increase in frequency, intensity, and duration, the need for proactive disaster risk management strategies is becoming increasingly urgent. Although disaster risk assessments exist at global, regional, and subnational scales, the North West Province of South Africa currently lacks an evidence-based, municipal-level disaster risk assessment. This gap will be addressed by conducting a municipal-scale disaster risk assessment aligned with the South African Climate Change Act (2024) and the Disaster Management Act (2002). Following the well-known framework of the INFORM risk index, this study integrates three key components of disaster risk: hazard exposure, vulnerability, and coping capacity. Hazard exposure encompasses both natural and anthropogenic hazards, while vulnerability indicators capture demographic and socio-economic conditions that influence a community's susceptibility to disasters. Coping capacity indicators reflect institutional readiness, infrastructure availability, and emergency response capacity. Sub-indicator data (from sources such as Statistics South Africa and the South African Weather Service) are standardised to a scale of 0-10 using min-max normalisation. The three indicators are calculated using the arithmetic means of the sub-indicators. The overall municipal disaster risk score is then derived using the geometric mean of the indicators. Preliminary analysis is expected to indicate significant spatial variation in disaster risk across municipalities, with higher risk levels likely concentrated in municipalities characterised by greater socio-economic vulnerability, limited institutional capacity, and higher hazard exposure. These findings will provide a municipal-scale disaster risk baseline for the province, enabling more targeted climate adaptation planning and supporting evidence-based decision-making for disaster risk reduction and building municipal resilience.

Keywords: Coping capacity, Disaster risk assessment, INFORM index, Vulnerability, Weather-related hazard exposure

M10 – Assessing the impacts of urbanisation on land use and land Cover (LULC) in Polokwane Local Municipality

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Sub-programme: Climate Change, Air Quality and Impacts

Supervisor: A Ngie

Abstract

Urbanisation is a major cause of global environmental transformation, and one of the main aspects of urbanisation is the changes of land use and land cover (LULC). In South Africa, urban growth has significantly changed land use and land cover (LULC), affecting the biodiversity, water resources and ecosystem services. Over the past 15 years, there has been urban sprawl and population expansion in Polokwane Local Municipality which significantly transformed patterns of LULC. There has been limited research on LULC change in Polokwane Local Municipality. The study aimed to evaluate how urban growth is affecting the LULC in Polokwane Local Municipality from 2010 to 2025. It made use of multi-temporal satellite images for the year 2010, 2015, 2020 and 2025 to detect land use and land cover change over time. Landsat 5, Landsat 8 and Landsat 9 images were accessed from the United States Geological Survey (USGS) utilising the Google Earth Engine (GEE) platform. Random Forest algorithm was used to classify the images into built-up, vegetation, croplands, bare soil and water bodies. Between summer 2010 and 2025, land use and land cover analysis showed increases in water bodies from 5.89 km² to 7.18 km² (+21.9%), built-up areas from 1,712 km² to 1,828 km² (+6.8%), vegetation from 1,450 km² to 1,543 km² (+6.4%), and croplands from 206 km² to 250 km² (+21.4%). In contrast, bare soil decreased substantially from 319 to 136 km² (–57.4%).

Keywords: GEE, LULC, Random Forest, Satellite Images

M11 – Signal vs Noise in OJIP curves: A semi-automated outlier detection for chlorophyll fluorescence data

Marlien Potgieter

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Sub-programme: Crop Production and Soil Management

Supervisor: J Berner

Abstract

Chlorophyll fluorescence data were collected from millet plants using the Hansatech M-Pea and used to develop a semi-automated decision support system. The objective was to improve the efficiency and consistency of data cleaning while reducing the risk of accidentally removing biologically meaningful data. Since all analyses that follow depend on quality input data, producing a homogenous dataset from which to work becomes critical. The semi-automated system identifies OJIP curves that differ in overall shape or fluorescence magnitude from the mean population. It is based on modified z-scores calculated using the median and median absolute deviation (MAD) values. Flagged curves are then manually reviewed, and the before and after removal curves are compared for every plant. Following scan-level filtering, plant averages within each pot are compared, and the significance of each step of their OJIP transients is tested to determine whether all plants can be retained as a single biological unit. This approach combines rapid statistical screening with expert review, avoiding pitfalls of a fully automated workflow, which may fail to distinguish technical artefacts from biological variation. This method of detection is expected to reduce the time of data cleaning and increase the uniformity of decisions made, thus improving the reliability of downstream analysis.

Keywords: Chlorophyll Fluorescence, Decision Support, Semi-Automatic, Outlier, OJIP curves

M12 – Investigating the best practices to control molluscs in Brassicaceae and Solanaceae crops among smallholder farmers in the Hessequa Municipality

Simthandile Brandon Ponti

MSc candidate

Sub-programme: Crop Production and Soil Management

Supervisors: S Mnguni, J Strauss

Abstract

Molluscs, especially snails and slugs, are major pests in vegetable production in the Hessequa Municipality in the Western Cape, South Africa. They cause substantial crop losses through seedling mortality, leaf damage, defoliation, and reduced plant growth, especially during early crop establishment. Their activity is strongly influenced by environmental conditions such as soil moisture, temperature, irrigation practices, and crop residue management, which vary across farming sites. This study aims to evaluate and compare selected mollusc control strategies to identify the most effective and sustainable options for managing molluscs in Brassicaceae and Solanaceae crops among smallholder farmers in the Hessequa Municipality in the Western Cape, South Africa. Specifically, this study will assess mollusc pressure and crop damage across three smallholder farming sites, experimentally compare cultural, biological, plant-based, and chemical control methods; evaluate their effectiveness in reducing mollusc populations and crop damage; and develop practical Integrated Mollusc Management (IMM) guidelines for smallholder farmers. A participatory mixed-methods approach will be employed using on-farm trials at three sites within the Hessequa Municipality. Treatments will be arranged in a Randomised Complete Block Design with three replicates of each treatment alongside control plots. Data collection will include mollusc counts, crop damage assessments, seedling survival, plant growth, yield measurements, and environmental variables such as soil moisture and irrigation frequency. The data will be used to determine treatment effectiveness and relationships among measured variables. The findings of this study are expected to provide baseline evidence and practical recommendations for sustainable strategies suitable for smallholder vegetable production systems in the Hessequa Municipality and similar agro-ecological regions.

Keywords: Antimicrobial resistance, Brassicaceae, Crop damage, Integrated Mollusc Management, Microplastics, Smallholder farmers, Snails and Slugs, Solanaceae, SurveiMolluscs, Sustainable farming, Wastewater-based Epidemiology



M13 – The response of floodplain wetlands to human utilisation: Implications for conservation and management (uMfolozi Floodplain System)

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MSc candidate

Sub-programme: Environmental Management

Supervisors: M Dlamini, D Boshoff, N Ayob

Abstract

Floodplain wetlands are among the most ecologically significant landscapes on Earth, supporting approximately 40% of the world's species and delivering a broad range of ecosystem services critical to biodiversity and human well-being. Despite their importance, they are increasingly threatened by land use changes driven by human activities, particularly land conversion for agriculture, and by natural processes, resulting in widespread degradation. Although considerable research has examined LULC changes in floodplain wetlands, crucial knowledge gaps persist regarding recent wetland dynamics and their underlying causes. While previous studies have improved the understanding of LULC changes and their impacts, they remain limited in their coverage of recent (2018-present) dynamics and rarely integrate LULC mapping, change detection, and spatial analysis of underlying drivers. This gap restricts policymakers from making informed decisions regarding wetland management and conservation, especially in highly vulnerable systems such as the uMfolozi Floodplain System. This study, therefore, seeks to address these gaps by systematically investigating LULC dynamics, mapping and analysing LULC changes (2018-present), and linking the observed patterns to underlying drivers using geospatial analysis. This will be achieved by conducting a systematic literature review using the PRISMA technique, mapping and analysing LULC changes (2018-present) using remote sensing and GIS, and finally conducting a spatial overlay analysis to link the observed changes to potential underlying drivers. Findings have the potential to provide researchers and policymakers with evidence-based data essential for sustainable environmental management, enabling them to identify patterns of floodplain wetland degradation and strengthen resilience to human activities and LULC changes.

Keywords: Floodplain wetlands, Human activities, Geospatial analysis, Land use/land cover (LULC)

M14 – Complex urban risk systems and future resilience: Navigating compounding climate vulnerabilities across South African municipalities

Siya Tokwane

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Sub-programme: Disaster Risk Science

Supervisor: D Van Niekerk

Abstract

Urban risk is increasingly being shaped by climate change through compounding and cascading vulnerabilities that extend beyond narrow sector-based risk management. Within South African metropolitan municipalities, the traditional siloed experience of hazards such as flood, drought, heat and storm is being superseded by interactions between hazard events and other urban subsystems including urban infrastructure, social inequities and institutional capacities. These interactions give rise to complex urban risk systems characterised by non-linearity, feedback mechanisms and interdependencies that cross scales (Batty, 2013; IPCC, 2022). South African metropolitan municipalities such as Johannesburg, eThekweni, Cape Town and Tshwane face increasing climate pressures while dealing with persistent governance and infrastructural deficits. Although attention to urban resilience and disaster risk reduction has increased in policy and practice in these municipalities, approaches to managing urban risk continue to be fragmented, sector-specific and hazard-focused, thereby hindering adequate responses to cross-cutting urban risk interdependencies (Pelling, 2011; Meerow, Newell & Stults, 2016). This paper investigates how cascading climate risks are manifested within South African metropolitan municipalities from the vantage point of complexity and urban resilience thinking. It argues that governance approaches adopted within metropolitan municipalities fail to properly recognise and respond to the interconnections between ecological systems, urban infrastructure and institutional frameworks. It conceptualises urban risk as a complex adaptive system in which risk is constantly being produced through the interactions among urban subsystems. The paper employs a qualitative comparative case study methodology to assess how risk interdependencies are shaped in urban risk assessments, planning documents and disaster risk management frameworks of South African metropolitan municipalities. It provides empirical insights into systemic risk interdependencies, fragmented governance and existing resilience building measures, contributing to urban resilience

literature with a systems-based lens of urban climate risk governance, which is aligned with ongoing discourse on cascading risk and multi-scale adaptation.

Keywords: Cascading climate risks, Climate change adaptation, Complex adaptative systems, Disaster risk reduction, Multi-scalar governance, South Africa, Urban resilience



M15 – Diversity and composition of epiphytic corticolous lichens along an urban–rural gradient of three cities

Abraham Ryke

MSc candidate

Sub-programme: Ecological Interactions and Ecosystem Resilience

Supervisor: M Struwig

Abstract

Urbanisation is a major driver of biodiversity change, restructuring communities through environmental filtering, habitat modification and pollution. Epiphytic lichens are sensitive bioindicators of these changes, yet most studies rely on simple urban–rural contrasts, limiting understanding of how lichen communities respond across heterogeneous land-use mosaics, particularly in the Global South. This study quantifies patterns of diversity, community composition, and indicator species turnover of corticolous lichens across a multi-category urban–rural gradient in three cities within South Africa’s Highveld Grassland Bioregion of the Grassland Biome (Klerksdorp, Potchefstroom, and Vanderbijlpark). By incorporating protected, agricultural, residential, commercial, and industrial land uses, the study provides a replicated, multi-city framework for assessing lichen responses to land-use intensity. We (1) assess changes in lichen diversity and community composition along the gradient, (2) quantify community turnover and compositional shifts associated with increasing urban intensity, and (3) identify indicator species linked to specific land-use categories and evaluate their potential for biomonitoring. Suitable host trees are selected based on bark condition and minimum diameter of 15 cm. Lichens are sampled using a standardised ladder-quadrat method at 1.3 m and analysed using diversity metrics, community composition analyses and indicator species approach. We hypothesise that increasing land-use intensity acts as an environmental filter, reducing diversity and driving compositional turnover toward pollution-tolerant and disturbance-adapted taxa. We further expect that lichen communities will exhibit non-random restructuring across land-use types, enabling the identification of reliable indicator species. By moving beyond binary urban–rural comparisons, this study advances urban lichen ecology and provides a scalable, indicator-based framework for monitoring land-use impacts on biodiversity.

Keywords: Biodiversity loss, Bioindicator, Environmental filtering, Land-use, Urbanisation

M16 – A systematic review on community and stakeholder perceptions of fire occurrences and management in the Grassland biomes

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Supervisors: N Sibiya, D Boshoff, T Wepener

Abstract

Grasslands play a crucial role in the Earth's ecosystem, supporting biodiversity, livestock, and cycling nutrients. Most grassland fires happen in Africa during dry winter seasons. Climate change has negative impact on biodiversity with some effects visible and highly projected for the future. As climatic variability intensifies fire risk, tensions escalate between stakeholders, including rural communities. In grassland ecosystems, controversies surround fire use stem from colonial-era policies restricting livelihood-based fire use. Fire-prone landscape management poses a significant global challenge, particularly in biodiverse areas where communities practice traditional fire-use. These communities have used landscape fire as a management tool, boosting biodiversity, managing fire risk, and supporting livelihoods. However, urban populations and conservation organisations raise concerns over perceived landscape fire risks. Overlooking varied stakeholder interests, power imbalances, and differing environmental knowledge threatens current and future fire management approaches. This review will employ Web of Science, Scopus, Science Direct and thematic synthesis of wildfires for the years 1995-2025 to capture historical and recent perspectives, identify key perceptions, conflicts and management recommendations among stakeholders. The aim is to investigate community and stakeholder perceptions of fire in grassland ecosystems. This study will provide evidence for adaptive, culturally sensitive fire-management strategies, enhancing conservation and mitigating bushfires.

Keywords: Africa, Biodiversity, Climate change, Conservation, Fire management, Grasslands, Stakeholder perceptions, Traditional fire-use

M17 – Mapping agro-climatic suitability for sunflowers across the North West Province

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Sub-programme: Climate Change, Air Quality and Impacts

Supervisors: H Havenga, WH Cloete, S Piketh

Abstract

The North West province accounts for over 29% of the country's share in sunflower production (Department of Agriculture Forestry and Fisheries, 2026). As the second largest provincial sunflower producer, understanding how climatic variables influence the crop suitability has become increasingly important to manage sunflower yields and to determine possible regions for future cultivation. Climate variables and growing parameters for sunflowers are obtained from agronomic guidelines and crop-climate literature. Climate and crop data seasons between 1990/91-2025/26 was acquired from Copernicus' ERA5 reanalysis data, and Grain South Africa. These agro-climatic parameters are analysed into a spatial suitability index, applying methods from Peter et al. (2020), using a weighted overlay in QGIS to reclassify into five ranges then these agro-climatic suitability classifications are mapped across the province. The results display a decreasing suitability gradient from east to west across the province, influenced by declining mean precipitation, increased temperature ranges and evapotranspiration rates. The sunflower agro-climatic suitability map provides farmers and agricultural representatives a tool to plan for optimizing land use and cropping decisions for climate specific regions most suitable for sunflower cultivation across the North West province.

Keywords: Agro-climatic suitability, Crop-climate relationships, Sunflowers

M18 – Population dynamics and agroecological distribution of lepidopteran pests of sorghum in South Africa

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Sub-programme: Environmental Management

Supervisors: S Mnguni, L Muladzi

Abstract

Sorghum is indigenous to Africa and remains an important crop in the semi-arid tropics of Africa and South Asia. In South Africa, the crop is produced by both commercial and smallholder farms across six provinces: Free State, Mpumalanga, Limpopo, North West, Gauteng, and KwaZulu-Natal. However, its production is constrained by lepidopteran pests that reduce yield and grain quality. This study aims to determine the population dynamics and distribution, and abundance of lepidopteran pests of sorghum in South Africa to develop a more effective Integrated Pest Management (IPM) plan. The study will compare two provinces (i.e., North-West and Limpopo), selected for their contrasting climatic conditions. In each province, three localities will be chosen to represent different agro-ecological zones (low vs. mid vs. high temperature extremes). The selection of the localities will be guided by sorghum production distribution, environmental variability, available pest infestation, and historical records. Field surveys will be conducted over two consecutive growing seasons using a W-shaped sampling design. The data will be analyzed using GenStat and SAS software to identify regional differences in all the variables measured. The findings are expected to contribute to a better understanding of lepidopteran pest dynamics and support the development of region-specific IPM strategies for sustainable sorghum production in South Africa.

Keywords: Abundance, Climatic variability, Damage severity, Distribution patterns, Diversity, Integrated Pest Management, Lepidopteran pests, Richness, Sorghum

M19 – Climatic and edaphic filtering of plant functional traits (PFTs) along a semi-arid mountain gradient

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Sub-programme: Ecological Interactions and Ecosystem Resilience

Supervisors: N van Staden, S Siebert, H van der Merwe

Abstract

Climate and soil are expected to act as environmental filters, excluding species that lack suitable functional traits for persistence. Plant traits therefore provide a mechanistic window into the ecological strategies that enable survival under environmental constraints. While trait data exist for some species groups in South Africa's semi-arid savanna systems, studies explicitly linking plant traits to climatic and edaphic (soil) filtering remain limited, particularly in mountain environments that support endemic and under-sampled floras. This study investigates how climatic and edaphic filters shape plant functional trait composition and ecological strategies across a semi-arid mountain gradient in the Griqualand West Centre of Endemism. We will (1) synthesise existing floristic and trait datasets, (2) collect additional trait data across sites spanning climatic and edaphic gradients, (3) test for patterns of trait convergence along the gradient, and (4) assess whether forage species occupy distinct regions of trait space, associated with favourable conditions, exhibiting certain ecological strategies. The environmental gradient is approximated by four mountain systems positioned along an east-west axis of decreasing precipitation and soil fertility. Climatic and edaphic variables are quantified and integrated into a composite stress gradient. Functional traits include specific leaf area, leaf dry matter content, leaf size, plant height, and growth form. We hypothesise that increasing aridity and declining soil fertility will promote functional convergence toward conservative resource-use strategies, characterised by reduced leaf area and size, and increased leaf dry matter content. These trait-environment relationships have applied relevance for rangeland management by identifying species likely to persist, provide forage, and recover under future environmental change scenarios.

Keywords: Ecological Resilience, Environmental filtering, Griqualand West Centre of Endemism, Rangeland Management

M20 – Estimating particulate matter (PM) 10-2.5 exposure through LUR model for unmonitored sites in South Africa

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Sub-programme: Climate Change, Air Quality and Impacts

Supervisors: R Burger, F Neumann, T de Klerk

Abstract

Air pollution is a leading environmental-health challenge facing urban areas and has led to close to 7 million annual deaths globally. In South Africa, Fixed air quality monitoring stations are commonly used to keep track of air quality and are sparsely distributed. As a result of limited access to data and non-scalability, air-quality measuring systems are not able to supply air-pollution data with high spatiotemporal resolution. In this study, A Land use regression (LUR) is used to estimate air pollution exposure across unmonitored areas within South Africa. By statistically linking geolocating values of observed pollutants with explanatory factors defining sources and modifiers of air pollution trends, including land use characteristics, traffic intensity, this study predicts Particulate Matter (PM) 10-2.5 levels at unmonitored areas. Three LUR models were created (two seasonal and one annual) through an ESCAPE-based linear and non-linear regression (Hybrid) method. The hybrid LUR was validated through leave-one-out-cross-validation and tested for correlation using ground stations. Annual measured mean PM10-2.5 were 29.9 $\mu\text{g}/\text{m}^3$ and 33.2 $\mu\text{g}/\text{m}^3$, respectively. Local sources including Waste burning, unpaved roads, population density, grass burning, and grills were good predictors for PM10-2.5, including burned scars. This study illustrated that LUR modelling for particulate matter may be successfully applied across unmonitored sites within South Africa at different scales using local sources of PM. Explanatory power of PM spatial variability through LUR is higher due to AOD derived from 60-meter satellite data and the potential effect of regional transient sources. The study was able to create PM10-2.5 seasonal exposure maps and estimates.

Keywords: AOD, Air-Quality, Land Use, LUR, Particulate Matter

M21 – Strengthening climate governance for sub-national climate action: Case study of the North West Province, South Africa

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Sub-programme: Climate Change, Air Quality and Impacts

Supervisors: R Burger, S Opiyo, P Mukwevho, NS Wesch, K Mmolutsi, I Botha

Abstract

Sub-national governments play a critical role in translating global climate commitments into context-specific action, yet they often face significant governance, institutional and operational constraints. This paper presents the development of the North West Climate Change Strategy and Implementation Plan (NWCCSIP) in South Africa as a case study from which other climate-vulnerable regions, particularly in the Global South, can draw practical lessons. The North West Province, a mining-dependent and semi-arid region, is already experiencing rising temperatures, increased rainfall variability, prolonged droughts, and more frequent flooding, posing risks to socio-economic development and environmental sustainability. Using a Theory of Change framework supported by multi-stakeholder participatory workshops, this study sought to integrate climate change adaptation, mitigation and resilience across provincial sectors. Findings identified governance constraints as the barrier to implementation, including fragmented decision-making, weak alignment between policy mandates and municipal budgeting, and climate change as an unfunded mandate at the local level. Institutional limitations, including the absence of dedicated climate units, shortages of skilled personnel and limited technical capacity, further constrain implementation, while political dynamics and competing service delivery priorities often deprioritise climate action. Operational barriers include reliance on outdated climate data, siloed planning processes, and reactive decision-making. Stakeholders emphasised locally grounded data, stronger interdepartmental coordination and realistic, phased implementation pathways. The study demonstrates that strengthening governance coherence and institutional capacity is a prerequisite for effective climate action, offering practical insights for similar contexts across the Global South.

Keywords: Climate action, Climate change, Municipalities, Perceptions, Stakeholders

M22 – Efficacy of selected South African entomopathogenic fungal isolates against *Phthorimaea operculella* (Zeller) (Lepidoptera: Gelechiidae)

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Sub-programme: Integrated Pest Management

Supervisors: H du Plessis, VM Paradza

Abstract

The potato tuber moth (PTM), *Phthorimaea operculella* Zeller (Lepidoptera: Gelechiidae), is a major pest of potato in South Africa that reduces tuber quality and yield. The use of entomopathogenic fungi (EPFs) presents a viable and sustainable biological control alternative to chemical control. The aim of this study was to determine the pathogenicity of four EPF isolates, viz., NWU-Met-1, NWU-Met-3, NWU-Met-6, and NWU-Met-8, to PTM first instar larvae and prepupae. The concentrations tested ranged from 1×10^5 to 1×10^9 cfu/mL. Pathogenicity bioassays against first instars were done using the leaf dip method, and prepupae larvae were exposed to inoculated sterile soil. First instar larval mortality was below 50% for NWU-Met-3 at all the concentrations. The remaining three isolates had LC₅₀ values ranging between $1.1 - 3.2 \times 10^7$ cfu/mL. Lower LC₅₀ values of 4.2×10^5 cfu/mL, 2.5×10^6 cfu/mL and 1.2×10^6 cfu/mL were recorded for prepupae exposed to isolates NWU-Met-1, NWU-Met-3 and NWU-Met-6, respectively. The isolate that caused the highest prepupal mortality across all concentrations, NWU-Met-8, recorded a median lethal concentration below the lowest tested concentration. The high virulence of NWU-Met-8 indicates significant potential for further testing as a possible biocontrol option for PTM in integrated pest management strategies.

Keywords: Biological Control, Entomopathogenic fungi, Integrated Pest Management, Pathogenicity, Potato tuber moth

M23 – Effects of copper oxide nanoparticles on host–parasite interactions in a freshwater system

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Sub-programme: Aquatic Ecosystem Health

Supervisors: V Wepener, NJ Smit

Abstract

Freshwater ecosystems are increasingly exposed to emerging contaminants, with limited knowledge on the consequences of e.g. metal-based nanoparticles exposure. Copper oxide nanoparticles (CuO NPs) are environmentally relevant because they can alter copper bioavailability, induce oxidative stress and affect organism condition. Most aquatic ecotoxicology studies still evaluate single organism responses, leaving multi-host parasite pathways, such as trematode life cycles, poorly represented. This proposed study addresses that gap by assessing how CuO NPs may influence trematode transmission across freshwater snails as first intermediate hosts, free-living cercariae as transmission stages and the African turquoise killifish, *Nothobranchius furzeri*, as the second intermediate host. Field-collected snails from the Potchefstroom region will be screened for cercarial shedding using light-stimulated protocols; selected non-shedding snails may be retained for later re-screening or dissected to detect whether non-patent infections were present. Acute fish embryo toxicity testing will generate LC10 and LC20 exposure concentrations for CuO, which will guide subsequent snail, cercarial and adult/sub-adult fish exposure methodology. Endpoints will include snail survival and cercarial shedding; cercarial survival, swimming behaviour and infection success; fish embryo toxicity; and fish behavioural, biomarker and molecular responses. CuO NP exposure is expected to modify cercarial production, impair cercarial performance and influence fish responses and parasite transmission success. By linking ecotoxicology with environmental parasitology, this research will move beyond direct toxicity alone and help clarify how nanoparticle pollution may reshape freshwater host–parasite dynamics and multi-stressor interactions in aquatic ecosystems.

Keywords: Cercariae, Copper oxide nanoparticles, Freshwater ecotoxicology, Freshwater snails, Host–parasite interactions, Multi-host life cycle, Nanoparticle pollution, *Nothobranchius furzeri*, Oxidative stress, Trematode transmission

M24 – Assessing the potential of cosmic-ray neutron sensing to estimate yield potential in grain crops

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Sub-programme: Climate Change, Air Quality and Impacts

Supervisors: K Moloto, H Havenga, WH Cloete

Abstract

Improving regional food security under a varying climate requires accurate, continuous field-scale crop yield forecasting throughout the agricultural growing season. However, traditional monitoring methods are limited by a technological scale gap; manual destructive sampling is accurate but labour-intensive, while optical remote sensing faces flight-window constraints, satellite cloud-obscuration, and canopy saturation. This study evaluates the efficacy of Cosmic-Ray Neutron Sensing (CRNS) as a non-invasive, continuous alternative to provide field-scale biomass and yield predictions regardless of cloud cover or canopy density. The study was conducted across a 4-hectare mixed maize and soybean field. Ground-truth biomass datasets were established through destructive crop sampling across multiple growth stages. Plant samples were separated into individual plant components and weighed both wet and dry to calculate the Biomass Water Equivalent (BWE). High-resolution drone imagery was integrated with ground observations to generate spatial biomass estimates between sampling dates. Concurrently, hourly neutron counts from a CRNS probe were corrected for atmospheric influences to isolate vegetation-related hydrogen signals. Grain yield forecasts were derived by estimating total dry matter production, accounting for the mixed-crop field composition, and applying crop-specific Harvest Index values. Results demonstrate that CRNS-derived hydrogen signals can successfully track field-scale biomass dynamics throughout the growing season, providing continuous observations that are not affected by cloud cover or canopy saturation. These findings highlight the potential of CRNS as a scale-appropriate tool for operational crop monitoring and yield forecasting, supporting improved agricultural decision-making and reducing production risk through more informed resource allocation.

Keywords: Cosmic-Ray Neutron Sensing, Biomass Water Equivalent, Harvest Index, Precision Agriculture, Yield Forecasting

M27 – The taxonomy and systematics of fossil Scarabaeidae in Orapa Diamond Mine, Botswana

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Sub-programme: Earth System Sciences, Soils and Resources

Supervisor: S Mnguni

Abstract

The fossil record for insects dates back to the Carboniferous, but Coleoptera first appeared in the Permian. Although beetles have a long evolutionary history, many beetle lineages are poorly represented in the fossil record. The Scarabaeidae are a good example of this. They are a diverse family. Some of the subfamilies are Scarabaeinae, Melolonthinae, Cetoniinae, Dynastinae, and Rutelinae. The rarity of fossil scarabs hampers our understanding of their evolution and palaeoecological importance. Only one species is known from the Melolonthinae at present and the Scarabaeidae fossils from the Orapa Diamond Mine of Botswana are still poorly known. This limits comparisons with other contemporaneous faunas and inhibits ecosystem reconstructions. To address this gap, this study investigates the taxonomy and systematics of fossil Scarabaeidae from the above-mentioned Cretaceous rock deposit. The fossils Scarabaeidae are housed at the Evolutionary Studies Institute (ESI) of the University of the Witwatersrand. These are studied utilizing comparative morphology and imaging techniques. Specimens are examined, photographed, identified, and described to the lowest possible taxonomic level. Thereafter, the morphological characteristics of the fossil Scarabaeidae will be compared to the extant Scarabaeidae using standard terminologies and character matrices. The research is expected to determine whether the collection is unique or has affinities with other Cretaceous fossil Scarabaeidae. The findings will help us better understand the Scarabaeidae evolution and improve the palaeoecosystem reconstruction of the deposit.

Keywords: Crater lake, Cretaceous, Lacustrine sediments, Turonian

M26 – Assessment of agrochemical compatibility and efficacy of entomopathogenic fungi targeting *Phthorimaea operculella* (Zeller) (Lepidoptera: Gelechiidae) under laboratory conditions

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Sub-programme: Integrated Pest Management

Supervisors: VM Paradza, H du Plessis

Abstract

The potato tuber moth (*Phthorimaea operculella* Zeller) is a major pest of potato production in South Africa, causing significant economic losses. Entomopathogenic fungi (EPFs) could serve as biological control agents for this pest. However, successful integration of EPFs into integrated pest control strategies, require compatibility with commonly used agrochemicals such as fungicides used for control of plant pathogenic fungi. The aim of this study was to assess the *in vitro* compatibility of five EPF isolates with three fungicides under laboratory conditions. The fungicides, cymoxanil, difenoconazole and mancozeb were incorporated into culture media (SDA) at the recommended field concentrations. The EPF isolates, NWU-Met-2, NWU-Met -3, NWU-Met-4, NWU-Met-5 and NWU-Met-8 were individually exposed to fungicide-treated media and evaluated for conidial germination, radial growth, and sporulation. The effects of fungicides on conidial germination, radial growth, and sporulation varied significantly among the EPF isolates. Control treatments for all the isolates showed high conidial germination (>95%). Cymoxanil caused low inhibition (<15%) whilst difenoconazole and mancozeb completely inhibited germination. A similar trend was observed for radial growth and sporulation. At 15 days post-treatment, the control colonies showed the greatest radial growth and sporulation followed by the cymoxanil-treated colonies. In contrast, the difenoconazole- and mancozeb-treated colonies exhibited the highest levels of inhibition amongst the treatments. These findings provide valuable information on the compatibility of EPF's with fungicides from different FRAC groups. It can therefore be used to inform application times in integrated insect and disease management programmes for potato in South Africa.

Keywords: Agrochemical compatibility, Biological control, Entomopathogenic fungi, Fungal growth, Potato tuber moth

M27 – Institutional and stakeholder perspectives on plastic waste reduction in JB Marks Local Municipality

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Sub-programme: Environmental Management

Supervisor: C Roos

Abstract

Plastic waste has emerged as one of the most pressing environmental challenges in the twenty-first century, with global plastic production projected to reach approximately 600 million tonnes by 2030 if current trends continue. Plastic waste is placing increasing pressure on municipalities responsible for waste management. In South Africa, despite existing legislative frameworks, a persistent gap remains between national policy intent and municipal-level implementation. This gap is evident in local municipalities, where institutional capacity constraints, limited financial resources, and fragmented governance arrangements undermine the effectiveness of plastic waste reduction initiatives. This study examines institutional and stakeholder perspectives on plastic waste reduction initiatives in the JB Marks Local Municipality, with a focus on Potchefstroom. A qualitative case study design was adopted, drawing on institutional and stakeholder theories as conceptual frameworks. Primary data were collected through semi-structured interviews with 10-15 key stakeholders, including municipal waste management officials, environmental officers, representatives from the North-West University Health and Safety Department, and private waste management contractors. Secondary data were obtained through a systematic review of municipal documents. These documents included waste management by-laws, the integrated development plan, the integrated waste management plan, and relevant municipal reports. Thematic analysis was used to analyse the interview data, while evidence from the documents was assessed using a structured evaluation framework. Data triangulation was applied to enhance the credibility and trustworthiness of the findings. The findings revealed that the JB Marks Local Municipality has implemented waste-reduction initiatives, including waste diversion, public awareness campaigns, and recycling programs. Plastic waste reduction in JB Marks Local Municipality is constrained by factors such as inadequate staffing, insufficient financial resources, limited technical expertise, insufficient infrastructure, weak enforcement mechanisms, and institutional capacity limitations. Government fragmentation is characterized by weak coordination between municipal departments

and limited collaboration with the private sector. Despite these challenges, several opportunities for strengthening plastic waste reduction efforts were identified. These included strengthening institutional capacity, promoting collaborative governance approaches, and integrating informal waste reclaimers into municipal waste management strategies. The findings contribute to the growing body of knowledge on municipal plastic waste governance and provide practical insights for improving plastic waste reduction initiatives in South African municipalities.

Keywords: Institutional perspectives, JB Marks Local Municipality, Municipal governance, Stakeholder perspectives, Plastic waste reduction, Recycling



M28 – Spatial accessibility patterns and transport mode choice among university students in Potchefstroom, South Africa

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Sub-programme: Environmental Management

Supervisors: NS Wesch, R Burger

Abstract

Student travel patterns have been widely investigated to inform sustainable urban transport policies. Travel behaviour is influenced by factors such as urban size, transport infrastructure, and land-use characteristics. In South Africa, increasing student enrolment has placed greater pressure on university cities, with off-campus students often facing greater mobility and accessibility challenges than those living on campus. However, detailed data on student travel behaviour remains limited, particularly in smaller urban areas. This study aims to analyse the accessibility and transport mode-choice behaviour of university students in Potchefstroom. Data will be collected through a revealed-preference (RP) questionnaire comprising demographic and travel-behaviour characteristics from students at North-West University, Potchefstroom. Questionnaire data will provide information on students' reported travel modes, travel distance, travel time, and other factors influencing their commuting behaviour. These data will be integrated with Geographic Information System (GIS)-based accessibility indicators, including spatial distribution of student residences and density, road-network analysis, and isochrone maps, to assess students' accessibility to campus. Discrete Choice Models (DCMs) will then be employed to examine the factors influencing students' transport mode choices. Specifically, a Mixed Multinomial Logit (MMNL) model will be applied because it accounts for unobserved preference heterogeneity by allowing model parameters to vary across individuals. The application of the MMNL model enables the study to generate evidence-based insights into factors influencing the adoption of sustainable and non-sustainable transport modes. The findings are expected to support policymakers, transport planners and urban planners in developing sustainable commuting strategies and improving student accessibility in university cities.

Keywords: Accessibility, Isochrones, Mixed Multinomial Logit Model, Mobility, Transportation

PhD Posters

P1 – Integrating Indigenous Ecological Knowledge (IEK) into fish parasite taxonomy to support inclusive biodiversity research

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Sub-programme: Aquatic Ecosystem Health

Supervisors: KA Hadfield-Malherbe, W Malherbe, FM Phaka

Abstract

Parasitic organisms are important to ecosystems and can act as sensitive indicators of environmental change. Despite this, the taxonomy and genetic diversity of many South African fish parasites (especially external taxa like isopods and copepods) remain poorly studied. This project addresses these gaps using an integral framework that combines morphology, molecular characterisation and Indigenous Ecological Knowledge (IEK) concerning fish hosts and their parasite groups. The primary aim is to identify and characterise external parasites from the Kosi Bay Estuary. Morphology will be documented with high-quality digital illustrations and standardised in DELTA (Descriptive Language for Taxonomy) to produce formal species descriptions and accessible diagnostic keys. Complementary molecular characterisation targeting mtCOI, 16S rRNA and 18S rRNA will refine species boundaries reveal cryptic diversity and reconstruct phylogenetic relationships. Concurrently, the study will document traditional names and cultural knowledge of fish and their parasites. Integrating IEK will broaden participation, safeguard local knowledge systems and align biodiversity research with community priorities. Expected outcomes include a detailed species descriptions a regional parasite checklist, DNA barcode reference data illustrated identification tools and a catalogue that links scientifically recognised species with their indigenous names. Together, this will advance parasitology in southern Africa, enhance fish health monitoring and strengthen dialogue between scientific and local communities. The resulting integrative dataset will contribute to national and global understanding of fish-parasite interactions, biodiversity and ecosystem health.

Keywords: Fish parasites, Indigenous Ecological Knowledge, Molecular analyses, Morphology, Taxonomy

P2 – Phage therapy targeting multidrug-resistant *Aeromonas* species in wastewater treatment plants

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Sub-programme: Biodiversity and Conservation Ecology

Supervisors: K Lekota, OMM Thekiso

Abstract

Aeromonas species are Gram-negative, opportunistic pathogens widely distributed in aquatic environments, including wastewater treatment plants and receiving water bodies, where they act as reservoirs of antimicrobial resistance genes and virulence determinants. Clinically relevant species such as *Aeromonas hydrophila*, *Aeromonas caviae*, and *Aeromonas veronii* have been increasingly associated with infections in humans and animals, raising concerns regarding their role in the environmental dissemination of antimicrobial resistance. This study aims to establish a seasonally stratified surveillance programme to investigate the occurrence of *Aeromonas* spp., associated ARGs, and lytic bacteriophages in WWTPs within the North West Province, South Africa. Seasonal wastewater samples will be collected from selected WWTPs and receiving rivers to assess bacterial community dynamics using high-throughput sequencing approaches. The occurrence and diversity of *Aeromonas* spp. will be determined using conventional culture-based methods, molecular identification and whole-genome sequencing. Genomic analyses will be conducted to characterize the resistome and virulome profiles of multidrug-resistant isolates and identify clinically relevant resistance determinants. In addition, lytic bacteriophages targeting MDR *Aeromonas* spp. will be isolated from wastewater, characterized and evaluated for their host range and antibacterial efficacy. The study is expected to generate baseline data on the seasonal distribution of *Aeromonas* species and ARGs in wastewater systems while improving understanding of their contribution to environmental antimicrobial resistance dissemination. Furthermore, the isolation of locally adapted lytic bacteriophages may demonstrate the feasibility of phage-based biocontrol strategies to reduce MDR *Aeromonas* populations and associated resistance and virulence genes, thereby contributing to sustainable interventions at the wastewater-environment interface.

Keywords: *Aeromonas*, ARGs, Bacteriophages, MDR

P3 – A non-invasive approach to soil moisture monitoring in South African drylands

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Sub-programme: Climate Change, Air Quality and Impacts

Supervisors: K Moloto, H Havenga

Abstract

Soil moisture (SM) measurements are essential for precision agriculture, and water resource management. This variable is traditionally measured with sensors that are invasive, labour-intensive, and subjected to uncertainties. This study examines the use of cosmic-ray neutron sensing (CRNS) as an accurate and non-invasive method that measures SM over large spatial areas. The CRNS detects fast (epithermal) neutrons, which are produced from high-energy cosmic-ray particles. These particles originate from the Sun and distant galaxies that enter the atmosphere of Earth, creating cascades of secondary cosmic-rays. These secondary cosmic-rays contain epithermal neutrons that interact inversely with hydrogen atoms in the soil. This work focuses on converting epithermal neutron count rates to volumetric water content (VWC) using the standard N0 calibration method that measures SM estimates across a footprint of a radius of approximately 250m and a measurement depth of up to 0.3m. However, this method does require calibrations and corrections. Therefore, the CRNS-derived SM measurements were validated against seventeen low-cost in-situ capacitance-based probes. We subsequently compare area-averaged SM estimates derived from the in-situ probes with CRNS measurements and evaluate the CRNS correction process. Results showed a strong correlating between CRNS-derived and in-situ SM estimates ($R^2=0.68$, $p<0.001$). Both measurement methods exhibited similar temporal trends and responded consistently to rainfall events, with the in-situ sensors generally responding slightly later than the CRNS measurements. This suggests the CRNS detects a more rapid changes to near-surface hydrogen content across the measured footprint. These results demonstrate that the CRNS is a reliable tool for field-scale SM monitoring in South Africa and has significant potential for supporting precision agriculture and water resource management.

Keywords: Precision agriculture, Soil moisture, Volumetric water content, Water resource management

P4 – Application of a Safe and Sustainable by Design (SSbD) framework to determine the ecotoxicological responses of *Daphnia magna* to graphene family materials.

Zikhona Menze

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Sub-programme: Aquatic Ecosystem Health

Supervisor: V Wepener

Abstract

Graphene Family Materials (GFMs), including graphene, graphene oxide, and reduced graphene oxide, have gained significant attention due to their unique physicochemical properties and wide range of applications in engineering, agriculture, medicine, and environmental remediation. Their large surface area, surface chemistry, variable oxidative states, and hydrophilic or hydrophobic characteristics make them particularly effective for applications such as water purification and pollutant adsorption. Despite these advantages, there is little knowledge of the environmental effects of these products once they are released into the environment. Understanding their interactions with biological systems is crucial for assessing their potential risks and ensuring their safe and sustainability use across the various applications. The main aim of this study is to apply the Safe and Sustainable by Design (SSbD) framework to identify potential environmental risks and sustainability challenges, supporting the development of safer and more sustainable GFMs. To evaluate the effects of GFMs and to better understand the materials potential environmental and toxicological impacts, the species *Daphnia magna* (water flea), will be used as a bioindicator given that it responds rapidly to environmental alteration and degradation. A range of analytical techniques will be employed for material characterization and toxicity assessment. ICP-MS will be used to determine chemical composition and impurities, while TEM, SEM, and AFM will characterize the morphology and structural properties of the materials. Non-labelled techniques such as xCELLigence and Cytoviva will be used to monitor cellular responses and visualize material interactions. Whole organism response will be determined using the dynamic energy budget approach that is a formal metabolic framework that explains *D. magna* acquire, store, and utilize energy and matter throughout their entire life cycle. The SSbD framework will aid in identifying potential risks and sustainability issues at the initial stages of the design, manufacture, use and disposal.

Keywords: *Daphnia magna*, Graphene, Graphene oxide, Reduced graphene oxide, Safe and Sustainable by Design (SSbD)



P5 – Optimising cowpea productivity through integrated climate-smart strategies in South Africa’s summer rainfall regions

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Sub-programme: Climate Change, Air Quality and Impacts

Supervisor: L Myeni

Abstract

Climate variability and climate change pose significant challenges to agricultural productivity, food security, and environmental sustainability in South Africa’s summer rainfall regions. Rising temperatures, recurrent droughts, rainfall variability, and extreme weather events threaten the sustainability of rainfed crop production systems. Cowpea (*Vigna unguiculata* L. Walp), a drought-tolerant legume with high nutritional and economic value, has been identified as a promising climate-resilient crop. However, existing studies largely assess management practices such as planting dates, cultivar selection, and plant density independently through short-term field trials, limiting understanding of their combined effects under changing climatic conditions. Integrated assessments that simultaneously consider climate risks, productivity, climate resilience, and environmental sustainability remain limited. This study aims to identify climate-smart management combinations that optimise cowpea productivity, enhance climate resilience, improve carbon storage, and support environmental sustainability across South Africa’s summer rainfall regions. Historical climate data will be analysed using climate indices, including the Standardized Precipitation Index (SPI), Standardized Precipitation Evapotranspiration Index (SPEI), and temperature-based stress indicators to identify major climatic risks affecting cowpea production. Climate trends will be assessed using the Mann–Kendall test and Sen’s slope estimator, while GIS-based spatial analysis will identify agro-climatic suitability and climate risk zones. The identified climate risks will guide the selection of adaptation strategies for evaluation using the Decision Support System for Agrotechnology Transfer (DSSAT) crop simulation model. Management options, including planting dates, plant densities, and cultivars, will be assessed for their effects on yield stability, water-use efficiency, climate resilience, and soil carbon dynamics. The study will develop a region-specific decision-support framework to identify optimal climate-smart management strategies for cowpea production. The findings will support farmers, researchers, and policymakers in promoting sustainable and climate-resilient agricultural systems in South Africa.

Keywords: Climate indices, Climate-smart agriculture, Climate variability, Drought risk, Legumes



P6 – Science-Policy interface and collaborative governance in wildfire management

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Abstract

Wildfires in South Africa are increasingly shaped by climate change, land-use pressure, invasive alien plants and expanding settlements, while governance remains fragmented across sectors and spheres of government. This study examines how policy coherence, institutional arrangements and science-policy interactions shape integrated wildfire management in South Africa. It aims to develop and appraise an evidence-informed collaborative governance framework that can strengthen mandate clarity, coordination, accountability and knowledge use. A sequential mixed-methods design will be used. Policy, legislative and integrated fire management planning documents will first be analysed to assess coherence, implementation arrangements and monitoring provisions. Semi-structured interviews and focus groups with key stakeholders will then explore coordination practices, implementation constraints and evidence use. Authorised Department of Forestry, Fisheries and the Environment Working on Fire programme datasets will be analysed to describe spatial and temporal patterns in activities, resource deployment, response actions and selected operational indicators. The findings will be integrated through joint displays and comparison matrices to develop a practical governance framework for improving integrated fire management planning, institutional coordination and evidence-informed wildfire governance.

Keywords: Adaptive management, Collaborative governance, Institutional fragmentation, Integrated fire management, Policy coherence, South Africa, Wildfire governance

P7 – Freshwater fish biodiversity in the Limpopo River Basin: Current knowledge, gaps, and conservation implications

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Abstract

The Limpopo River Basin (415,000 km²) is one of the largest transboundary river systems in southern Africa, spanning South Africa, Botswana, Zimbabwe, and Mozambique. The basin encompasses diverse climatic zones, geomorphological settings, and land-use types, and supports a rich freshwater fish assemblage comprising approximately 73 species across 18 families. Species composition varies along pronounced longitudinal and altitudinal gradients, shaped by both contemporary environmental conditions and historical hydrological connectivity. Despite this diversity, current knowledge of freshwater fish biodiversity within the basin remains spatially uneven and taxonomically incomplete. This study synthesises published literature and biodiversity records to evaluate patterns of fish diversity, ecological dynamics, and key knowledge gaps across the basin. The literature shows a strong geographic bias towards the Olifants River system, where research has largely focused on fish assemblage structure, ecological integrity, pollution, and habitat transformation. In contrast, large portions of the basin remain poorly sampled, limiting basin-wide inference. Hydrological variability is a major driver of fish community dynamics, influencing recruitment, dispersal, and habitat availability through alternating drought and flood regimes. These dynamics are reflected in seasonal reproductive patterns and early life-history processes described in larval fish studies. However, these remain poorly resolved across much of the basin. Parasitological research provides valuable insight into ecosystem and host health but is spatially fragmented. In addition, the spread of non-native species is emerging as an increasing pressure on native fish assemblages. Taxonomic uncertainty remains a key constraint, particularly among morphologically similar and cryptic taxa. Molecular approaches, including mitochondrial DNA barcoding (COI) and environmental DNA (eDNA), have revealed previously unrecognised genetic diversity and improved species detection, suggesting that true species richness is likely underestimated. Overall, despite advances in selected regions, substantial gaps remain in spatial

coverage, taxonomic resolution, and methodological integration, highlighting the need for coordinated basin-wide biodiversity assessments to inform conservation and management.

Keywords: Environmental DNA (eDNA), Fish assemblages, Freshwater fish biodiversity, Limpopo River Basin



P8 – Assessing farmer's perceptions of wetland use, governance dynamics and geospatial sustainability patterns in the uMfolozi Floodplain System, KwaZulu-Natal

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Sub-programme: Environmental Management

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Abstract

Floodplain wetlands in Sub-Saharan Africa are critical socio-ecological systems that support biodiversity, ecosystem services, and rural livelihoods. However, these ecosystems are increasingly degraded by interacting pressures associated with small-scale farming. While existing studies document drivers such as overgrazing, pollution, agricultural intensification, and climate variability, the literature remains fragmented, geographically uneven and insufficiently synthesised. This gap constrains a clearer understanding of the relative importance of socio-economic and ecological drivers in shaping wetland sustainability. The study aims to systematically review the socio-economic and ecological drivers influencing wetland degradation and sustainability in small-scale farming systems across Sub-Saharan Africa. The review will follow PRISMA guidelines to gather, screen, and evaluate relevant peer-reviewed studies published between 2000 and 2025 that focus on the floodplain wetlands context and smallholder agricultural systems. The review will assess the main drivers, how they interact and the spatial patterns, as well as the methods used in existing studies. The study is expected to identify key drivers of wetland change, highlight knowledge gaps and regional biases and propose a framework linking small-scale farming to wetland sustainability. It will also provide evidence to support policy, land use planning and wetland management in Sub-Saharan Africa.

Keywords: Africa, Degradation, Floodplain wetlands, Small-scale farming, Socio-economic and ecological drivers, Sustainability



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